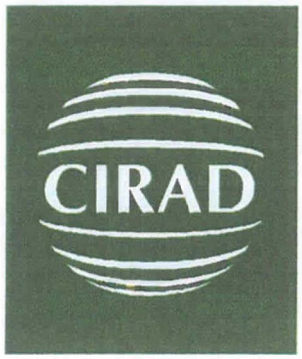


Department Territories,
Environment and People
Cirad-tera

INSTITUTE OF NATURAL RESOURCES

An Associate Institute of the University of Natal

The sugar cane harvest amongst small South African growers: General organisation and the role of small contractors

(case study at Amatikulu)

Pierre-Yves Le Gal
Eric Requis

CIRAD/TERA n°86/99
November 1999

Summary

Over the past few years the South African Sugar Industry has integrated the production of small black growers. Placed today in a context of liberalism and the quest for competitiveness, it is looking for ways to improve the efficiency of this group of farmers. The management of the harvest to the mill is one area that can be getting improved upon with respect to supplies, reduction of delays and production costs. The hypothesis was that the observed problems are essentially caused by the small contractors that conduct the harvest for the farmers. Therefore, a study was conducted over a period of six months in order to 1) specify the context in which these businesses evolve; 2) analyse their performances and management methods; 3) come up with recommendations for improvement. Conducted at the Amatikulu sugar mill, the study highlighted the irregularity of contractor's performances concerning the quantity of cane delivered per day. This irregu'arity is explained by problems of financial management and by the way in which work is organised with the growers. Accordingly, small scale contracting is rarely profitable. But the contractors are not the only ones responsible for these problems. The sub-committees, responsible for co-ordinating the harvest from small growers' fields to loading zone, do not succeed in their role. They are not proactive in solving the difficulties encountered by the contractors in order to fill their allocations. In addition to training the contractors in financial management, in the organisation of work and in the management of information, we propose that a joint enquiry be conducted into the organisational systems being put in place, to increase the overall efficiency of the small cane production sector.

Key words: harvest, sugar cane, small contractor, production cost

Contents

Introduction

Since the publication of the Sugar Act in 1936 which gave large management autonomy to the South African Sugar Industry, it has sought to integrate the small black farmers by facilitating their access to credit and by financing other accompanying actions like the creation of rural schools. Today these producers number 45 000 and they are responsible for 10% of the total cane production.

The recent de-regulation of the sugar industry following the liberalization of the South African economy has raised new difficulties. Confronted by the uncertainty of world markets, its competitiveness must be improved (O'Reilly, 1998). But, the small growers' yields are generally weak (30 to 40 t/hectare) and their harvesting system is poorly organised. Furthermore, their support services are expensive: at the rate of R7 per ton produced and 400 000 tons delivered by the small growers, the Amatikulu mill pours R3 million per year into improving their technical and economic performances.

This situation has become so problematic that two South African sugar groups, Tongaat Hulett and Illovo Sugar, are developing diversification strategies with sugar beet and are decentralising production into countries which are climatically better suited to sugar cane (notably Swaziland, Mozambique, Malawi and Mauritius). However they must be aware of the stakes and the social obligation which the support to the small-scale farmers represents. The improvement in the production of cane by these growers is dependent on 3 things:

- Increase of cultivated cane areas: the current average per farmer is between 1.5 and 2 hectares;
- Increase of average cane yields;
- Improvement in harvesting conditions and in the transport of cane to all the mills with the dual objective of diminishing costs and diminishing losses, particularly of sucrose.

The increase of cane lands is presently a difficult task to achieve because it concerns land tenure within the black communities. In the province of Kwa-Zulu Natal where a large amount of cane is cultivated, land distribution generally rests with the traditional Zulu chief. But he can be reluctant to increase individual farms because it can affect the main area which he controls. However, emergence of medium-scale farms of approximately 70 to 100 hectares is envisaged from the dismantling of the mill production areas, but this will not really increase the total area of cane cultivation.

The increase in yield is a central objective of the small growers support services through the technical training, which they offer. The progress margin is substantial since the yield of large commercial farms is in the region of 70 tons per hectare. The efficiency of the support carried out, regarding the farmers' practices and constraints, needs to be evaluated.

The improvement of harvesting conditions is a point frequently raised in the sugar industry especially since the mills are supplied by a number of small growers (Le Gal, 1996). The transfer of cane from the fields to the mill must take into consideration the regularity of daily supplies. It creates co-ordination problems between the different operations being carried out and the different stakeholders who are employed (cutters, growers, service providers, mill). On this level the South African situation is characterised by severe under-delivery in the small growers' zones with respect to their allocations or uncontrolled delivery delays from the fields to the mill. The mill tends to blame these problems on the small contractors that carry out the harvest for a number of growers.

The South African Cane Grower Association (SAGGA) employed the INR to conduct a training programme aiming at improving the performance of the contractors. A diagnosis of the reasons for these problems and the role that the different stakeholders play was conducted beforehand. This six month study was undertaken in 1998 and took the form of a post-graduate project jointly run by CIRAD and the INR and co-financed by SAGGA and the French Ministry of Foreign Affairs (Requis, 1998). This document sums up this study in four parts. After presenting the South African sugar industry, we specify the problem studied and the methodology utilized. Then, we present the results and finish up with some suggestions for action.

1. Context and problem

1.1. *The general organisation of the South African sugar industry*

The majority of sugar cane is produced on the East Coast in the provinces of Kwa-Zulu Natal and Mpumalanga (map 1). Over the past fifteen years sugar production has stabilised between 1.5 and 2.5 million tons. For various reasons (duration between two harvests exceeding 12 months in certain areas, the carry over of non-cut cane from one year to the next) only 300 000 of the 400 000 planted hectares are under production. The drop in production is essentially due to the dry years (1981,1984,1992 and 1993) and can force the country to import sugar. In a normal year the situation is reversed and exports represent 40 to 50% of the total production.

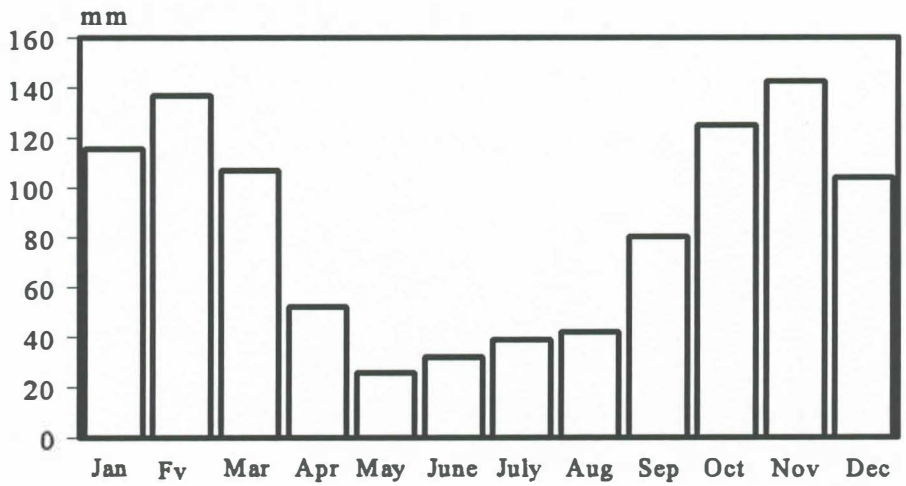
Sixteen mills are responsible for the transformation of the cane. Eight mills belong to Illovo Sugar Limited (48% of the production) and five to Hulett Sugar Limited (36% of the production). The two mills in Mpumalanga are part of Transvaal Sugar Limited and the last mill is held by a co-operative (Union Co-operative Limited). The cane production area is divided into three parts :

- The Kwa-Zulu Natal coast with clayey soil, a low altitude of less than 200 m and no frost in July, (Schultze, 1997) covers 68% of the total area. Depending on the specific location, the rainfall is between 800 and 1200 mm. This is the most limiting factor to production. Maturation starts with the marked dry season at the end of April, which provides good trafficability for harvesting assets (figure 1).

-17% of the total area is located in the Natal Midlands, where the rainfall is most unfavorable (between 800 and 1000 mm).

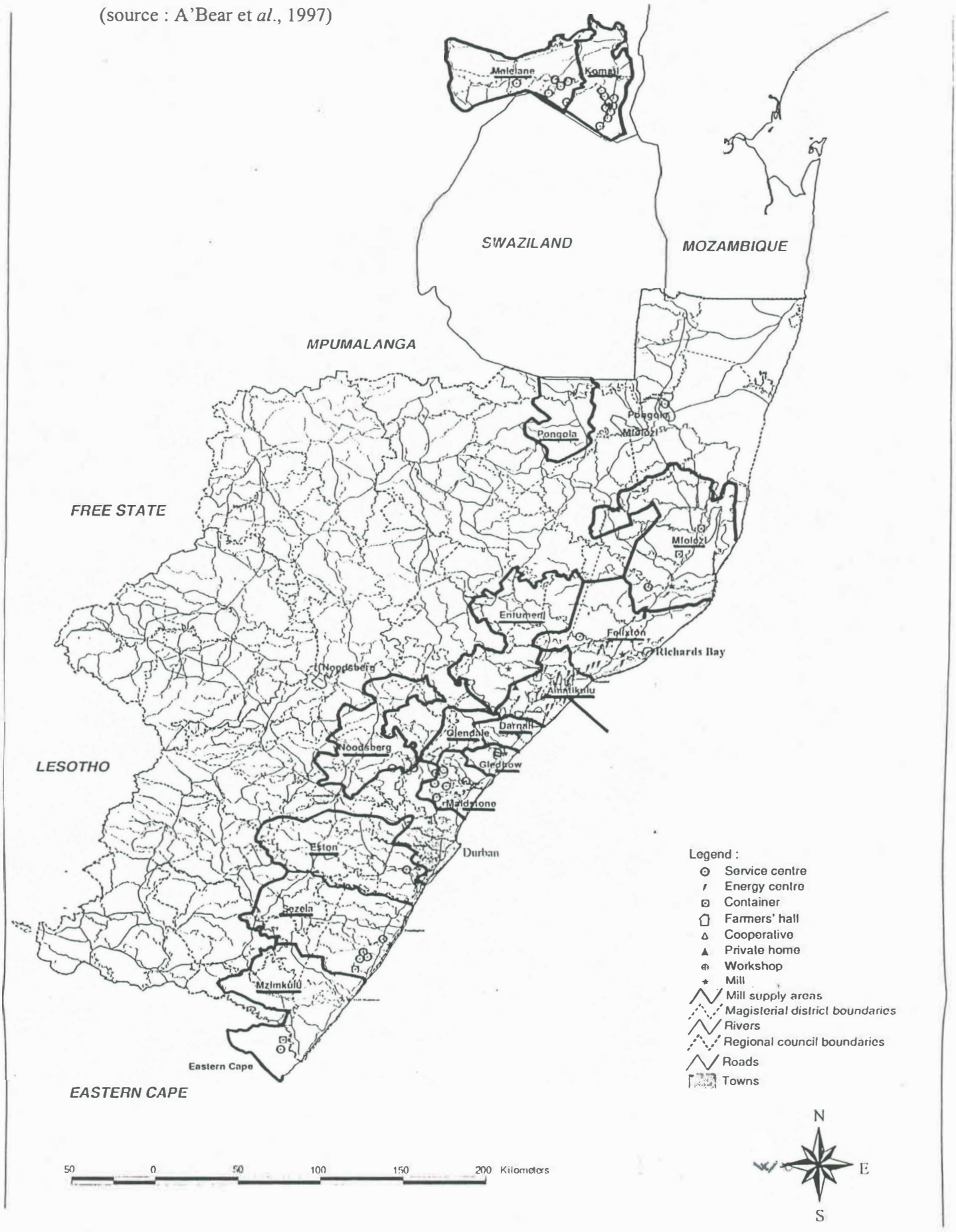
- The remaining 15% is cultivated in Mpumalanga and is under irrigation.

figure 1:Monthly rainfall in Amatikulu (average 1982-1997)



Map 1 : Location of the mills and their areas of production in Kwazulu-Natal and Mpumalanga

(source : A'Bear et *al.*, 1997)



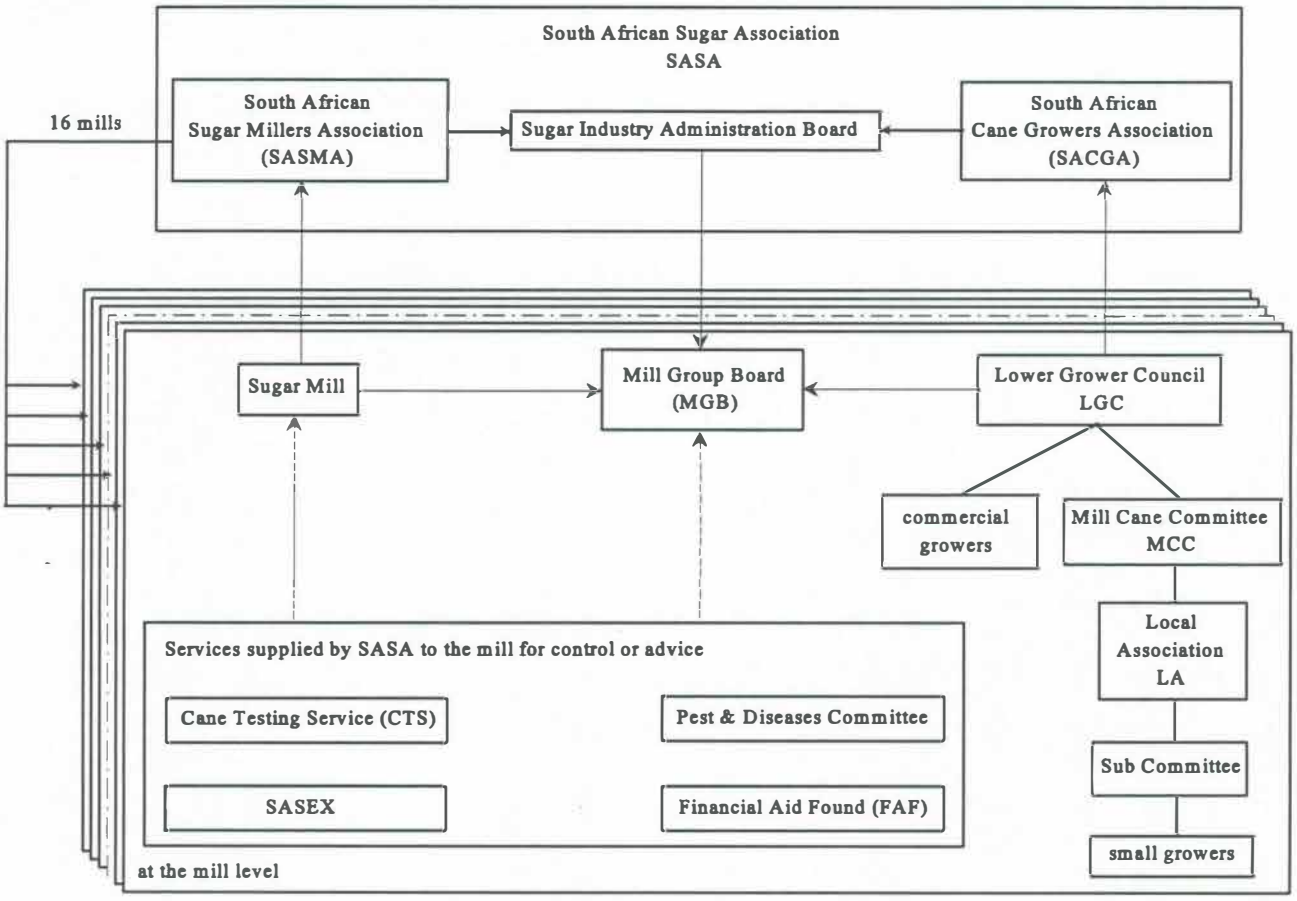
Cane growers are grouped into three classes according to their size and location (table 1). The distribution between the small and large growers vary from one mill to another. Some mills, such as Noodberg and Mzimkulu, have very few contributions from small growers. However they cover 20 to 40% of the total supplies to the mills at Glendale, Entumeni and Amatikulu (A'Bear and al., 1997).

table 1: Characterization of cane growers according to their category

Farm category	population	farm size (ha)	% total cane production
small growers	45000	1.5 - 2.0	127018
commercial growers	2000	150 - 200	
mill farms	?	?	

The operation and organisation of the entire industry is regulated by the Sugar Act under the aegis of the South African Sugar Association (SASA) (figure 2). Three main stakeholders can interact between the mill and its supply area: i) those responsible for the mill, ii) the Local Growers Council (LGC) who represent all growers supplying the mill, iii) the Mill Group Board (MGB) consisting of equal representation from the growers (designated by the LGC) and the sugar mill. The cane deliveries are organised by the MGB which acts as a consultation authority between the growers and the mill. This means the choice of the harvest season duration and the assignment of daily allocations. It also manages the relationship with the SASA which provides some directives.

figure 2 : General organisation of the South African sugar industry



Representation of the small growers on the LGC is organised according to three levels, which are funded by deductions from their takings:

- The sub-committee includes all the growers who are geographically located near a loading zone to which a delivery allocation to the mill is assigned. It is managed by headquarters which are elected every year[1].

- The Local Association (LA) consists of several sub-committees. It is essentially responsible for the determination of the tariffs applicable to the contractors.

- The Mill Cane Committee (MCC) includes all the Local Associations of the area. It constitutes the ultimate representation and defense of the interests of the small growers within the LGC.

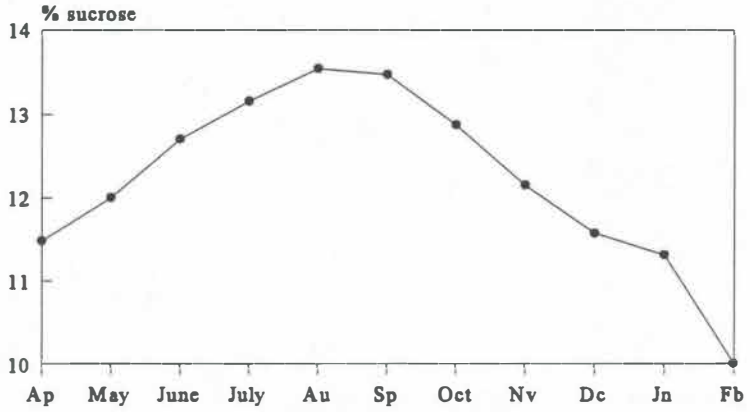
Every month the grower is paid according to the equivalent tonnage of sugar calculated by a formula which takes into account the rate of extractable sugar, the rate of fiber, and the purity of the juice (coefficients used by the Amatikulu mill).

P = tonnage of cane x RV % x Price of Sugar

RV % = % sugar - 0,35 x % NonPol - 0,02 x % fiber

The price of sugar is calculated from an average over the whole season. A regulation is made at the end of a season based on the advances recieved by the grower. The rate of extractable sugar is also adapted to the average rate obtained for all the deliveries of the season coming from the whole supply area. This method of payment is an incentive for the growers to deliver during the periods when the sucrose rate is lower (figure 3).

figure 3 : Variation of sucrose rate during the season (national average from 1985 to 1996)



(sources : Lamusse, 1986 to 1989 ; Lionnet, 1990 to 1996)

The services provided by the contractors are paid according to a grid established by the LA which takes into account the operations carried out and the distance from the field to the loading zone (table 2). The tariff determined by the LA is based on the previous year's figures which are increased according to the rate of inflation (5% in this case). There is no evaluation of costs related to the state of contractors' equipment, manpower or amount of work. The mill usually pays the contractor once it has been informed of the contract between him and the grower.

[1]The expression "sub-committee" will be referred to these headquarters in the rest of the text and the term "growers" means the producers dependent on this sub-committee.

table 2: Tariff structure of harvest operations

distance from field to loading zone (km)	loading + transport	cutting + loading + transport
0-1	6.09	20.24
1-2	7.32	21.50
2-3	9.70	23.88
3-4	11.52	25.70
4-5	13.60	27.78
5-6	15.70	29.88
6-7	17.80	31.98
7-8	19.84	34.02
8-9	22.00	36.12
9-10	24.10	38.26
10-11	25.29	39.47
11-12	26.55	40.73

1.2. ***Organisation of the harvest in the supply area: the Amatikulu case***

Within a given industrial structure, the harvest of a production area is organised around three essential parameters (Gaucher et al, 1997): the duration of the campaign and its starting date, the assessment of tonnages and the assignment of delivery allocations, and the daily management of supplies.

- Determination of the campaign duration

The Sugar Act decrees that cane cutting must start by the 1st April, at the earliest. The precise date of the opening of the mill is determined every year by the sucrose rate of the cane and the climatic conditions (possibility of harvesting in good conditions). The season's duration is fixed according to the estimation of the total amount of cane divided by the crushing capacity of the mill. The stopping date is Christmas time when the sucrose rate drops (rainy season) and when labour is scarce (holiday time). The 1997-1998 campaign at Amatikulu started on the 1st April and its duration was fixed at 37 weeks with an extra week to compensate for possible breaks during the season.

- Estimation of productions and assignment of delivery allocations

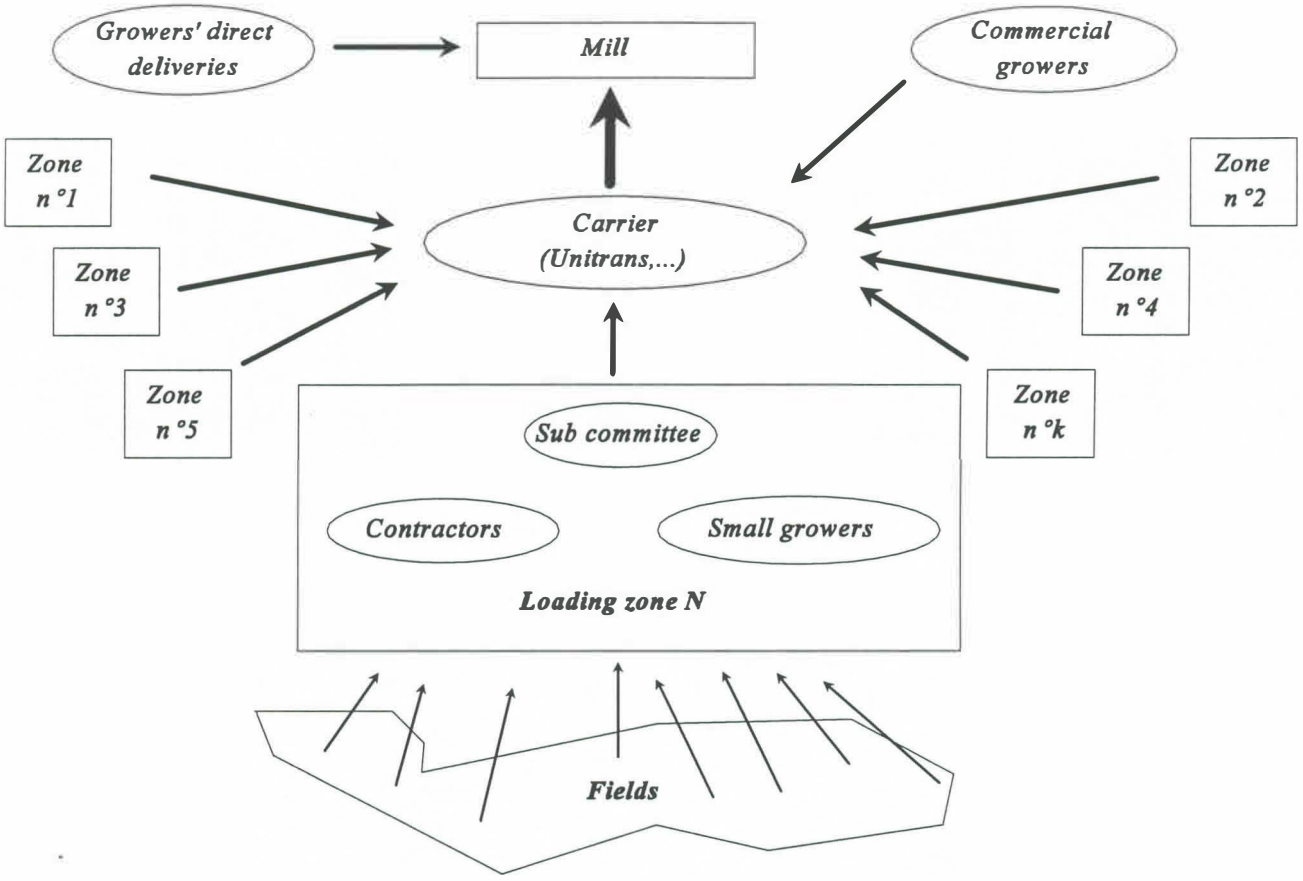
The commercial growers make their own estimations which are considered reliable by the mill. The small growers' productions are assessed and totalled by the sub-committee with the help of a supervisor from the mill. The mill then compares this evaluation with the previous year's figures before it is validated.

The MGB gathers all the assessments and then provides the weekly allocations to the commercial growers and to the sub-committees according to the chosen duration of the season. These allocations are re-adjusted every 5 weeks based on the results of the previous period, the amount left to deliver and the growers' wishes. The small growers can request an increase in the allocations of up to 5% but this must be justified and negotiated when it exceeds this threshold.

- Organisation of the daily supplies

The organisation of daily supplies must meet with 2 objectives: i) the contributions must be regulated to tie in with the mill's capacity to crush the cane; ii) delays between the cutting and the crushing must be limited as this influences sugar degradation and therefore the quantity of the extracted sugar and the growers' income.

figure 4 : Organisation of harvest from fields to the mill



In Amatikulu, the deliveries are sent directly to the mill (some commercial growers and a minority of small growers) or pass through an intermediate step at the loading zone (figure 4). Most of the small growers follow the second option which is organised as such:

- The grower wanting to harvest his cane gets in touch with a contractor who loads and transports the cane to the loading zone and, if necessary, takes charge of the cutting. The cane is burnt and the cutters put it into batches of 2 to 7 tons which are then chained and loaded onto a trailer with the assistance of a hydraulic winch.

- Each batch is transported by the contractor to the loading zone where it is weighed using a crane and identified with a label placed by an employee of the sub-committee (grower's identification code, tonnage, cutting date).

- The mill distributes the weekly allocation over 5.5 days (from Monday to Saturday morning) and converts it into a number of trucks weighing from 30 to 35 tons (hilos) which are sent every day to the zones once a sufficient quantity of cane has been confirmed by radio. The sub-committee has to regulate the loads of the individual growers in order to fulfil this allocation.

- The batches are loaded into the hilos by crane. The chains are taken off and left at the zone before being collected by the owners. A form is filled in recording the batches per hilo. The grower gets his own evaluation of sucrose rate when his delivery has filled a hilo. Otherwise the average rate of the zone is applied.

-The hilos are weighed entering the mill and once empty. The identification code, weight and sucrose rate of the batches are computerised and sent to the SASA for the calculation of the monthly payments to the growers.

The dispatching of the small growers' cane from their fields to the mill involves a number of stakeholders and is therefore influenced by each one's behaviour and their interactions (table 3). This can be evaluated using various indicators: respect for the delivery allocations during the season, delays between the cutting and delivery to the sugar mill, amount of non-harvested cane at the end of a season carried over to the next year, and the costs of the different stages in the process. As a result of the lack of available information locally, only two aspects (whether or not the allocations are respected and the evaluation of cost) will be analysed in this study.

1.3. ***The problem***

The analysis of available data and a collection of the stakeholder's positions involved in the harvest highlighted the following points:

- 10 to 20% of the small grower's production is carried forward from one year to the next. These figures are vague because they are based on annual estimation of production. But they underline the intensity of the phenomenon. The reasons for this situation can be circumstancial. In 1997 there was a long strike at the Amatikulu mill in July and the harvest was disturbed by strong rain in September-October. The non-harvested cane during these periods was not carried forward at the end of the season. But there are also structural problems linked with the organisation of supplies at the mill.

table 3: Relationship between stakeholders and harvest operations

Stakeholder	Operations undertaken	other related stakeholders
grower	1. Manages cane cropping 2. Chooses the cutting date 3. Eventually provides cutters and pay them 4. Pays the contractor 5. Weeds and fertilizes the cane crop and, if necessary, replants it	1. Manpower 2. Contractor 3. Manpower 4. Contractor, mill 5. Contractor (planting)
contractor	1. If necessary, cuts cane and pays cutters 2. Loads cane 3. Transports cane to the loading zone 4. Leaves the batches on the zone after identification and weighing	1. Cutters, growers 2. Cutters eventually 3. - 4. Sub-committee, zone crane
sub-committee	1. Manages the mill allocation 2. Identifies the batches coming to the zone	1. Grower, Contractor 2. Contractor, crane
carrier	1. Manages the crane and weighs batches 2. Transports cane from the zone to the mill 3. Is paid by the mill	1. Contractor, sub-committee 2. - 3. Grower, mill
mill	1. Receives cane and collects the data related to each batch 2. Weighs the batches a second time 3. Samples trucks for sucrose assessment 4. Pays the growers and the contractors	1. Carrier 2. - 3. CTS 4. Grower, Contractor
CTS	1. Gathers the identification and sampling data for each batch	1. Mill

- This overall irregularity results from difficulties encountered by the sub-committee in regulating the daily deliveries, as shown by the figure at Mvutshini where the available information at the headquarters applies to the loads for the whole season (figure 6)[1]. The amount of cane delivered varies from single to double from one day to the next.

- Delays between burning and delivery to the mill are very variable in the same area (figure 7) and can exceed the norms, considered between 24 and 48 hours. These delays are mainly due to transport from the field to the loading zone, as the transfer from the loading zone to the mill, which is carried out by the transport company, is more regular (figure 8).

We have assumed that these irregularities and delays in deliveries from the small growers could be due to the problems faced firstly, by the sub-committees to co-ordinate growers and contractors and secondly, by the contractors' management of the harvest tasks. This second hypothesis is the most commonly accepted by the stakeholders. It is based on the following contractors' characteristics :

- old equipment in a poor state and unreliable because of lack of maintenance
- lack of professionalism with little attention to delays in deliveries and quality of cane
- goals of social prestige rather than economic profitability
- competition, exacerbated by too many companies, prevents the most technically efficient from emerging.

These declarations are not based on accurate facts that have been analysed. Actually, little information exists on the performances of contractors and their management methods. Moreover they are not completely listed by the mills (situation at Amatikulu). Considering these different elements we have organised our study around the two following questions:

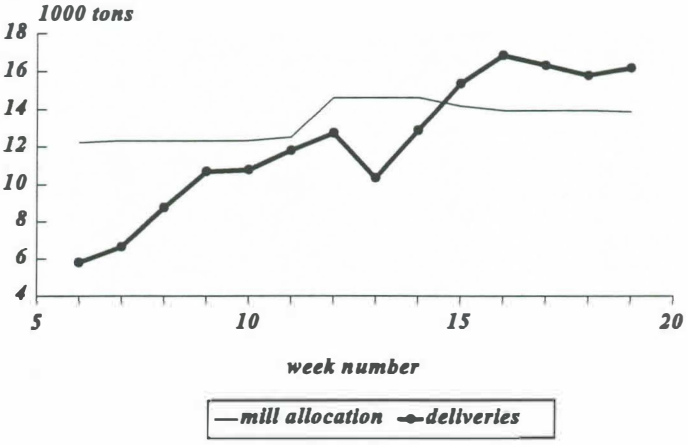
- *How do the contractors' management methods and their performances explain the problems observed in the organisation of the harvest ?*

- *How does the relationship between the contractors, the sub-committees and the growers influence their management methods ?*

This second question resulted in an extension of our study from the contractor level to the sub-committee level, and into the way the sub-committee manages the flow of cane between the growers, the contractors and the mill.

[1]It concerns daily quantities delivered by the contractors to the loading zone and not the quantities delivered to the mill by the hilos.

figure 5 : Total small growers' mill allocations and deliveries in Amatikulu during the 1998 season



(source : Amatikulu mill)

figure 6 : Daily allocations and deliveries in Mvutshini loading zone (1997)

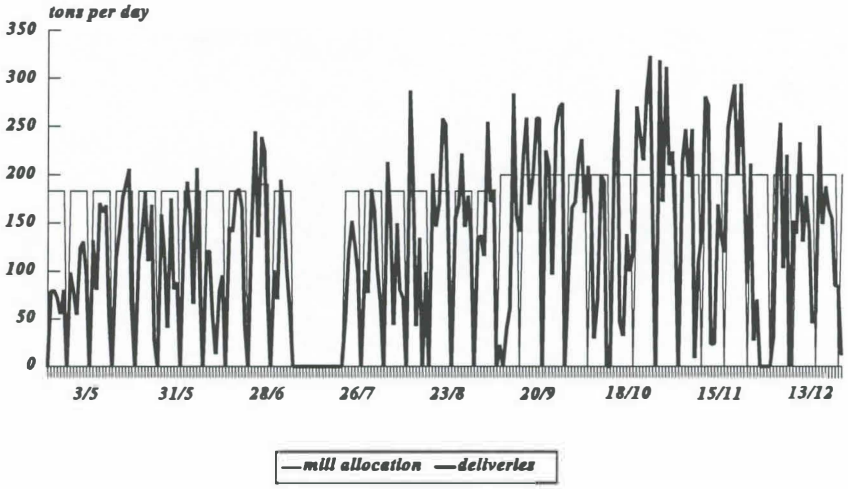


figure 7 : Delays between burning and crushing for 8 mills in 1998

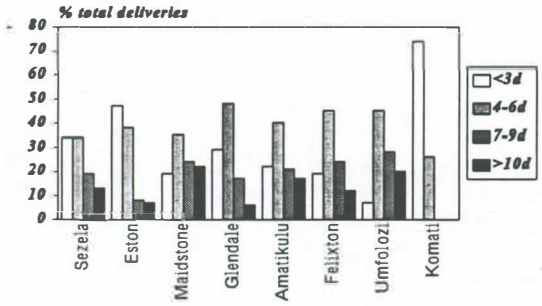
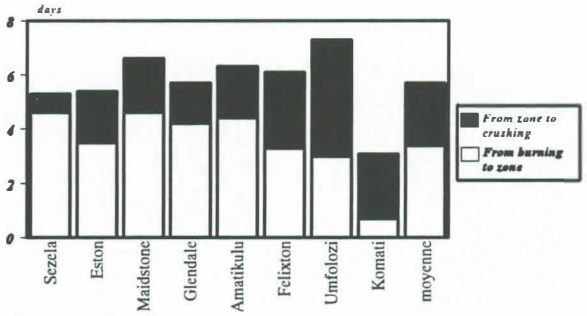


figure 8 : Structure of the delay between burning and crushing for 8 mills (1998)



2. Methodology

Our analysis is based on the work conducted by CIRAD in La Réunion concerning the organisation of supplies to the sugar mills (Gaucher *et al.*, 1997) as well as the management of the contractors' business who conduct the harvest for a number of growers (Dagallier *et al.*, 1997). Both cases involve defining the rules used by the stakeholders in order to make management decisions, measuring the effects of these decisions on the performances of their activities, and defining the key parameters determining these performances.

Regarding the organisation of the supplies by the mills and the sub-committees, we were interested in the way in which i) the distribution of the supply allocations are planned from the mill to the sub-committee and also from the sub-committee to the growers and contractors ii) the mill and sub-committee adjust to the uncertain events experienced during the season (deficit or excess of supplies, break-downs and rain).

The analysis of the contractors' operation was structured around: i) a description of the structure of their business ii) an understanding of their objectives, iii) an understanding of their work organisation methods, their strategies and practices concerning maintenance and financial aspects. Their technico-economic performances were evaluated using available data from the mill, the sub-committee, contractor or from simulated cases.

The sampling was conducted on 3 levels and four entities: sugar mill, sub-committee, contractor and grower. The objective was not so much to obtain an overall vision of the contractors' situation, (which would need an extensive investigation with several variables) but to understand the management process in a number of limited cases. So, the results of this study would need to be validated and enriched by a follow-up investigation involving other cases.

A single mill was chosen in order to limit travel time and to benefit from the same management for all the other entities investigated. Amatikulu was chosen as it fulfils the research criteria, that is to say: it includes a large number of small growers among its suppliers, as well as a large number of contractors with problems, (A'Bear *et al.*, 1997), it is in a safe location and is interested by the subject being studied.

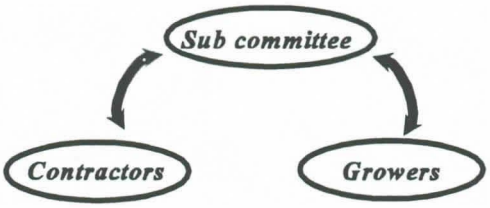
The sub-committees have been chosen within a conceptual framework describing the co-ordination processes between growers and contractors. Three cases were assumed (figure 9). The first corresponds to a centralised figure where the sub-committee plans the relations between the growers and the contractors during the season. It establishes the cutting schedule of the growers and assigns them a contractor. This case requires a powerful and well structured sub-committee. It was not encountered at Amatikulu.

The second type is a decentralised model where the sub-committee approves a group of contractors to whom they assign a weekly delivery allocation for the season. The daily regulation is made afterwards at the loading zone, according to the actual deliveries. Mvutshini's sub-committee fills this case in our sample.

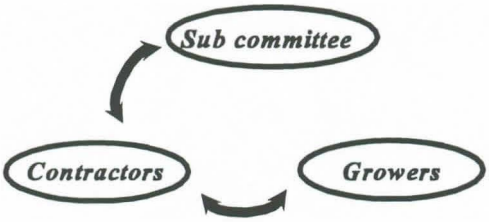
In the third type, the sub-committee lets the growers and contractors freely organise and regulate the deliveries to the loading zone. In our study this situation is represented by Mpungose's sub-committee. From the first to the third type, there is a gradual process where the planning of supplies is replaced by the adaptation to uncertain deliveries Planning gives the stakeholders a better view of the oncoming season and better control of some parameters, such as the regularity of supplies. But it calls for a forceful system in terms of organisation as well as information management which probably explains why it is missing at Amatikulu. At the present time the eventual superiority of planning can be studied only by simulation.

Since there was no accurate and exhaustive data available, the choice of contractors was carried out with the sub-committee according to a list based on the amount of cane they delivered and the number of days they worked during the previous season. In order to provide diversity, the two permanent contractors at Mpungose were chosen as well as seven of the 30 contractors listed at Mvutshini (table 4). The growers (15 at Mvutshini and 5 at Mpungose) were questioned at random and on site.

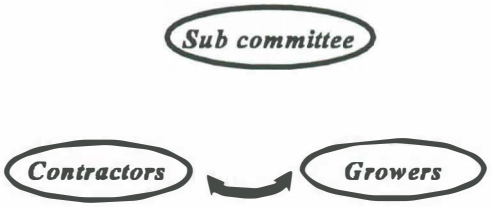
figure 9 : Three theorical types of organisation between sub-committee, growers and contractors



type 1 : the sub committee centralizes the relationship between growers and contractors



type 2 : the sub committee provides allocations to the contractors



type 3 : the sub committee does not interact with growers and contractors

table 4: Sampling grid for contractors'survey

		total tonnage dealt with processed in 1997-98		
		<750 t	750 à 2000 t	>2000 t
frequency of delivery*	<30 %	V4,V5,V6		
	>30%		PV1, PV2,V3,V7	V1, V2

* proportion of worked days relative to total workable days during the season

Apart from discussions with key participants concerning the overall organisation of the sugar industry, the information was collected using qualitative interviews and quantitative data (table 5). However, the latter were generally missing as the contractors and sub-committees did not have a systematic recording system for their activities. This raises the problem of the information system on which the stakeholders make their decisions.

table 5: Information collected by type of stakeholder

Level Investigated	Information Collected
Sub-Committee	. estimate of the amount of cane harvested during the season . management of delivery allocation and relations between growers and contractors . methods used to monitor the daily deliveries to the loading zone . methods of reacting to fluctuations in cane deliveries . methods of evaluating the season
Contractor	. structure of the business (equipment, labour, activities, history) . organisation of work (daily and annual goals) . maintenance of equipment . financial management . management of information . objectives and projects . technico-economic performances
Grower	. the place of cane in domestic activities . practices of cane cutting . knowledge of the quality of cane and relation with the rate of payment . criteria for choice of contractor . perception of the role of sub-committees

3. **Results**

3.1. ***The Amatikulu sugar mill***

3.1.1. *General characteristics*

The mill at Amatikulu is located on the north coast of Kwa-Zulu Natal (map1). It was built in 1906 and renovated in 1964. It has the capacity to crush 2.2 million tons of cane during a season of 37 weeks, at 385 tons per hour , 24 hours a day and 6.5 days a week. Over the past 3 years the production of the 15000 small growers has increased from 20 to 25 % but, the mill works below its theoretical capacity (table 6). Only 10 000 small growers are considered active in an area of approximately 10 000 hectares divided between 26 sub-committees. 400 contractors are listed in this area which is more than all the contractors from other mills put together.

table 6: Annual tonnage delivered to Amatikulu mill according to the grower's type

	1995		1996		1997		yield
	tonnes	%	tonnes	%	tonnes	%	1997
commercial growers	1 043 064	79.5	1 026 354	76.2	1 249 270	75.2	60-75 t/ha
small growers	268 864	20.5	321 225	23.8	397 757	24.8	35-40 t/ha
total tonnage	1 311 928		1 347 579		1 660 491		

The mill extension service provides support to the small growers and ensures their payment. This service is organised by area supervisors and resource center clerks, under the responsibility of three area managers and a regional manager (head of extension service). The supervisors are assigned to one or several sub-committees. They are responsible for transferring information between the mill and the sub-committee, assisting with the estimations of production, ensuring that agronomic advice is relayed to the growers and ensuring that the season runs smoothly. Full time clerks work at centers on the loading zones. They are in radio contact with the mill and assist the growers and the sub-committee in meeting the requirements of the refinery.

The mill's strategy with regards small growers has not been precisely explained even though it has a close bearing on the way in which their production will be managed. Does it try to exploit an additional amount of cane once its business has become profitable with the commercial growers? Or does it count on these productions in order to improve its profitability? In the first instance the mill would probably be less strict with regard to the allocations provided to the small growers. However, as a result of the variability in production according to the yearly rainfall, the mill's position can evolve and change over the year. From 1992 to 1993 the mill looked to recover a maximum amount of production available from the small growers but in 1998 we observed a more relaxed attitude.

3.1.2. *General organisation of supplies*

The planning of supplies designed by the MGB is operated under the control of the mill reponsible for cane supply and transport. Monitoring and adjustment of deliveries are managed separately between the commercial growers and the small growers. The first group quickly communicates their changes in contributions which are reported to other similar growers.

The situation is more complex amongst the small growers who tend to under deliver at the beginning of the season and surpass their allocations later on. To resolve these problems the mill adopts the following rules: If there is a deficit in the deliveries, the extension service first aims at regulating the contributions between the sub-committees by re-allocating the 6 trucks which are reserved on a daily basis for the small growers. If this adjustment is not sufficient, the person in charge of supply reports the missing quantities to the commercial growers who are ready to deliver more cane. This rule also applies in the case of rain as the contractors then have more difficulty in going into the sloping fields with their underpowered tractors. These adjustments depend on the non-systematic co-operation by the commercial growers. They involve a certain amount of uncertainty with regards to the total contributions at the end of a season, when the small growers exceeds their part by more than the initially planned 25%, by cumulating carry-overs.

When there are excess deliveries to the loading zone, the mill carries over the allocation to the sub-committees who are under delivering at this time. The mill then increases the number of trucks allocated to the zone. The mill therefore has a simple and relatively flexible way of adapting to the irregularity in contributions from the small growers. If no carry-over is possible, the mill has two solutions:

- leave the cane at the loading zone with the risk of increasing the delay between cutting and delivery for the later batches, as the oldest cane takes priority.
- transport the excess cane to the mill yard where it will be stored and then processed at the end of the week. The mill has a tolerance margin between its real and theorical crushing capacity (e.g. increasing the weekly crushing period by an hour).

However, in both cases excesses tend to increase the delay between cutting and delivery and therefore to decrease the quantity of recovered sugar for the mill as well as the growers. Under-supply and carry-over of cane from one season to the next, on the one hand, and drop in the average quality of cane on the other hand, are indicators of problems experienced by the mill. But, this mill does not seem to give itself the oppotunity to solve these problems, e.g. by taking more direct action on the growers. The origin of these problems is being researched by looking at the sub-committee and contractor's behaviours.

3.2. ***Role and operation of the sub-committees***

The sub-committees at Mvutshini and Mpungose were originally joined but they separated when there was an increase in the number of growers. They are adjacent and depend upon the same Local Association. So their contractors adhere to the same tariff structure and cannot compete on price with one another. Despite their common origin, these two sub-committees have different characteristics

3.2.1. *Characteristics of the sub-committees investigated*

The Mvutshini sub-committee covers 4230 hectares of which 1050 was allocated to the cultivation of cane in 1997. It is located in an area of transition between flat grounds cultivated by commercial growers and steep hills cultivated by small growers. The estimated production for 1998 was 33000 tons harvested by 38 potential contractors. The loading zone is situated in the middle of the area and the distance between the plots of land and the zone does not exceed 6 km. It has a service centre managed by the sugar mill. The president is in charge for his seventh year and the treasurer in his fifth. The mill considers this team to be efficient and, in fact, some data regarding the cane supplies are recorded and available.

The Mpungose area presents more constraints. It covers 2990 hectares and is situated in the hills which are difficult to access and cultivate. Only 276 hectares were planted with cane in 1997. The estimated production for1998 was 10000 tons harvested by two permanent contractors and 14 temporary ones who come mostly from Mvutshini. The loading zone is located on the border of the area of production and the distances between the fields and the loading zone can reach 12 km. The roads are difficult for the underpowered tractors and the loaded trailers. The headquarters of the sub-committee have just been renewed but the mill considers its performance to be poor. Indeed one cannot find any information on the progress of harvesting seasons at its office.

3.2.2. *Management of cane supplies*

According to the sub-committee headquarters the management of supplies at Mvutshini progresses as follows:

i) Before the start of the season the sub-committee asks every registered contractor to supply his maximum delivery capacity. This is calculated based on the weight of a batch and the number of batches delivered per day. This depends on the number of cutters made available by the contractor at the rate of 2 cutters per lot per day. But, he is limited by the number of chains available.

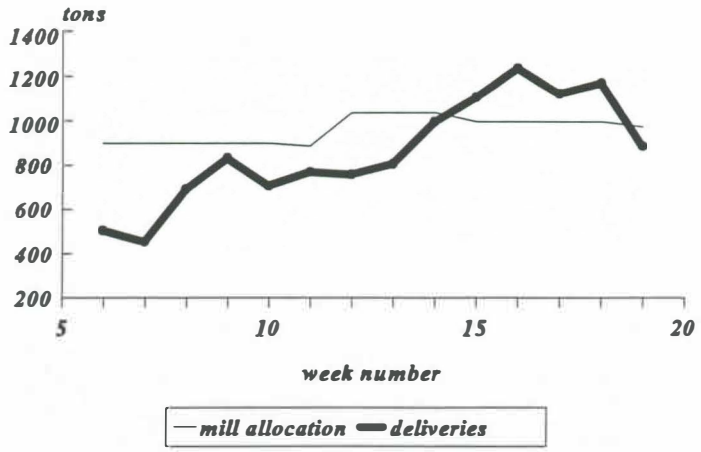
ii) The accumulated requests of the contractors generally exceed the allocation provided by the mill. Therefore, the sub-committee contacts each contractor and negotiates with them until the two values are adjusted. The most reliable contractors usually benefit from a higher allocation.

iii) During the course of a season the sub-committee can transfer unfulfilled allocations from one contractor to another. It is therefore important that the sub-committee monitors each contractor' s supplies.

iv) During the day, the clerk responsible for completing the labels on the batches, adds up the weight of the batches delivered. When the overall allocation provided by the sub-committee is reached, the clerk tells the contractors to limit their deliveries, then forbids them to deliver more.

The application of these rules is not yet systematic and underlines a number of difficulties. Thus, during the 1998 season the allocation provided to the contractors was 3 to 4 times the allocation provided by the mill. No adjustment was made and even so, the sub-committee found itself in a situation of under-supply throughout the beginning of the season (figure 10). This position would allow the sub-committee to avoid possible conflicts with contractors unhappy with their allocation, while getting some latitude to face individual under-supply. On the contractors' side, an over-estimation of their delivery capacity prevents them from being limited should some opportunities occur to increase their deliveries during the season (e.g. loan of chains or increase in the size of the cutter team).

figure 10 : Delivery curve in Mvutshini zone



(source : Amatikulu mill)

figure 11 : Delivery curve in Mpungose zone

(source : Amatikulu mill)

The management of excesses by the sub-committee's clerk is hardly ever very rigorous. Although no data is collected, we frequently observed up to 20 batches of cane left behind at the zone after the hilos had left. It is evident that the contractors do not respect requests even if they have to leave their chains unused for 24 hours or more. Relations between the contractors and the sub-committees are not rigorous, and extend the practices observed at the mill level. It leads the sub-committee to shift the responsibility of the supplies to the contractors which is the case at Mpungose.

In this case the sub-committee gives no particular instructions to the contractors who operate in its zone. The delivery capacity of the 2 permanent contractors is actually inferior to the allocation provided by the mill and they can function without too many constraints. To complete their contributions, the sub-committee contacts the contractors at Mvutshini either directly or *via* the Mvutshini sub-committee. So the deliveries recorded at the zone are the overall result of individual behaviours, but the sub-committee can only note afterwards digression from the overall allocation.

Mpungose experiences more structural difficulties. The low number of permanent contractors raises the grower's risk of not being harvested when he wishes. The difficult transport conditions lower the overall performance of the harvest task. This is amplified by the practice of paying the cutters per batch (R20 to R40) and not per ton as is done at Mvutshini (R10). The average weight of the batches reveals this (less than 4 tons at Mpungose compared with 4.5 tons at Mvutshini) and forces the contractors to conduct more trips for the same quantity of cane on the field. The operating costs are higher by approximately 20%.

Nevertheless the delivery curves observed during the study are very similar on the two sub-committees (figure 11). The performances of the contractors at Mvutshini are therefore also questionable.

In both cases the improvement of the sub-committee's role regarding the management of supplies is hindered by the lack of training of those responsible who are not motivated to assume this voluntary and complex activity[1] The management of information reflects this problem: the data (collected or not) are never analysed or reported to those in charge and therefore cannot serve as indicators to monitor or evaluate the season.

3.3. *Position of growers*

As a result of time constraints, we were limited to 20 interviews with growers which allowed us to draw some general trends without having an exhaustive and precise vision of their diverse strategies regarding sugar cane and its harvest. Overall, 75% of growers surveyed own between 1 and 3 hectares with no-one exceeding 8 hectares. Almost half of them do not know their production for 1997 and the others' yield ranges between 30 and 40 tons per hectare. The total production of a grower is therefore limited and would not be enough to take care of family needs. In fact, cane appears to be a source of cash and does not constitute their principal income (A'Bear *et al*, 1997). This comes from pensions or money sent by family members who work on the mines or in the cities.

As the introduction of cane into the black communities has often simply consisted of renting fields with the mill conducting all the operations, the growers have a limited knowledge of the crop. Even today they tend to subcontract most of the operations, including fertilisation and weeding. The decision to cut the cane is made because of:

- need for funds
- respect for a regular interval between cuts (12 months at Amatikulu)
- availability of a contractor to conduct the work
- estimation of the maturity of the cane

Their hierarchy varies from one grower to another, but the main tendencies stand out. The need for funds surpasses other criteria and can cause a grower to cut cane at 7 months. Available funds have a reverse effect

[1] At Mvutshini the management of supplies necessitates the co-ordination of 1000 growers and 30 contractors who must respect the daily allocation provided by the mill for the whole season. Planning and monitoring the transfer of cane from the fields to the zone would mean using management tools which those in charge at present are not capable of using.

: without funds to pay his cutters, the grower will delay the cut. Few are aware that they can get an advance on payment of R10 per tonne delivered during the week following the delivery.

The search for a contractor only becomes a priority at the end of the season when the demand for harvesting can exceed the offer to perform the activity which seemed of little urgency at the beginning of the season. Generally, the search for a good maturity comes after that of tonnage especially if the batches are mixed together in the hilos.

The growers are dependent on the sub-committee to relay information to the mill and to provide them with agronomic advice. They are not interested in how the sub-committee structures its relations with the contractors. Their positions remain purely individual, without a collective vision of the loading zone operation.

They attempt to be trustworthy in their relations with the contractors but they only warn them a month or a month and a half before the cutting date. Therefore, the contractors cannot hope to plan their season and the growers can find themselves without a contractor at the end of a season. These verbal contracts remain flexible as the growers change contractor at the first sign of a problem. The exact date of the harvest is chosen by the contractor in line with the growers wishes. The tariff is not negotiated as the contractor accepts the price decided by the Local Association.

3.4. ***The contractors***

Our analysis of the contractors' management methods comes up against scarcity of available information, in general as well as in the studied case. If the mill provides them with certain services (advance of funds, assistance in mechanical maintenance) it does not know their needs and performances because it does not deal directly with them. On the sub-committee side, they only have to establish and adapt themselves to the uncertainties regarding the number of functional contractors each day and their individual performances.

3.4.1. *General characteristics of the contractors*

The contractors are usually growers who have decided to invest in a set of equipment (tractor, loader and chains) for different reasons. Amongst the younger ones (between 30 and 40 years) they aim to develop a local and profitable activity, while the older ones aim more to offer a service to the community. Whatever the age, this investment allows them to be independent towards the other contractors and to acquire a certain amount of social prestige. The contractors can obtain loans from the Kwa-Zulu Finance Corporation (KFC) if they prove a minimum volume of work.

Basic equipment consists of an under-powered tractor usually bought second-hand from a commercial farmer for between R35 000 and R50 000, a back-end loader, R3000 to R6000[1] and a set of chains (R400 to R5000 for a single chain). The chains are central to the contractor's equipment and organisation . They control the potential number of daily trips.

If he does not drive himself, the contractor employs a driver who is paid R20 per day or R300 to R650 per month depending on the volume of work. An assistant helps him with the chains and the loading of the batches onto the trailer (R10 to R15 per day or R150 to R500 per month). Some contractors also provide cutters who are usually women. They are becoming more difficult to find as it is hard work. This influences the harvest performance through their ability to execute the tasks rapidly, the size of the batches and the quality of work provided (neatness of cane).

3.4.2. *Analysis of technical performances*

On the Mvutshini sub-committee in 1997 the total volume of cane delivered every day to the loading zone by all the contractors varied between 20 and 325 tons - resulting in a means of 150 tons and a coefficient of

[1]Lateral or basket loaders are less frequent. Basket loaders are limited to very steep lots because they have to be loaded by hand.

variation inter-daily of 73%. To analyse this heterogeneity and to link it to management methods, it was agreed to break up the variable in the following way (figure 12):

$$(1)\quad V_i = \sum_{k=1}^{C} T_{ki}$$

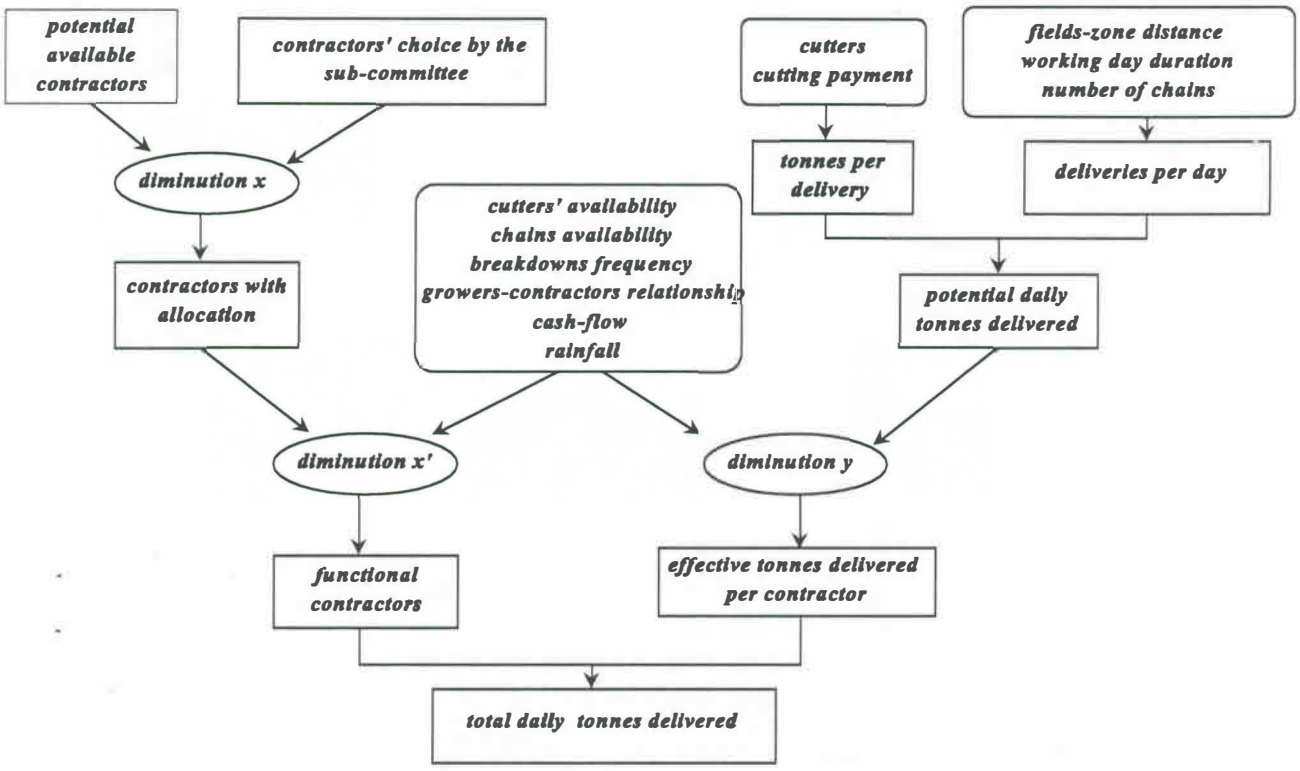
with V_i = total volume of cane delivered on day i
C = number of active contractors on day i
T_{ki} = tonnage loaded by contractor k on day i

and

$$(2)\quad T_{ki} = \sum_{l=1}^{L} P_{lki}$$

with L = total number of batches loaded by contractor k on day i
P_{lki} = weight of batch l loaded on day i by contractor k

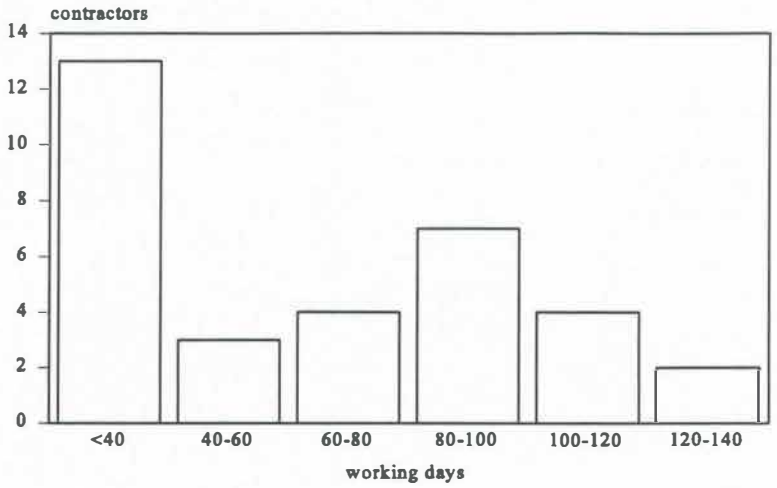
figure 12 : Decomposition of the daily tonnage delivered by a zone



It seems that at Mvutshini the number of active contractors on a daily basis is approximately 10 with a standard deviation of 4.2, and the daily tonnage per contractor is 15 tons with a standard deviation of 4.6 tons. The total amount of cane brought in each day depends more on the number of active contractors than on the average tonnage per contractor (coefficients of correlation respectively equal at 0.87 and 0.41).

The irregular activity of the contractors is a major uncertainty for the sub-committees. Only 6 of the 33 contractors in the Mvutshini area work more than one day out of two during the 198 days of the season (figure 13). Close to 40% of them work less than 20% of the available days. These results do not bear in mind the possible days of work accomplished in other areas. But they show that the organisation chosen by the sub-committee in preparation for the season and which assign allocations to each contractor, is extremely unrealistic in comparison with their real functioning. To a large degree this explains why the sub-committee finds itself in a chronic situation of under-supply despite a number of potential deliveries which is much greater than the allocation provided by the mill.

figure 13 : Contractors' classification of the number of working days during the 1997 season



This irregularity presents variable profiles with regard to the contractors, even among the more regular ones (figure 14). Their inactivity can be due to external risks (closing of the mill following strikes) or to internal management reasons which delay the start of their activity (PV I) or involve breakdown in activity during the season (V2). There are some "days off" which are inexplicable as their daily activity has not been monitored.

The tonnage delivered daily by one contractor can vary largely. Some days V2 supplies more than 70 tons, others less than 10 tons. This irregularity is not a result of weight of batches ($r^2 = 0.17$) which are controlled by the cutters (table 7). For all the cutters surveyed the weight varied from 4.2 to 4.8 tons with one exception at Mpungose (3.4) where the cutters are paid by the batch and not by the ton.

This irregularity is mainly due to the number of deliveries conducted each day ($r^2 = 0.92$) which varies as much between individuals (2 to 5.5 deliveries in the sample investigated) as it does from one day to the next with the same contractor (table 8). These variations are not linked to the total number of chains owned by the contractor, as they are under-utilised in every case.

As a result of their irregularity, the contractors' performances are largely uncertain and they complicate any planning or co-ordination exercises which the sub-committee would like to undertake. This variability is explained by the risks encountered by the contractors during the start of their activities and by the management decisions that they take to try and resolve them. The shortness of our investigation and the small amount of available data on contractors did not permit us to closely analyse the relations between their management methods and their performances. We therefore sought to ascertain, by interview, the main tendencies of operation which can explain these uncertain performances.

figure 14 : Delivery curve of two contractors during the 1997 season

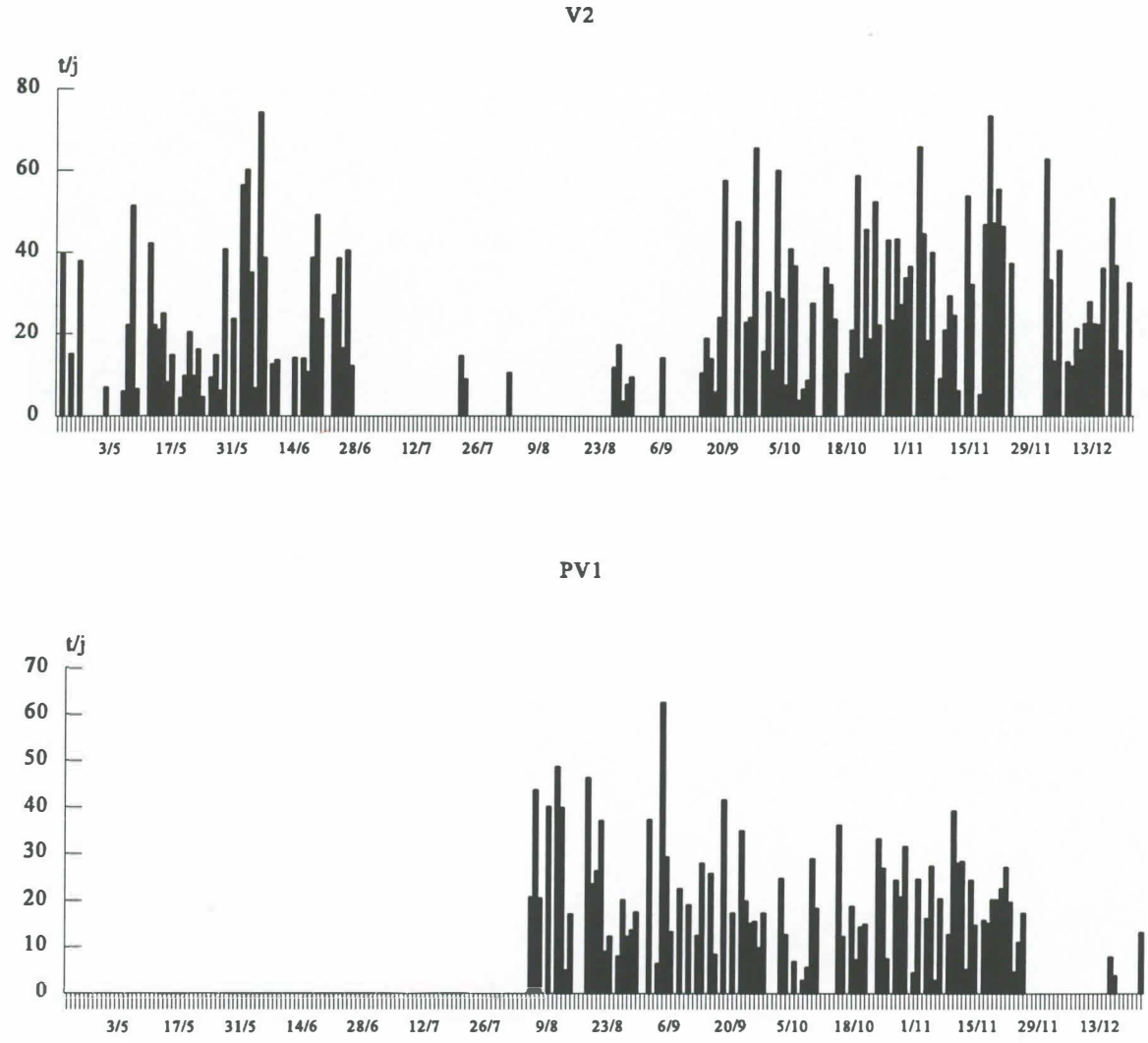


table 7: Variation of the average weight of batch

	May	August	November	average
average weight of a batch (t)	4.8	4.7	4.2	4.5
standard deviation	1.1	1.0	1.0	1.0

table 8: Variation of the number of batches delivered daily per contractor and his available chains

	P1	P2	PV1	PV2	V1	V2	V3	V6	V7
number of pair of chains	8	8	10	8	13	13	10	4	12
number of batches delivered daily average	3.2	3.8	5.3	4.1	4.7	5.6	3.7	2.0	2.0
standard deviation	1.3	1.8	2.8	2.3	2.3	4.3	2.3	1.0	1.0

3.4.3. *Management methods*

The different functions carried out by every contractor are grouped into 4 main spheres: management of equipment and employee, management of customers, financial management, and management of information.

The management of employees does not generally give the contractors any problem as the tasks are simple and labourers are readily available. In contrast, worn out material is at risk of breaking down. If a breakdown occurs, its duration is dependent on cash availability or ability to obtain a loan. They then attempt to undertake temporary repairs which often result in a similar breakdown. The lack of records does not allow to assess the frequency of these breakdowns which influence the number of contractors active per day and the number of deliveries per day. In the light of our interviews, the risks seem limited as little engine power is needed to do the work. Nevertheless, this point needs to be quantified as does the relationship between the state of the equipment and the costs of fuel and lubricant.

Management of customers means the search for growers and the organisation of work for the entire season. Paradoxically, and in spite of their low working time, the majority of contractors maintain that don't have enough time to canvass clients. They design and conduct their work programme once requested by the growers, according to the following procedure:

i) Clients' requests are registered on a waiting list of which the horizon never goes beyond a month or even a week especially amongst the contractors who do little work[1]. No date of commitment is made to avoid disputes linked to delays due to breakdown, lack of cutters, rain, etc.).

ii) The duration (D) of task is estimated for every client based on the number of batches (L) in the field and the number of cutters (CP) provided by the contractor:

$$D = (L \times 2) / CP$$

This calculation has a margin of error of about 20 % linked to the varying size of the batches and a second one due to the assessment errors in production by the growers. Furthermore, it assumes that the contractor is able to evaluate his work capacity (number of cutters, number of chains, travel time, unloading at the zone) and the demand of the zone (allocation eventually provided).

At this stage, the contractor could logically aggregate his individual requests, take an overall security margin linked to breakdowns and estimation errors, and then evaluate, on a monthly or weekly basis, the saturation of his planning. This kind of planning is not current amongst the contractors interviewed.

iii) The order to burn the next grower's field is given by the contractor once the current task is finished or, in less frequent cases, the day before. This way of sequencing the two tasks which need to be synchronised (cutting and loading) explains why on certain days only one lot is delivered to the zone (end of previous task before the next has really started).

iv) The time it takes to fulfil the task depends on factors that vary from one contractor to another and from one day to the next: length of working day, number of cutters available (sometimes supplied by the growers), type of loader[2] the number of available chains, power of tractor traction, accessibility and distance from the field to the zone.

Financial management is a key factor in the activity of the contractor. It is limited to the management of funds, firstly because the absence of tax collection means they do not have to provide an operating account, secondly because they do not take into account depreciation or reserve to renew their equipment. Most contractors run into financial problems because the mill only pays the contractors at the end of the month which follows the harvest. Therefore at the beginning of the season, the contractors have to advance 2 months of cash (salaries,

---

[1]Contractors with a very low level of activity do not do any planning.

[2]Basket loaders take much longer to fill: 30 mn to 1 hour for a batch of 5 tons and 4 cutters compared to 5 to 10 mn with a mechanical loader.

fuel, spare parts) when their equipment may need fixing. This critical situation is solved differently according to the case:

- the contractors with the least activity are the most concerned. They cannot obtain a loan from the mill (granted if a minimum amount of 5000 tons is delivered) which delays their start until they have got enough money. Then their activity increases according to their funds.

- some contractors start normally but delay the payment of salaries and bills for the first two months or stop as soon as they lack money, waiting for the mill to pay them.

- a minority try to plan their expenses by calculating their volume of work and available funds at the beginning of the season or reserve the necessary amount at the end of the previous season to cover the activities of the first two months.

The contractors face difficulties creating a working capital because they do not control their tariffs (decided by Local Association) and they cannot easily evaluate their production costs. Without calculating a margin and without planning their volume of activity they cannot establish a cash plan or create reserves to renew and increase their set of equipment. Since access to credit is not systematic and often impossible for the small grower, their performances are very sensitive to risks that requires funds, like breakdowns.

This misreading of the intensity of their activity and of their results comes from a lack of collection, processing and storage of information. Usually the contractors just note down their tonnage for every client in order to verify their agreement with the payments. But, this data is destroyed once the payment has been made. Without records and without accountancy, the contractors cannot monitor and evaluate their activities. They have no database to support their investments and planning decision-making.

3.4.4. *Production costs and operation accounts*

Without available information we have reconstructed and analysed the production costs by simulating scenarios. To do so we have developed a simulation program which allows us to reconstruct an operation account for each contractor on one loading season, given the information mentioned in table 9.

The simulation provides the tonnage carried out during the season, the receipts, the total expenses and profits and the average production cost of a ton of cane. The sensitivity of the production costs in comparison with the average weight of load, number of daily loads and number of days worked per week are also calculated.

These calculations have been made for 5 contractors with various sets of activities. The results are contrasted (table 10). Only V1 makes a real profit while creating a working capital for the next season. V2 and P1 are balanced; the first reserves significant funds to pay cash for a new tractor, the second grants himself a fixed monthly salary. PV1 is very loss-making because his performances are too poor to pay his loan back to the KFC. V6 is limited by his low amount of activity.

The simulation allows one to evaluate, in each case, the impact of improvement in performance on these economic results. Thus P1 must aim for a tonnage of 3900 tons to balance his costs. He must increase the average weight of his batches to 5 tons or he must increase his working week by half a day. However, this assumes his capacity to find enough customers and to re-organised his planning of work as a result.

These results, although partial, highlight the fact that contractors have great difficulty in making enough profit to i) cover their needs ii) renew their equipement even on the second-hand market. On the one hand the prevailing tariffs are too low and do not follow an accurate analysis of the conditions of production and on the other hand, the contractors perform poorly in terms of total tonnage, number of days worked during the season and the loads made per day. These poor results do not appear to be sufficient enough to eliminate the small contractors who subsist, in spite of everything, from one year to the next.

table 9 : Basic information structuring the simulation program

Characteristics of the season	
imposed by mill	. starting and finishing dates . number of weeks of cutting
sub-committee	. number of days worked per week . loads allocated per day
Local Association	. tariff according to 2 methods "transport" and "cut + transport" depending on the distance between fields and zone
Characteristics of contractor's equipment	
tractor and loader	. brand, type, age, purchase price, year of purchase, way of purchase
chains	. number
methods of financing	. characteristics of fund contribution and loan (duration, capital)
Performances of contractor	. average weight of load . number of loads per day (limited by the number of chains available) . average distance between fields and zone . time loading . duration of working day
Expenses	
goods (fuel, oil, filters, pneumatics)	. quantity per tractor working hour . unit price
labour (driver, assistant, mechanic, cutters, others)	. quantity of work provided
maintenance	. spare parts . service cost
loans	. annuity

table 10: Simulated cost of production for 5 contractors

	PV1	V1	V2	P1	V6
Amount of days worked per week	4	3	4	4	1
Weight of loads	4.3	4.6	4.3	3.4	4.6
number of loads per day	5.3	4.7	5.6	3.2	2.0
Average Tariff (R/t)	13.0	24.5	24.5	18.9	11.0
Salaries Contractors (R/month)	-	-	-	300	-
Driver (R/month)	-	400	650	400	-
Assistant (R/month)	300	200	300	300	-
Cutters (R/ton)	-	10	10	-	-
Other expenses	loan KFC	R12000*	R18100**	-	-
Total tonnage loaded (tons)	3370	2400	3600	1600	230
Total profit (Rand)	-2600	520	0	-180	-760
Production cost (R/t)	13.7	24.3	24.5	19.0	14.3

* reserves to ensure cash-flow at the beginning of a season

**reserves for renewing equipment

3.4.5. *Synthesis*

As a result of these observations, the contractors encountered at Mvutshini and Mpungose can be divided into 2 extreme groups based on their amount of activity. The first group are those who have a high annual tonnage, above 2000 tons. They are entreprising which means they possess a substantial set of equipment, renewed regularly, a qualified manpower, and management and organisational methods aiming at planning activities on a monthly basis at least.

On the opposite side, are the contractors who load less than 750 tons per season, have worn out material, conduct the work themselves and plan few or none of their activities. With no financial opportunities (pension, inheritance), their futures appear precarious and sensitive to financial risks and mechanical problems.

The contractors located between these two extreme classes are in a transition phase and their evolution will depend largely on their capacity to rationalise their activities and to find new customers. Although we did not meet any in our sample, contractors who live comfortably within the region of 750 to 1500 - 2000 tons per season, have probably other sources of revenue.

4. **Discussion and recommendations**

This study is based on the fact that the harvest of the small growers' cane experiences some problems: delays between cutting and crushing, under-supply to the mill at the beginning of the season and postponing production from one year to the next. The sugar industry explains these problems by assuming that they are the result of the poor performances by contractors, who are an indispensable link between growers and the mill.

Although the sample of contractors was limited, our study confirms this hypothesis as it shows that the contractors' technical performances (measured in tons of cane delivered per day) are very irregular and cause problems for the sub-committees who are responsible for the management of the daily allocation assigned by the mill. This irregularity is mainly due to two parameters: the number of active contractors on a given day and the number of deliveries per day and per active contractor.

Over and above external risks such as mill strikes and rain, the daily activity for a contractor is linked to the internal management methods and its reactivity when faced with uncertain events such as breakdown of equipment. Two elements play a major role in the results: the management of funds, especially at the beginning of the season while waiting for the first payments from the mill, and contractors' capacity to plan their work schedule at least one month in advance. These poor performances lead, for the most of them, to difficulties in balancing their costs with the present tariffs which are not negotiable, and also in renewing equipment which is often worn out.

But the contractor is not the only one responsible for these difficulties in the planning and operation of the harvest. The growers are also responsible particularly at the beginning of a season. Some of them are hesitant to cut cane which is still immature and from which the yield can increase with age, while others do not have the available funds to pay cutters.

The sub-committees also play a central role in these problems as they are responsible for co-ordinating the loads to the zone. The two case studied show that no one is really able to plan and control the deliveries by the growers and contractors. This unrigourous attitude can only accentuate the difficulties in regulating the daily loads of cane to the factory.

Also, the mill does not adopt a clear position on the subject. By playing with the possible carry-over of deliveries between sub-committees on one side and between commercial growers and small growers on the other side, it appears to adapt its operation to the hazardous events encountered. Nevertheless, our study did not allow us to have a more precise vision of the mill strategies.

The problems experienced in harvesting the the small growers' cane are not explained totally by the poor contractor's performances. Problems of co-ordination between the different stakeholders who are involved in the transfer of cane from the fields to the mill, are also to blame. So, improving the organisation of the mill supply means an overall consideration of stakeholders and their relationship.

This diagnosis was made on the basis of one mill, two sub-committees and some contractors, and a few months time spend in the field. It therefore requires to be validated on a larger scale. Nevertheless, it already allows one to make some recommendations for a more efficient system of relations between growers, contractors and millers.

Support focused on the contractors to help them improve the control of their activities or to improve their economic environment are clearly justified in the present context. We sugggest the following training activites, which could require management and simulation tools:

- management of funds (planning expenses, saving to face technical problems or to renew equipment);

- planning activities (better management of relations with the growers, assessing potential performance of work, working full-time, designing rules to deal with unforseen events);

- maintaining and renewing material to ensure its reliabity and deciding when it is technically and economically justified to renew it;

- management of information in order to monitor the activities in time (clients, tasks), the operation of equipment (working duration, maintenance) and the costs (accounting), to periodically assess the technical and economic performances, and to keep a record of the businness.

Some actions concerning the contractors' environment are also required: creation of mechanical workshops in the vicinity, access to flexible short-term credit facilities.

The combination of these actions with a drastic limitation of the number of contractors, keeping on only those who perform the best, requires further investigation on the most effective organisation at the level of the mill area of production. In the present case where the sub-committee plays a central role between the mill, the growers and the contractors, the following are envisaged as ways facilitating the deliveries to the zone:

- the sub-committee manages the planning of the contractor' s supplies and adjusts them to the mill requests. The contractors continue to directly manage their relations with the growers.

-the sub-committee manages relations between the contractors and growers by establishing a plan for the entire season as a result of the allocation provided by the mill.

In both cases, members of the sub-committee must be trained and supported to monitor and control their plans: they will also need some financial interest (remuneration) and some legitimity from growers and contractors, which assumes that some profit will result from their actions. This evolution will also call for a review of the methods of payment to the contractors: uniform cutting tariff, payment for a ton of sugar in order to integrate the notion of quality into their reasoning. Tools of management and of planning support need also to be designed.

A second organisational form would consist of getting rid of the intermediate role played by the sub-committee with two alternatives:

i) The mill organises its supplies by dealing directly with the small growers, who will have to find contractors when they need them. The mills in La Réunion presently operate according to this system. However, this option seems unrealistic in the South African situation if one takes into account the low production of the small growers and its management costs into account.

ii) The mill delivers the allocations directly to the contractors. This system reduces the decision making chain and the number of stakeholders involved. It makes selecting the best contractors much easier. It would require that the loading zones be restructured, as their number and their location would have to be reconsidered in another logistic framework. But the contractors selected by the mill would have to show significant gains in productivity and reliability. Their payment could integrate some criteria linked to the quality of the delivered cane which would motivate them to reduce the delays between cutting and delivery to the mill.

Interest in reducing the number of contractors must be considered in relation to the chosen organisational system. Our observations have shown that the smallest contractors are able to sustain themselves despite their poor or even absent economic profitability. But, they represent a work potential, admittedly weak, but real, on whom the sub-committee can lean in the case of failure by businesses who appear solid.

In reducing the number of contractors, the millers and the growers increase their dependence on people who may not adapt to a new way of organising their activities and supplies. So substantial benefits for the overall chain are not guaranteed. Some problems can already be envisaged: planning difficulties linked to the atomisation of production, increase in transport costs, extra costs for monitoring and controlling a larger set of equipment and manpower, and increased sensitivity to uncertain events.

These issues do not concern the contractors alone, they require an overall group reflection on the organisation of relations between growers, contractors and millers at the production area level. A study of this kind, presently being conducted by CIRAD in La Réunion and in Mauritius, has made it possible to test by way of simulation, the effects of an organisational form linked to an area of production on the total amount of sugar produced yearly (Gaucher *et al.*, 1997 and 1998).

The issues studied with the millers in La Reunion and Mauritius concern i) the restructuring of the sugar industry (closing factories and reception centres, re-designing supply zones), ii) the choice between season's duration and performances of industrial equipment, iii) the rules governing supplies (allocation rules, management of deliveries depending on risks), iv) the management of cane quality and the control of internal diversity of production areas. This approach could be interesting for the South African Sugar Industry in its search for better efficiency and better integration of small growers.

*
* *

Bibliography

A'Bear D.R., Louw C.L. and McKechnie J.P., 1997. *Evaluation of the need for and role of rural service centres in small holder cane growing areas for the promotion of the small cane growing industry*. INR, n°158, 96 p.

Dagallier J.-C., Le Gal P.-Y., Rubrice E., 1997. Intérêts et limites des différentes formes d'organisation assurant la récolte de la canne à sucre à La Réunion. In *Actes du 4ème Congrès ARTAS-FACAS*, Saint-Denis, La Réunion, pp. 223-239.

Gaucher S., Soler L.-G., Le Gal P.-Y. et Siegmund B., 1997. Un modèle de simulation pour l'aide aux choix d'organisation de l'approvisionnement d'entreprises agro-industrielles : Application au cas de la filière canne à sucre. In *Actes du 4ème Congrès ARTAS-AFCAS*, Saint-Denis, La Réunion, pp. 641-652.

Gaucher S., Leroy P., Soler L.-G., Tanguy H., 1998. *Modelling as a support for diagnosis and negotiation in the redesign of agro-food industries supplying organisation.* G.W. Ziggers, J.H. Trienekens, P.J.P. Zuurbier (eds), Proceedings of the third international conference on chain management in agribusinness and food indsutry, Wageningen Agricultural University, 679-689.

Lamusse J.P., 1986. *Sixty-first annual review of the milling season in southern Africa.(1985-1986).* Proceedings of the SASTA, pp. 9-25.

Lamusse J.P., 1987. *Sixty-second annual review of the milling season in southern Africa.(1986-1987).* Proceedings of the SASTA, pp. 42-58.

Lamusse J.P., 1988. *Sixty-third annual review of the milling season in southern Africa.(1987-1988).* Proceedings of the SASTA, pp. 12-28.

Lamusse J.P., 1989. *Sixty-fourth annual review of the milling season in southern Africa.(1988-1989).* Proceedings of the SASTA, pp. 7-24.

Le Gal P.-Y., 1996. *La gestion collective de la récolte de la canne à sucre à la Réunion. Propositions pour un projet de recherche.* CIRAD/SAR n°54/96, 38 p.

Lionnet G.R.E, 1990. *Sixty-fifth annual review of the milling season in southern Africa.(1989-1990).* Proceedings of the SASTA, pp. 130-146.

Lionnet G.R.E, 1991. *Sixty-sixth annual review of the milling season in southern Africa.(1990-1991).* Proceedings of the SASTA, pp. 1-16.

Lionnet G.R.E, 1992. *Sixty-seventh annual review of the milling season in southern Africa.(1991-1992).* Proceedings of the SASTA, pp. 1-18.

Lionnet G.R.E, 1993. *Sixty-eighth annual review of the milling season in southern Africa.(1992-1993).* Proceedings of the SASTA, pp. 1-19.

Lionnet G.R.E, 1994. *Sixty-ninxth annual review of the milling season in southern Africa.(1993-1994).* Proceedings of the SASTA, pp. xix-xxxviii.

Lionnet G.R.E, 1995. *Seventieth annual review of the milling season in southern Africa.(1994-1995).* Proceedings of the SASTA, pp. 101-120.

Lionnet G.R.E, 1996. *Sixty- annual review of the milling season in southern Africa.(1995-1996).* Proceedings of the SASTA, pp. xx-xl .

O'Reilly G., 1998. The South African Sugar Industry. *International Sugar Journal*, 100 : 266-268.

Requis E., 1998. *La récolte de la canne à sucre chez les petits planteurs sud-africains : orgaznisation générale et rôle des petites entreprises de travaux agricoles*. Mémoire de fin d'études INA-PG-CIRAD-INR, 51 p. + annexes.

Schulze R.E., 1997. *South African atlas of agrohydrology and climatology*. Water Research Commision, Pretoria, Report TT92/96.