TECHNOLOGICAL CHANGE AND EMPLOYMENT IN SOUTH AFRICAN AGRICULTURE : THE CASE OF MAIZE HARVESTING IN THE WESTERN TRANSVAAL, 1968-1981

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ABSTRACT

Changes in the choice of technique in the harvesting and delivery of maize and weeding, the causes of these changes, and their consequences for employment and unemployment, were investigated. Data was collected for 61 farms in six magisterial districts of the Western Transvaal for the period 1968-1981. In 1968 about 30 percent of the crop was being harvested mechanically; by 1981 95 percent. Sacks, in which almost half of total output was being delivered to depots in 1968, had, by 1977, been almost completely displaced by bulk handling. From 15 percent of the total crop area if 1968, weed sprays were being applied to 95 percent in 1981. There was an increase of about 75 percent in the average surface area of farms, and more than a doubling in the average yield per hectare. The greatest part of most of these changes occurred between 1973 and 1977. The causes of changes in the choice of technique were sought both in theory - neo-classical and historical-materialist - and in empirical evidence. A growing shortage of men but not of women, the convenience and controllability of combine-harvesting, and economies of scale generated by the increasing size of farms, were all important causes. But the cost advantage of mechanical- over hand-harvesting on all except the smallest farms is what appears to have been crucial. For various reasons, this was not fully exploited until the middle '70s. Exogenous developments in technology, rather than changes in relative factor prices, should be seen as the fundamental cause of changes in harvesting techniques. Seasonal workers were still employed to glean after combine-harvesting and to hoe spray-resistant weeds, but whereas in the late '60s seasonal harvesting teams consisted typically of a comparatively large number of workers from black rural areas, mainly adults - women in the majority - and a few children, by the late '70s they were composed of a

comparatively small number, most of whom were the wives and children of permanent farm workers, living on white farms. Between 1968 and 1981, the number of seasonal jobs per 1 000 hectares of maize fell by about 70 percent in harvesting and delivery, and by 60 percent in weeding. Rough estimates show total seasonal employment to have fallen from about 105 000 to 43 000 annually, the mechanization of reaping being the most important single cause. The employment of permanent workers in harvesting and delivery declined by almost 50 percent per 1 000 hectares, enabling the total number of workers to contract from about 30 000 in 1969 to 25 000 in 1976. Since 1977 employment patterns have stabilized. Though few men appear to have become unemployed because of changes in technology, women from black rural areas, chiefly in Bophuthatswana, have generally not been able to find other jobs. The real wages of permanent workers rose by 150 percent between 1970 and 1981, while those of seasonal workers increased only marginally. Changes in both wage and employment patterns have greatly narrowed the distribution of agricultural income.

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"It is in the community ... that God's love is mediated to us."

"All things come from You and of Your own do we give You."

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ABBREVIATIONS

BENBO/BENSO	:	Bureau for Economic Research re Bantu/Black Development
KK	:	Koster Koöperatiewe Landboumaatskappy Bpk.
M,F,C	:	Men, women, children
N.A.	:	Not available
NWK	:	Noordwes Koöperasie Beperk
PTO	:	Power-take-off (tractor-drawn/driven)
RSA	:	Republic of South Africa
SALDRU	:	Southern African Labour and Development Research Unit
SP	:	Self-propelled
SWT	:	Suid-Westelike Transvaalse Landbou-koöperasie Beperk
TEBA	:	The Employment Bureau of Africa

CONVERSIONS

1 hectare	=	1,1675 morgen
1 (metric) tonne	=	1,102 (imperial) ton

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ON THE SUBJECT AND ITS CHOICE

1.1 UNEMPLOYMENT IN SOUTH AFRICA

This thesis investigates three issues:

1. the changes in the choice of maize harvesting, delivery and weeding techniques that occurred on farms in the Western Transvaal between 1968 and 1981;
2. the causes of these changes;
3. their consequences for employment and unemployment.

The greater part of the analysis is about the effect of technological change on employment patterns, but the ultimate concern is not so much with employment as with unemployment. So the essential question is: has technological change in South African agriculture led to unemployment? The means of attempting an answer is a micro-study with a highly specific focus.

If one had to choose a single feature by which to characterize each decade, for South Africa in the 1960s it would probably be 'boom', and for the 1970s - or at least for their second half - 'unemployment'. Most people would agree that jobs during the latter part of the '70s were hard to come by.[1]

For the majority of middle class South Africans, knowledge of this came through the news media; but for most working class people no such secondhand source was needed. Especially if one was black, and one's family was resident in a black rural area, the problem of finding work could never have been greater. Quite apart from legal restrictions, competition for urban jobs was intense, and - what was new - even the

traditional jobs on white-owned farms could no longer be relied on if nothing else turned up.[2]

Because the recession was not confined to South Africa, it is easy, in seeking the causes of high unemployment, to go no further than contemporary international economic circumstances. Certainly these were important, and may even have been the dominant factor in the 70s, though this is not generally agreed upon.[3] But it would be wrong to stop the search at that point: other developments of a more local but less visible nature may also have played a part. The structure of the entire South African 'labour market' needs to be studied for changes that either increased the supply of workers or reduced the demand for them. On the supply side, for example, the State's population relocation programme may have increased the number of wage work-seekers.[4] Studies which will clarify this are in progress.[5] On the demand side, changes of technology may have reduced the demand for labour.

In South Africa a debate on the relationship between technological change and unemployment began in the late 70s and is still in progress.[6] But, partly because data is scarce, few contributions to date have attempted to go beyond theoretical exposition into the realm of empirical verification. The object of this research is- in a small way - to start to fill this gap.

As has been explained, the research focuses on the highly specific operations of harvesting and delivering maize and weeding on farms in the Western Transvaal between the years 1968 and 1981.

But why a micro-study? Why agriculture? Why maize farming? Why harvesting, delivery and weeding? Why the Western Transvaal? And why 1968 to 1981?

1.2 WHY A MICRO-STUDY?

By nature, most empirical studies necessitate micro-studies. Detailed information on the operations and workers affected by technological change, and the nature, causes and effects of this change, is seldom available from secondary sources. So primary data needs to be collected. Limitations on time and resources then generally restrict the study to a micro-level.

There are also reasons why one might prefer a micro approach to the study of technological change in agriculture: first, at a micro level, it is sometimes possible to avoid the difficulties of defining and measuring 'capital' in its abstract form, that are inherent in macro-studies.[7]

Second, in South African agriculture, macro employment statistics are often unreliable because of the extensive employment of seasonal workers. Several writers have commented on this.[8] By asking about the number and duration of employment of seasonal workers, a micro-study can overcome this difficulty.

Third, there is the problem of deducing from changes in the capital:output, labour:output and capital:labour ratios, whether new techniques have been introduced. For example, it is not always easy to distinguish between capital widening, in which the same technique is used, and capital deepening, which implies the adoption of new techniques.[9] It may also be difficult to detect the difference between various forms of technical change that do not involve the use of additional labour-saving capital equipment.[10] Detailed information about techniques and the employment associated with them can be gathered in micro-studies.

Of course, small-scale investigations have problems of their own. The field-work necessary to collect primary data, though usually rewarding, is also time-consuming and expensive. And, critically, the conclusions apply strictly only to the operations techniques, area and period studied,

though it may be possible to make inferences about related activities. This study was designed with the intention of making the applicability of its conclusions as wide as possible.

Ultimately one's method depends most on what one is looking for. If unemployment is to be understood as more than just a faceless statistic, then one needs to know at least who the unemployed are, and how they came to be unemployed. Information of this nature can only be collected by micro-studies.

1.3 WHY AGRICULTURE?

One of the papers presented at a conference on farm labour in South Africa in 1976 was entitled "Agriculture: The Nation's Largest Employer".[11] Just because farming provides such a large proportion of total employment, it is important to examine the incidence and impact of technological change in this sector.

Ironically, almost as the paper was being presented, its title became outdated. In the middle 70s, a milestone was passed when manufacturing replaced agriculture as the largest provider of jobs.[12] But this was perhaps to be expected: the decline in the relative level of employment in agriculture has been a feature of economic development in most industrialising countries.[13]

Arguably, a milestone of still greater significance was passed at the beginning of the 70s when the decline in the absolute number of jobs in agriculture became unambiguous.[14]

No less important are the demographic implications. In the United States, as recently as 1950, there were 23 million people living on farms, and 9,9 million farm workers. By 1980, the corresponding numbers were 6 million and 3,7 million, falls of about 75 and 65 percent respectively.[15]

The magnitude of this demographic change prompted the suggestion that "agriculture may be the realm where the mechanisation of human work has so far had the greatest effect".[16]

Does the downturn in the total number of farm jobs necessarily mean that capitalist agriculture in South Africa has now entered the same phase that it did in the United States somes decades ago?[17] Most indications are that it does. Mechanisation has long been on the increase on South African farms: statistics of the numbers of machines and implements bear witness to this.[18] Yet, not until the 1970s was the net impact of this increase to reduce the absolute level of farm employment. One can identify several reasons for this.

Mechanisation makes it possible either to produce the same output with fewer workers or to produce a greater output with the same number of workers. Until the 1970s it seems, on balance, to have done the latter. Both the more intensive use of land and the use of more land-saving capital inputs help to explain this: though the total surface area of farms changed little, the proportion under cultivation increased steadily, roughly doubling between 1930 and 1970,[19] while the input of fertilizer and other intermediate capital goods, many of which are land-saving, rose continuously until the mid-1970s.[20] The levelling out of these trends during the past decade has certainly contributed to the fall in employment.

There is evidence of a continuation of mechanisation during the 1970s, but it is not without its ambiguities. On the one hand, the Economic Development Programme (1978-87) refers to an average annual increase in the capital:labour ratio in agriculture of no less than 5,9 percent between 1969 and 1977, as against 2,8 percent for the preceding six years.[21] The compilers concluded that mechanisation did not merely continue in the 70s but accelerated. The Parliamentary Working Committee on the Economic Position

of the Farmer which reported in 1979, came to a similar conclusion.[22]

Nattrass points to the simultaneous fall in the labour: output ratio and rise in the capital:output ratio, in the early 70s - the first time this had occurred - which, as she argues, is an indication of capital-deepening rather than capital-widening.[23] And the numbers of all major categories of motorized equipment on farms increased steadily at least until the late 70s, except for motor cars.[24] All these suggest a continued build up of machinery through the '70s.

So it comes as a surprise to find that the gross value of machinery, implements, motor vehicles and tractors, measured at constant 1975 prices, after rising slowly between 1960 and 1971, started to decline in 1972 and continued gradually downwards until 1979.[25] Even measuring this on a per permanent worker basis makes little difference, merely delaying the peak by two years.[26] The explanation is not obvious, particularly in view of the tendency of most machines to increase in size and hence in value, even at constant prices. The answer may lie in the method of compilation of the statistics, both of the value of machinery and of the price index.

When all the evidence is taken into account, it seems fairly certain that mechanization did, in fact, increase during the '70s. Coming at a time when the intensity of land-use had stopped increasing, and the growth in the input of land-saving intermediate goods had begun to slow, mechanization must rank as the most important cause of the decline in farm employment.

Intimately connected with mechanization was the fall in the number of farming units.[27] Starting in the 1950s, the consolidation of farms gradually gathered momentum in the 1960s, and then more than doubled its pace in the 1970s.[28] Economies of scale in the use both of machinery and of

labour accompanied this development, and would probably also have been one of its major causes.

One other factor which may also have played a role in the decline of farm employment is what one could call an 'autonomous increase in labour productivity', attributable to higher levels of schooling, better training, improved wages and living conditions, greater motivation, etc.

Clearly, a large part of the function of an empirical study should be to ascertain the presence or absence of each of the above factors and to gauge their significance in changing employment patterns.

Finally, the sheer paucity of existing information on the relationship between technological change and employment on farms in South Africa is an additional reason for focusing on agriculture. As Bromberger has remarked of this relationship in a broader context, "there is no doubt that the subject deserves to be studied".[29]

1.4 WHY MAIZE FARMING?

One way to broaden the validity of micro-studies is to examine a large rather than a small industry so as to make the potential number of parallels greater. It was partly with this in mind that maize farming was chosen.

Several criteria could be used to judge the size of a farming sector. For instance, the number of farms, the surface area used for the activity, the number of workers, or the value of output. From published census data, there is no way of identifying farms that produce maize, or whose chief source of income is from maize, so the number of farms and the number of workers cannot readily be established. Surface area is less than ideal as a means of comparison because some activities, such as pastoral farming, are more land extensive relative to output and employment than others, such as arable farming. However, between field

crops, a comparison on this basis would not be unreasonable. The surface area planted with maize has for many years been considerably greater than for any other crop.[30]

Perhaps the most satisfactory common denominator, with the data that is available, is the value of output. On this scale, maize production ranks as by far the most important farming activity in South Africa. Since 1960, except in the drought year 1973, the annual gross value of maize has always been larger than that of any other farm product. Its total value between 1960 and 1981 was roughly 1,8 times greater than that of the next most important product, cattle and calves slaughtered, and 3,4 times greater than the next most important field crop, wheat.[31]

1.5 WHY HARVESTING AND WEEDING?

The two seasons of most intense activity in field crop farming are always planting and harvesting. In between, there is much work to be done, notably weeding, but the urgency is never as great. In many parts of the United States, by tradition the number of workers or potential workers[32] resident on farms was generally large enough to cope with the crucial tasks at the beginning and end of the agricultural cycle.

Until the end of the 1930s, tradition changed slowly.[33] Then, with the new decade began a new era: Rasmussen relates how "World War II was the impetus to the virtually complete transition to mechanization".[34] This he called "the second American agricultural revolution ... the change from animal power to mechanical power".[35] With the transition came a fundamental change in the traditional employment pattern.

On farms in the Mississippi Delta, Day identified two stages of change[36]: in the first, tractors reduced the number of workers required at planting time. The response

of farmers, he says, was to begin to reduce employment on a year-round basis, and instead to employ workers only when seasonal needs dictated - at harvesting and weeding time. Demographically, this meant the shift of a portion of the rural population from farms to nearby villages. In the second stage the adoption of combine-harvesters made the redundancy of many of these village dwellers complete: with both threshing[37] and reaping now performed by machines, there was no longer a need for most seasonal workers.

"An important question", Rasmussen observes, "is what ... happened to the displaced farm population. In earlier times surplus farm workers supplied much of the manpower needed for the industrialization of the economy. (But) since the second American agricultural revolution many of the displaced farm people have gone to the cities, often to an impoverished and bleak situation. Others are now among the rural poor."[38]

It is important to know how far the same processes have occurred in South Africa, or are likely to do so. Day's model does not fit exactly: at least in the first stage there are some notable differences. To start with, tractors in this country seem until fairly recently, to have been used more to widen than to deepen the capital structure.[39] The period of most rapid increase in the employment of tractors occurred in the 15 years after the Second World War: during this time their numbers increased no less than six-fold.[40] However, the effect was not to reduce the number of permanent workers. If anything, it continued to grow, although comparatively slowly.[41] The main reasons for this, as argued earlier[42], seem to have been the more intensive use of land and the more extensive use of land-saving capital inputs. The push off farms during this period appears to have been confined largely to the off-spring of workers living on farms, as opposed to the workers themselves.

Wilson has drawn attention to a second difference: "in the

peculiar political circumstances of South Africa, (those) labourers (who were) pushed off the land during this first stage did not, as in Mississipi, have the right to settle in nearby villages. They were compelled to go 'back to the homelands'"[43], there to enter the migrant labour pool. Whether they were subsequently employed seasonally on farms would, to a large extent, have depended on whether the labour bureau in that part of the 'homeland' was open to urban employers, or whether it recruited exclusively for farmers.[44]

In fact, the combination of events identified by Day as constituting 'the first stage' of mechanization in the Mississipi, namely a simultaneous growth in the number of tractors and season workers, and decline in the number of permanent workers, never occurred in South Africa. For, despite the continued increase in the number of tractors throughout the '60s[45], the numbers of seasonal and permanent workers did not rise and fall respectively, but remained on a rather uneven plateau.[46] Only after 1969 is an unmistakable and almost unbroken decline in permanent employment to be seen. And, at almost exactly the same moment, seasonal employment also started to contract.[47] So, although the number of tractors increased still further in the 1970s[48], at no point did the three events take place simultaneously.

Despite these differences, there are indications that by the end of the 1960s, the country's largest farming sector, maize production, was entering the second phase outlined by Day. Prompted partly by tighter conditions in the labour market caused by the prolonged economic boom, calls were being heard for the mechanization of maize harvesting, some showing the labour-displacing potential of combine-harvesters.[49] One such analysis claimed that "farmers who used combines saved an average of 70 percent of the labour involved in the (maize) harvesting and threshing process".[50]

From 1971 on, the number of seasonal workers did indeed start

to fall.[51] What needs to be determined is the extent to which this reflects, on the one hand, the labour-saving predictions made about combines, and, on the other, the use of more capital-intensive techniques for weeding - the only other operation for which large numbers of seasonal workers were still employed. And, crucially, whether the reduction in employment has meant an increase in unemployment.

1.6 WHY THE WESTERN TRANSVAAL?

Of the regions defined by the Maize Board as the major maize-producing regions of South Africa[52], the Western Transvaal, comprising the eleven magisterial districts Bloemhof, Christiana, Coligny, Delareyville, Klerksdorp, Koster, Lichtenburg, Potchefstroom, Schweizer-Reneke, Ventersdorp and Wolmaransstad (see Figure 1), is arguably the most important. Between the production seasons 1967/68 and 1979/80, it planted the largest area of maize - on average about 26 percent of the total - and reaped the largest crop - on average almost 30 percent of the total - each year, with few exceptions.[53] In terms of the relative importance of maize in each region, the Western Transvaal also ranked first: in 1975/76, the eleven districts concerned earned roughly 95 percent of their income from maize, a far higher percentage than any other region and implying almost complete maize monoculture.[54]

One additional consideration influenced the choice of region, namely, the availability of secondary data. Since the middle '50s, the Division of Agricultural Production Economics of the Department of Agriculture and Fisheries has conducted detailed annual surveys of the costs of maize production in three important maize-farming regions, one of which is the Western Transvaal. The main findings are published[55], and are used to help determine prices paid to farmers by the Maize Board[56], but most of the detail remains unpublished. The Department kindly offered to make the questionnaires and tabulations available. Though little of the data appears below, it was crucial in enabling the

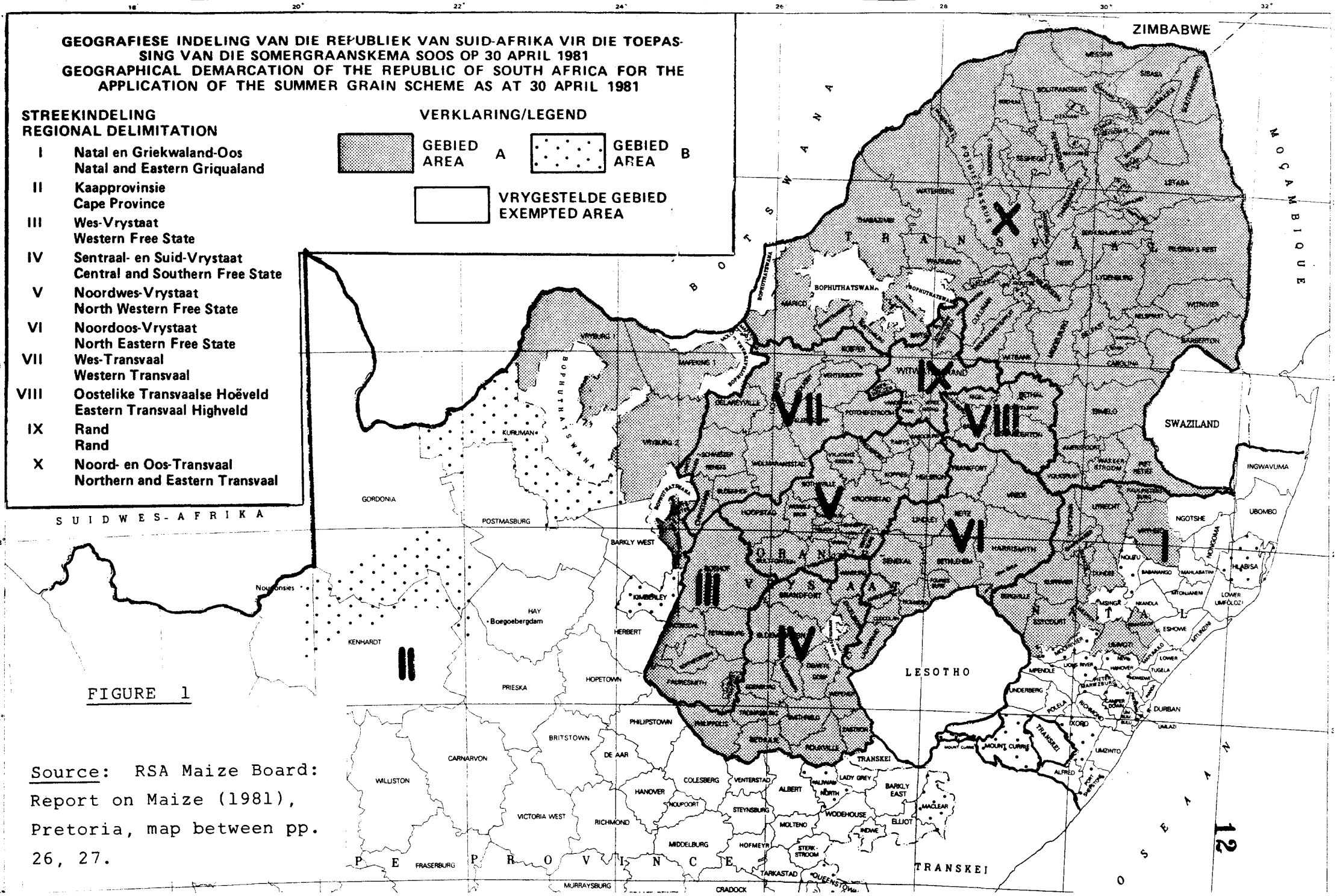

FIGURE 1

Source: RSA Maize Board: Report on Maize (1981), Pretoria, map between pp. 26, 27.

research to start and in giving it direction.

1.7 WHY 1968-1981?

A preliminary analysis of data collected by the Division of Agricultural Production Economics, showed that very few farmers in the Western Transvaal were making use of combine harvesters in 1966.[57] For this reason, it was decided to make the starting year for data-collection 1968[58], just before the downturn in agricultural employment.

The author's survey was carried out in 1982 shortly before the maize harvesting season began. The last year for which data was available was therefore 1981.

THE METHOD OF DATA COLLECTION AND ANALYSIS

This chapter describes the way in which two field surveys were carried out to collect primary data from farmers and workers, and the methods used to analyse the data.

2.1 THE SURVEY OF FARMERS IN THE WESTERN TRANSVAAL

2.1.1 The Questionnaire: Objectives and Design

The most important part of the field research concerned the records and opinions of maize farmers in the Western Transvaal. Full details of the questionnaire that was used to sample them, are given in Appendix A.

In the first two sections, a series of questions was asked to construct a chronology of the maize-harvesting and weeding techniques used by each farmer between 1968 and 1981, and to record the employment associated with each technique. The purpose of collecting this information was to generate two sets of cross-sectional time series relating respectively to techniques and employment, which could be used to measure the degree and rate of change of each. It was not the intention to synthesize a production function from these series. As Heady and Dillon point out[1], data of this nature is generally unsuitable for such a purpose.

In the third section a further series of questions was asked to find out which, of a wide range of potential factors, had played a part in farmers' decision to mechanize (or not to mechanize) maize harvesting.[2] Farmers were then asked to identify the three most important factors in their own decision and to place these in order of importance.

The final section concerned the consequences of mechanizing (or not mechanizing) maize harvesting, and consisted partly of directed response and partly of open-ended questions.[3]

In the two non-statistical, non-factual parts of the questionnaire - sections 3 and 4 - extensive use was made of directed response questions, where it might appear that a few open-ended questions would have been adequate.[4] There are two reasons for this: firstly, the replies to open-ended questions are often difficult to analyze, and secondly, a small number of open-ended questions does not usually produce the same depth of information as a fairly comprehensive list of directed response questions. Where less well-specified issues were involved and the nature of the answers was difficult to anticipate, open-ended questions were used.

2.1.2 The Sample[5]

2.1.2.1 Sampling frame

The area regarded by the Department of Agriculture as the most important maize-producing region of the Western Transvaal[6] includes most of 8 of the 11 magisterial districts which comprise the Western Transvaal region, as defined by the Maize Board (see Figure 1). The 8 magisterial districts concerned are: Coligny, Delareyville, Klerksdorp, Koster, Lichtenburg, Schweizer-Reneke, Ventersdorp and Wolmaransstad. Of these, Lichtenburg is by far the most important[7], followed by Wolmaransstad and Delareyville, which produce similar tonnages, and then Schweizer-Reneke The remaining four, Coligny, Klerksdorp, Koster and Ventersdorp are all smaller producers.[8]

To make the sample as representative as possible, it was essential to include the four largest producers. To save time and expense, only two of the smaller group were included, namely Coligny and Koster. The grounds on which these two were chosen were as follows. For reasons that will be explained later[9], farmers were contacted through the co-operatives to which they belonged. Very roughly,

Lichtenburg, Delareyville and Coligny fall into the area of operation of Noord-Westelike Koöperatiewe Landboumaatskappy (referred to after this as NWK), Wolmaransstad and Schweizer-Reneke into Suid-Westelike Transvaalse Landbou Koöperasie's area (SWT), Klerksdorp area (SWK), while Koster has its own co-operative, Koster Koöperatiewe Landboumaatskappy (KK). Since it was necessary to contact NWK to organize the survey in Lichtenburg and Delareyville, it required no additional arranging to include Coligny. The choice to approach KK rather than SWK was made arbitrarily.[10] The six magisterial districts which formed the sampling frame were therefore Coligny, Delareyville, Koster, Lichtenburg, Schweizer-Reneke and Wolmaransstad.

2.1.2.2 Population

Within these six districts there can be few farms on which no maize is produced.[11] The farms most relevant to the research were those on which maize contributed more to income than any other crop or animal. These farms, or rather farming units, made up the target population.

The distinction between 'farms' and 'farming units' is important. For census purposes, the Department of Statistics defines a farming unit as consisting of "one or more separate farms or portions of land, whether they are contiguous or not, provided they are situated in the same magisterial district and are operated as a single unit".[12] The distinction between magisterial districts is immaterial.[13] But what is important is the operation of one or more separate farms or portions of land as a single unit: unless the various sections "lie far" apart, the machinery used on one part is likely to be used on the others too. So farmers' choice of technique is like to be made with the entire farming unit in mind, and it was in respect of this unit that they were questioned.[14]

The precision of a sample is determined by its stability and its representativeness. The former depends on the size of the sample, both absolutely and in relation to the

population, and the latter primarily on the method of selection.

2.1.2.3 Stability

If it is planned to draw statistically valid inferences from a survey, then some form of random sample selection is essential. Statistical validity was an important consideration and the initial intention was to select a sample on a random basis. In the event, it was not possible to obtain a list of the population because the three co-operatives were reluctant to make their members' registers available, and could not have been expected to release confidential information about the percentage of each member's income derived from maize.[15]

It did not seem reasonable to ask the co-operatives to identify farmers who qualified in terms of locality and source of income, and then to select them on a statistically random basis. So some form of non-random sample had to be accepted. One result was that no minimum sample size could be specified that would enable sampling errors to be estimated within pre-determined confidence limits. The best that could be done was to make the sample size as large as possible, given the constraints of time and expense.

Prior to the introduction of random sampling techniques in 1976, the Department of Agriculture visited about 100 farmers each year during its cost surveys.[16] After 1976, this fell to about 90.[17] In the six weeks allocated to the author's survey, it proved impossible to interview this number of farmers. The length of the questionnaire and practical problems, such as travelling between farms, waiting, and not interfering with meal-times, reduced the average number of interviews per day to two. At the end of the six weeks, 61 farms had been visited.[18]

Table 1 shows the number of farms of the 61 visited which were being operated by their present owners in each of

these four years. The sample sizes correspond to these numbers.

TABLE 1: The Size of the Sample 1968, 1973, 1977 and 1981.

Year	Number of farming units
1968	37
1973	48
1977	54
1981	61

It is not possible to calculate the proportion of the population comprised by these samples because the size of the population is unknown, but it was always greater than 1 percent.[19]

2.1.2.4 Representativeness

To overcome the absence of a population list, the co-operatives were asked to select names from their members register according to certain criteria. This they agreed to do. They also undertook to approach the farmers concerned to request their participation in the survey. This non-random sample selection method makes it impossible to determine the degree of representativeness of the findings according to standard statistical criteria.[20] Their generality is therefore a matter of opinion.

The selection technique was nevertheless designed in such a way as to achieve a characteristic cross-section. The technique adopted by the Department of Agriculture in its annual surveys[21] was to include "a representative number of farms of all size groups ... (excluding only) exceptionally big farming business ... (and) very small farms which may be compared with small-holdings"[22] in its sample. "An attempt (was) also made to have the co-operating farmers

spread evenly over the entire region and not merely concentrated in certain parts of it."[23]

Co-operatives were asked to select respondents according to the two criteria, farm size and geographical location. In addition, they were explicitly requested to disregard the reputed 'efficiency' or 'inefficiency' of farmers.

2.1.2.4.1 The size distribution of farming units

There were several practical difficulties both in specifying the number of farming units in each size group, and in selecting farms to fit the specifications. The first of these was caused by the lack of adequate data. Most agricultural censuses do include frequency distributions of farming units according to surface area, by magisterial district. But these are the distributions of all farms, not of those that derive their income chiefly from maize. The co-operatives themselves are the best source of this information, but do not keep it in the form of neatly categorized frequency distributions. It is also confidential. Once more, it did not seem reasonable to ask for it to be categorized - no small task - for the purposes of the survey.

So census data was used to give the co-operatives a rough selection guide. Following the Department of Agriculture's precedent, the largest and smallest census categories were excluded. But even so, at least two of the co-operatives experienced difficulty in finding members who met the requirements at the lower end of the scale, and it seemed that these categories were over-represented in the selection guide. In retrospect, this is not surprising because the census data on which the guide was based was collected in 1976 - no census statistics have been published since then.[24] And, as the findings of chapter 3 show[25], the average surface area of farming units appears to have increased considerably since then.

Another problem in meeting the specifications concerned the 13 year period of the study. Farming units which fell into one category in 1981 may have fallen into another in previous years. Again, chapter 3 shows that this happened frequently. Short of requesting the co-operatives to do a great deal of additional research, it would not have been possible to know this in advance, and even if it had been, it would have required either an extra-ordinary balancing act or the visiting of many extra farms, to obtain the right distribution in each of the 13 years.

Finally, not all the farmers who had been selected and who had agreed to participate, were available for interviews at times that could be accommodated in the author's schedule. Time and expense simply did not allow more than a limited amount of waiting and re-tracing of steps. Thoughtfully, the two larger co-operatives had placed more than the requisite number of names on the list, while the third made ad hoc telephone arrangements when necessary. But this did sometimes mean that farmers in the 'wrong' size group had to be visited.

In the end, practical difficulties overcame theoretical niceties, and the predetermined size distribution was abandoned. All that was attempted was, in a very rough and ready sort of way, to see that a 'reasonable' spread of farming units of different sizes was visited. Table 2 overleaf suggests that this objective was met to a fair degree.

The standard deviation[26] of the sample for 1981 indicates that the 'spread' was widest in that year. Not surprisingly, as the size of the sample and the mean became smaller - working back towards 1968 - so too did the standard deviation.[27]

The 'fairness of the spread' depends not only on its breadth, but on its correspondence to the size distribution of the population as a whole. Table 3 overleaf compares the

TABLE 2: The Distribution of the Gross Surface Area in Various Years of Farming Units Visited

Area in hectares	1968	1973	1977	1981
	% of sample	% of sample	% of sample	% of sample
0 - 199	4,2	3,1	0,0	8,5
200 - 299	16,7	9,4	2,4	8,5
300 - 499	29,1	25,0	41,5	22,0
500 - 999	33,3	50,0	24,4	22,0
1000 - 1999	12,5	9,4	19,5	25,4
2000 and over	4,2	3,1	12,2	13,6
TOTAL	100,0	100,0	100,0	100,0
Mean (ha)	664	709	1033	1155
Standard deviation (ha)	391	543	951	1202

TABLE 3: The Distribution of the Gross Surface Area of Farms Visited and Comparative Census Data

Area in hectares	% of Sample (1968)	% of Population (1969)	% of Sample (1973)	% of Population (1973)
0 - 199	4,2	23,2	3,1	27,1
200 - 299	4,2	12,7	9,4	13,2
300 - 499	33,3	23,9	25,0	23,2
500 - 999	33,3	25,8	50,0	23,5
1000 - 1999	20,8	11,1	9,4	10,1
2000 and over	4,2	3,3	3,1	2,9
TOTAL	100,0	100,0	100,0	100,0
Mean (ha*)	775	587	709	548
Standard deviation (ha*)	456	1004	543	695

(*1973, 1977, 1981 hectares; 1968 morgen)

Sources: See Note (28)

Table 3 continued.

Area in hectares*	% of Sample (1977)	% of Population (1976)	% of Sample (1981)
0 - 199	0,0	28,0	8,5
200 - 299	2,4	12,7	8,5
300 - 499	41,5	22,3	22,0
500 - 999	24,4	24,2	22,0
1000 - 1999	19,5	9,9	25,4
2000 and over	12,2	2,9	13,6
TOTAL	100,0	100,0	100,0
Mean (ha*)	1033	553	1155
Standard deviation (ha*)	951	855	1202

(*1973, 1977, 1981 hectares; 1968 morgen)

Sources: see note (28)

values in Table 2 for maize farms to census data for all farms in the region.

The comparison is only rough because no census data on farms size is available in 1968, 1977 and 1981. The closest equivalents are to be found in the 1969 and 1976 censuses.

In the middle classes - from 200 to 999 hectares - the two distributions are fairly similar. Only in the smallest and largest classes is the comparison poor: the percentage of small farming units in Table 2 is disproportionately low, and that of large farming units disproportionately high, except in 1973. To some extent this reflects the intentional exclusion of very small farms, but since it was also the intention to exclude very large farms, it may be that the samples were unrepresentatively 'top-heavy'.[29] Without more appropriate information, one cannot be certain about this, but in the analysis which follows, this qualification should be borne in mind.

2.1.2.4.2 The geographical distribution of farming units

The second criterion by which the co-operatives were asked to select farms was geographical location. Many of the difficulties described in the previous section were encountered again.

So, as before, all that was attempted eventually was "to have the co-operating farmers spread evenly over the entire region"[30], which, as Table 4 and Figure 1A overleaf, illustrate was also achieved fairly satisfactorily.

The dispersion was at its most even in 1981, the only year for which prior data was available. In earlier years, the pattern was fairly similar - Wolmaransstad in 1968 being the only notable exception. In practice, the dispersion in all four years was rather wider than is suggested by Figure 1A, because a number of farming units consisted of tracts of land in two or more magisterial districts.[32] In Figure 1A, the location of such farms is marked at the site of the owner's residence.

Once more, though the population is not perfectly represented by census data, comparison of the distributions in Table 4 with the relevant census data shows the degree of representativeness of the samples. From Table 5 overleaf it can be seen that while the 'fit' is generally reasonable, Lichtenburg is consistently under-represented. The corresponding over-representation is shared more or less equally between Delareyville, Schweizer-Reneke and Wolmaransstad. For Coligny and Koster the match between census and sample is close.

2.1.2.5 Reliability

Errors in inferences about the population as a whole based on samples, may be divided into two categories: sampling errors and non-sampling errors. The first arise from the fact that data has been collected from a small proportion of the population, and so are inherent in all samples,

TABLE 4: The Geographical Distribution in Various Years of Farming Units Visited

Magisterial District	1968		1973		1977		1981	
	No. of Farms	% of Sample	No. of Farms	% of Sample	No. of Farms	% of Sample	No. of Farms	% of Sample
Coligny	2	5,4	2	4,2	4	7,4	4	6,5
Delareyville	6	16,2	8	16,7	9	16,7	12*	19,7
Koster	6	16,2	6	12,5	8	14,8	10	16,4
Lichtenburg	5	13,5	11	22,9	12	22,2	12	19,7
Schweizer-Reneke	7	18,9	10	20,8	10	18,5	11	18,0
Wolmaransstad	11	29,8	11	22,9	11	20,4	12	19,7
TOTAL	37	100,0	48	100,0	54	100,0	61	100,0

(* includes one farming unit in the Vryburg magisterial district[31]).

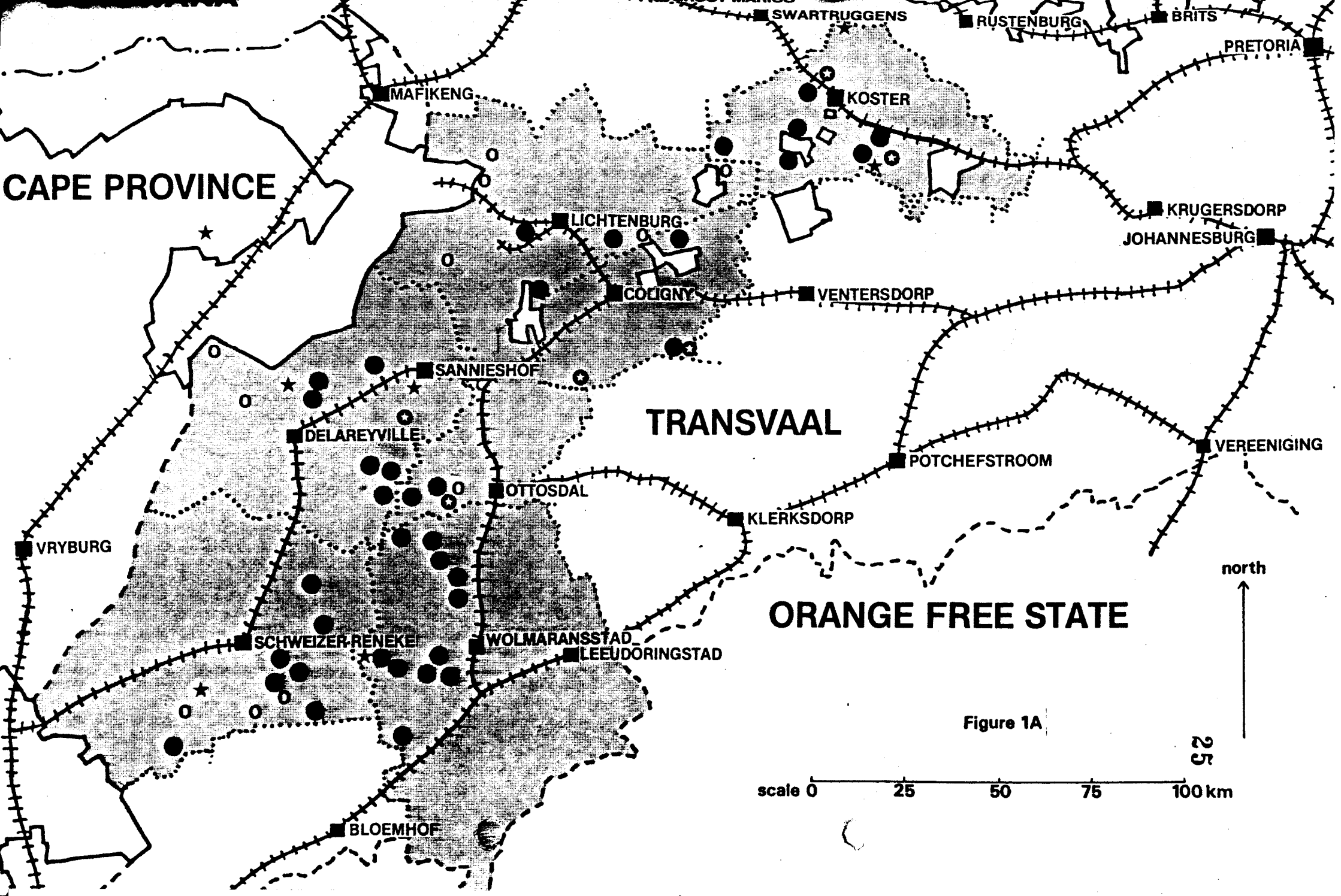
SWARTRUGGENS
RUSTENBURG
BRITS
PRETORIA
MAFIKENG
KOSTER
CAPE PROVINCE
LICHTENBURG
KRUGERSDORP
JOHANNESBURG
COLIGNY
VENTERSDORP
SANNIESHOF
TRANSVAAL
DELAREYVILLE
VEREENIGING
POTCHEFSTROOM
OTTOSDAL
KLERKSDORP
VRYBURG
north
ORANGE FREE STATE
SCHWEIZER-RENEKE
WOLMARANSSTAD
LEEUDORINGSTAD
BLOEMHOF
scale 0 25 50 75 100 km
25

Figure 1A

FIGURE 1A: The Geographical Distribution of Farming Units Visited

KEY

(Map to be read in conjunction with Table 4)

- ● - farming unit for which data was available for 1968 -1981
- O - farming unit for which data was available for 1973 - 1981
- ✪ - farming unit for which data was available for 1977 - 1981
- ★ - farming unit for which data was available for 1981 only
- ▒ - area covered by six magisterial districts included in survey
- —·—·—·— - South Africa - Botswana border
- ——————— - Bophuthatswana boundary
- — — — — — - provincial boundaries
- ..... - magisterial district boundaries
- ++++++++++++++ - railways
- ■ LICHTENBURG - main cities/towns

Sources:

1. Bureau for Economic Research re Bantu Development (BENBO): "Bophuthatswana Economic Revue 1975", Pretoria, 1975, map between pp.34, 35.

2. RSA, Department of Community Development, Chief Director of Surveys and Mapping: 1:250 000 topocadastral maps no's 2524, 2624, 2724, 2526, 2626, 2726, Cape Town, 1980.

TABLE 5: The Geographical Distribution of Farming Units Visited and Comparative Census Data

	% of Sample (1968)	% of Population (1968)	% of Sample (1973)	% of Population (1973)	% of Sample (1977)	% of Population (1976)	% of Sample (1981)
Coligny	5,4	4,9	4,2	7,6	7,4	7,3	6,5
Delareyville	16,2	13,8	16,7	13,8	16,7	12,2	19,7
Koster	16,2	14,8	12,5	14,5	14,8	15,7	16,4
Lichtenburg	13,5	25,5	22,9	31,6	22,2	29,7	19,7
Schweizer-Reneke	18,9	14,9	20,8	16,9	18,5	13,7	18,0
Wolmaransstad	29,8	26,1	22,9	15,6	20,4	21,3	19,7
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Sources: See Note (33)

however carefully drawn. The second are caused by not adhering to sample specifications, or by recording incorrect information, and therefore depend on the care with which a sample is drawn and the data collected.

2.1.2.5.1 Sampling error

The degree of sampling error depends upon the degree of stability and representativeness of the sample. In the case of random samples, the probable sampling error can be estimated within chosen confidence limits. For non-random samples no such mathematical calculations can be made, but it is still possible to get a sense of the likely order and direction of sampling error from basic facts. For example, the fact that the sample size diminishes the farther back in time the collection of data goes, indicates that the degree of stability diminishes too. So the estimates for 1981 are likely to have the least degree of sampling error, and those for 1968 the greatest. If the samples were random, the probable increase in the error would be less than proportionate to the decrease in the sample size[34] and it is probable that similar relationship exists here.

The sample sizes in Table 1 correspond to the maximum number of observations possible in each year. In many cases data is missing but generally the number of unrecorded or obviously incorrect[35] observations is small. Only instances where the number of errors and omissions is significant have been noted.

Representativeness will have been reduced by three factors:

(a) the unwillingness of some farmers to take part in the survey;

(b) the inclusion of a disproportionately large number of very large farms and a correspondingly small number of very small farms; and

(c) the under-representation of farms in the Lichtenburg magisterial district and the over-representation of

those in Delareyville, Schweizer-Reneke and Wolmaransstad.

No record is available of the proportion of farmers contacted by the co-operatives who did not agree to be interviewed. But none of the co-operatives complained of difficulties in this respect. So it can be assumed that the incidence of refusal was not great. However, it could be argued that the data reflects rather better-than-average farming practice, because farmers who felt they had something to hide would have been more likely to refuse to be questioned. But even if this is so, it is not clear what the implications are for data on mechanization and employment. It could lead to an over-estimate of the former and an under-estimate of the latter, or quite the reverse.[36] So the influence of factor (a) on sampling error cannot be predicted, but it is probably small.

To the extent that factor (b) was present, the level of mechanization is likely to have been over-estimated and the level of employment under-estimated. The effect of factor (c) is less obvious. On the one hand, farming units in the Lichtenburg district on average produce more maize than those in Delareyille, Schweizer-Reneke and Wolmaransstad.[37] So under-representing Lichtenburg may have led to under-estimating mechanization and over-estimating employment. On the other hand, the average size of farming units appear to have grown faster in Delareyville, Schweizer-Reneke and Wolmaransstad than in Lichtenburg.[38] So, capital-intensity and retrenchment may also have grown faster (in Delareyville, etc.). This assumes that output per farming unit and mechanization are positively related[39] - an assumption borne out in practice.[40]

The relative strength of the factors is unknown. However, the presence of two factors which tend to cause an upward bias in estimates of the number of combines and a downward bias in estimates of the number of jobs as against one which does the opposite, suggests that the analysis may reflect a higher-than-average level of mechanization and a

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lower-than-average level of employment. But there is no reason to expect the distortion to be gross.

2.1.2.5.2 Non-sampling error

Much harder to assess, is the presence and influence of non-sampling errors. The source of such errors is incorrect information, recorded either because inaccurate answers were given to questions, or because questions were put to the wrong respondents. To some degree both occurred.

Of the 61 farming units one in fact lay completely outside the sampling frame, as can be seen in Figure 1A. In three other cases, while the farmer's residence lay just inside the boundary, some of the maize fields lay just outside it. Although there was a strong case for excluding the former, and a weaker one for excluding the latter, the information from all four was included.[41] None of the four displayed a pattern of mechanization and employment appreciably different from the overall, so the non-sampling error from this source is likely to be negligible.

The two most important reasons for incorrect answers are ambiguity in the questions and inaccurate records. Because most of the questions were of a fairly straightforward nature, seeking objective statistical or simple factual information rather than opinions[42], it is reasonable to discount ambiguity as a significant source of error.

The possibility of error from inaccurate records needs much closer examination. Is it reasonable to expect accurate information from farmers on events that took place, in some cases, as long as 13 years ago? The answer depends on the nature of the information. Few farmers will remember or have year-by-year written records of the precise number of seasonal workers employed for maize harvesting and weeding. But, if one starts by asking each farmer what

techniques he used to harvest and deliver maize, and when he changed from one technique to another, few farmers will have difficulty in remembering. Not one farmer in the survey had to look up written records to answer this. Attaching employment to techniques is easier than remembering it in the abstract. So farmers were then asked roughly how many workers they had employed with each technique, for how many weeks they had been employed, whether they had included men, women or children, where they had been recruited, and so on. Because the number of jobs and the duration of employment varied from year to year, some farmers gave their answers in the form of a range, while others gave them as approximate averages.

For this reason, the employment estimates in chapters 4 and 5 should not be accorded undue accuracy: they are only approximate. But since almost all are averages, and since the object is merely to establish trends, not to make precise calculations, the quality of the data is quite acceptable. Given the non-random nature of the samples, to have aimed for a greater degree of accuracy would have been inappropriate. The data in chapter 3 - on techniques in use, farm size and yield per hectare - is likely to be more accurate.

The probable degree of non-sampling error therefore varies according to the variable. Where it is likely to have been greatest, this has been remarked on either in the text or in the footnotes.[43] But one generalization does seem in order: in common with sampling error, one can expect the size of the non-sampling error to increase with the age of the data. Both for statistical and for non-statistical reasons the estimates for 1968 are likely to be less accurate than those for 1981.

One other potential source of non-sampling error arises from what one could call 'class bias'. Because all the data was collected from farmers - representing the interests of capital - and because much of it concerned the employment, wages and working conditions of labour,

the information could, consciously or unconsciously, have been biased in favour of capital. Perceptions of matters involving opposing class interests are likely to depend on the class to which the respondent belongs. The ideal would have been to interview both farmers and workers. On farms this was generally not possible, and might even have been counter-productive in the case of permanent workers[44]. But the off-farm residence of seasonal workers - out of season - made it easier to interview them.

It was partly with the intention of assessing the degree of non-sampling error that a second field trip, to the Transkei, was undertaken. This aspect of the research is described in detail in section 2.2. What is relevant here is that, in the course of the trip, seasonal workers employed in 1981 and previously on four of the farms visited, were interviewed, and the same questions concerning inter alia the number of workers employed, the durations of employment and the payment of wages were asked. Quite without prompting, most of the answers bore a close resemblance to those given by the farmers concerned. It was hoped to continue this exercise in Bophuthatswana, where the majority of seasonal workers not resident on white farms, live.[45] But time did not permit. While the four farms for which it was possible to cross-check information only represent about six percent of the total, the corroboration received in these cases does suggest that the error resulting from class bias is not serious.

2.1.2.6 Comparability of samples

From about 180 hours of interviewing[46] more data was collected than could be analyzed manually for each of the 13 years. Partly for this reason and partly because of the problem of comparability[47], it was decided to select four years for close scrutiny. The years chosen were 1968, 1973, 1977 and 1981, which divided the 13 years into three more or less equal periods.[48]

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This had the effect of dividing farmers into four groups:

Group A: those from whom information was available from 1938 onwards, which included the 37 farmers

Group B: those from whom information was available from 1973 onwards, which included the 37 in group A plus a further 11; making a total of 48

Group C: those from whom information was available from 1977 onwards, which included the 48 of group B plus a further 6; making a total of 54

Group D: those from whom information was available in 1981, which included the entire group of 61 farmers.

The four correspond to the four samples whose sizes are reflected in Table 1.

An alternative procedure would have been to divide the 61 into four mutually exclusive groups, namely, those from whom information could be obtained for all 13 years; those for whom this was possible only for 8 years; and so on. The size of the respective samples would then have been 37, 11, 6 and 7. This method was rejected because only the largest sample would have had a reasonable degree of statistical stability.

One complication inherent in the classification that was adopted concerns comparability. If one wishes to compare say, the percentage of the maize crop harvested mechanically in 1968 with the analogous percentage in 1973, 1977 and 1981, the ideal is to use the same sample, say group A, each year. If the percentage for group A in 1968 is compared with the percentage from group B in 1973, group C in 1977 and group D in 1981, the level of comparability is not as high. On the other hand, the strength of this method is that it uses the maximum amount of information in each year. Both approaches have something to

recommend them, and so it was decided to make both possible in presenting the data. This is the reason why most of the tables in chapters 3, 4 and 5 take the following form:

Group	1968	1973	1977	1981
A	x	x	x	x
B	-	x	x	x
C	-	-	x	x
D	-	-	-	x

Each x stands for a particular value. By definition, no information was available for groups B, C and D in 1968, groups C and D in 1973, and group D in 1977.

In graphing the data, to make trends more easily discernible, only the values for group A in 1968, group B in 1973, group C in 1977, and group D in 1981 have been represented. Thus, while the maximum amount of data has been used in each year, the level of comparability is less than the maximum[49]. This should be borne in mind when interpreting the graphs.

The whole technique of analysis and representation is like taking a series of snapshot stills as opposed to shooting a movie. The detail of the movie is richer, but more difficult to take in, whereas the snapshot misses out what happens between pictures, but makes it easier to study and compare what is in them. It is hoped that this technique will leave readers in no doubt as to the magnitude of many of the changes that have occurred on maize farms in the Western Transvaal since 1968.

2.1.3 Organization of survey

For a variety of reasons, farmers are often reluctant to be interviewed.[50] It is therefore advisable to approach them through an acceptable channel, such as agricultural

co-operatives[51], of which most are members.[52] The three co-operatives from whom assistance was requested were most helpful, both in securing the participation of farmers and in giving practical advice on how to organize the survey. It is no empty acknowledgement to say that without their help, the field research would not have been possible.

The survey was conducted during the second half of February and March (1982) - a relatively slack season on most maize farms.[53] This made it easier to arrange interviews, but it did mean that the harvesting operations that were the focus of the research were not in progress.[54] Fortunately this was not essential because when the idea of the research was first mooted - in 1979 - the full range of basic harvesting techniques had been observed.[55] An additional advantage of undertaking the field research before the harvesting season was that it was possible to interview a number of seasonal workers in an off-farm situation shortly afterwards.[56]

The pattern of interviews was roughly as follows: from the list of names, addresses and telephone numbers[57] supplied by the co-operatives[58], the names of a small group of farmers living not too far apart[59] were selected. These farmers were then contacted by telephone to arrange suitable meeting times.[60] Since most interviews lasted about three hours, it was never possible to organize more than two in a day.[61]

The first half-hour of interviews was generally taken up with casual conversation[62], after which the formal business of working through the questionnaire was tackled. All interviews were conducted in the language of the respondent's choice, which, in most instances, was Afrikaans.[63] The importance of this cannot be over-estimated. It is also difficult to exaggerate the value of face-to-face interviews:[64] not only was a near-complete response[65] - but often almost as much as to be learnt from casual conversation as from the questionnaire.[66]

2.2 THE SURVEY OF SEASONAL WORKERS IN THE TRANSKEI

By comparison to the survey of farmers, the preparation and organization of the survey of seasonal workers was rudimentary. Though a questionnaire was drawn up and used (see Appendix B below), so that there was some system to the gathering of information, informality and improvisation were the hallmarks of the survey. So it was in no sense a sampling survey, and the evidence that was collected, though valuable, was in no way amenable to detailed statistical analysis. Sheer lack of data about the population would have made formal sampling impossible even had this been contemplated.

The visit to the Transkei was undertaken partly to try to corroborate the information given by farmers[67], but more to try to find out more about the characteristics of seasonal workseekers. Initially two trips were planned, one to the Transkei and the other to Bophuthatswana, the two main off-farm sources of seasonal workers,[68] but time allowed only one. It was carried out over about a week in early May (1982) just prior to the departure of workers to the Transvaal and Orange Free State for the start of the harvesting season.

One of the questions farmers had been asked concerned the place of residence of seasonal workers. It emerged that several farmers employed teams assembled and controlled by the same man. Though no-one knew his surname, it appeared that he lived near Dordrecht in the North-Eastern Cape, and that he owned a shop and some trucks.

In Dordrecht, an evening in the 'pub' and a morning's questioning of shop-keepers, workers and officials led eventually to his name[69] and whereabouts - in the village Umhlanga[70], on the railway line between Dordrecht and Indwe, just inside the Transkei border. Through this connection, contact was established with other men in the village who also assembled teams of seasonal workers who were employed inter alia in the Western Transvaal, and those contacts led in turn to several others. In all, nine such 'foremen' and several other people who had

worked in seasonal teams were interviewed in three villages - Umhlanga, Macubeni[71] and St. Augustine's - in the Glen Grey magisterial district. (See Figure 32, below.)

From discussions with farmers, it was also apparent that seasonal workers had in the past been recruited from Sterkspruit[72] in the Herschel magisterial district. In that part of the Transkei it turned out that recruiting was done on a rather different basis: whereas in Glen Grey teams were put together by foremen who were in direct contact with farmers[73], in Herschel most recruiting was done by labour agencies operating from Sterkspruit. Officials of four agencies[74] were interviewed, and it was established that only one acted on behalf of Western Transvaal farmers and did so only on a very small scale.[75]

Most discussions took place in a mixture of Xhosa, English and Afrikaans. The author does not speak Xhosa, but was able to arrange to be accompanied in Glen Grey by a member of the community who was thoroughly trilingual.

Only a part of the information gathered in the Transkei was drawn on directly[76] in writing this thesis. It is planned to make other findings available in a separate paper.

FACTORS INFLUENCING EMPLOYMENT : CHANGES IN TECHNOLOGY, FARM SIZE AND YIELD

Many factors have a bearing on the number and characteristics of workers a farmer will employ to harvest his maize crop. In terms of neo-classical price theory, they are summed up in the demand and supply curves for labour. These are held to determine both the number of workers who will find employment and the wage rate they will receive. This chapter concerns neither the wage rate nor - more fundamentally - the validity of the neo-classical model. It accepts the framework afforded by the model, and focuses on the three variables which appear to be the most important, determinants of the position of the demand curve, and thereby, to a large extent, of the number of workers employed. It will be shown later that these factors influence not only the number of workers but also their characteristics.

The three variables concerned are technology, the surface area of farming units and the crop yield per hectare. Of the three, technology has the most profound long-term influence.

3.1 CHANGES IN TECHNOLOGY[1]

The annual agricultural cycle on maize farms in the Western Transvaal starts with the first spring rains, usually in October. The moisture softens the rock-like winter ground making it easier to plough and more welcoming as a seed-bed. Ploughing and planting have to be done quickly before the moisture evaporates or drains away, leaving the soil unworkable again. So spring planting is a time of concentrated activity, with farmers and workers often using tractors and planting equipment from before daybreak until well into the night. But because this is largely a

mechanical operation nowadays, there is no call for large teams of seasonal workers. Nor are they needed for the less hurried activities that follow soon after - the spraying of chemical weed-killers and the spreading of fertilizer.

Only when the khaki-bush, the castor-oil bush and the wild oats - which are resistant to most weed-killers - appear in December or January do farmers think of calling in seasonal workers. By this stage, the maize is usually too high to take tractors into the fields to plough up the weeds. This is still possible if the rows are wide enough to let a small tractor in, but generally they are planted more closely now, and there are other reasons - for example, to do with soil compaction - why this method of controlling weeds is no longer popular.

By February or March most weeding is over. The maize has started to lose its greenness and little needs to be done until it is dry enough for harvesting in May or June. If ground-nuts or sunflowers or sorghum have been planted harvesting activities start a month or two earlier. Sunflowers and sorghum are harvested almost entirely by combine nowadays, although the work of gathering the left-overs 'agter die masjien' - 'gleaning' to be more formal - is still done by hand. In contrast, ground-nuts are still mostly reaped manually and call for a good deal of seasonal labour for a short period.

So, if they are lucky, seasonal work-seekers may find almost continuous employment from December to August. But it is not until the maize has ripened that most activity begins. Then, as in the planting season, work starts early - as soon as the frost has melted - and goes on until darkeness falls, and often later for combines with lights. This is the time when almost every farmer hires seasonal workers whether it is for the full, traditional gamut of harvesting activities - reap, thresh, bag, and deliver, a rarity nowadays - or to glean after the combine has done its work. There is haste. The sooner

the harvest is in the sooner farmer and worker get paid, and the shorter the season the earlier the ploughing that completes the cycle can be done.[2]

Changes in technology have affected almost every activity in the agricultural cycle and continue to do so. Only three sorts of activity are considered here - the most important of those which have traditionally involved seasonal workers, namely weeding and harvesting and delivering the maize crop.

One could argue that harvesting and delivery are simply two parts of the same activity. They are distinguished here because it is possible to alter the technology of one without changing that of the other. Weeding is clearly a separate operation altogether.

3.1.1 Harvesting

'Harvesting' is taken to refer to the two separate operations, reaping - or removing the 'head' from the stalk - and threshing - or removing the seeds from the head. Both can be done by hand or mechanically but it is many years since maize was last threshed by hand in the Western Transvaal. In describing the various techniques, hand threshing is not considered. The basic alternatives are therefore: reaping by hand and threshing mechanically, or reaping and threshing with the same machine, i.e. (mechanical) 'combine' harvesting. In both cases, a number of variations are possible.

3.1.1.1 Hand harvesting

As one would expect, hand-reapers walk down the rows - normally though not always one to a row - picking the heads from the stalks and putting them into a sack which they carry with them. Most farmers keep their empty plastic fertilizer bags for this purpose.

The sacks can be handled in various ways:

(i) they can be emptied in a heap at the edge of the field, which means that the threshing machine must be moved from heap to heap;

(ii) they can be placed (unemptied) in a heap for collection and transport to the threshing machine (which stays in one place);

(iii) they can be emptied directly onto a trailer drawn by a tractor which moves slowly through the fields with the reapers. When the trailer is full, the load is taken to the threshing machine (which again stays in one place). This is known as 'hand harvesting in bulk'.

Method (iii) seems to have become the most widely-used before the adoption of mechanical harvesting: about 75 percent of farmers[3] said that they had been using it at the time of the change, as were most of the farmers who were still harvesting wholely or partly by hand in 1981.[4]

A survey of about 100 Western Transvaal maize farmers undertaken by the Department of Agriculture in 1967[5], found that more than 70 percent of farmers were using method (ii) at that stage, and only about 13 percent method (iii). So there must have been a considerable swing in favour of the latter during the later '60s and early '70s, before harvest-mechanization occurred. Because it involved the re-organization of existing resources rather than the purchase of new capital equipment, it is easy to dismiss this change of technique as being of little importance. In fact, as is explained later, this re-organization saved more labour than the silos which were were being built at about the same time although silos may have had a more profound influence on the pattern of employment in the long run.

The number of workers and the capital equipment is much

the same for all three methods. Typically, a team of seasonal workers, anything between ten and two or three hundred strong is employed to do the reaping, while the tractors used for transporting the heads for threshing, which may vary from one to a small fleet, are driven by permanent workers.

Threshing machines are really little more than horizontally rotating cylindrical sieves through which the heads, leaves and all, ('blaarkoppe') are passed. The dryness of the maize[6] and the violent motion ensure that the leaves are quickly torn off and the seeds loosened from the cobs. The seeds fall through the sieve into a chute to which a sack is attached, and the cobs and leaves fall out of the lower end of the sieve.[7] The machines are powered by a tractor. Most combines, however large and sophisticated, operate on the same principle, though they may have their own power source. Threshing machines are frequently still used to process the gleanings picked up behind the combine.

Reaping and threshing may be carried out simultaneously or in sequence. Where they are done simultaneously the team of seasonal workers is divided in two, most of the men staying with the threshing machine to do the heavy work of handling sacks.[8] Often, though, the whole team reaps, and then, when sufficient heads have been collected, changes to threshing and delivery. From the point of view of employment, the difference in technique is not important.

On nearly 80 percent of farms in the survey[9], only one threshing machine is or was used. So, in most instances the requisite capital equipment for threshing would be one tractor and one threshing machine, only one tractor driver - a permanent worker - is called for, and two or three seasonal workers to keep the hopper of the threshing machine full.[10]

3.1.1.2 Combine harvesting

In contrast to wheat[11], maize was harvested entirely by hand until the 1950s when mechanical combine-harvesters made their appearance in South Africa. Then, for the first time, farmers were faced with a choice between fundamentally different harvesting techniques - different not only in physical process, but also in the proportions of capital and labour involved.

For a decade or so combines made little impact. One can suggest several reason for this: the experimental nature of the machines, the relative ease with which seasonal workers could be found[12], the smaller size of farms[13], and information and learning costs.[14] It was not until the middle '70s that mechanical harvesting became the rule rather than the exception.[15]

The first combines were pulled by tractors and took their power from the propeller shaft of the tractor. For this reason they are often called 'PTO' (power take-off) combines. By comparison to later generations of combines, they are simple, robust, reliable, well-suited to smaller farming units, and relatively inexpensive, so it is not surprising to find that the majority of combines currently in use in the Western Transvaal are still of this type.

In the late 1960s a second fundamental change in the range of harvesting techniques occurred with the marketing of the first self-propelled ('SP') combines. These, as the name implies, were no longer drawn by tractors but were equipped with their own engine. They also had a considerably greater intake capacity which made it possible to harvest the same area with fewer machines and drivers. But relative to PTO combines, they are more complex, temperamental, suited to larger farming units, and expensive to buy and maintain.

The mechanical process is similar for the two types of combine. The machines move down the rows either cutting off the plants near the base and taking them in in their

entirety, or, in the latest models, stripping just the head from the stalk by means of revolving spiral. Whichever technique is used, the threshing process is much the same as described above, though there may be more than one rotating sieve. The threshed seeds are collected in a tank which is emptied periodically into a truck or trailer by an auger.[16] This can be done either when the combine is stationary or while it is moving.

Opinions vary as to the relative efficiency of combines and hand-harvesters, but even farmers most convinced of the superiority of machines still employ seasonal workers[17] to supplement them. Gleaning behind the combine is almost universal.

Sometimes, hand harvesting is the only option, for example, where many plants have been blown over, or where rain has made the ground marshy. A few farmers who use combines also choose to harvest a proportion of the crop by hand, generally either to attract seasonal workers who would otherwise be reluctant to take on gleaning (wage rates for gleaning are usually lower than for harvesting[18]), or to leave the stalks standing for fodder.[19]

In addition, the planting pattern may make it less efficient to reap some rows mechanically. In most instances rows are planted at intervals which match the intake equipment of farmers' combines. But ease-of-harvesting is only one of several considerations in the never-ending debate about ideal row-width and sometimes the spacing of rows is such that a small part of the crop has to be harvested by hand if an unnecessary waste of fuel is to be avoided..

The advent and growing sophistication of combines have therefore not led to the complete disappearance of seasonal employment at harvest-time, although they have certainly brought about a massive contraction in jobs.[20]

Typically mechanical reaping and threshing call for one or more SP combines and/or PTO combines and tractors; the

equivalent number of drivers[21] and, in the case of PTO combines, an additional worker travelling on each combine to clear blockages, etc.; and a team of seasonal workers for gleaning and perhaps for hand-harvesting a few rows.

3.1.1.3 The incidence and nature of change in harvesting techniques

The simplest and most direct way of measuring the rate of diffusion of harvest-mechanization is to classify farming units according to basic technique - hand or combine - over a period of time. Also, farmers might use both techniques simultaneously: this introduces an additional category. Table 6 has been constructed using the "snapshot" method described above.[22]

Table 6 and Figure 2 overleaf, show the pattern of change clearly. At the start of the 13 year period, about 80 percent of farming units were harvesting exclusively by hand. By the end, almost 90 percent were using combines only. Those who used both methods never represented more than a few percent. Surprisingly perhaps, the 'cross-over' year was reached only in 1974.

If the period 1968 - 73 saw a substantial number of farmers opting for combines, the four years that followed saw a still more substantial degree of change. This left little further scope for mechanization, and in the years between 1977 and 1981 only a few more farmers moved from hand harvesting to machines. The reasons for the acceleration that occurred between 1974 and 1977 are not immediately clear. However, one factor was almost certainly the record crop harvested in 1974, and the above-average harvests that followed in 1975 and 1977.[23] These would both have placed a strain on seasonal labour resources and have encouraged the purchase of machinery by providing farmers with larger-than-usual incomes.

TABLE 6: The Diffusion of Mechanical Harvesting Techniques.
(Percentage of Farming Units Using Each Basic Technique).

Year	1968			1973			1977			1981		
Group	Hand	Combine	Hand and Combine	Hand	Combine	Hand and Combine	Hand	Combine	Hand and Combine	Hand	Combine	Hand and Combine
A	81	16	3	54	38	8	11	81	8	5	89	6
B	-	-	-	56	38	6	13	81	6	6	88	6
C	-	-	-	-	-	-	13	82	5	5	89	6
D	-	-	-	-	-	-	-	-	-	7	85	8

FIGURE 2 THE DIFFUSION OF MECHANICAL HARVESTING TECHNIQUES

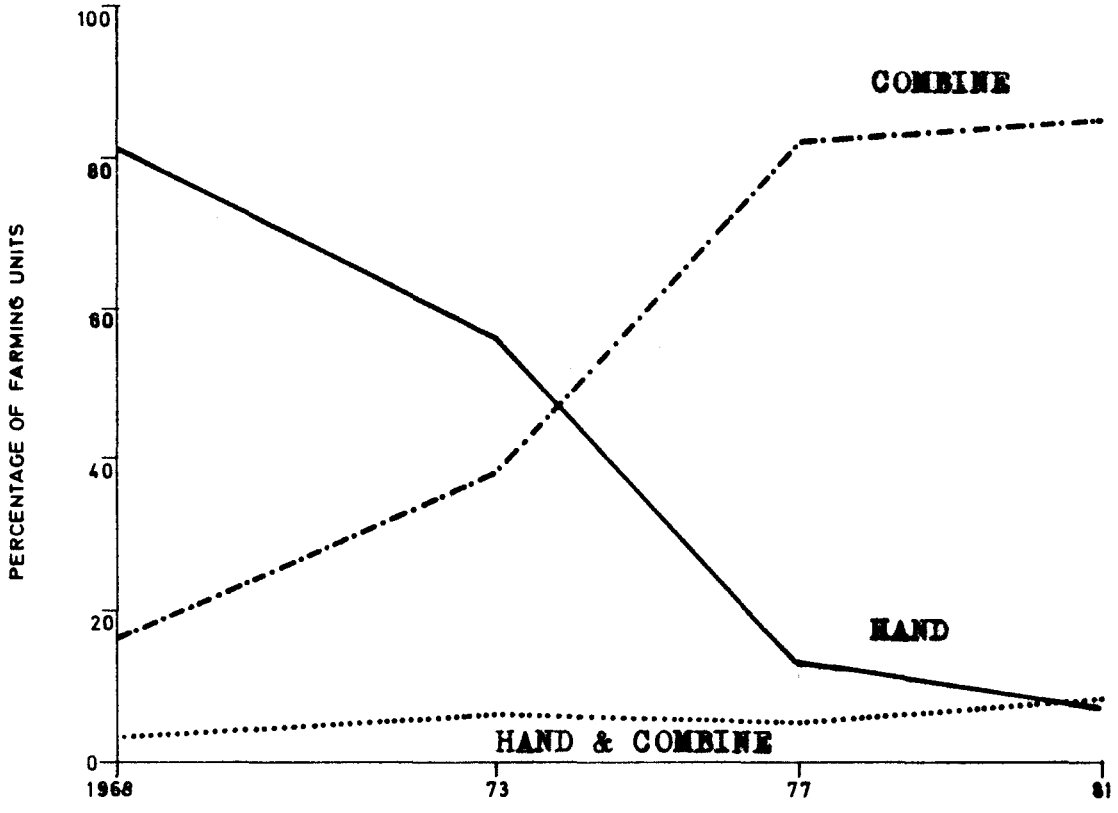
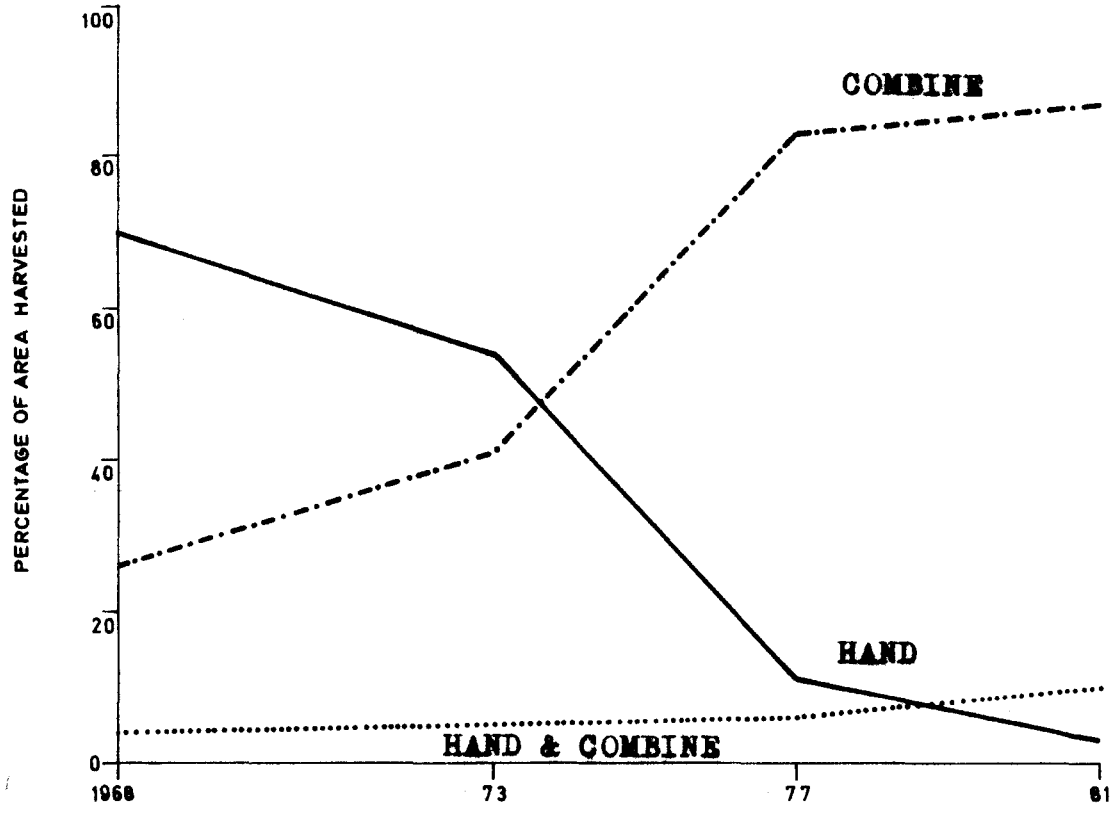


FIGURE 3 THE DIFFUSION OF MECHANICAL HARVESTING TECHNIQUES



A second and equally powerful factor was the increase in the size of farming units.[24] Although the average surface area seems to have increased continuously throughout the 13 years, the rate of increase between 1973 and 1977 was quite extra-ordinary: for group B (the largest comparable group) the average rise was 51 percent and for group A no less than 65 percent. The relative advantages of combines increase with the area harvested.[25]

Another important factor was the installation of bulk handling and storage facilities, which generally preceded the transition to mechanical harvesting. In essence, the building of silos eliminated the need for men in seasonal delivery teams, and this in turn made it possible - by introducing combines - to replace the large teams recruited in black rural areas with smaller teams drawn from local sources, which appears to have had several advantages for farmers. This is discussed in more depth in section 3.1.2.3 below.

Finally, the rise in mining and industrial wages that began in the early '70s[26], and the active policy of the mines to recruit more of its workers from within South Africa's borders[27], almost certainly attracted a significant number of male farm workers away from farm work.

All of these factors would have encouraged harvest mechanization.

Because farming units vary considerably in size, a more informative method of showing the transition process is to show the changing proportions of the total surface area - or better still of the total crop - harvested by the various methods. Complete details of the area and tonnage harvested were not collected which makes it impossible to calculate these statistics accurately. However enough data is available to estimate the relative areas reasonably well using weighted averages.[28] Table 7 and Figure 3 are constructed on this basis:

TABLE 7: The Diffusion of Mechanical Harvesting Techniques
(Percentage of Total Maize Area Harvested Using Each Basic Technique)

Technique / Year	1968	1973	1977	1981
Hand	70	54	11	3
Combine	26	41	83	87
Hand and Combine	4	5	6	10

For 1981, when sufficient data was available to calculate the respective areas precisely, the division was: hand 2 percent, combine 89 percent, hand and combine 9%. Splitting the last category into its two components, one arrives at the overall division: hand 5 percent, combine 95 percent.

Comparison of Tables 6 and 7 suggests that most of the first farmers who used combines cultivated areas that were larger than average. The 16 percent of farming units on which maize was harvested mechanically in 1968 accounted for as much as 26 percent of the total area harvested. This is what one would expect since the relative benefits to farmers of using combines - both financially and in terms of organization - increase as the area to be harvested increases.

In 1973 and 1977 the difference between the proportion of farming units using the various techniques and the corresponding areas, is much smaller - never more than 3 percent. This indicates that large and small farmer alike were choosing in favour of combines. This pattern continued in the last 4-year period, the only noteworthy difference concerning hand-harvesting in 1981: the 3 percent of the total surface area harvested by the 7 percent of farmers still using hand-labour means that it was mostly the

TABLE 8: Percentage of Farming Units Using 'Power Take-Off' and 'Self-Propelled' Combine Harvesters.

	1968			1973			1977			1981		
Group	PTO	SP	PTO + SP	PTO	SP	PTO + SP	PTO	SP	PTO + SP	PTO	SP	PTO + SP
A	17	0	0	33	11	0	58	25	6	59	24	11
B	-	-	-	32	11	0	57	26	4	63	21	10
C	-	-	-	-	-	-	58	25	4	65	21	9
D	-	-	-	-	-	-	-	-	-	62	23	8

smallest farmers who were still using manual techniques. Again, this is what one would expect.

Table 8 shows the percentage of farming-units in the various groups using the two types of combine-harvester.[29]

It is uncertain whether SP combines were available in the Western Transvaal by 1968, but whatever the case, all the combines in use at that point were tractor-drawn. The first SP combines went into use in the early '70s. PTOs generally seem to have been preferred to SPs: even in the years between 1973 and 1977 when the use of SPs spread most rapidly, purchases of PTOs grew proportionately faster.

Since 1977 there has actually been a reduction in the number of farms using SP combines. Many farmers complained of the unreliability of these machines and of the high cost and difficulty of maintaining them, and replaced or augmented them with PTO combines.

Surprisingly, perhaps, considering the substantial capital outlay and the proportion of the year for which combines stand idle, few farmers have ever employed harvesting contractors[30] and equally few have shared the ownership and use of a combine.[31] Almost all farmers own the harvesting machinery they use. The reasons for this do not need discussing, and the consequences for employment appear to have been minimal.

Of the minor crops produced in the Western Transvaal, groundnuts and sunflowers are the most important.[32] Details of harvesting techniques were not collected in the same depth as for maize, but it appears that groundnuts are still harvested by hand on most farms[33], while sunflowers have for some years been processed almost entirely by SP combines.[34] When groundnuts ripen, they need to be harvested quickly to prevent the pods from being torn off when the plants are pulled from the ground. The haste means that as many workers as possible are taken on and

planting is generally limited to a relatively small area.[35] For sunflowers, most farmers employ gleamers to work behind the combine, many of whom stay on for the much longer maize season and may also have been employed previously for weeding.[36]

3.1.2 Delivery

In the main maize producing regions of South Africa, farmers are obliged by law to sell all threshed ordinary maize[37] to the Maize Board. This is done through agricultural co-operatives, who also store the grain before despatch to purchasers. The farmer's final task is therefore to deliver his crop to a co-operative depot. There are two ways in which this may be done: in sacks or in bulk.[38]

3.1.2.1 Delivery in sacks

If the crop has been reaped by hand, it is passed through a threshing machine and emerges from an outlet chute into sacks. When a sack has been filled, the flow is cut off momentarily by closing the chute and the full sack is removed and replaced by an empty one. On the other hand, if the crop has been harvested by combine, the contents of the combine's tank will have been discharged every now and again into a bulk-trailer.[39] Most trailers are equipped with a sluice, which makes transferring the grain into sacks simple. If the trailer is not filled in this way, an auger can be used or the maize can be shovelled into sacks on the trailer.

All delivery sacks nowadays hold 70kg of maize, though in days gone by the standard weight was 200lb (90 kg). When a bag is full it should contain about 70 kg, but the exact weight needs to be checked before it can be sealed. So from the threshing machine or trailer sacks are moved to a scale and are topped up or emptied a little as need be. With the weight correct, they are sewn closed, ready for loading onto a truck or trailer.

Lifting 70 kg sacks is no easy task, especially when it has to be done all day and sometimes well into the night. Only men can be employed to do this - a requirement which often creates difficulties when it comes to raising a team of seasonal workers.[40] Normally four men - one at each corner of the sack - are assigned to loading, and another two on the truck itself for stacking and helping with unloading at the depot. Even for moving the sack from the threshing machine to the scale, two are needed, and another two to move it off and seal it. So usually at least ten men would be involved in the delivery process at the farmer's end. Then, of course, each truck or tractor towing a trailer needs a driver[41], and, unless the farm is small, two or more vehicles are used to ply between the threshing machine and the depot.

At the depot the sequence is: weighing the trailer with its full cargo[42], sampling the delivery for grading, off-loading, weighing the empty trailer, and stacking. For these tasks the farmer's workers are joined by a team from the depot, and the whole operation should take no more than about 20 minutes for a standard 90 sack load.[43] In practice, turn-round time depends largely on the length of the queue and can take several hours at peak periods.

In all then, as far as individual farmers are concerned, delivery in sacks calls for investment in one or more trucks or tractors and trailers, a scale, sacks and twine, a team of, say, twelve or more workers - most of whom are seasonal - and many hours of work. The farming community as a whole - as represented by the co-operative - is required to provide covered storage space, tarpaulins, a conveyor, stacking system, a weighbridge and grading equipment and to employ a substantial team of workers.

2.2 Delivery in bulk

From the point of view of workers delivery in bags represents a substantial number of jobs: from the point of view of farmers, on the other hand, it is a time-

consuming and expensive operation. It is not surprising therefore that since the early 1960s[44], co-operatives in the Western Transvaal have invested millions of rands in bulk handling and storage facilities. The towering concrete silos that one can see from so far away in the flatness of the Western Transvaal are the most obvious manifestation of these.

Whatever its merits or demerits in terms of substituting capital for labour, handling and storing grain in bulk certainly substitutes a relatively simple process for a more complicated one. On farms the output of the threshing machine or combine is allowed to flow directly into a bulk trailer. Hand-labour is required only to spread the flow evenly with a shovel. In other words, the need for filling and weighing each individual is eliminated, not to mention the sweat of handling thousands of sacks.

At the depot, the weight of the load is again determined by weighing the entire truck or trailer, first fully loaded and then empty. Off-loading is simply a matter of letting down the side of the trailer and shovelling the load into a chute.[45] Or, if a specially-built V-shaped bulk delivery trailer is being used, all that is necessary is to open the sluices in the bottom of the truck. Also, sampling for grading no longer requires the opening of sacks.

van Wyk estimates that even with the slower of the two off-loading methods, the complete delivery process at the depot takes roughly half as long in bulk as it does in sacks.[46] This of course, takes no account of the likelihood of having to wait in a queue which, whatever the technique, is where most delivery time is usually spent. Ceteris paribus, one would expect this to be shorter at depots with bulk handling facilities.

The main items of capital required for delivery in bulk are therefore: for farmers individually, one or more trucks, or tractors and trailers with closed sides, or special bulk

delivery trailers. Each truck or tractor and trailer needs a driver, and except for the special trailers, one or two workers with shovels. Most, if not all, are permanent workers. So less labour but more capital is involved (than for delivery in sacks).

For farmers collectively, the number of workers needed at the depot would probably be smaller, but this is insignificant when measured against the increase in investment called for: most silo complexes cost in excess of R1 million at present 1982 prices.

3.1.2.3 The incidence of change in handling and storage techniques

As before, the simplest way of measuring the rate of diffusion of the new technology is to divide farming units into those on which it had and those on which it had not been adopted, in a time series. This is done in Table 9, while Figure 4 overleaf presents the data graphically.

TABLE 9: The Diffusion of Bulk Handling and Storage Techniques.
(Percentage of Farming Units of which Maize was delivered in Sacks and in Bulk)

Year	1968		1973		1977		1981	
Group	Sacks	Bulk	Sacks	Bulk	Sacks	Bulk	Sacks	Bulk
A	56	44	26	74	0	100	0	100
B	-	-	25	75	0	100	0	100
C	-	-	-	-	2	98	0	100
D	-	-	-	-	-	-	0	100

FIGURE 4 THE DIFFUSION OF BULK HANDLING AND STORAGE TECHNIQUES

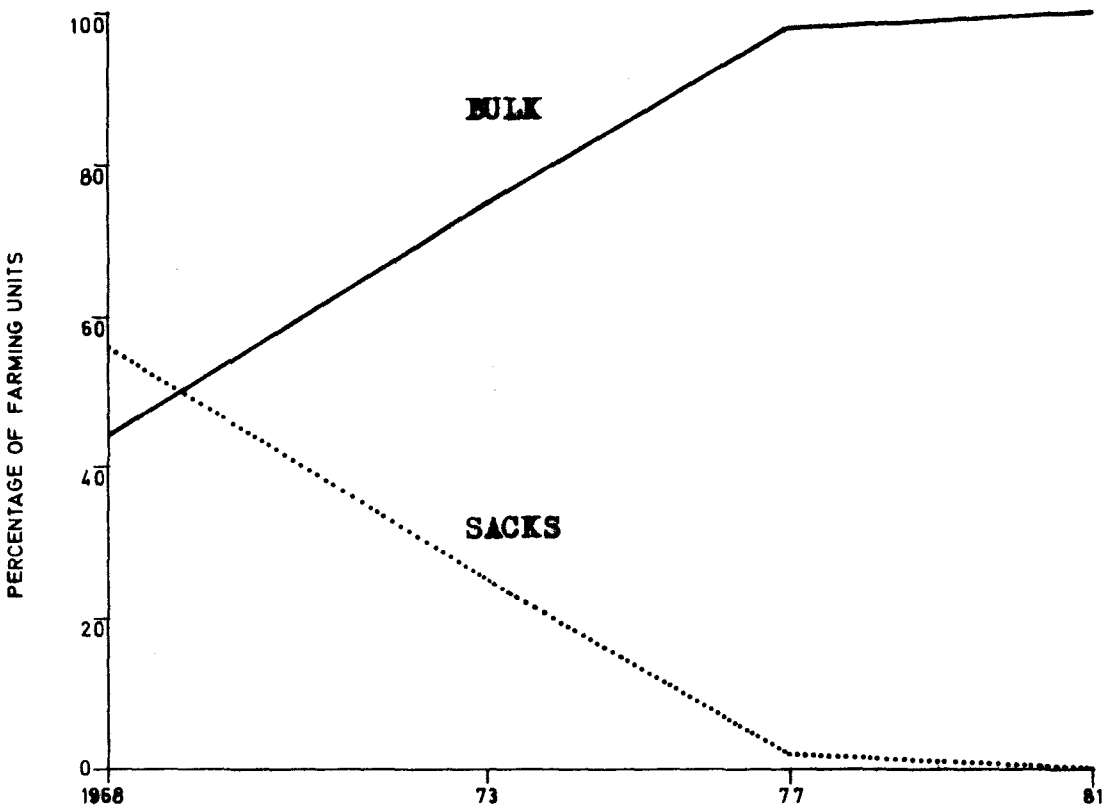
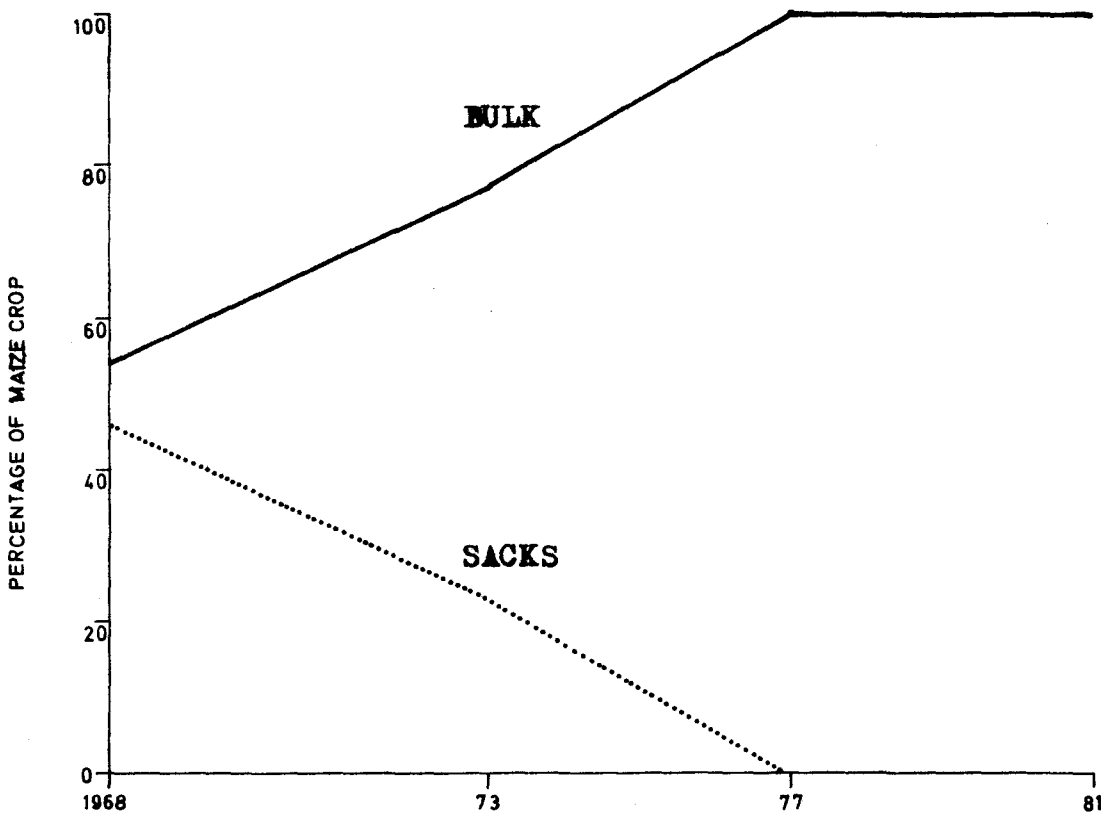


FIGURE 5 THE DIFFUSION OF BULK HANDLING AND STORAGE TECHNIQUES



In 1968 more than half of farmers were still delivering in sacks whereas by 1973 fewer than a quarter were. By 1977 sacks were effectively a thing of the past.[47]

By comparing Table 9 with Table 6, it can be seen that the development of silo capacity generally preceded the transition to mechanical harvesting. In 1968 44 percent of farmers were already delivering their crop in bulk whereas less than 20 percent were using combines. Five years later the respective percentages were 75 and 44. By 1977 almost all farmers were delivering bulk while 13 percent were still harvesting solely by hand. Only 15 percent of farmers in the survey started using combines before phasing out delivery in sacks.

It will be shown later that the adoption of bulk delivery techniques changed employment patterns not only directly as just described, but also indirectly by making it easier to substitute smaller teams of seasonal workers drawn from the families of permanent workers and consisting of women and children only, for larger teams recruited in black rural area and including men.

A more accurate measure of the spread of the new technique is the percentage of the entire crop delivered in bulk. The data does not permit a precise calculation, but it is possible to make a reasonable estimate.[48] Table 10 shows the results, and Figure 5 graphs them.

TABLE 10: The Diffusion or Bulk Handling And Storage Techniques for Maize
(Percentage of Crop Delivered in Sacks and in Bulk)

Year	1968	1973	1977	1981
Sacks	46	23	0	0
Bulk	54	77	100	100

Comparison of Tables 9 and 10[49] shows that the areas in which silos were sited first, were those in which output per farming unit was significantly greater than average. It appears that these districts mostly comprised the land surrounding the larger towns in the region[50] and probably also the prime maize producing land.

By examining the increase in total silo capacity and its geographical distribution, one can get a more immediate sense of the diffusion of bulk handling and storage techniques. Table 11 and Figure 6 record the growth of total silo capacity, while Table 12 and Figure 7 give details of its location. The silos included are only those constructed by the three co-operatives concerned[51], within or just outside the boundaries of the six magisterial districts surveyed, where the farmers in the sample would have been most likely to deliver.

Table 11 shows that total silo capacity in the region increased by no less than 340 percent between 1968 and 1981.[52] The most rapid (absolute) period of growth again seems to have been between 1973 and 1977, though the differences between this and the periods before and after is less marked than in the case of harvesting techniques (see Figures 6 and 3).

TABLE 11: The Growth of Total Silo Capacity in the Western Transvaal ('000 Tonnes Maize)

Co-operative	1968	1973	1977	1981
Noord-Wes	697	965	1562	1886
Suid-Wes Transvaal	157	328	551	720
Koster	2	110	146	146
TOTAL	855	1403	2259	2752

FIGURE 6 THE GROWTH OF TOTAL SILO CAPACITY IN THE WESTERN TRANSVAAL

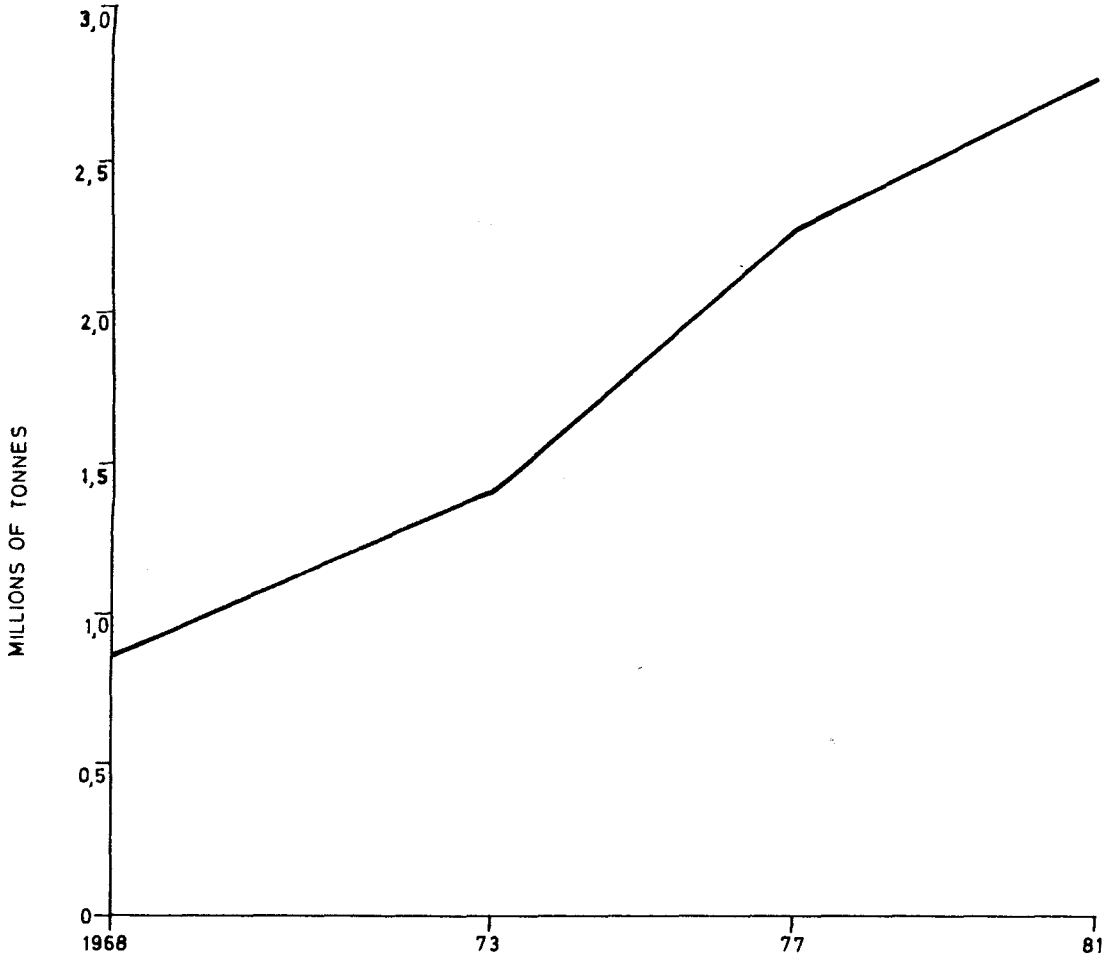


TABLE 12 Continued.

Site	1968	1973	1977	1981
Madibogo	X		XX	XXXX
Mafikeng	X			
Mareetsane	X		XX	
Migdol	X	XX	XXXX	
Nooitgedacht	X			
Oppaslaagte	X		XX	
Ottosdal	X		XXX	XXXX
Rostrataville	-	X		
Sannieshof	XX		XXX	
Taaiboschpan	-	X		
Vermaas	XX			
Suid-Wes Transvaal Koöperasie				
Amalia	-	-	-	XX
Bamboesspruit	XX		XXX	
Hallatshope	-	-	XX	
Kameel	-	X		XX
Kingswood	-	-	XX	
Leeudoringstad	-	X	XX	
Makwassie	X			XXX
Migdol	X	XX		XXX
Schweizer-Reneke	XX	XXX		
Wolmaransstad	-	XX	XXX	

(Continued overleaf)

TABLE 12 Continued.

Site	1968	1973	1977	1981
Koster Koöperasie				
Derby	-	X		
Grootpan	-	XX		
Koster	X			
Syferbult	-	-	X	

Source: Information Supplied by Co-operatives[53]

To make the relative importance of the many depots easier to take in at a glance, their capacities have been divided into categories represented by an appropriate number of Xs in Table 12.

The 44 silos in the region are widely distributed placing nearly all farmers within easy reach of bulk facilities.

In addition to the depots listed in Table 12, there are a number of other depots which still receive maize in sacks only, but these are few and small.[54] As one would expect, most silos are sited on railway lines. Those that are not and are obliged to make use of bulk road transport are all in the under-40 000 metric ton category.

Why were silos built? And why in those particular periods? The most likely reason for their construction is that it is cheaper to handle grain in bulk.[55] Certainly it is quicker and easier.

Since the construction of bulk facilities involves such an enormous substitution of capital for labour, if it

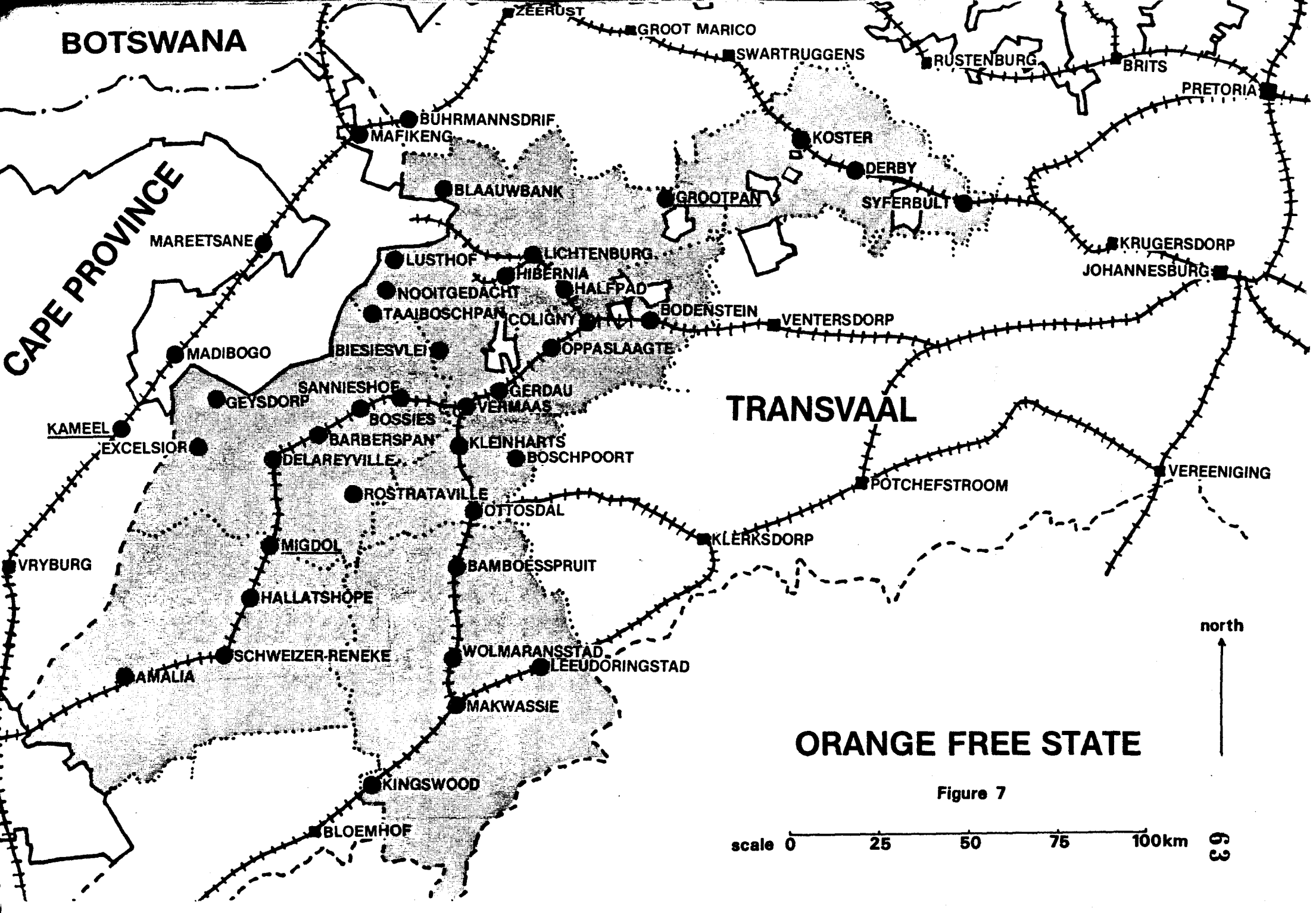

BOTSWANA
CAPE PROVINCE
TRANSVAAL
ORANGE FREE STATE
ZEERUST
GROOT MARICO
SWARTRUGGENS
RUSTENBURG
BRITS
PRETORIA
BUHRMANNSDRIF
MAFIKENG
KOSTER
DERBY
BLAAUWBANK
GROOTPAN
SYFERBULT
MAREETSANE
KRUGERSDORP
JOHANNESBURG
LUSTHOF
LICHTENBURG
HIBERNIA
NOOITGEDACHT
HALFPAD
TAAIBOSCHPAN
COLIGNY
BODENSTEIN
VENTERSDORP
MADIBOGO
BIESIESVLEI
OPPASLAAGTE
SANNIESHOF
GERDAU
GEYSDORP
VERMAAS
BOSSIES
KAMEEL
BARBERSPAN
KLEINHARTS
EXCELSIOR
DELAREYVILLE
BOSCHPOORT
VEREENIGING
POTCHEFSTROOM
ROSTRATAVILLE
OTTOSDAL
KLERKSDORP
MIGDOL
VRYBURG
BAMBOESSPRUIT
HALLATSHOPE
WOLMARANSSTAD
SCHWEIZER-RENEKE
LEEUDORINGSTAD
AMALIA
MAKWASSIE
KINGSWOOD
BLOEMHOF
north
scale 0 25 50 75 100km

Figure 7

FIGURE 7: The Geographical Distribution of Bulk Handling and Storage Facilities.

KEY

(Map to be read in conjunction with Table 12.

● **GERDAU** - site of silo served by one co-operative

● **GROOTPAN** - site of silos served by two co-operatives

■ **PRETORIA** - main cities/towns outside survey region

- area covered by six magisterial districts included in the survey.

—·—·—·— - South Africa in Botswana border

———— - Bophuthatswana boundary (1975)

– – – – – – - provincial boundaries

..... - magisterial district boundaries

++++++++++++ - railways

Sources: 1. Personal communications from Noord-Wes Koöperasie, Suid-Wes Transvaal Koöperasie, Koster Koöperasie, dated 2nd June 1982, 10th May 1982, and 4th May 1982 respectively.

2. Bureau for Economic Research re Bantu Development (BENBO): "Bophuthatswana Economic Revue 1975", Pretoria, 1975, map between pp.34, 35.

3. RSA, Department of Community Development, Chief Director of Surveys and Mapping: 1:250 000 Topocadastral Maps 2524, 2624, 2724, 2526, 2626, 2726, Cape Town, 1980.

could be shown that capital was relatively easily and cheaply available, this would be an encouragement to build silos. Similarly, if it could be shown that labour of an acceptable quality and at an acceptable price became more difficult to obtain, this would have the same effect. There is evidence that both occurred.

First, the State made loans for the construction of silos available at subsidized interest rates.[56] And second, many farmers expressed the opinion that men - who were essential for the heavy work of handling sacks - were usually poor seasonal workers, and more still spoke of the increasing difficulties and uncertainties of recruiting seasonal workers from Bophuthatswana, Botswana and Transkei. The reasons for this are discussed in chapter 6.[57] Most seasonal workers were drawn from these sources until well into the '70s, by which stage nearly all farmers were delivering in bulk.

While the building of silos relieved the problem of recruiting men, it did not on its own do away with the need to hire teams from Bophuthatswana, Botswana, and the Transkei[58] because the smallest team called for by hand-harvesting was still larger than most farmers could hope recruit locally, i.e. from the families of permanent workers on their own and neighbouring farms. The simultaneous peak of most farmers' seasonal labour requirements during the harvesting season limited the scope for hiring workers from farms other than one's own. However, the combination of mechanical harvesting and bulk-handling resolved the problem. Gleaning behind combines needed not only no men, but also much smaller seasonal teams. These could indeed be raised from the families of permanent workers, who were much less likely to be volatile and uncontrollable.

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So it is no overstatement to suggest that the introduction of bulk handling and storage techniques was the key that opened the way to the fundamental changes in employment patterns that accompanied harvest mechanization in the '70s.

The adoption of mechanical harvesting alone could not have achieved this. An appreciation of the potential created by silos for replacing large teams from 'external' sources (including men), with smaller teams from 'internal' sources (not necessarily including men) must have been a powerful additional reason for building silos.

Finally, two brief suggestions about the timing of the construction of bulk facilities: firstly, it was the boom of the '60s rather than the rise in mine wages and the new policy of the mines to recruit more South Africans that would have put pressure on the supply of able-bodied men willing to do seasonal farm work.[59] By the time changes in the mine labour market occurred, the silo-building programme was well advanced. And secondly, bulk handling and storage technology itself seems to have changed significantly in the mid-'60s: the first silos were all built on the 'horizontal' principle, but since about 1965 all except the smallest have been built in the familiar cylindrical shape.[60] This development may also account in part for the timing of the spread of silos.

3.1.3 Weeding

Having planted, the dryland farmer must simply wait for the main ingredient of success - rain. But there are two important ways, independent of nature, in which he may encourage the growth of his crop: fertilizing and weeding. Both can be done mechanically while the plants are still small enough to use a tractor without causing damage, but this is possible later only if the rows have been planted 7 feet or more apart - which is still a popular practice.[61] For weeding, the procedure is simply to uproot the unwanted growth by ploughing lightly. Early weeding has for many years been done in this way.

Later weeding on farms where the row width is less than 7 feet, has until recently, had to be done by hand. Hoes must surely be the most ancient of agricultural implements still in use today in an unchanged form. And for a good

reason they are very effective. But they are also great consumers of labour-hours, and there lies the rub. If one wants to economize on the use of labour, then other methods have to be devised. This is where chemicals come in. Spraying weedicides offers a labour-saving alternative to traditional half-hand, half-mechanical method.

3.1.3.1 Hand/mechanical weeding

In terms of capital equipment, a tractor and ploughing implement and a set of hoes are all that is necessary. To put these to use, one needs a driver and a team of workers.

Hand-weeding teams are usually smaller than hand-harvesting teams and include fewer men, the work being lighter and less urgent. This makes it easier to recruit them from the families of permanent farm workers. Local recruitment is assisted by the fact that weeding is often not carried on simultaneously on adjacent farms, as is the case with harvesting. Often,[62] because of the slackness of farming operations in mid-summer, farmers do not hire seasonal workers at all, preferring to use permanent workers who would otherwise be inactive.

3.1.3.2 Spraying

Weedicides are usually sprayed onto the soil during, or shortly after planting by a tractor towing or mounted with a tank and spraying equipment.

Though it saves labour[63], spraying has several disadvantages. It is not effective against all weeds - in particular, Khaki bush, castor-oil bush, wild oats and several grasses are impervious to the chemicals used on maize. In addition, for some types of weed-killer to become active, rain is required within a week or two of spraying. Needless to say, this does not always happen. Not only this, if weed-killers are not mixed and applied correctly they may either

not work at all; or may poison the ground killing the crop as well. In fact, one of the longer term problems created by many sprays is that they make the ground unsuitable for most other crops for two or three years after their application. Farmers become locked into existing crop patterns. Finally, because weedicides need to be used so early in the growth cycle, they may turn out to have been wasted if the crop is a failure.

The labour required for spraying is one or more tractor drivers and spray operators, and, in most instances, a small team of hand-hoers to deal with spray-resistant weeds. Most such teams are drawn from the families of permanent workers or even consist only of permanent workers. The capital goods needed are one or more tractors and sets of spraying equipment, and the chemicals themselves.

3.1.3.3 The incidence of change in weeding techniques

Table 13 and Figure 8 record the change in weeding techniques in terms of the percentage of farming units using each basic technique, or a combination of them, while Table 14 and Figure 9 do so in terms of the estimated percentage of the surface area weeded.

Only a small minority of farmers were using chemical weed-killers in 1968. Both mechanical harvesting and bulk handling and storage were considerably more advanced at that stage. The spread of the use of chemicals proceeded comparatively slowly at first, though it accelerated considerably between 1973 and 1977, and continued to grow at much the same rate until 1981.

The lower starting percentage and the slower initial rate of growth of spraying explain why the 'cross-over' year was rather later for weeding (1978) than for harvesting (1974) and delivery (1969). The transition was not complete by the end of the period: in 1981 a little less

TABLE 13: The Diffusion of Chemical Week-Killing Techniques.
(Percentage of Farms Using Each Technique)

Year	1968		1973		1977			1981		
Group	Hand/ Mech.	Chem.	Hand/ Mech.	Chem.	Hand/ Mech.	Chem.	Hand/ Mech. + Chem.	Hand/ Mech.	Chem.	Hand/ Mech. + Chem.
A	95	5	84	16	54	46	0	16	81	3
B	-	-	85	15	52	48	0	15	83	2
C	-	-	-	-	54	44	2	13	81	6
D	-	-	-	-	-	-	-	11	82	7

FIGURE 8 THE DIFFUSION OF CHEMICAL WEED-KILLING TECHNIQUES

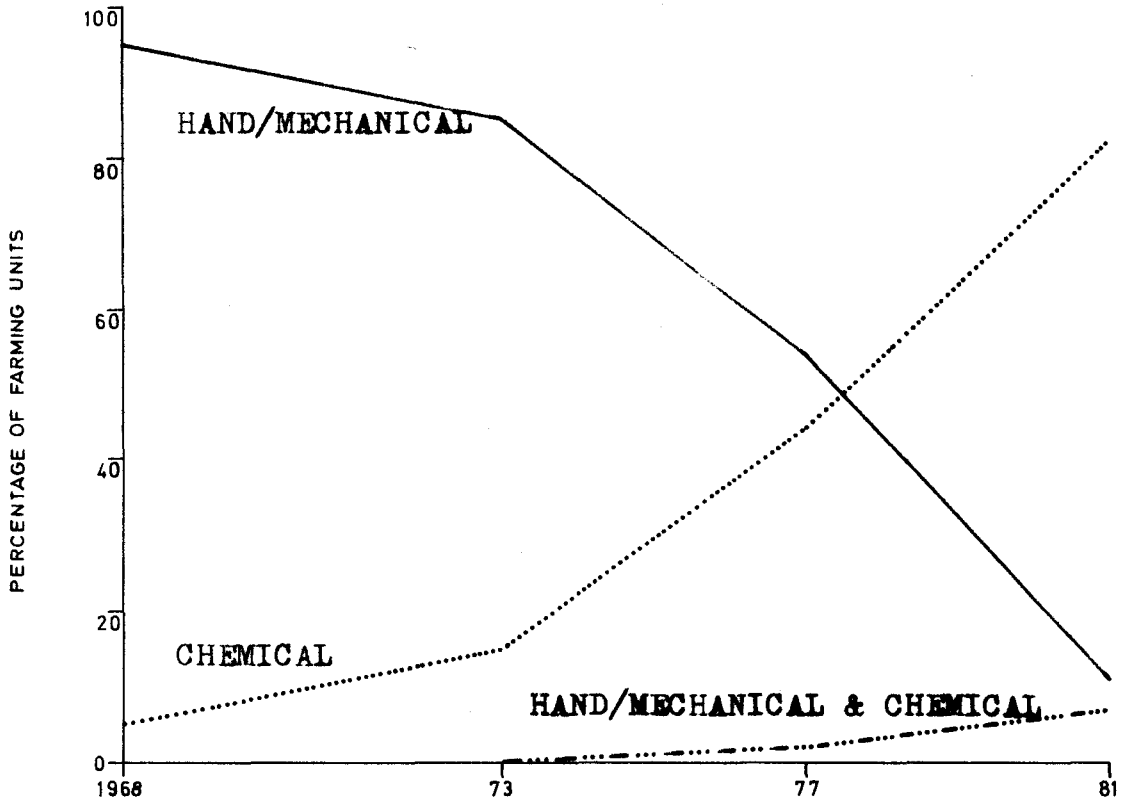

FIGURE 9 THE DIFFUSION OF CHEMICAL WEED-KILLING TECHNIQUES

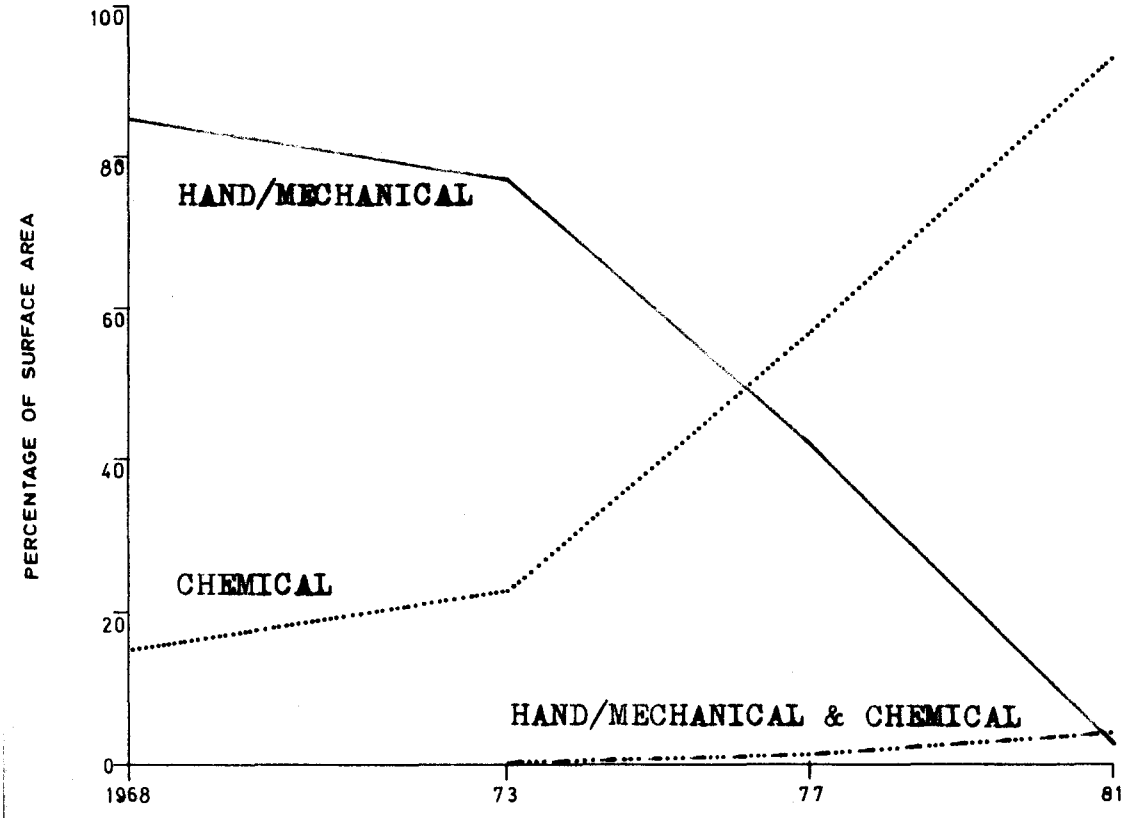

TABLE 14: The Diffusion of Chemical Weed-Killing Techniques
(Percentage of Total Crop Area Weeded Using Each Technique)

	1968	1973	1977	1981
Hand/Mechanical	85	77	42	3
Chemical	15	23	57	93
Hand/Mechanical and Chemical	0	0	1	4

than 20 percent of farmers were still using either hand and mechanical methods only or in combination with spraying.

The estimates in Table 14 are based on the assumption that all crops - not just maize - are sprayed and/or weeded by hand each year.[64]

If Table 13 and Table 14 are compared, it is noticeable that the percentage of the arable[65] area on which chemical weed-killers were used, always significantly exceeded the percentage of farming units on which sprays were used. The implication is that the new labour-saving technique was generally adopted more quickly on large farms than on smaller farms.[66] This is consistent with the trends shown in the diffusion of combine-harvesting, and bulk handling and storage. It also suggests that in each instance, economies of scale were inherent in the newer technique. This in turn, offers a partial explanation for the continuous increase in the average size of farming units described below.[67]

Why was spraying substituted for hand-hoeing? And why did the change occur when it did? Farmers were not questioned explicitly on the reasons for their choice of weeding technique so there is little evidence from this source. But several of the factors which seem most likely to have caused farmers to change their harvesting and delivery techniques probably operated in the case of weeding too, i.e. the relative cheapness, easiness, and effectiveness of the newer technique. To this one can add the easy availability of capital, problems in obtaining and managing seasonal labour, and economies of scale.

However, while most of these factors probably played a part, they do not appear to have been as cogent, as in the case of the other two operations. The saving of labour was smaller; the newer process was not very much simpler since teams of workers were still used to supplement spraying in most instances; and there were several technical and other difficulties inherent in the use of weed-killers, which limited their effectiveness. Also, hand-hoeing teams were generally smaller than hand-harvesting and delivery teams, seldom included men, and were drawn mostly from the families of permanent farm workers or even consisted of permanent workers themselves.[68] So it seems unlikely that scarcity of labour was a major influence, or that mechanization of harvesting and delivery created a strong incentive to change to weedicides in the way that the introduction of silos encouraged the purchase of combines.

For many farmers, the most important factor may have been a change in cultivation techniques. Deep ploughing appears to have given way to minimum tillage in many areas, the object of which is to conserve moisture and fuel. Even light ploughing to remove weeds increases tillage, so the use of weedicides fits in well with this policy. However, minimum tillage is by no means universal.[69]

Without further investigation, the timing of the transition to spraying is difficult to explain. Because the capital

investment in spraying equipment is smaller than that called for by combine harvesting, the potential economies of scale accompanying the accelerated increase in the size of farms after 1973 would also have been smaller. A more likely factor is the sharp increase in the fuel price which also occurred after 1973. A considerable saving of fuel is generated by eliminating the ploughing up of weeds.[70] This points towards changes in cultivating techniques as a further possible explanation, though the date of introduction and rate of diffusion of these changes are unknown. Finally, it is also possible that a significant improvement in chemical technology, giving weedicides a clear competitive advantage, occurred in the early '70s.

The nature, timing and extent of changes in technology have been adequately described: as the second major factor influencing employment, the same now needs to be done for the size of farms.

3.2 CHANGES IN THE SURFACE AREA OF FARMING UNITS

Recording the increase in farm size is important not only to gauge the extent to which larger farms may have been responsible for changes in employment patterns through economies of scale, but also to establish a constant yardstick against which to measure such changes. The simplest way of measuring the change in the size of farms is to calculate the average surface area.[71] Table 15 and Figure 10 set out the results.

TABLE 15: The Average Gross Surface Area of Farming Units (in Hectares)

Group	1968	1973	1977	1981
A	664	760	1257	1389
B	-	709	1074	1267
C	-	-	1033	1172
D	-	-	-	1155

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FIGURE 10 THE AVERAGE GROSS SURFACE AREA OF FARMING UNITS

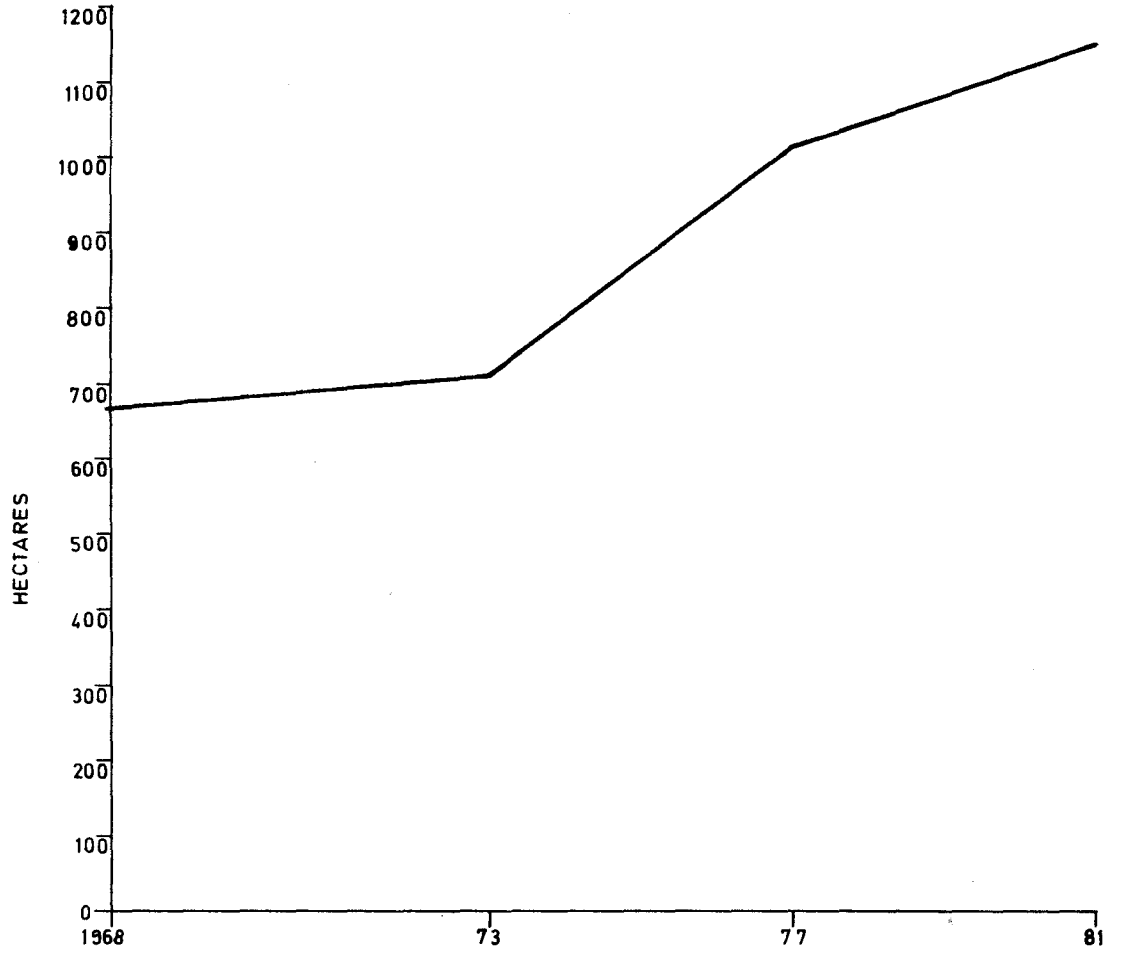
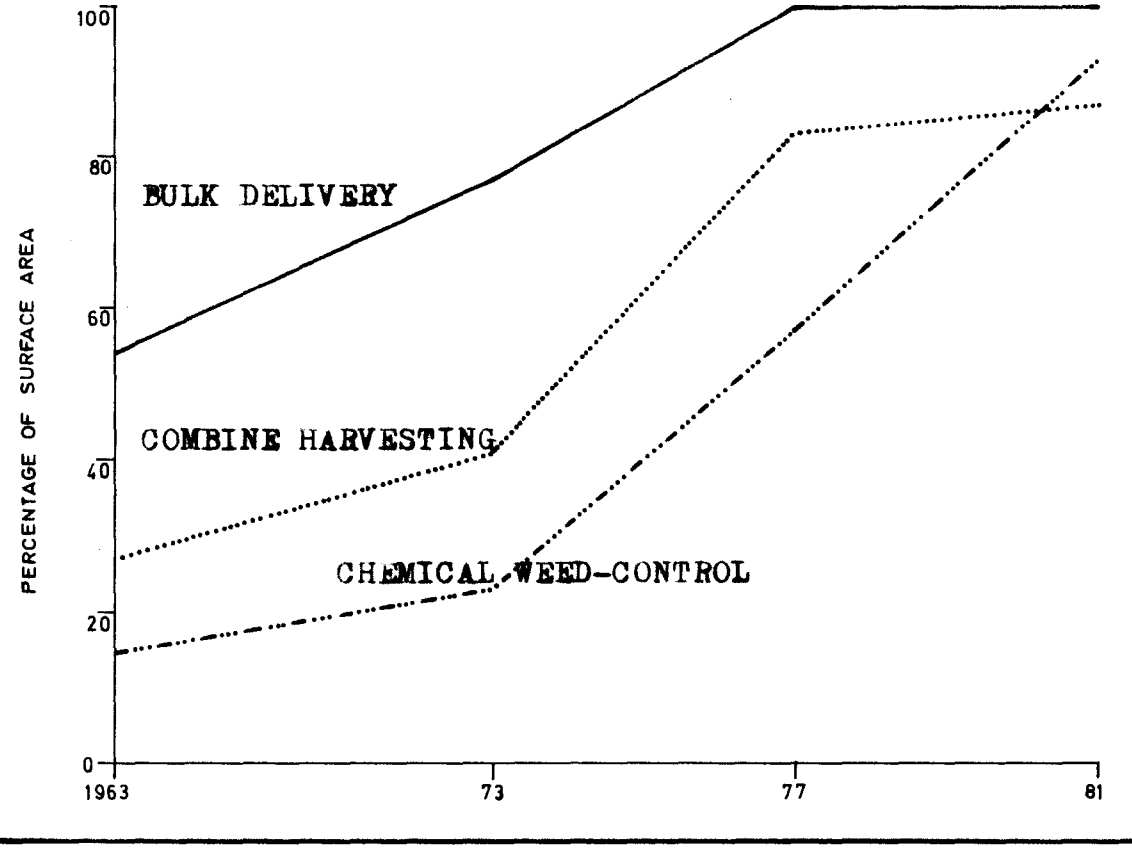


FIGURE 11 THE RELATIVE TIMING OF THE ADOPTION OF MORE CAPITAL-INTENSIVE TECHNIQUES



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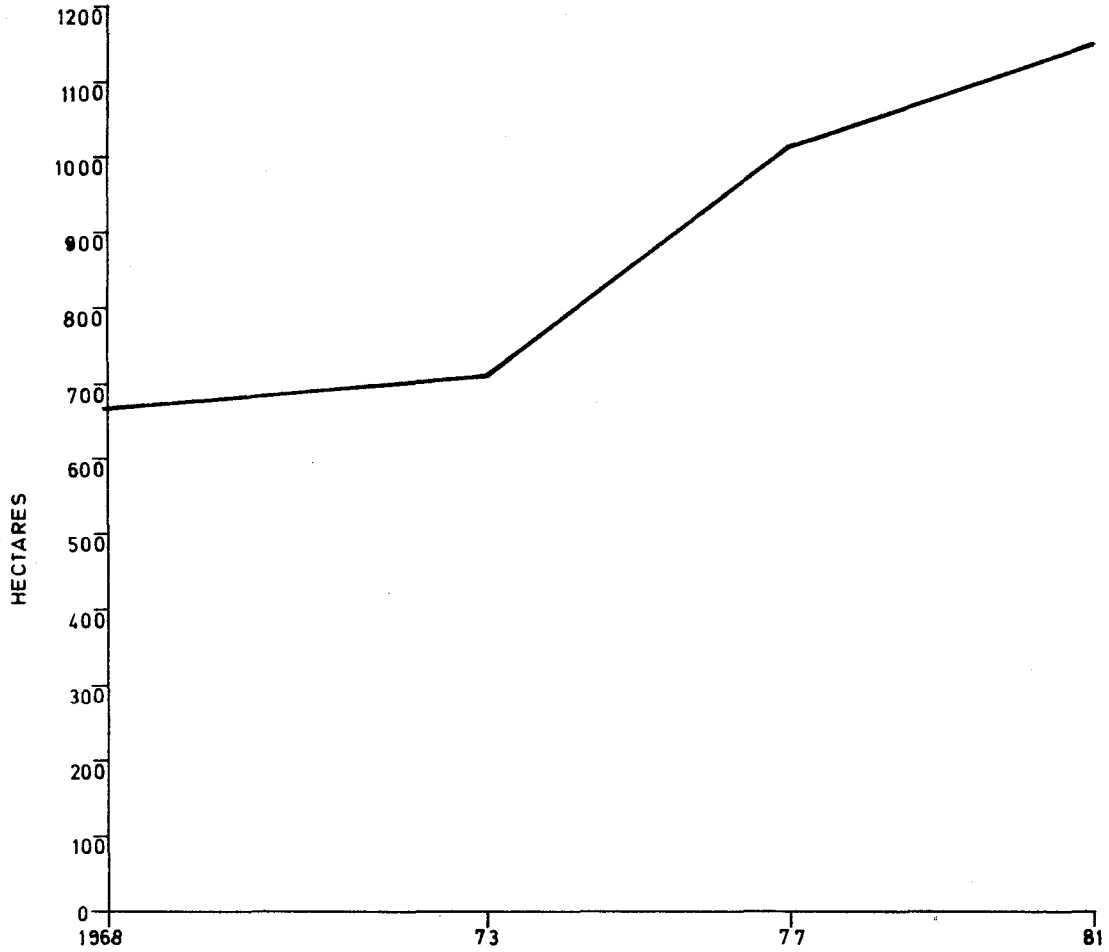

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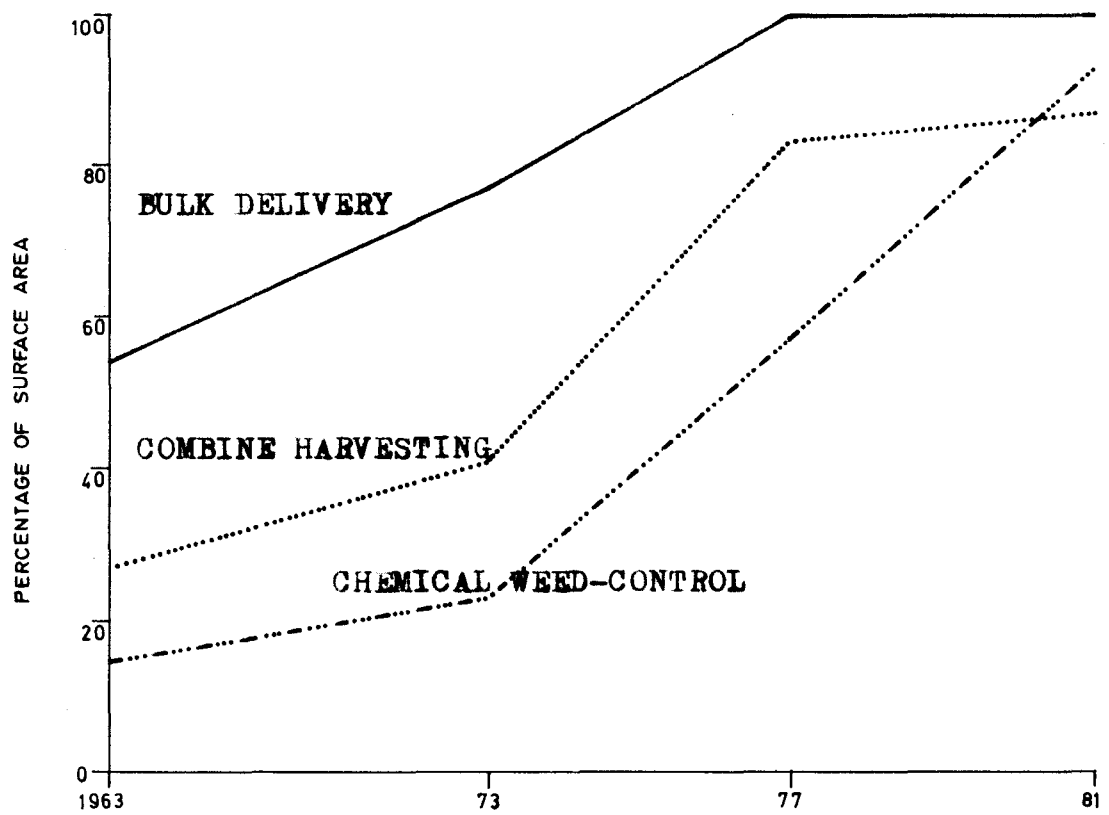


The general trend is clear: between 1968 and 1981 there was a consistent and very substantial growth in the average size of farming units. For the largest group in each year (illustrated in Figure 10), the overall increase was more than 70 percent, while for group A, which made up more than half of the total, the increase was more than 100 percent.

Nor was this expansion confined to a small proportion of progressive farmers. Of the farms for which sufficient data was recorded for 1968, no fewer than 50 percent had increased in size pre-1968; 35 percent did likewise between 1968 and 1973; between 1973 and 1977 the percentage was 53; and during the four years before 1981 about 27 percent of 61 units expanded. During the entire period, only 6 decreases were recorded. So the tendency to expand was indeed widespread.

The most rapid period of growth occurred between 1973 and 1977 when the average increase was about 45 percent, or between 10 and 11 percent annually (for the largest group). There is also a clear correlation between farm size and duration of ownership.[72] The longer established farmers tended to own the largest farms, which is what one would expect.

What were the causes of the growth in farm size? And what were the implications? The causes appear more complex than can be dealt with adequately at this point, and are often difficult to distinguish from the consequences. A range of factors such as the phase of the business cycle, the availability of credit, the profitability of maize farming, speculation and simply irrational desire probably played a part. Only factors affecting the relationship between employment patterns and farm size are considered.

Some clues as to what was cause and what was effect are to be found in the relative turning of developments. Figure 11 draws together the data for harvesting, delivery and weeding, and shows the diffusion of the more capital

intensive techniques. It is not possible to show the growth in the size of farming units on the same graph[73], but a comparison of Figures 10 and 11 gives a rough idea of the order of events.

By 1973, when the most rapid expansion in farm size began, only delivery in bulk had reached an advanced stage. While it is implausible to suggest that this was the main cause of the sudden spate of land purchases, it can nevertheless be seen as a contributory factor. The reasons are as follows: constraints on the availability, quality and management of seasonal labour have always been important determinants of the maximum size of farms. It makes little sense to plant a record acreage if, when it ripens, one cannot muster the manpower to harvest it.

As we have already seen, the introduction of bulk handling and storage facilities made it possible to harvest and deliver crops with a smaller seasonal team, and one not necessarily including men. This significantly loosened the labour constraint, and certainly made the purchase of hiring of additional land a more manageable proposition, even if it did not actually induce it. Furthermore, to the extent that bulk delivery and storage systems involved farmers both individually and collectively in the investment of larger amounts of fixed capital[74], economies of scale would probably have been present and would have added to the attractions of enlarging one's farm.

In their evidence, no farmers reported having bought or hired additional land as a direct consequence of using a combine-harvester. Quite often, the addition of land in fact, preceded the purchase of a combine. Nevertheless, combines coupled with silos should be seen as an important - indeed a critical - factor facilitating land purchase. Without them, the expansion of farming units on the scale that occurred would have been almost impossible. Regrettably, farmers were not questioned in detail about their reasons for purchasing or hiring more land.

What are more important here are the implications of larger land holdings, particularly for employment. Again, when questioned, few farmers said that they had mechanized harvesting as a direct result of acquiring more land. But this may have been a matter of perception - or perhaps a result of the way in which the question was asked - because other evidence indicates the contrary. Bearing in mind the frequent and wide-ranging complaints that farmers made about seasonal workers from Black rural areas, especially Bophuthatswana, it is unlikely that they would have wanted to enlarge their farms so substantially if they had been obliged to increase their recruitment of such workers proportionately.

This argument is supported by the number of cases in which an increase in farm size was either accompanied in the same year or followed a year later by the purchase of one or more combines. This occurred in 18 of the 76 recorded instances of the addition of land, i.e. an incidence of 23 percent.[75] At first sight the correlation does not appear to be strong, but it should be appreciated that most farmers added to their land-holdings bit by bit rather than in one large transaction, and that having once bought mechanical harvesting equipment they would generally have had some capacity to spare.

The connection between larger farms and more capital-intensive harvesting techniques is established beyond doubt when calculations are made of the relative cost-efficiency of hand and mechanical harvesting. Only for much smaller-than-average harvest areas and/or for much lower-than-average yields per hectare is hand harvesting more cost-efficient.[76] (See Figures 52-55 and Appendix C below).

Farmers who were questioned about employment on additional land purchased said that, in general, they did retain the permanent workers who had been employed by the previous owner, and preferred to 'rationalize' the use of their own workers. Some of the dismissed workers subsequently

found work on other farms, but many did not and were obliged to move with their families, mostly into Bophuthatswana. The effect of the consolidation of farms and the consequent retrenchment on permanent employment is discussed in more detail in sections 4.2 and 4.4 below.

Between 1968 and 1981 both the proportion of farm land cultivated and the proportion (of the total) planted with maize[77], decreased marginally on farms in the survey, though whether this was connected with the growth of individual farming units is uncertain. The average proportion of arable land fell from about 0,78 in 1968 to about 0,71 in 1981, the corresponding figures for maize being 0.69 and 0.65.[78] These trends reflect a slight shift away from arable and towards pastoral farming, and, within arable farming, a slight increase in the degree of specialization in maize production.[79] Though pastoral farming is probably less labour-intensive, but offers proportionately more job opportunities to workers without mechanical skills, the influence of these changes on the level and nature of employment is probably too small to be noticeable.

For the Western Transvaal as a whole, data collected by the Maize Board indicates that the area planted with maize increased marginally. The average area planted with maize during the first half of the period (1968 - 1974) was 1 128 000 ha, while during the second half (1975 - 1981) it was 1 182 000 ha[80], which represents a 4,8 percent increase. Data for the total area of farms is not available after 1976[81], so it is not clear whether this increase was the result of an increase in the total farming area or whether it took place at the expense of other crops or pastoral production. Whatever the case, the influence on the level and nature of employment is again probably too small to be noticeable.

Another implication of the growth in the size of farming units is an increase in the concentration of control. Since the total area of farms in the Western Transvaal

appears to have remained fairly constant between 1968 and 1976[82] - the last year for which census data is available - the enlargement of some farming units must have entailed the reduction or total disappearance of others, which in turn means a growing degree of concentration of control. The same is not necessarily true of ownership because land can of course be rented out rather than sold.

Lastly, an observation about what is really a quite astonishing rise in the average size of farms: one cannot help wondering whether for many farmers it does not represent an over-investment in land relative to other productive assets. Even in the middle '70s this was being suggested[83], and by the early '80s farming units were still larger. With the decline in the profitability of maize farming since the middle '70s[84], farmers may start placing more emphasis on better use of the land that they already have. If so, the growth in the average size of farming units may, at least for the present, have come to a halt, with all that that implies for employment.

3.3 CHANGES IN THE YIELD PER HECTARE

The third important influence on employment is the tonnage of maize produced per hectare, or the 'yield'. Ideally, one would want to record the tonnage produced against the area planted by each farmer in each year. However, such detailed information was not collected. The actual yields shown in the centre column of Table 16 were calculated by the Department of Agriculture for a region coinciding roughly with that covered by the survey.[85]

In addition to the actual yields, a series of expected yields has been calculated on the basis of the least squares linear regression equation:

$$y' = 1\,311{,}1 + 131{,}2x$$

where x = the year

and y' = the expected yield.

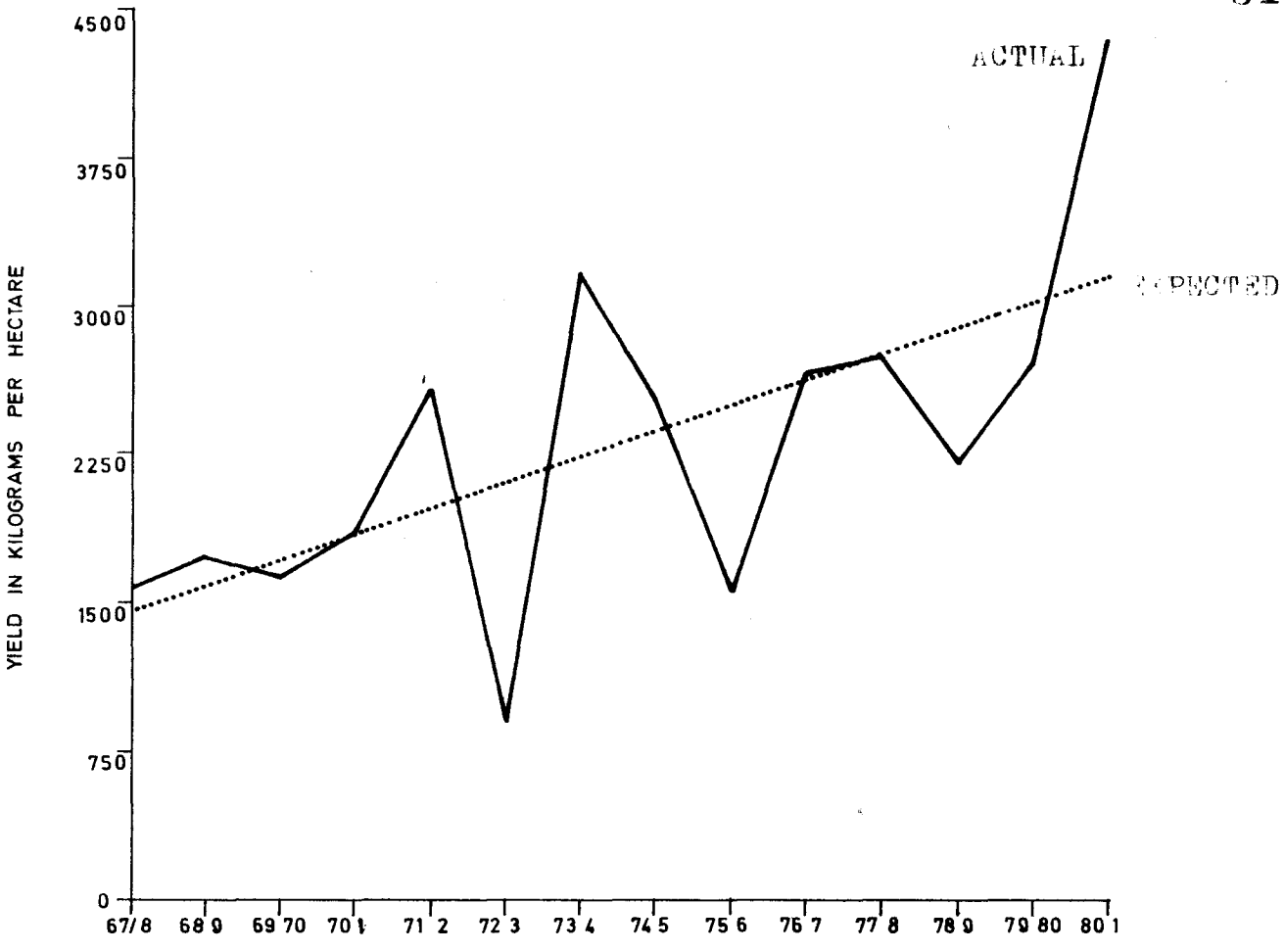
TABLE 16: The Average Yield of Maize, Western Transvaal, 1967/68 - 1980/81 (in Kilograms/Hectare).

Season	Actual (a)	Expected (b)
1967/68	1568	1442
1968/69	1726	1574
1969/70	1631	1705
1970/71	1853	1836
1971/72	2576	1967
1972/73	911	2098
1973/74	3162	2230
1974/75	2526	2361
1975/76	1555	2492
1976/77	2644	2623
1977/78	2739	2754
1978/79	2197	2886
1979/80	2708	3017
1980/81	4335	3148

Sources: (a) R.S.A., Department of Agriculture, Division of Agricultural Marketing Research: Abstract of Agricultural Statistics 1983 etc., Table 9, page 9.

(b) Own estimates (see previous page).

FIGURE 12 THE AVERAGE ACTUAL AND EXPECTED YIELD OF MAIZE, WESTERN TRANSVAAL, 1967/68–1980/81



Both series are graphed in Figure 12. The expected values are useful for two purposes: they make it easier to discern the overall trend, and they offer a less volatile basis for estimating employment on a constant output scale, e.g. number of workers per 1 000 tonnes harvested.[86]

The most noticeable features of Figure 12 are the sharp fluctuations in actual yield between 1972 and 1976, the extraordinary crop of 1981, and the marked upward trend of the expected yield. The two 'lows' in 1972 and 1976 were caused respectively by drought and floods. Conversely, to have reached the spectuacular 'high' in 1981, weather conditions throughout the region must have been near-ideal. But of more importance for economic analysis, is the overall upward trend: the co-efficient of x in the regression equation indicates that, on average, output grew by about 130 kilograms per hectare, or at compound rate of about 6,2 percent each year.

The causes of this trend can be divided into two broad groups: more inputs, and more productive inputs. If more inputs were used per hectare, they certainly did not include more labour: quite the reverse as later analysis shows. More than likely, they involved a greater input of capital per hectare in the form of machinery, fertilizer, pesticides, chemical week-killers, etc.

It is also likely that most of the capital inputs become more productive: the development and continuous improvement of seed hybrids is an obvious example. Table 60 and Figure 48 suggest that there was also a slight growth in the 'average skill level' of permanent workers.[87] It can be assumed that favourable weather conditions played a part in raising yields as well.

The most direct way in which a rise or fall in the yield

influences employment is in the number of seasonal workers taken on to harvest - or glean - and deliver the crop. A month or two before harvesting is due to begin, farmers inspect their fields - sometimes with the seasonal workers' foreman - to decide on the optimal strength of the seasonal team. The better the yield, the bigger the team. The number of permanent workers assigned to harvesting and delivery also depends on the yield.

Because harvesting activities require more labour than any others, one would expect the upward trend in output to have led to an increase in the number of workers, both seasonal and permanent. In practice, mechanization has resulted in quite the opposite, as Chapter 4 shows. Of course, by adding to output per farming unit, the rise in yields, no less than the increase in farm size, has opened the way to the realization of economies of scale by mechanization.

There is a sense in which the reverse has also taken place; that is, harvest mechanization has led to an increase in yields. For many farmers one of the most important reasons for buying combine-harvesters was to take the crop off the land more quickly.[88] And one of the most important reasons for doing this was to be able to plough earlier after harvesting so as to increase the soil's capacity to retain moisture, which, in turn, has a beneficial effect on the following season's crop. So the direction of causation has not been entirely from higher yields to harvest mechanization. Nevertheless, it was the changes in biological, chemical and other technology which raised yields and thereby encouraged harvest mechanization, that were most significant.

On the other hand, for most farmers the change to silos and combines took place before the change to weed-killing sprays. It would therefore be incorrect to regard the improvement in yields brought about by sprays as having contributed appreciably to the decision to mechanize harvesting and delivery: only about 8 percent of farmers

who purchased combines began using chemical weed-killers beforehand. The connection between these two forms of technological change is weak.[89]

It has been shown how changes in technology, in farm size, and in yield occurred in the Western Transvaal between 1968 and 1981. It has also been shown how, both individually and jointly, these changes may influence the level and nature of employment. What is needed now is to quantify the effects of the various forms of technological change on employment. To this we now turn.

31. One of the obvious criticisms is that, if it requires an increase in c/v for s/v to rise, then the direction of change of

$$\frac{\frac{s}{v}}{\frac{c}{v} + 1},$$

the rate of profit, is indeterminate, and will depend on the relative magnitude of the increases in c/v and s/v. Marx argued that s/v would rise faster than c/v at first, but that beyond some point the position would be reversed (see Howard and King: op.cit., p.204). Hence the tendency of the rate of profit to fall in the long run in capitalist economies. Needless to say, this is the subject of much debate. Howard and King discuss this and other criticisms in some detail (ibid., pp.198-199, 203 ff, 231).

32. See Section 6.3.3, esp. pp.223-226 below.

33. See Salter: op.cit., pp.35-38.

34. Rosenberg, N.: "Marx as a Student of Technology", in Levidow, L. and R.M. Young: "Science, Technology and the Labour Process: Marxist Studies", vol. 1, CSE Books, London, 1981, p.16.

35. Braverman, H.: "Labor and Monopoly Capital", Monthly Review Press, New York, 1974, p.195.

36. See, e.g., Heilbroner: op.cit., pp.109-110, 112-113.

37. Even at this level, maximization of the rate of unemployment is hardly likely to be an unqualified goal, both for 'security's' sake and because of the need for consumer demand to realize profits.

38. See Section 4.1.1, p.90 above.

39. From Chapter 4, notes 19 and 20, it can be calculated that between 1968 and 1977, about 52 percent of the labour saved in harvesting and delivering 100 standard 9-ton loads of maize was attributable to the change from hand- to mechanical-harvesting. About 38 percent was due to the re-organization of hand-harvesting, about 9 percent to the introduction of bulk methods of delivery, and less than 1 percent to the change from PTO to SP combines. (Between 1977 and 1981, total employment for these operations changed little.) When weeding is taken into account, these percentages becomes 39, 28, 7 and less than 1 of the total reduction in seasonal employment respectively, the change of weeding technique making up the balance (26 percent).

40. See, e.g., Figure 11 above.

41. Metcalf: op.cit., p.69. (The article discussed by Metcalf is Griliches, Z.: "Hybrid corn: an exploration in the economics of technical change", Econometrica, Vol. 25 (4), October 1957, pp.501-522.)

42. i.e. combine-harvesters, bulk delivery systems and chemical weed sprays.

43. Perusal of the annual reports of Massey-Ferguson and Malcomess, two of the largest combine-harvester suppliers in South Africa, revealed the following:

    (a) There was a delay in fulfilling sales orders for Massey-Ferguson's range of SP combines in 1974 and 1975. According to the company, this was caused by a combination of circumstances: two excellent agricultural seasons during which the demand for harvesting equipment boomed, and difficulties in obtaining supplies from overseas manufacturers.

    (b) Massey-Ferguson's subsidiary, Slattery - the dominant local manufacturer of PTO combines - reported a similar sales backlog in the same years.

    (c) Malcomess also experienced these conditions in 1974 and 1975, but noted that despite overseas supply delays harvesting equipment had been marketed on time - as in all other years between 1970 and 1976.

    It is possible that any sales lost by these two firms were gained by competitors, so the true extent of the supply constraint is hard to assess.

    Sources

    Massey-Ferguson (South Africa) Limited: Annual Reports, 1969-1975, esp. 1974, pp.5,9; 1975, pp.8,9;
    Malcomess Limited: Annual Reports, 1970-1976, esp. 1974, p.4; 1975, p.15.

44. See Section 2.1.1 , p.14 above.

45. For example, if a farmer rates 'labour unavailability' as the most important, 'quickness' (of combine-harvesting) second, and 'cheapness' (of combine-harvesting) third, these would have been given 3, 2 and 1 points respectively. All points for each 'reason' were added up and averaged.

46. The 53 percent for 'labour unavailable' given in Table 61 is probably an under-estimate: several of the answers categorized in the analysis as 'sundry' could have had the same meaning. (Where farmers had not mechanized harvesting - in two instances - this data could not be collected.)

47. It was not always clear what farmers meant by this, though they were probably referring to the elimination of the need for men to handle 90 kg sacks, and hence to the

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46. The 53 percent for 'labour unavailable' given in Table 61 is probably an under-estimate: several of the answers categorized in the analysis as 'sundry' could have had the same meaning. (Where farmers had not mechanized harvesting - in two instances - this data could not be collected.)

47. It was not always clear what farmers meant by this, though they were probably referring to the elimination of the need for men to handle 90 kg sacks, and hence to the

possibility of replacing larger 'external' teams consisting partly of men by smaller 'internal' teams which included few, if any, men. (See Section 3.1.2.3, p.57 above.)

None of the directed-response questions concerned bulk delivery, as its potential importance was not appreciated until after the survey had started. The answers involving this factor were given when farmers were asked to identify the three most important factors in their decision to mechanize. If an explicit, directed-response question had been asked about this, it might have emerged as more important.

48. Again, some of the 'sundry' answers could have fitted into the 'combine harvesting quicker' category. Fifty-three percent could be an underestimate.

49. Metcalf: op.cit., pp.40-41.

50. Sources (of Table 62):

W_{a1} : Table 25 above.

W_{i1}, W_{i2} : R.S.A. Department of Statistics: South African Statistics 1974, etc., pp.7.6, 7.7, 7.38, 7.39; 1982, pp.7.6, 8.19.

W_{i3} : R.S.A. Department of Statistics: Statistics of Houses and Domestic Servants, October 1973 and of Flats, May 1973 (11-03-09), Table A11.1, pp.10-12; ibid., 1980 (11-03-16), Table A11.1, pp.10-12; R.S.A. Department of Statistics: South African Statistics 1982, etc., p.8.24. The estimates for 1968-1977 are the unweighted arithmetic means of the average monthly wage in cash only of full-time black female 'general' domestic servants in 'all houses' in the urban areas Witwatersrand, Pretoria, Vaal Triangle, Bloemfontein, OFS goldfields and Kimberley. For 1978-1980, Klerksdorp is included as well. For 1981, the estimate was based on the increase between 1980 and 1981 of the 'weighted average index of cash wages of full-time domestic servants' (see South African Statistics, 1982, etc.loc.cit.) The 'cash only' figure was chosen so as to make the wage comparable with the wages of other groups of workers in the table, including seasonal farm workers, which were also calculated on a 'cash only' basis.

W_{i5} : R.S.A. Department of Statistics: South African Statistics 1974, etc., pp.7.12, 7.43; 1980, p.7.7; 1982, p.7.7.

51. Sources (of Table 63):

W_{a2} : Table 26 above.

W_{i1}, W_{i2} : as in note 50.

W_{i4} : as in note 50, but calculated on an 'all-inclusive' basis so as to be comparable with wages of permanent farm workers. Strictly speaking, this makes the basis of comparison with mining, manufacturing and construction wages - all calculated as 'cash only' - unequal. In practice this makes little difference, because domestic wages are so much lower than these three. The comparison with permanent farm wages is more important.

52. For a full discussion of why the wages of black mine workers rose in the first half of the 1970s, see Wilson, F.: "Current Labour Issues in South Africa", in Price, R.M. and C.G. Rosberg: "The Apartheid Regime", Institute of International Studies, University of California, Berkley, 1980, pp.154-159.

53. The premises of this assumption are: most farm workers have relatively few industrial skills; almost all mining workers come from rural areas; since the early '70s the mining industry has attempted to recruit a greater proportion of its workers from within South Africa; influx control makes the search for other industrial jobs difficult.

54. "(TEBA) has a dozen offices in and around Bophuthatswana and recruited 33 161 mine labourers in 1976 as against only 6 392 in 1970". (Buro vir Ekonomiese Navorsing insake Bantoe Ontwikkeling (BENBO): op.cit. (1977), p.51).

55. "This increase (described in note 54) was mainly due to an intensive recruiting campaign and better salaries and working conditions at the mines" (ibid.). This change of policy is well documented. See also, e.g., Knight, J.B.: "Is South African running out of unskilled labour?", in Wilson, Kooy and Hendrie: op.cit., p.44.

56. See concluding paragraph of Section 6.3.2.1, p.214 and note 69 below.

57. See Table 65 and Figure 57 below.

58. See Table 16 and Figure 12 above. This assumes the trend in 'black' yields to be similar to the trend in 'white' yields. The relative output levels do not matter.

59. See Chapter 1, note 1 above.

60. These estimates are open to criticism too (see Section 7.2.2.2, pp.251-253 below), but are still helpful in a number of respects, e.g. in giving a breakdown by race, sex and region, and are a great improvement on the previous near-complete absence of data.

61. Van der Merwe, P.J.: "Black Employment Problems in South Africa", Finance and Trade Review, Volkskas, Pretoria, Vol. XII (2), December 1976, Table 8, p.73.

62. Ibid. Van der Merwe's estimates differ most from Simkins'

in respect of their starting point. Whereas van der Merwe puts black unemployment on white farms at 1,7 percent in 1970, Simkins estimates it to have been about 20 percent throughout the '60s. (See Simkins, C.E.W.: "African Population, Employment and Incomes on Farms outside the Reserves, 1923-1969", unpublished paper, University of Cape Town, 1981, pp.7,8).

63. School attendance figures by no means tell all, but they are the most accessible indicator of the level of formal education. Between the 1970 and 1980 censuses there was a 73 percent increase in the number of black pupils at lower primary schools in white rural areas, a 170 percent increase in the number at higher primary schools, and a 300 percent increase in the number at secondary schools. (Sources: R.S.A. Department of Statistics: Population Census, 1970, Bantu - Age, Occupation, Industry, School Standard, Birthplace (02-02-02), Table 2, p.11; ibid., 1980 Social Characteristics (02-08-02), Table 12, p.366). Different methods of compilation make it difficult to compare school attendance in black rural areas.

For evidence of the increase in the number of farms schools and school attendance between 1959 and 1972, and some critical reflection, see Plaut, T.: "Farm Schools for African and Coloured Children in South Africa", SALDRU Farm Labour Conference Paper No. 17, University of Cape Town, 1976. (About 25 percent of black children between the ages of 5 and 14 in the Bloemhof, Christiana, Coligny, Delareyville, Koster, Lichtenburg, Schweizer-Reneke, Ventersdorp and Wolmaransstad magisterial districts were estimated to have attended school in 1972 - ibid., Table 12, p.22).

64. Some farmers said that many young black workers were less prepared to submit to the authority of a foreman nowadays because they felt they were better educated than him. This had led to a deterioration in the performance of seasonal teams.

65. See Section 5.1.3.5 above.

66. One of the functions of these boards and their predecessors, the Labour Tenancy Control Boards, was to regulate the number of black workers on farms. (See Morris, M.: "State intervention and the agricultural labour supply post-1948", in Wilson, Kooy and Hendrie: op.cit., p.70).

67. See Section 5.1.3.1, esp. p.143 above.

68. See Surplus Peoples Project: op.cit. The only localities in which this appears to have happened (on a small scale) are Vermaas and Migdol (see Figure 7 above).

69. Apart from their physical disqualification from employment in mining and construction (see note 56 above), many women are either not familiar with the domestic appliances found in most white homes or are not sufficiently fluent in English or Afrikaans to communicate adequately with potential employers. (This effectively disqualifies them from domestic services too.)

70. The Current Population Survey records that in November 1980 and November 1981, the urban unemployment rate for black males was 6,3 and 7,0 percent respectively, while the comparative rates for black females were 15,9 and 12,2 percent respectively. (See R.S.A. Department of Statistics: Statistical News Release, P27.3, 14 May 1981; 24 June 1982.)

71. Sources (of Table 64):

W_{a1} : Table 25 above

W_{a2} : Table 26 above

P_k : R.S.A. Department of Agriculture and Fisheries, Division of Agricultural Marketing Research: Abstract of Agricultural Statistics 1982, etc., Table 101, p.197 (index for 'implements')

P_a : ibid., Table 7, p.7 (net producers' price of yellow maize).

72. Until 1979 the price recorded in the Abstract of Agricultural Statistics was the same for both yellow and white maize. Thereafter the price for white maize was slightly the higher. Yellow maize was selected because its output in the Western Transvaal was slightly the greater. (See R.S.A. Maize Board: op.cit. (1981), Annexure V, p.19).

73. There is actually a range of prices depending on colour, grade and cleanness. The price used here is the net producers' price for yellow maize, best grades, uncleaned, including 'distress payments', 'export profit payments', etc., (see R.S.A. Maize Board: op.cit. (1981), Annexure XXIV, p.38).

74. See Table 16 and Figure 12 above.

75. i.e. a movement along the same isoquant, the production function remaining constant. In Metcalf's model of the labour market, the production function is assumed to remain constant, 'technology' being an exogenously determined variable.

76. Cogan, J.: "The Decline in Black Teenage Employment: 1950-70", in American Economic Review, Vol. 72 (4), September 1982, p.627. (The additions in brackets are my own).

77. See, e.g., Tables 32 and 23A above.

78. See Tables 25 and 26 above.

79. See Section 6.3.2.1, p.213 above.

80. A relatively small rightward shift of the demand curve (given a larger leftward movement of the supply curve) would also be consistent with a fall in the level of

employment and a rise in the equilibrium wage rate. This possibility is not discussed because the data indicates that the demand curve did not move rightwards.

81. See Table 55 and Figure 42 above.

82. Although farmers were not asked explicitly about this, it was evident from the questionnaire that most questions concerned the work done by seasonal teams. Only one or two farmers referred specifically to a shortage of permanent labour, and it was generally clear when they were talking about permanent workers.

83. See Table 10 and Figure 5 above.

84. See Section 1.6 above.

85. Unfortunately, it is not clear whether the comments referred to seasonal or permanent workers.

86. See Table 16 and Figure 12 above.

87. This assumes farmers' comments about the reluctance of seasonal workers to take employment in years when their own crops are good, are correct. See Section 6.3.2.1, p.212 above.

88. Perversely, 1976 is the first year in which real seasonal wages appear to have risen normally after 1968! (See Table 25 and Figure 22 above).

89. See note 43, and Table 16 and Figure 12 above.

90. For example, the expectation of a larger than average income or profit may have encouraged the purchase of capital equipment. The Jacobs Committee reported that the average net income per R100 of capital invested on farms in the summer grain area was R15,00 in 1974 and R11,22 in 1975, as against an average of R10,94 for the 5 years 1974-1978 (inclusive). (R.S.A. Werkskomitee insake die Ekonomiese Posisie van die Boer etc.: op.cit., Table 7(a), p.48).

91. Fisher, L.H.: "The Harvest Labor Market in California", Harvard University Press, Cambridge, Massachusetts, 1953, p.11.

92. "To place the essential elements of the farmer's employment decisions in proper focus", Fisher makes three assumptions. "The first ... is that the harvest operation is a separate economic enterprise, and that decisions made relative to it are independent ... To be sure, ... decisions (concerning the area to plant, etc.) have been guided by expectations of yield, price and labor costs. These decisions once made, however, the harvest decisions become almost totally independent of them.

"The second assumption is that the total harvest cost is labor cost. This is in close accord with non-mechanized operations.

"The third assumption is that the labor employed is compensated at piece rates" (ibid. p.10).

On maize farms in the Western Transvaal prior to harvest mechanization, the first assumption was fully met. The second less fully: if harvesting is taken to include reaping and threshing, then both the transport of the 'blaarkoppe' to the threshing machine and the threshing itself are mechanized. Only the latter requires machinery usable solely at harvest time. The third assumption was roughly half fulfilled (see note 93).

93. An analysis of data for the Western Transvaal collected by the Department of Agriculture in its annual surveys, shows the following:

TABLE 64A: Method of Payment of Seasonal Harvest Workers (Percentage of Farms)

Year	Daily Cash Wage	Proportion of Crop	Total
1969	51	49	100
1970	50	50	100
1971	40	60	100
1972	31	69	100
1973	51	49	100
1974	60	40	100
1975	63	37	100
1976	69	31	100

The payment of a proportion of the crop - usually about 5 percent for hand harvesting (see Chapter 4, note 57 above) - is, in effect, piece rate payment, because the same proportion is paid regardless of the number of workers or days. A fixed daily cash wage is, of course, not a piece rate. On average, about 48 percent of farms between 1968 and 1976, paid a piece rate, but it is noticeable that in the first four years, when hand-harvesting was more common, payment by this method was more popular.

94. See Table 61 above. Note the high priority given to 'combine harvesting quicker'.

95. In this instance, one cannot easily use the argument that farm wages were temporarily above their equilibrium rate - causing a temporary excess of supply in the labour market - to explain unemployment. If this had been the case, one would expect farm wages to have fallen subsequently, whereas they rose in the case of permanent workers and

remained more or less unchanged in the case of seasonals. On the other hand, at no stage did either wage ever rise significantly in relation to mining or manufacturing wages, though permanent wages did show an appreciable increase against construction and domestic workers' wages in the second half of the '70s.

96. Strictly, blacks not employed on white farms have no right to remain in white rural areas. Unlike in 'prescribed' urban areas, blacks can never obtain the right, in terms of the Black (Urban Areas) Consolidation Act (No. 25 of 1945), to reside permanently in 'non-prescribed' white rural areas. Legal residence depends on employment, or more correctly, on farmers' permission which normally goes with employment. Without permission, residence amounts to trespass rather than contravention of influx control regulations. (See also chapter 5, note 152 above.)

97. It is assumed that people with little income other than from wage employment cannot remain voluntarily unemployed for long. (See Section 6.3.2.1, esp. p.213 above).

98. Some farmers had owned combines since the middle 1950s. However, it is probable that the quality of combines improved steadily from the time that they first appeared on the market. Most farmers felt that this had happened and said that it had influenced their decision to mechanize but was not amongst the most important factors.

99. See Section 6.2.1, esp. p.192-198 above.

100. See van Wyk: op.cit. (1970), chapters VI, VII. See also Appendix C below.

101. See Table 16 and Figure 12 above.

102. See Tables 15 and 15B and Figure 10 above.

103. See Section 3.2, esp. p.77 above.

104. The argument applies equally to rented land.

105. This is the procedure adopted in standard American and British texts. (See, e.g., Hunt, D.: "Farm Power and Machinery Management" (6th ed.), Iowa State University Press, Ames, Iowa, 1973, Chapter 4; and Culpin, C.: "Profitable Farm Modernization" (3rd ed.), Crosby Lockwood, London, 1975, pp.53-57.) van Wyk, from whose work the method used in Appendix C was adopted, used this standard procedure.

106. Caveat: no time limit for harvesting, e.g. 8 weeks, was assumed in calculating the values in Figures 52-55. For this reason PTO combine harvesting always appears cheaper than SP combine harvesting. In practice, beyond a certain tonnage, a second PTO combine would need to be purchased to complete harvesting within an acceptable

period. This would more or less double the cost of PTO combine harvesting. (Of course, the same is true of SP combines beyond a greater tonnage.) There are therefore discontinuities in the cost curves which are not shown in the diagrams. But this would not affect the decision to change from hand to mechanical harvesting. Figures 52-55 are adequate for the purpose for which they are used here.

107. Data for 7 of the 61 farms was missing: estimates based on average values were used where this occurred, but even some incorrect assumptions based on these estimates would still have left the percentage of farms handling less than the critical tonnage small.

108. See Appendix C below.

109. If the price indices of farm implements, fuel and labour had been 100 in 1970 (no data for permanent farm wages is available before this), then by 1981, at current prices, farm implements would have risen to 349, fuel to 842, permanent labour to 790, and seasonal labour to 385. Relative to wages, the price of capital equipment fell, improving the competitive position of more capital-intensive techniques. Surprisingly, mechanical harvesting may also save fuel: whereas hand harvesting requires at least two tractors for reaping and threshing (one in the fields and one threshing), PTO combine harvesting requires only one tractor, though its fuel consumption may be greater than either of the two involved in hand harvesting. Both factors suggest that 'some movement (of prices) in favour of mechanical harvesting probably occurred'. (Index Sources: implements and fuel - R.S.A. Department of Agriculture, Division of Agricultural Marketing Research: op.cit. (1983), Table 100, p.196 and Table 102, p. 108 *respectively; permanent and seasonal labour: Tables 26 and 25 above respectively.)*

110. Assuming that the average yield per hectare was the expected yield (see Table 16 above), the minimum area required to make mechanical harvesting cheaper than manual, would have been roughly 185 ha in 1968, 135 ha in 1973, 105 ha in 1977 and 80 ha in 1981. The expected yield is used in preference to the actual yield because, although the size of the crop on the land in the year in which a combine is purchased may influence a farmer's decision, purchases of durable capital inputs, such as combine-harvesters, are presumably also made in the expectation of crops of a certain size in years to come. Whichever yield is used, the percentage of farms falling below the critical hectarage is small.

Writing in 1964, van Wyk calculated the critical area to be between 175 and 200 morgen (about 150 and 170 hectares). (van Wyk, J.J.: "Wat is goedkoper - meganies of handoes?", in Boerdery in Suid Afrika, Vol. 40 (3), June 1964, p.35). So the estimates above do not look unrealistic and may even be conservative.

111. See Section 6.2.1 , p.199 above.

112. Tractors and trailers, used for threshing and transport from field to threshing machine, have so many other uses on farms, especially at planting time, that it is unlikely that they would be sold on the phasing-out of hand harvesting.

113. See Appendix C below.

114. Changes in relative factor prices may have helped bring about the development of new maize harvesting techniques in the United States, but the transfer of those techniques to South Africa was scarcely a function of changes in relative factor prices locally.

115. See Figures 52-55 above.

116. R.S.A. Commission of Enquiry into Agriculture: op.cit. (1970), p.165.

117. See Table 61 above. The respective percentages in the table cannot simply be added because some farmers would have included both factors in their 'top three', leading to double counting. Probably between 60 and 70 percent would have given one or the other of these reasons.

118. See Table 61 above. For example, eliminating 'labour problems' certainly makes control of production easier.

119. Strictly, this is not correct. The assumptions about 'freedom', 'individuality' and 'utility maximization' could also be modified. For example, utility could be measured in terms not only of profit but also of prestige. A number of farmers felt that some (other!) farmers did purchase capital equipment, such as combines, more for the status it appeared to confer than for its economic value. But none of these three assumptions seems to need significant qualification.

120. See Metcalf: op.cit., p.68.

121. Ibid. See also Mansfield, E.: "Technical Change and the Rate of Imitation", in Rosenberg: op.cit. (1971), p.310.

122. See R.S.A. Commission of Enquiry into Agriculture: op.cit. (1970), p.164.

123. Ibid., p.163.

124. See van Wyk's series of articles published in the widely-read "Farming in South Africa" (published in English and Afrikaans) in 1964. (See note 110, and Chapter 1, note 49, above.)

125. See note 98 above.

126. Mansfield: op.cit., p.310.

127. Almost all maize produced in Areas A and B of South Africa, as defined by the Maize Board (see Figure 1 above), must be marketed through the Board at a standard price per grade fixed by the Board. (See also Chapter 3, note 37 above.)

128. with fewer moving parts, the durability of PTO combines is generally greater than that of SP combines. Data collected by the Department of Agriculture in its annual survey of maize production costs in 1976, showed the average age of PTO combines in the Western Transvaal to be about 4 years. SP combines by comparison were on average about 2 years old. (See also Section 3.1.1.2, esp. p.43 above.)

129. This would presumably have occurred as those who had combines gained experience and their experience became more widely known. (See also R.S.A. Commission of Enquiry into Agriculture: op.cit. (1970), pp.163-164.)

130. See Section 6.3.3, p.226, 227 above.

131. See Section 3.2, esp. pp.75-76 above.

132. See Table 64 and Figure 50 above.

133. One could argue that the gradual fall in information and learning costs led to the purchase of more combines and so loosened any constraint on farm size imposed by labour shortages.

Peterson and Hayami make the important point that "as nonfarm earnings increase, farm size (in terms of output) tends to increase in order to provide farmers with somewhat comparable incomes. In economic terms we might say that as the opportunity cost of (farmers' own) labour increases, unit labor costs increase on small farms relative to those on larger farms, hence scale economies appear and average farm size increases" (op.cit., p.531). Boom conditions between about 1972 and 1975 would presumably have led to a rise in nonfarm incomes. Assuming some lag in the relationship, one would predict, on the basis of Peterson and Hayami's argument, that some expansion of farm size should occur in the mid-'70s - which did, in fact, happen (see, e.g., Figure 10 above). However, this is surely but one of many factors (see also Section 3.2, pp.75-76 above).

134. See note 27 above.

136. Presumably, land rent would remain the same, at least in the short run, regardless of the method of harvesting. But, ceteris paribus, the interest on capital would increase the greater the amount invested, so both this and profit would increase with mechanical harvesting (for farms larger than the critical size - see note 110 above).

All this assumes that the land and capital equipment are owned by the farmer. If not, the change in the size of s, surplus value accruing to the farmer, is indeterminate without further information.

137. See Section 6.3.3, esp. p.227-228 above.

138. See Section 6.2.2, esp. p.201-202 above.

139. See, e.g., Tables 18 and 23 above, showing the reduction in seasonal and permanent workers employed in harvesting and delivery.

140. See note 64 above.

141. Some farmers said that their status as citizens of independent foreign countries had made both workers and immigration and labour officials 'more cheeky'.

142. See Section 6.3.2.1, esp. p.210 above.

143. There are several reasons for this: first, the cost of transport is eliminated. Second, though the registration of all workers is required by law, generally only permanent workers and seasonal workers who must be recruited through official channels, i.e. those who do not live on white farms, are registered in practice. Few farmers said that they registered seasonal workers who lived on their own or neighbouring farms, partly because these workers were usually drawn from a pool, and it was not always the same people who worked each day, making registration difficult. Registration involves the payment of fees, so non-registration would avoid this cost. And third, it is not necessary to provide accommodation and at least some of the food normally supplied to teams of migrant workers, to workers who sleep and eat at home.

144. See Table 34 and Table 44 above.

145. See Tables 25 and 26 above.

146. See, e.g. Braverman: op.cit., pp.213-233.

147. See Table 60 and Figure 48 above.

148. See Table 59 and Figure 47 above.

149. See Section 6.2.2,, p.202 above.

150. See, e.g., R.S.A. Commission of Enquiry into Agriculture: op.cit. (1970), p.175.

151. For example, in contrast to many other items of capital equipment, no tariff duty is payable on the import of agricultural machinery; both petrol and diesel fuel are available to farmers more cheaply than to the public in general; until very recently, lower-than-market

interest rates were charged on loans to farmers by the Land Bank and by agricultural co-operatives; and, since 1977 it has been possible for tax purposes to write off the entire cost of new capital goods in the year of purchase. (See R.S.A. Commission of Enquiry into Agriculture (chairman S.J. du Plessis): Third Report, RP 19/1972, Chapter V for further details.)

152. See e.g., Morris, Nattrass, Knight: op.cit., in Wilson, Hendrie and Kooy: op.cit.

153. See Fiske, S.G.: "Minimum Wages Won't Help", Farmer's Weekly, issue no.72015, 16th April 1982, p.30.

154. See R.S.A. Office of the Economic Adviser to the Prime Minister: op.cit., Vol. 1, pp.34-35; Vol. 2, pp.14-15.

155. See, e.g., Howard and King: op.cit., pp.16, 200.

156. This is not to suggest that there is little to distinguish neo-classical and Marxian economic theory, merely that, at least in this context, there is some overlap in their analyses of the reasons for technical change.

NOTES - CHAPTER 7

1. See Section 1.1, p.1.

2. See Table 17.

3. See Table 22.

4. See Table 18.

5. See Table 23.

6. See Tables 19 and 24.

7. See Table 20.

8. See Table 21.

9. This can be calculated by multiplying the data in Table 19 by the relevant figure in Table 20. The number of worker-weeks per 1 000 tonnes fell from 690 for Group A in 1968 to 103 for Group D in 1981 - roughly an 85 percent drop.

10. See Table 25.

11. See Table 26.

12. See Figure 22.

13. See Figure 23.

14. See Section 4.3, p.106.

15. See Table 28.

16. See Table 29.

17. The difference is between 30 and 35 percent on a per farming unit basis and between 55 and 60 percent on a per 1 000 hectare basis. (See Tables 30A and 30B.)

18. See Section 4.5, p.122.

19. See Table 23A.

20. Sources: as for Table 23A.

21. See Table 34.

22. See Table 36.

23. See Table 40.

24. See Table 41. Note: the proportion of men, women and children in teams is unknown. Only the percentage of teams that included each is certain.

25. See Table 42.

26. See Table 43.

27. See Table 35.

28. See Table 44.

29. See Table 46.

30. See Table 49.

31. See Table 50.

32. See Table 51.

33. See Table 45.

34. See Table 57.

35. See Table 60.

36. See Table 59.

37. Farmers who switched from hand to combine harvesting in the second half of the '70s still gave labour shortage as an important reason for doing so.

38. Also, were those who left farm jobs of their own accord able to find other employment?

39. See Chapter 1, note 1, and Section 7.2.2.2, esp. pp.251-253.

40. Sources: (of Table 65)

Seasonal agriculture: Table 32.
Permanent agriculture: Table 23A.

Mining (total): R.S.A. Department of Statistics: South African Statistics (1974) etc., p.7.5; (1982) p.7.6; (Bophuthatswana): for 1970 and 1976, BENBO: op.cit. (1977), p.51; for 1978-1981, TEBA: personal communication, op.cit.

Manufacturing: R.S.A. Department of Statistics: South African Statistics (1974) etc., p.7.7; (1982), p.7.6.

Construction: R.S.A. Department of Statistics: South African Statistics (1974) etc., p.7.12; (1982), p.7.7.

Domestic work: except for domestic workers on white farms, no regular count is made of the total number of domestic workers in South Africa. It was therefore necessary to estimate the trend. From data collected annually by the Department of Statistics, it is possible to calculate the average number of domestic workers per 100 white-owned houses in the 12 principle urban areas:

TABLE 65A: Percentage Distribution of Houses According to Number of Full-Time Domestic Workers

Year	Percentage of houses with					Average No. of workers per 100 houses
	no workers	1 worker	2 workers	3 workers	4 or more workers	
1968	49,3	41,1	7,6	1,6	0,4	62,9
1969	50,1	41,3	7,0	1,4	0,2	60,4
1970	49,6	41,3	7,6	1,1	0,4	61,6
1971	49,6	41,3	7,6	1,2	0,3	61,5
1972	51,2	40,2	7,2	1,1	0,3	59,3
1973	52,2	39,1	7,4	1,0	0,2	57,8
1974	55,3	37,4	6,2	0,8	0,3	53,6
1975	56,2	37,3	5,4	0,9	0,2	51,7
1976	59,0	35,3	4,9	0,7	0,1	47,7
1977	60,6	34,0	4,7	0,6	0,1	45,7
1978	62,0	32,9	4,5	0,4	0,2	44,0
1979	61,1	34,0	4,2	0,6	0,1	44,7
1980	60,0	35,3	4,1	0,6	0,0	45,3

Source

R.S.A. Department of Statistics: Statistics of Houses and Domestic Servants October 1972 and of Flats May 1972, Twelve Principal Urban Areas in South Africa (11-03-08), Table 9, pp.13-14; 1973 (11-03-09), Table A9, pp.7-8; 1974 (11-03-10), Table A9, p.8; 1975 (11-03-11), Table A9, p.8; 1976 (11-03-12), Table A9, p.8; 1977 (11-03-13), Table A9, p.8; 1978 (11-03-14), Table A9, p.8; 1979 (11-03-15), Table A9, p.8; 1980 (11-03-16), Table A9, p.8.

The average number of domestic workers per 100 houses was calculated on the assumption that where there were 4 or more domestic workers per house, the average was 4,5 workers. Because of the very small percentage of houses involved, the overall average is not sensitive to this assumption.

From 1972 a distinction was made between full- and part-time domestic workers. If the data for both categories is used, the average number of domestic workers per 100 white houses fell from 93,6 in 1972 to 78,6 in 1980. Proportionately, this is a slightly smaller fall than for full-time workers only.

What needs to be known to calculate the total number of domestic workers employed in the 12 metropolitan areas is the number of

houses each year. Data is available only for 1951, 1960 and 1970 from the respective population censuses. To estimate the numbers concerned, the average (compound) growth rate between 1960 and 1970 was calculated and extrapolated to 1980. On this basis, the number of houses is found to be approximately 307 000 in 1968 and 461 000 in 1980. By multiplying the number of houses by the average number of domestic workers per 100 houses, one arrives at an estimate of the total number of domestic workers in the 12 areas concerned.

If it is assumed that the trend in the remaining urban areas is similar, then an index of total employment of domestic workers can be calculated. The index in Table 65 is for full-time domestic workers.

Note: 1. Roughly 60 percent of domestic workers between 1972 and 1980 were employed on a full-time basis.

2. Roughly 59 percent of white-occupied houses in the 1951, 1960 and 1970 censuses were in the 12 principal urban areas. (See: R.S.A. Department of Statistics: Statistics of Houses and Domestic Servants, etc., (1980), Table A.1, p.1.)

41. See Table 25.

42. See Section 6.3.2.1, esp. pp.211, 214.

43. See Tables 41 and 50.

44. See Table 26.

45. See Section 6.3.2.3, especially discussion of Figure 51(a), pp.218-219.

46. i.e. 'greater' South Africa, including the 'independent black states'.

47. See Table 52.

48. In 1970, the mining industry recruited 47 236 workers in the Transkei. By 1976 this had risen to 122 135, an increase of 159 percent. (Source: TEBA: personal communication, op.cit.)

49. Between 1977 and 1981, the level at times rose as high as 149 874 and fell as low as 109 936 (ibid.). But there was no consistent rise or fall.

50. Estimates by region were only begun in January 1979.

51. The number of black workers (of both sexes) reported to have been employed in white agriculture was 873 000 in October 1977 and 1 093 000 in October 1981. During the same period reported unemployment fell from 633 000 to 408 000. (Source: R.S.A. Department of Statistics: Statistical

News Release P27.3, 18th September 1978, Table I; 15th January 1982, Table 1.)

52. The fluctuations in the upward trend of male employment were comparatively small: this is illustrated by the fact that the proportion of all black male employment contributed by agriculture never rose above 24,3 percent and never fell below 21,4 percent between October 1977 and October 1981. There was no obvious seasonality in the data.

By comparison, black female employment in agriculture fluctuated much more noticeably - between 13,7 and 19,4 percent of total employment. A fairly regular annual cycle, reaching its high point in June and its low point in October or November, is also evident. It may be more than merely coincidental that the only year in which the upswing in the cycle was not significant was 1979, in which the maize harvest was considerably below average. (See Table 16 and Figure 12 above for the Western Transvaal. The results were similarly poor in almost all other maize-producing regions - see e.g., R.S.A. Maize Board: op.cit. (1981), Annexure VI, p.20.) (See also Figure 18.)

(Employment data source: R.S.A. Department of Statistics: Statistical News Release, P27.3, 18th September 1978; 11th January 1979; 14th May 1980; 18th August 1980; 18th December 1980; 20th May 1981; 7th October 1981; 15th January 1982; 22nd July 1982; 22nd October 1982 - Table 1 in all cases.)

53. See Section 1.6.

54. See Section 1.4.

55. A rise in permanent farm employment is not irreconcilable with the slight fall in the number of permanent workers per 1 000 ha engaged in harvesting and delivery between 1977 and 1981 (see Table 23). On the one hand, not all permanent workers on any farm need be involved in harvesting, and on the other, there was a slight increase in the area of maize planted in the second half of the '70s (see Section 3.2, p.78 above).

56. Commenting on the difference between the CPS and his own estimates of unemployment between 1978 and 1981, Simkins points out: "When one looks for the sectors that would account for the faster CPS employment growth, they turn out to be ... agriculture, commerce and services, just the sectors where our estimates are least firmly based because of the difficulties of measuring both wage and subsistence employment in agriculture, the informal sector and domestic service. It is clear, however, (that) the CPS reports in the short-term employment growth rates much faster than long term rates in these sectors. This may be grounds (sic) for suspecting the accuracy of the CPS - or perhaps under conditions of slow growth of employment in other sectors, people are crowded into

low-income jobs in these sectors (as) an alternative to unemployment". (Simkins, C.E.W.: "Structural Unemployment Revisited", SALDRU Fact Sheet No. 1, University of Cape Town, December 1982, p.10.)

57. See Section 4.5, p.122.

58. See, e.g., Table 53.

59. The level varied annually between 190 000 to 200 000 and 250 000 to 260 000. (Source as in note 52.)

60. See Table 65 and note 40.

61. Non-agricultural employment in black rural areas is limited, and Simkins estimates no increase in agricultural employment in these areas at least since 1970. (See Simkins: op.cit. (1982), Table 4, p.5.)

62. For index of urban domestic service employment, see Table 65. The number of domestic workers on farms fell from about 779 000 in 1969 to 514 000 in 1978. (Sources: R.S.A. Department of Statistics: South African Statistics (1974) etc., p.7.5; R.S.A. Department of Statistics: Statistical News Release P.9, 10th July 1980, p.3.)

63. e.g. KwaZulu, Lebowa. The term 'national states' is used by the CPS to distinguish non-'independent' black areas from 'independent neighbouring states' such as Transkei and Bophuthatswana.

64. Source: R.S.A. Department of Statistics: Statistical News Release P.27.3, 14th May 1980; 24th June 1982.

65. Ibid. The 8,8 percent may be incorrect because the rates for males and females were both higher than this, at 9,6 and 11,1 percent respectively.

66. The unemployment rate for males both in November 1980 and in November 1981 was given by the CPS as 0,8 percent. For females in the same months, it was 8,2 and 5,5 percent respectively. (Source: R.S.A. Department of Statistics: Statistical News Release P.27.3, 20th May 1981; 24th June 1982.)

67. The comparative figures for the same months as in note 66 were: males 9,8 and 9,6 percent respectively, and females 17,7 and 11,1 percent respectively (ibid.).

68. "For purposes of the survey the unemployed are defined as persons who desire to work and who comply with all the following requirements:

- did not work, i.e. worked less than 5 hours during the previous 7 days,

- attempted to find work during the previous month,
- are able to accept a position within one week,
- are between the ages of 15 and 64 in the case of men or 15 and 59 in the case of women".

(R.S.A. Department of Statistics: Statistical News Release P.27, 18th September 1978, p.2.)

It is instructive to compare this definition to the following observation by Braverman: "... unemployment is only the officially counted part of the relative surplus of the working population which is necessary for the accumulation of capital and which is itself produced by it. This relative surplus population, the industrial reserve army, takes a variety of forms in modern society, including the unemployed; the sporadically employed; the part-time employed, the mass of women who, as houseworkers, form a reserve for the 'female occupations'; the armies of migrant labor, both agricultural and industrial; the black population with its extraordinarily high rates of unemployment; and the foreign reserves of labor." (Braverman: op.cit., p.386). The context of Braverman's study was the United States, but these categories are no less present in South Africa.

69. Simkins: op.cit. (1982), p.10.

70. Simkins: op.cit. (1981), p.8.

71. van der Merwe: op.cit., Table 8, p.73.

72. See, e.g. Bromberger: op.cit.; Gerson: op.cit.

73. In interviews, many farmers complained of the number of 'leeglêers' (idlers) in the district and of squatters on farms where there were no whites resident.

74. See Morris: op.cit., esp. pp.69-71,for a discussion of the legislation concerned.

75. See Table 53.

76. Simkins: op.cit. (1982), p.10.

77. Berg, M. (ed.): "Technology and Toil in Nineteenth Century Britain", CSE Books, London, 1979, p.6.

78. Urbanization is another important consequence, though it falls outside the scope of this thesis.

79. In 1959, before the maize harvesting revolution, but when mechanical wheat harvesting equipment had long been in use, harvesting machinery contributed no more than 2 percent to the total sales of agricultural implements, while threshing machines accounted for about 8½ percent. (See R.S.A. Commission of Inquiry into the Cost and Profit Margins in respect of Agricultural Implements and the

Components thereof (chairman: H.J.J. Reynders): Report RP 10/1962, Table 44, p.50). Later data is not available at present.

80. The last census of the manufacturing sector was in 1976.

81. R.S.A. Department of Statistics: Census of Manufacturing, 1967-68 (10-21-17), Table 2.1, p.62; ibid., 1976 (10-21-32), Table 7.1, p.141.

82. The Reynders Commission recorded that 4 072 workers of all races were employed in the manufacture of agricultural implements in South Africa in 1958. By 1968 this had risen to 8 078 - more or less a doubling - but the total subsequently fell to 6 922 in 1976. (Sources: R.S.A. Commission of Inquiry into the Cost and Profit Margins etc.: op.cit., Table 45, p.50; R.S.A. Department of Statistics: Census of Manufacturing etc., 1967-68, Table 2.1, p.62; 1976, Table 7.1, p.141.)

83. See Section 1.3, esp. p.4 and Section 4.5, p.122.

84. In 1959, the number of workers of all races employed in the wholesaling of agricultural implements was 2 391, as against 4 594 in production. No record of employment in retailing is available. (R.S.A. Commission of Inquiry into the Costs and Profit Margins etc.: op.cit., p.75; Table 45, p.50.)

85. It is not known whether most sacks were imported or not. If they were imported, the effect of bulk delivery on employment in sack manufacturing and distribution would have been very small.

86. Berg: op.cit., p.6.

87. See Table 61 and Section 6.3.3, esp. p.227-228.

88. Braverman: op.cit., esp. parts I and II.

89. Table 59 shows a large drop in the number of machine operators (and manual workers) per 1 000 t and per 1 000 ha harvested, between 1968 and 1977. But the proportionately smaller decline in the number of permanent workers between 1969 and 1976 (see Table 23A) suggests that relatively few drivers were actually laid off, harvesting and delivery being only two of many tasks performed by them.

90. Though Table 60 shows only a small increase over the 13 years in the proportion of permanent workers who operated machines to those who performed manual tasks, if the reduction in the number of seasonal workers - all of whom were manual - is taken into account, then the ratio moves considerably in favour of machine operators.

91. This may be starting to change. For example, the Orange-

Vaal General Workers Union includes a number of farm workers. But international experience suggests that it will be a long time before farm workers' organizations make a noticeable impact. The increase in the proportion of full-time permanent farm workers may accelerate the process.

92. See Section 4.3, p.106.

93. Note: the value of housing was not included in the calculation of the all-inclusive wage of permanent workers in Table 26. (For reasons, see Chapter 4, note 60.)

94. Most farmers visited had built brick houses for their permanent workers - the traditional mud and stone huts built by workers with their own materials on their arrival are now in the minority in the Western Transvaal. Some farmers have also provided communal recreation facilities though few seem to have built baths or showers, and the number of toilets is almost always small (relative to the number of households). Many farmers said that improved houses and education facilities were a stronger attraction to good workers than good cash wages, and that, with the pull of industry becoming ever greater, it would be essential in the future to provide these facilities to retain good workers.

95. Two weeks paid leave between seasons was virtually standard on the 60 farms visited. Only in a few cases did conditions differ. On most farms, sick leave was paid too, though not what was called 'Maandagsiekte' (week-end hangover)! Some farmers required a doctor's certificate before paying.

96. See Sections 3.1.1.1 and 3.1.1.2.

97. See Sections 3.1.3.1 and 3.1.3.2.

98. See Table 58.

99. See Table 59.

100. Because of the long hours and the tiring nature of the work, two drivers - a principal and a relief - are often assigned to one combine. (See Chapter 3, note 21.)

101. Some farmers spoke of preferring to travel hundreds of kilometres rather than going to the trouble and expense of delivering in sacks. Having geared one's harvesting to delivery in bulk, using sacks means having to purchase sacks, obtain a scale, hire additional workers (men, who are often not easy to find) and slow down the harvesting rate to fit in with the slower delivery rate. So farmers' attitudes are understandable. (See also Chapter 3, note 41.)

102. See van Wyk: op.cit. (1970), pp.16-20.

103. See, e.g., R.S.A. Commission of Enquiry into Agriculture: op.cit. (1970), pp.171-173.

104. See, e.g., The Farm Labour Project: "Submission to National Manpower Commission on Farm Labour", no place of publication given, 1982, (ISBN 06020063114), pp.25-28 and photocopies of press-cuttings on "Health Conditions, Accidents".

105. See Section 5.3.3, esp. Table 57 and discussion thereof.

106. See Table 52.

107. See Tables 53 and 56.

108. Peterson and Hayami: op.cit., p.530.

109. Ibid.

110. See Section 1.5, p.8.

111. See Chapter 1, notes 17 and 33.

112. Ruttan, V.W. and T. Stout: "Regional Differences of Technical Change in American Agriculture", Journal of Farm Economics, Vol. 42, February 1960, pp.52-68, referred to in Peterson and Hayami: op.cit., pp.531-532.

113. See Section 1.3, esp. p.4.

114. This includes both the increase in the real wages of permanent workers and the shift of seasonal jobs from 'outsiders' to the families of permanent workers.

115. Braverman: op.cit., p.386.

116. Gerson: op.cit., pp.151-152.

117. Howard and King: op.cit., p.196.

118. Ibid., p.199.

119. Ibid., p.201. Howard and King's quotation from Marx is apposite: "Between 1849 and 1859, a rise in wages practically insignificant, though accompanied by falling prices of corn, took place in the English agricultural districts ... what did the farmers do now? ... They introduced more machinery, and in a moment the labourers were redundant again in a proportion satisfactory even to the farmers. There was now 'more capital' laid out in agriculture than before and in a more productive form. With this the demand for labour fell, not only relatively but absolutely." (Marx: op.cit., p.638.)

120. Ibid., pp.201-202.

121. Ibid., pp.195-203.

122. "Marx considered the twin processes of the centralization of capital and the growth of the reserve army as the most important structural factors that would bring class conflict to a revolutionary pitch" (Howard and King: op.cit.,

p.227). But in the light of their critique of his analysis of these two factors, the authors conclude that "Marx's own view of the causes of revolution is of limited relevance today" (loc.cit.).

123. This is especially true if the definition of 'unemployment' is closer to Braverman's than to that of the CPS. (See note 68.)

124. Erwin, A.: "An Essay on Structural Unemployment in South Africa", S.A. Labour Bulletin, Vol. 4(4), July 1978, pp. 51-69.

125. Since many of the women, if not the men, who lost their jobs on farms have probably not been able to find alternative employment for some years, the question arises of what is meant by the 'short run'.

126. See, e.g., Figure 11.

127. See Section 7.2.2.1, esp. pp. 248 - 249 and notes 51, 52 and 59.

128. At this moment, it is hard to see what further major labour-saving technological changes could occur on maize farms in the Western Transvaal, even should minimum wage legislation bring about a rise in the average wage. But this could be a case of 'famous last words'. In 1959, only a few years before the maize harvesting revolution began, the Reynders Commission felt it safe to say: "Reference has ... been made to the possibility of developing a maize combine ... (but) not much should be expected in this connection." (R.S.A. Commission of Inquiry into the Cost and Profit Margins etc.,: op.cit., p. 25.)

129. At least two State bodies have expressed this view. See R.S.A. Office of the Economic Adviser to the Prime Minister: op.cit. (Vol. 2), p.7; and R.S.A. Komitee van Ondersoek na Landelike Hervorming: Verslag, Government Printer, Pretoria, 1975, part 1, p.112. The latter referred explicitly to the western highveld.

130. See R.S.A. Commission of Enquiry into Agriculture: op. cit. (1970), p.97; and R.S.A. Komitee van Ondersoek na Landelike Hervorming: op.cit., pp.106, 108.

131. For example, the net producers' price for yellow maize (best grades, unclean) paid by the Maize Board during the marketing season 1980/81, was R115,00 per tonne. Between March 1980 and February 1981, the Chicago futures market price for U.S. No. 2 yellow corn fluctuated between about R84 and R114 per tonne, averaging in the region of R100. (Source: R.S.A. Maize Board: op.cit., (1981), pp.10, 38.)

132. In interviews, several farmers said they had already converted some of their maize fields into planted pasture, or were planning to do so, while the manager of SWT

Co-operative's Schweizer-Reneke branch said his sales of grass seed in the 1981-82 season had been abnormally high.

133. See Section 1.6 above. The Marais Commission expressed the opinion that mechanization of maize harvesting was most advanced in the Western Transvaal, though this had still to be confirmed. (R.S.A. Commission of Enquiry into Agriculture: op.cit. (1970), pp.168-169.)

134. For details of fruit harvesting techniques in the Western Cape, see Levy, B.: "Seasonal Migration in the Western Cape", in Wilson, Kooy and Hendrie: op.cit., p.101.

135. For a full account of this see Cargill, B.F. and G.E. Rosmiller (eds.): "Fruit and Vegetable Harvesting Techniques: technological implications", Rural Manpower Centre, Michigan State University, East Lansing, Michigan, 1969.

136. See Office of the Economic Adviser to the Prime Minister: op.cit. (Vol. 1), Table 5.2, p.47; (Vol. 2), Section 1, Annexure 3, p.19.

137. The Gross Domestic Product at factor cost at constant 1975 prices was R26 330 m in 1977 and R31 501 in 1981. The average compound growth rate was 4,63 percent. (Source: South African Reserve Bank: Quarterly Bulletin, No. 143, March 1982, p.S84.)

138. The rate of growth of the real GDP in 1982 was about minus 1 percent (R.S.A. Minister of Finance: Budget Speech 1983-84, in Budget Supplement to Cape Times, 31st March 1983, p.2). Furthermore, "it now appears that the anticipated economic upswing in most (industrial) countries will not materialize during the second half of 1982 but only in 1983, and will be milder than previously expected. As in the past, any new economic upswing in South Africa will be heavily dependent on economic recovery in the industrial countries and will only follow with a certain time lag." (South African Reserve Bank: Annual Economic Report, Pretoria, 1982, pp.6,7.)

139. Simkins: op.cit., (1982), Table 5, p.6.

140. Ibid.

141. Cogan: op.cit., p.621.

142. Ibid.

143. Peterson and Hayami: op.cit., p.528.

144. Peterson and Hayami suggest that "mechanical innovations would be more likely to be labor-saving than biological or chemical technology" (ibid., p.530). But, as this thesis shows, both weedicides and new better-standing maize hybrids have helped bring about a reduction in employment.

145. Schmitz and Seckler come to a similar conclusion in respect of the mechanization of tomato harvesting in the United States, and propose various fiscal methods of achieving this. (Schmitz, A. and D. Seckler: "Mechanized Agriculture and Social Welfare: The Case of the Tomato Harvester", in American Journal of Agricultural Economics, Vol. 52, November 1970, pp.569, 575-576.)

APPENDIX A

A B B R E V I A T I O N S

bes.	:	Besonderhede
H-K	:	Huur-koop
M,V,K	:	Mans, vrouens, kinders
S-A	:	Self-aangedrewe
V,S	:	Voltyds, seisoens

TECHNOLOGICAL CHANGE AND EMPLOYMENT IN SOUTH AFRICAN AGRICULTURE: THE CASE OF MAIZE-HARVESTING IN THE WESTERN TRANSVAAL, 1968-1981

M.A. (EKONOMIE) VERHANDELING : M.J. DE KLERK

SKOOL VIR EKONOMIE, UNIVERSITEIT KAAPSTAD

OPNAME VRAELYS

INLEIDING

- groete
- eie naam
- dankie!
- onderwerp van vraelys
- redes vir opname
- vertroulikheid (geen name of adresse of telefoon nommers gepubliseer of vir ander persone, maatskappye of staatsdepartmente gegee nie)
- voorreg om enige vraag te beantwoord of om te weier om te beantwoord
- wil u graag die uitslae van die opname sien?
- iets wat u wil vra voordat ek begin?

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- voorreg om enige vraag te beantwoord of om te weier om te beantwoord
- wil u graag die uitslae van die opname sien?
- iets wat u wil vra voordat ek begin?

A. **ALGEMENE INLIGTING** Datum:

1. Naam:

2. Adres:

3. Landdros-distrik

4. Telefoon nr

5a. Status van persoon met wie onderhoud gevoer word: eienaar/mede-eienaar/bestuurder/huurboer/ander (bes.)

5b. Getal mede-eienaars:

	Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(✓) Besonderhede (insl. rede(s), datum)
6a.	Indien onderhoud nie met eienaar nie, is eienaar (naam onnodig): boer/werk in die stad/ openbare maatskappy/private maatskappy/ander (bes.)	
6b.	Indien (mede-)eienaar: is plaas gekoop/geërf	
6c.	Ander plase: besit/medebesit/gehuur/ander (bes.) getal: distrik(te):	
7a.	Plaasgrootte:	
7b.	Bewerk:	
7c.	Gewasse (oppervlakte):	

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(√) Besonderhede (insl. rede(s), datum)

8. Handelsdiere (getal):

9. Belangrikste vorm van inkomste:

10a. Plaasbestuurder: ras:

10b. Bestuurder se werk:

11a. Eienskappe van land: plat/heuwelagtig/
klipperig/moerasagtig/ander (bes.)

11b. Grondtipe(s) waarin mielies verbou word:

12a. Basiese mielieoesmetode: meganies/hand

12b. Basiese oesmetode van ander gewasse:

meg./hand	meg./hand
meg./hand	meg./hand
meg./hand	meg./hand

13. Mieliesaaipatroon:

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(√)	Besonderhede (insl. rede(s), datum)

14a. Alle voltydse arbeiders: (Man = M, Vrou = V, Kind = K)

Taak	Perm. plaas-inwoner	Trek-arbeider	Pend-elaar	Ander (bes.)
masjien-bestuurders				
Voormanne				
wagters				
algemene arbeiders				
huis-bediendes	M V K	M V K	M V K	M V K
ander (bes.)				

Taak	Perm. plaas-inwoner	Trek-arbeider	Pend-elaar	Ander (bes.)
masjien-bestuurders				
Voormanne				
wagters				
algemene arbeiders				
huis-bediendes	M V K	M V K	M V K	M V K
ander (bes.)				

14b. Indien nie permanente plaasinwoner, familie se woonplek:

14c. Indien pendelaar, reisafstand en vervoer-middel:

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(✓)	Besonderhede (insl. rede(s), datum)

15a. Alle seisoenarbeiders: (Man = M, Vrou = V, Kind = K)

Taak	Perm. plaas-inwoner	Trek-arbeider	Pend-elaar	Ander (bes.)
	M	M	M	M
	V	V	V	V
oesvolk	K	K	K	K
	M	M	M	M
	V	V	V	V
optelmense	K	K	K	K
	M	M	M	M
	V	V	V	V
onkruidmense	K	K	K	K
	M	M	M	M
	V	V	V	V
ander (bes.)	K	K	K	K
	M	M	M	M
	V	V	V	V
	K	K	K	K
	M	M	M	M
	V	V	V	V
	K	K	K	K
	M	M	M	M
	V	V	V	V
	K	K	K	K

Taak	Perm. plaas-inwoner	Trek-arbeider	Pend-elaar	Ander (be (bes.)
	M	M	M	M
	V	V	V	V
oesvolk	K	K	K	K
	M	M	M	M
	V	V	V	V
optelmense	K	K	K	K
	M	M	M	M
	V	V	V	V
onkruidmense	K	K	K	K
	M	M	M	M
	V	V	V	V
ander (bes.)	K	K	K	K
	M	M	M	M
	V	V	V	V
	K	K	K	K
	M	M	M	M
	V	V	V	V
	K	K	K	K
	M	M	M	M
	V	V	V	V
	K	K	K	K

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(√) Besonderhede (insl. rede(s), datum)

15b. Bron van seisoenarbeid:

- families van voltydse plaasarbeiders op eie/ander plaas: (distrik(te))
- swart plasies in Transvaal/Bop'tswana: (distrik(te))
- swart dorpe in Bop'tswana (dorpe)
- swartwoonbuurtes naby blanke dorpe in Transvaal: (dorp(e))
- woonvolk op eie/ander plaas: (distrik(te))
- ander (bes. insl. distrik/plek)

15c. Indien pendelaar, reisafstand en vervoermiddel:

15d. Woonplek gedurende indiensneming: tuis/plaas/ander (bes.)

16. Getal permanente families op plaas:

	ras(se)
eienaar(s)	

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(√) Besonderhede (insl. rede(s), datum)

19. Huisvesting van arbeiders:

	Permanente arbeiders en families wat op plaas woon	Voltydse trek-arbeiders	Seisoen-arbeiders van ander plekke terwyl hulle op plaas woon	Permanente arbeiders en families wat op plaas woon	Voltydse trek-arbeiders	Seisoen-arbeiders van ander plekke terwyl hulle op plaas woon
huis/kampong						
tent/ander						
grootte						
getal kamers						
lopende water						
koud/warm bad/ stortbad						
toilet						
elektrisiteit huis vry van huur/gehuur (rente)						
ander (bes.)						

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(✓) Besonderhede (insl. rede(s), datum)

Opvoeding van arbeiders

20a. Het die meeste arbeiders in lae primêre skool/hoër primêre skool/hoër skool geslaag?

20b. Na-skoolse tegniese opleiding:

20c. Plaaskinders meestal op skool op: dorp in Transvaal/dorp in Bop'tswana/'n plaasskool/ ander (bes.)

20d. Afstand van skool:

20e. Plaasskool of eie plaas? Ja/Nee

B. **BESONDERHEDE VAN MIELIEOESMETODE: MEGANIES** (Vra net as boer meganies oes)

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(✓) Besonderhede (insl. rede(s), datum)

Stropers

1a. Getal selfaangedrewe:
Getal sleepstropers:

1b.

	Fabrikaat	Model	Jaar ver-vaardig	S-A/ sleep	Enjin-krag
1					
2					
3					
4					

	Fabrikaat	Model	Jaar ver-vaardig	S-A/ sleep	Enjin-krag	Verkoop/ geskrap (jaar)
1						
2						
3						
4						

1c.

	besit/ mede-besit/ gehuur	jaar gekoop	nuut/ gebruik	koop prys	koop metode kontant/H-K/huur-gebruik (lease)
1					
2					
3					
4					

	besit/ mede-besit/ gehuur	jaar gekoop	nuut/ gebruik	koop prys	verkoop prys/skrap waarde	koop-metode
1						
2						
3						
4						

	Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(√) Besonderhede (insl. rede(s), datum)

1d. Indien mede-besit, getal mede-eienaars:

Gebruik hulle ook stroper(s)? ja/nee

1e. Indien gehuur, rente:

Indien sleepstroper(s), trekker(s) gebruik:

2a.

	Fabrikaat	Model	Jaar ver-vaardig	enjin krag
1				
2				
3				
4				

	Fabrikaat	Model	Jaar ver-vaardig	Enjin krag	Verkoop/ geskrap (jaar)
1					
2					
3					
4					

2b.

	besit/ mede-besit/ gehuur	jaar gekoop	nuut/ gebruik	koop prys	koopmetode kontant/H-K/huur-bruik (lease)
1					
2					
3					
4					

	besit/ mede-besit/ gehuur	jaar gekoop	nuut/ gebruik	koop prys	verkoop prys/skrap waarde	koop-metode
1						
2						
3						
4						

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(✓) Besonderhede (insl. rede(s), datum)

2c. Indien mede-besit, getal mede-eienaars:
Gebruik hulle ook trekker(s)? ja/nee

2d. Indien gehuur, rente:

Arbeiders

3a. Getal in mielieoesproses gebruik:
(Voltyds = V, Seisoen = S)

	Bestuurders	Optelmense	Ander (bes)
V			
S			

	Bestuurders	Optelmense	Ander (bes)
V			
S			

3b. Oesperiode: getal weke
dae/week uur/dag

Oesperiode: getal weke
dae/week uur/dag

3c. Beloning van arbeiders:

	Bestuurders	Optelmense	Ander (bes)
Kontant			
% Opbrengs			
Sakke mielies			
Kos (gratis)			
Huis (gratis)			
Land (gratis)			
Ander (bes)			

Losvolk se beloning in laaste jaar:

	Kontant	%Opbrengs	Sakke mielies	Kos (gratis)	ander (bes)
M					
V					
K					

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(√) Besonderhede (insl. rede(s), datum)
Indien % opbrengs, totale opbrengs:	Indien % opbrengs, totale opbrengs:

Voltydse arbeiders se beloning in laaste jaar:

Kontant	%Opbrengs	Sakke mielies	Kos (gratis)	Huis (gratis)	Land (gratis)

ander (bes.)

Handoes: getal gebruik (laaste jaar)

Bestuurders V S

Voormanne V S

Oesters V S

dorsarbeiders V S

Ander (bes.)

Oesperiode: getal weke
dae/week uur/dag

Losvolk se beloning in laaste jaar:

Kontant	%Opbrengs	Sakke mielies	Kos	Ander (bes.)

Indien % opbrengs, totale opbrengs:

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(✓) Besonderhede (insl. rede(s), datum)

4. Koste van mielieoes:

	Totale koste	R/ton	R/ha
Verlede seisoen			
laaste seisoen van sleepstroop			
laaste seisoen van handoes			

4. Verwante operasies:

Operasie	Metode
Lewering van oes	massa/sakke
Onkruidbeheer	chemies/hand/meganies

C. **BESONDERHEDE VAN MIELIEOESPROSES: HANDOES** (Vra net as boer nog met die hand oes)

Destyds	Aansienlik verander sedert 1968?. Nee(x) Ja(√) Besonderhede (insl. rede(s), datum)

Basiese oesmetode

1a. Elke oester het sak: ja/nee

1b. Trekker en sleepwa in landerye/sleepwa langs landerye gelos

1c. Sakke in sleepwa leeggegooi/sakke byeengemaak om na dorsmasjien vervoer te word

1d. Los koppe in dorsmasjien gegooi/sakke in dorsmasjien leeggegooi

1e. Lewering: massa/sakke

Toerusting in mielieoesproses gebruik

2a. Trekkers:

	Met sleepwa gebruik	Met dorsmasjien gebruik	Met sleepwa gebruik	Met dorsmasjien gebruik	Aanvullende besonderhede
getal	1		1	1	Nommer: 1
fabrikaat	2		2	2	2
	1		1	1	verkoop/
model	2		2	2	geskrap

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(✓) Besonderhede (insl. rede(s), datum)

	Met sleep-wa gebruik	Met dorsmasjien gebruik	Met sleep-wa gebruik	Met dorsmasjien gebruik	Aanvullende besonderhede
jaar	1	1	1	1	jaar
vervaardig	2	2	2	2	verkoop-
jaar	1	1	1	1	prys/
gekoop	2	2	2	2	skrap
nuut/	1	1	1	1	waarde
gebruik	2	2	2	2	
enjin	1	1	1	1	
krag	2	2	2	2	
besit/	1	1	1	1	
mede-besit	2	2	2	2	
gehuur	1	1	1	1	
koopmetode	2	2	2	2	
kontant/H-K/huur-	1	1	1	1	
gebruik	2	2	2	2	

Indien mede-besit, getal mede-eienaars:

Gebruik hulle ook die trekker(s): ja/nee

Indien gehuur, rente:

2b. Sleepwa(ens) in landerye gebruik:
getal: kapasiteit:

	Destyds		Aansienlik verander sedert 1968? Nee(x) Ja(✓)	Besonderhede (insl. rede(s), datum)

2c.	Dorsmasjiene:	1	2	1	2	
	getal					nommer: 1 2
	fabrikaat					
	model					verkoop/ geskrap
	jaar vervaardig					jaar
	jaar gekoop					verkoopprys
	nuut/gebruik					skrapwaarde
	kapasiteit					
	besit/mede-besit					
	gehuur					
	koopmetode					
	kontant/H-K/huur-gebruik					

Indien mede-besit, getal mede-eienaars:

Gebruik hulle ook die dorsmasjien(e): ja/nee

Indien gehuur, rente:

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(✓) Besonderhede (insl. rede(s), datum)

3a. Getal in mielieoesproses gebruik:

	Bestuurders	Voormanne	Oesters	Dorsarbeiders	Ander (bes.)	Bestuurders	Voormanne	Oesters	Dorsarbeiders	Ander (bes.)
V										
S										

3b. Oesperiode: getal weke:
dae/week: uur/dag:

3c. Werwing: basiese metode:

Agente:

Beloning van agente:

Vervoermiddel:

3d. Beloning van arbeiders:

	Bestuurders	Voormanne	Oesters	Dorsarbeiders	Ander (bes.)	Bestuurders	Voormanne	Oesters	Dorsarbeiders	Ander (bes.)
Kontant			M					M		
% Opbrengs			V					V		
			K					K		

	Destyds					Aansienlik verander sedert 1968? Nee(x) Ja(√) Besonderhede (insl. rede(s), datum)				
3d.	Bestuur-ders	Voor-manne	Oesters	Dors-arbei-ders	Ander (bes.)	Bestuur-ders	Voor-manne	Oesters	Dors-arbei-ders	Ander (bes.)
	Sakke mielies									
	kos (gratis)									
	huis (gratis)									
	land (gratis)									
	ander (bes)									

Indien % opbrengs, totale opbrengs:

Allerlei

4a. Onkruidbeheermetode: chemies/hand/meg.

4b. Indien hand, word dieselfde oesarbeid gebruik? ja/nee

Destyds	Aansienlik verander sedert 1968? Nee(x) Ja(√) Besonderhede (insl. rede(s), datum)

4c. Gerame loonkoers:

4d. Besonderhede van enige ander gebruik van seisoenarbeid:

5. Koste van mielieoes:
totaal: R/ton: R/ha:

6a. Mieliestroper ooit op plaas gebruik?
ja/nee

6b. Indien ja, jaar/jare:

6c. Redes daarvoor:

6d. Redes nie aangehou nie:

D. **REDES VIR KEUSE VAN MIELIEOESTEGNIEK**

(Afkortinge: ja, baie = √+; ja = √; ja, effens = √-;
nee = x; onseker = ?)

Oesarbeid

1a. Het die beloning van handoesarbeiders aansienlik toegeneem/afgeneem/dieselfde gebly voordat u besluit het om 'n stroper te koop/in die laaste jare?

1b. Het dit u besluit(e) om mielies met 'n stroper/met die hand te oes beïnvloed? .....; ten gunste van/teen 'n stroper te koop?

1c. In u mening, die belangrikste rede(s) waarom dit gebeur het is:

- kompetisie van werkgewers wat hoër lone betaal: .....
- indien ja, watter werkgewers veral (name onnodig):
- inflasie .....
- ander rede(s) (bes.):
- verwag u dat dit in die toekoms gaan styg? .....

2a. Was die beskikbaarheid van handoesarbeiders groter/kleiner/dieselfde voordat u besluit het om 'n stroper te koop/in die laaste jare?

2b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop?

2c. In u mening, die belangrikste rede(s) waarom dit gebeur het is:

- meer/minder boere wat handoesarbeiders tegelykertyd soek: .....
- arbeid te ver weg verplaas ..... indien ja, redes:
  - regering het hul land gekoop ..... (jaar:)
  - onwettige woonvolk deur regering/boer verplaas ..... (jaar:)

- voltydse plaasarbeider en familie wat op plaas gewoon het na eie keuse na Bop' tswana/blanke stad gegaan het, b.v. om werk te soek: .....
  (jaar:)

- stedelike swart woonbuurte deur regering na Bop'tswana verplaas: ..... (jaar:)

- arbeiders nie verplaas nie, maar vrou nie oeswerk soek nie: .....

- ander rede(s): (jaar:)

- verwag u dat hulle in die toekoms minder/meer/dieselfde beskikbaar sal word? .....

3a. Het u gevind/vind u dat oesspanne redelik maklik/moeilik was/is om te beheer? .....

3b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

3c. In u mening, wat is/was die belangrikste rede(s) daarvoor?

- oesarbeiders is meestal on/betroubare persone

- oesspan het te groot/kleiner/op 'n redelike getal geword/gebly

- dit is redelik maklik/moeilik om oesspanne met kos te voorsien

- oesspanne is redelik maklik/moeilik om te behuis

- geld om oesspanne weekliks te beloon is redelik maklik/moeilik om te kry en te bestuur

- betroubare voormanne is redelik maklik/moeilik om te vind

- oesspanne vermors 'n groter deel van die mielieopbrengs as stropers

- ander (bes.):

Stropers

4. Die pryse van beide stropers en brandstof het sedert 1968 aansienlik toegeneem. Het dit u besluit om 'n selfaangedrewe stroper/'n sleepstroper te koop/nie te koop nie beïnvloed? ..... ten gunste van/teen 'n self-aangedrewe stroper/'n sleepstroper/geen stroper te koop.

5a. Wanneer/as u 'n stroper bestel (het), was/sal dit dadelik/na 'n kort tyd/na 'n lang tyd gelewer (word)?

5b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

6a. Watter geldbron het u/sal u gebruik om 'n stroper te koop? eie geld/lening.

6b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

7a. Indien lening gebruik, het u/sal u dit van 'n maatskappy/ private persoon gekry/vra?

7b. Besluit beïnvloed, ens? ... ten gunste van/teen 'n stroper te koop.

8a. Indien van 'n maatskappy geleen, watter soort maatskappy, en watter soort lening? (naam van maatskappy onnodig): .....

8b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

9a. Was dit redelik maklik/moeilik (of sal dit redelik maklik/moeilik wees) om geld te leen toe u/as u 'n stroper gekoop het/wil koop?

9b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

10a. Het rentekoerse op lenings om stropers te koop toegeneem/ afgeneem/teen dieselfde vlak gebly toe u 'n stroper gekoop het.

10b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

10c. In die toekoms, as 'n stroper wil koop, sal 'n verandering

in die rentekoerse op lenings vir stropers u besluit aansienlik beïnvloed? .....

10d. Die inflasiekoers in Suid Afrika is in die laaste jare amper so hoog soos die rentekoerse op middel-termyn lenings (b.v. vir stropers). Het dit/sal dit u besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

11. In 1977 het die belastingswet verander om boere die volle koste van nuwe toerusting, b.v. 'n stroper, as 'n produksieuitgawe in die koopjaar te laat afskryf (d.w.s. 100% waardeverminderingkoers). Het dit/sal dit u besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

Relatiewe pryse

12a. In u mening, het die (totale) koste van mielies meganies te oes vinniger/stadiger/teen die selfde koers as dié van handoes toegeneem, toe u besluit het om 'n stroper te koop?

12b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

12c. Indien u nog met die hand oes, sal sulke relatiewe prys bewegings u besluit beïnvloed? ..... ten gunste van/ teen 'n stroper te koop?

13a. Wat was die goedkoopste manier om mielies op u plaas te oes toe u 'n stroper gekoop het? Selfaangedrewe stroper/sleepstroper/handoes.

13b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

13c. Indien u nog met die hand oes, wat is op die oomblik die goedkoopste manier om op u plaas mielies te oes? selfaangedrewe stroper/sleepstroper/handoes.

13d. Beïnvloed dit u besluit om met handoes aan te hou? ..... ten gunste van/teen handoes.

14a. Verander die goedkoopste, mielieoesmetode van seisoen tot seisoen op u plaas? .....

14b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

14c. Indien goedkoopste metode verander, wat is die belangrikste rede(s) daarvoor? oesoppervlakte ..... mielieopbrengs/ha ..... duur van die oesperiode ..... loonkoerse ..... brandstof en herstelkoste ..... ander (bes.)

14d. Verwag u dat dit goedkoper/duurder/dieselfde koste gaan wees om in die toekoms mielies op u plaas meganies te oes?

14e. Besluit beïnvloed, ens? ..... ten gunste van/teen meganies te oes.

Allerlei

15a. Is dit vinniger om mielies met 'n stroper/met die hand op u plaas te oes?

15b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

15c. Waarom is spoed belangrik? bederwing van pitte ..... koppe val af ..... stam met koppe val plat ..... steel ..... kan vroeër ploeg ..... minder kans dat nie in massa kan lewer nie ..... ander (bes.)

15d. In u mening, hoeveel weke is op u plaas (i) 'n voldoende oesperiode ....., (ii) die langste aanvaarbare oesperiode ..... vir u mielieoes?

16a. Het stropers in die onlangse jare meer/minder doeltreffend (t.o.v. vermors, spoed, ens) geword?

16b. Het stropers in die onlangse jare meer/minder betroubaar (t.o.v. meganiese defekte) geword?

16c. Het stropers in die onlangse jare meer/minder doelmatig vir die omstandighede van u plaas (b.v. grootte, terrein) geword?

16d. Besluit beïnvloed, ens? ... tne gunste van/teen 'n stroper te koop.

17a. Is stropers gewoonlik redelik maklik/moeilik om in stnad te hou en te herstel?

17b. Het u stroper u ooit gedurende die mielieoes seisoen in die steek gelaat? ... (Bestuurder/werktuigkundige se skuld .... Defek in stroper ...).

17c. Indien ja, hoelank het dit stukkend gebly? .....

17d. Wie doen die basiese instandhouding?

17e. Waar word dit gedoen?

17f. Indien op plaas en plaasarbeider, het hy 'n opleidingskursus bygewoon? .....

17g. Is herstelfasiliteite redelik goedkoop/duur; redelik vinnig/stadig; van 'n redelike hoë kwaliteit/sleg?

17h. In u mening, watter skoolvlak is nodig om 'n stroper redelik goed in stand te kan hou? ....

17i. Het al hierdie faktore u besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

18a. Is opgeleide of ervare stroperbestuurders redelik maklik/moeilik om te kry?

18b. Hoe het u stroperbestuurders hul opleiding of ervaring gekry?

18c. In u mening is dit nodig om 'n hoërskoolse opvoeding te hê om 'n bekwame stroperbestuurder te wees?

18d. Is leerling-stroperbestuurders redelik maklik/moeilik om op die plaas op te lei?

18e. Omtrent hoe lank neem dit om hulle op te lei?

18f. Het al hierdie faktore u besluit beïnvloed ens? ..... ten gunste van/teen 'n stroper te koop.

19a. Is vermorsing groter met stropers/handoes?

19b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

20a. Gebruik u 'n stroper/kan u 'n stroper gebruik om op u plaas ander gewasse te oes?

20b. Watter gewasse?

20c. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

21a. Is u landerye redelik goed/sleg vir die gebruik van 'n stroper gepas?

21b. Indien sleg, rede(s):

21c. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

22a. Leen u ooit 'n stroper aan/van iemand?

22b. Hoeveel keer per jaar? .... (Hoeveel plase?)

22c. Huur u ooit 'n stroper aan/van iemand?

22d. Hoeveel keer per jaar? .... (Hoeveel plase?)

22e. Gebruik u dit ooit op 'n ander plaas wat deur u besit/ mede-besit/gehuur/bestuur is?

22f. Hoeveel keer per jaar? .... (Hoeveel plase?)

22g. Waarom verkies u om dit te doen/nie te doen nie?

23a. Leen/huur u gereeld ander toerusting?

23b. Indien ja, watter toerusting?

23c. Waarom verkies u om dit te doen/nie te doen nie?

24a. Sedert u 'n stroper gekoop het, het u 'n groter/kleiner/ dieselfde bedrag geld gedurende die oesseisoen nodig gehad (in vergelyking met handoes)?

24b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

25a. Was dit nodig/sal dit nodig wees om enige aansienlike veranderinge in die reëling van u plaas (b.v. in die grootte en vorm van u mielielanderye) en aan ander aspekte van u meganisasiepatroon (b.v. in ploeg) te maak, om u stroper doeltreffend te laat werk?

25b. Indien ja, wat was die belangrikste daarvan/sal die belangrikste daarvan wees?

25c. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

26. As die oppervlakte van u plaas/mielielanderye in

aansienlike mate na 1968 verander het (A6, A7, bl 1 bo), het dit u besluit beïnvloed, ens? ..... ten gunste van/ teen 'n stroper te koop.

27. Watter faktore beperk die meganisasie van die mielie-oesproses op u plaas, d.w.s. waarom koop/huur u nie meer en/of groter stropers nie?
oppervlakte van plaas/mielielanderye .....
gebrek aan geld ..... ander .....

28a. Het die taamlike gereelde toeneming van die mielieprys u besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

28b. Is u tevrede met die toename wat plaasgevind het?

28c. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

29a. As u 'n stroper besit, het u 'n besonder goeie finansieële jaar gehad toe u besluit het om 'n stroper of nog 'n stroper te koop.

29b. Besluit beïnvloed, ens? ..... ten gunste van/teen 'n stroper te koop.

30a. Weet u van 'n meer/ewe doeltreffende mielieoesmetode wat op u plaas sal pas (in vergelyking met u huidige metode)?

30b. Indien ja, waarom gebruik u dit nie?

30c. Indien ja, beteken dit dat u meer/minder/dieselfde getal/geen stropers sal moet hê?

30d. Indien ja, beteken dit dat u groter/kleiner/dieselfde grootte/geen stropers sal moet hê?

31a. Wanneer sal u 'n huidige stroper(s)/dorsmasjien(e) verkoop/skrap? .....

31b. Waarom?

31c. Sal u dan 'n groter/kleiner/dieselfde grootte/geen stroper/dorsmasjien koop/huur?

31d. Sal u dan meer/minder/dieselfde getal/geen stroper(s)/ dorsmasjien(e) koop/huur?

32a. Is u tevrede met u huidige mielieoesmetode?

32b. Is daar enige groot nadele?

32c. Indien ja, watter is die belangrikste daarvan?

33a. Wat was die drie belangrikste redes waarom u u huidige mielieoesmetode gekies het? (in volgorde van belangrikheid)

1.

2.

3.

33b. Wat/wie was die belangrikste raadbronne/raadgewers wat u gehelp het om hierdie oesmetode te kies?

33c. In u mening, is dit waar dat sommige boere stropers koop om nie by die bure agter te bly nie?

33d. Indien ja, sal u sê dat hierdie praktyk algemeen is?

34a. Sal u moontlik/waarskynlik ooit (weer) met die hand/ met 'n sleepstroper/ met 'n selfaangedrewe stroper mielies op u plaas oes? .....

34b. Indien ja, onder watter omstandighede sal u so maak? (antwoord):

E. GEVOLGE VAN DIE MEGANISERING VAN DIE MIELIEOESPROSES

Verrigting

1a. Het die meganisering van die mielieoesproses die produktiwiteit van arbeiders wat in oeswerk betrokke is verhoog? (d.w.s. die deel van die totale opbrengs wat deur elke arbeider opgelewer is) .....

1b. Kan u min or meer skat hoeveel dit toegeneem het? .....
Indien ja, skatting:

2a. Het die meganisering van die mielieoesproses die volgende verrig?
(i) opbrengs/ha: ..... skatting
(ii) wins op mielieproduksie: ..... skatting
(iii) opbrengs op kapitaal belê: ..... skatting

2b. Het u die tipe mielies beplant as gevolg van oes maganiesering verander?

2c. Indien ja, het dit (i) die opbrengs ..... (ii) die kwaliteit van die finale produk ..... verbeter? ander belangrike besonderhede?

Indiensneming

Hoeveel van die afname/toename in die getal arbeiders en families in u diens het, volgens u skatting, as 'n direkte gevolg van maganiesering van die volgende operasies, die plaas verlaat?

Operasie	Voltydse arbeiders	Seisoen-arbeiders	Families
mielieoes			
onkruidbeheer			
groter trekkers			
alle meganisering			

3b. Weet u:
(i) waar hierdie mense/families nou woon?

(ii) watter soort werk hulle nou doen, óf,of hulle werkloos is?

Kredietvereistes/uitgawes

4a. Het u middel-termyn kredietvereistes vir kapitaal-toerusting as gevolg van die meganisering van die mielieoesproses aanmerklik toegeneem? .....
(skatting van toename:)

4b. Het u kort-termyn kredietvereistes vir brandstof, kunsmis, lone ens. as gevolg van dié meganisering aansienlik toegeneem? .....
(skatting van toename:)

5a. Wat is nou die drie grootste uitgawes op u plaas (in volgorde van belangrikheid)?

1. (.....%)

2. (.....%)

3. (.....%)

5b. Wat was hulle voordat u 'n stroper gekoop het?

1. (.....%)

2. (.....%)

3. (.....%)

5c. As lone nie in albei 5a en 5b verskyn, weet u watter posisie hulle in albei gevalle geneem het?
(5a ....%;
5b ....%)

Allerlei

6a. Was die gebruik van stropers 'n belangrike rede waarom u enige veranderinge in u gewas - of weiding - patroon gemaak het? (Sien A7, bl. 1 bo) .....
Indien ja, belangrikste besonderhede:

6b. Was die gebruik van stropers 'n belangrike oorsaak van enige veranderinge in u plaasoppervlakte? .....
Indien ja, belangrikste besonderhede:

7a. Het die gebruik van stropers dit moontlik gemaak om groter beheer oor die hele oesproses te beoefen?

7b. Indien ja, op watter maniere? Minder afhanklikheid op:

- arbeiders:
- die weer:
- ander (bes.):

7c. Het u meer afhanklik van ander groepe/faktore geword?

7d. Indien ja, op watter maniere? Meer afhanklik op:

- die weer:
- brandstofverskaffers:
- werktuigkundiges:
- onderdeelverskaffers:
- finansieringsmaatskappye:
- ander (bes.)

8a. Het die meganisering van die mielieoesproses u eie/ u arbeiders se lewenspatroon aanmerklik verander?

8b. Indien ja, op watter wyse?

	Self	Arbeiders
- langer/korter vakansies		
- langer/korter werksdae/weke		
- minder onaangename werk		
- ander (bes.)		

8c. Kan u sê of dit die lewenspatroon van die mense,wat u tevore as oesarbeiders indiensgeneem het,verbeter/ versleg het? .....

8d. Op watter wyse?

9a. In u mening, wat is die drie belangrikste gevolge van die meganisering van die mielieoesproses op u plaas? (in volgorde van belangrikheid)

1.
2.
3.

9b. Watter veranderinge in die mielieoesproses verwag u in die toekomende vyf jaar?

9c. Is u met die gevolge van die mielieoesproses op u plaas tevrede?

9d. Indien nee, watter aspekte is mees onbevredigend?

9e. Is u met die gevolge van die algemene meganiserings-proses in die Suid Afrikaanse landbou tevrede?

9f. Indien nee, watter aspekte is mees onbevredigend?

9g. As ons van die algemene landboumeganiseringsproses praat, in u mening, wat is die drie belangrikste maniere waarop dit u plaas verander het?

1.
2.
3.

10a. Baie plaasarbeiders het die landbou in die laaste 20 jaar verlaat. In u mening, is dit goed/sleg vir boere/arbeiders?

10b. Kortliks, waarom?

10c. Verwag u enige probleme/voordele, b.v. werkloosheid, politiese moeilikhede?

10d. In u mening, is armoede/werkloosheid 'n ernstige probleem in

(i) Wes-Transvaal:
(ii) Bophuthatswana:
(iii) Suid-Afrika:

10e. Indien ja, behoort boere iets daaroor te doen? ..... Watter soort maatreels behoort hulle te neem?

10f. Watter soort maatreels behoort die regering te neem?

10g. Watter soort maatreels behoort arbeiders self te neem?

11a. Het u enige opmerkings wat u wil maak/vrae wat u wil vra?

11b. Dit is moontlik dat enkele belangrike vrae uit hierdie vraelys uitgelaat is. Indien wel, mag ek u weer nader? .....

BAIE DANKIE VIR U HULP!

APPENDIX B

TRANSKEI QUESTIONNAIRE

(Note: This questionnaire was not duplicated and filled in - one copy per respondent - as in the case of Appendix A. For further details, see Section 2.2 above.)

QUESTIONS FOR RECRUITERS (I.E. FOREMEN), SEASONAL WORKERS IN TRANSKEI

1. Name: Residence: How long recruiting for?

2. Seasonal Workers

   a. how many people wanting seasonal farm work?

   b. how many people finding seasonal farm work?

   c. how many teams?

   d. who are they? - sex?
      - age?
      - single women/men, families?
      - same people from year to year?

   e. where do they come from?

   f. have many people moved into these areas from 'white' SA in recent years?

   g. have there been any changes in (a)-(f) in recent years?
      details?

   h. what has caused these changes? Satisfied?

   i. how are people contacted? (personal recruitment/ labour bureaux, etc.)

3. Seasonal Work

   a. whom do they work for? - how are these farmers contacted?

   b. what sort(s) of work?

   c. in which areas?

   d. for how long do they work each year/week/day?

   e. how many employers are there?
      farmers with whom contracts are explicitly signed?
      others?

   f. do they have any other forms of work at other times of year?

   g. would they prefer to have other work, e.g. a full-time job in a city?

   h. for how long have Transkei people been doing this work?

   i. have there been any changes in (a)-(h) in recent years? (details?)

j. what has caused these changes? Satisfied?

k. if people are no longer able to find jobs in seasonal farm work, have they been able to find other work? (where, what sort, etc.?)

4. Conditions of Employment

a. how are they paid?

b. how much are they paid?

c. how are a team's earnings shared?

d. how much maize/money do they bring home?

e. what do they do with maize brought home?

f. how are workers transported?

g. how is maize transported?

h. how much do they pay recruiter?

i. what sorts of food/shelter/facilities do they have?

j. do they have a contract with farmer/recruiter? (do they understand the contract? are contracts completed in full?)

k. what rights do they have if, say, they feel the contract has been broken or they have been mistreated?

l. what complaints do they have?

m. how can they make complaints/requests?

n. have there been any changes in (a)-(m) in recent years? (details?)

o. what has caused these changes? Satisfied?

5. Organization/General

a. how are teams organized?
   - who makes decisions?
   - who cooks, washes?
   - what happens if someone gets sick/hurt or wants to come home?
   - Workmens' Compensation paid?
   - does this happen often?

b. is recruitment of this sort legal?

c. how/where are they registered?

d. have there been any changes in the law in recent years which have made it easier/more difficult to get seasonal farm work?

e. are there other similar recruitment schemes?
   - where? (Transkei/Bophuthatswana/elsewhere?)
   - whom to contact?
   - how?
   - do farmers/others come to labour bureaux?

f. foreman/worker self - age?
   - other forms of work/income?

APPENDIX C

METHOD OF ESTIMATION OF COSTS OF HARVESTING BY HAND, BY TRACTOR-DRAWN COMBINE AND BY SELF-PROPELLED COMBINE

(See Figures 52-55)

1. THE STUDY UNDERTAKEN BY THE DEPARTMENT OF AGRICULTURAL ECONOMICS AND MARKETING

Empirical cost estimation in agriculture is seldom a straightforward exercise. It is not simply a matter of taking figures out of a well-kept ledger. Conditions vary so much between one farm and the next, let alone between regions, that costs cannot readily be compared. As van Wyk points out in connection with maize harvesting, "'n wesentlike probleem by ... 'n ondersoek is die geweldige aantal veranderlike faktore wat hulle invloed op die ekonomie van die oesproses ... laat geld" (op.cit. (1970), pp.3-4). His list of examples, which is not exhaustive, includes no less than 20 such variables.

The project - of which van Wyk was leader - undertaken in the late 1960s by the then Division of Agricultural Economic Research of the Department of Agricultural Economics and Marketing, to estimate the costs of the many alternative techniques of harvesting and delivering maize, was a remarkably painstaking and thorough attempt to take the most important of these variables into account. An extract from van Wyk's description of the research method illustrates:

> "Die basiese gegewens ... is by 'n monster mielieboere versamel terwyl die verskillende oesprosesse aan die gang was. By die versameling ... is gepoog om 'n aantal herhalings van elke belangrike proses te verkry. Die inligting is ingesamel om die grootste moontlike reeks veranderlikes te dek. Waar tye opgeneem is, is dit met behulp van stophoorlosies gedoen. Oppervlaktes en afstande is met maatlyne afgemeet en opbrengste is van akuraat bekende oppervlaktes bereken. Arbeidsure is bereken oor 'n lang periode

> vir sowel spanne as individuele arbeiders. Standaardtye is vervolgens bereken deur regressielyne te pas op die resultate by verskillende opbrengspeile. ... 'n vloeikaart (is) opgestel wat die ... kombinasies van prosesse aangee waaruit die totale oes, dors en lewerings-prosesse saamgestel is ... Staandaard-tye is bereken vir elke individuele proses volgens opbrengs per morg en ryspasiëring ... Kosteberekenings (is) vir elke af-sonderlike proses gedoen" (ibid, p.5).

van Wyk goes on to define the costing procedure, the cost data sources and the assumptions made in connection with the chief cost variables, depreciation, interest charges, repairs, fuel and labour (ibid, pp.5, 6, 56). The over-all procedure is widely accepted, though many variations are possible within it. Hunt (op.cit., pp.51-65) and Culpin (op.cit., pp.53-57) describe similar procedures.

The conclusions of the Department's study of most relevance here are that:

- yield per hectare (morgen) does not influence the unit cost of hand harvesting greatly, but reduces the unit cost of mechanical harvesting considerably,

- hand harvesting in bulk (see section 3.1.1.1, p.41 above) is much the cheapest method of hand harvesting,

- there is little difference between the cost of hand harvesting and of PTO combine harvesting, at low yields (i.e. about 1,5 tonnes per hectare and below), but that the superiority of PTO combine harvesting becomes clear as the yield increases,

- if the capacity of SP combines is fully utilized, the unit cost of harvesting is lower still than for PTO combines. (Ibid, pp.60-61)