REFEREED PAPER

LONG TERM POSITIVE IMPACT OF STRUCTURAL REFORMS ON CANE PRODUCTION PROCESSES AT KENANA SUGAR CO, SUDAN

IBRAHIM AE

Kenana Engineering and Technical Services, PO Box 11375, Khartoum, Sudan
ahmed.elhaj@kenana.com

Abstract

Since its inauguration in 1981, the Kenana Sugar Company (KSC) has maintained a steady growth, achieving targeted production levels almost every year. In the mid-nineties, Kenana developed a new extension of agricultural land of about 10 000 feddans (4200 ha), that enabled the introduction of new farming techniques. Since then cane yields have continued to improve, maintaining an average above 40 tons/fed (>95 t cane/ha.). Consequently, the factory produced more and more refined sugar. However, despite the improvement in cane yields, the parallel production costs escalated. Since the cost of cane comprises about 60% of the produced sugar cost, its reduction has become vital to the survival of KSC. Structural reform measures (termed 'transformation') were adopted by management in the 2007/08 season, aimed at reducing costs of production, harvesting and transport. Positive results have been achieved.

Keywords: Kenana, Sudan, transformation effects, sugarcane, production, processes, costs

Introduction

Kenana Sugar Company (KSC) was established in the mid-seventies of the past century and was the result of co-operation between the Arab States and Entities and the Sudanese authorities. The investment size is in the vicinity of one billion US dollars, and KSC is registered as a private limited company.

The total area of the farm is about 105 000 feddans (44 100 hectares), of which about 80 000 feddans (33 600 ha.) are harvested annually to produce about 3.7 million tons of sugarcane. The factory original capacity was 300 000 metric tons of refined sugar. This has been upgraded to 450 000 metric tons.

Since its inauguration in 1981, KSC has maintained a steady growth and has been achieving its targeted production levels almost every year. In the 1995/96 season, KSC developed a new extension of agricultural land of about 10 000 feddans (4200 ha), that enabled the farm to adopt new techniques such as crop fallows to improve soil physical characteristics, which deteriorate normally under continuous monocropping. Since then cane yields have continued to improve, maintaining an average yield above 40 tons/feddan (tcf). In fact, 45-48 tcf (107-114 tons/ha) has become the norm. Consequently, the upgraded factory has managed to produce more and more refined sugar.

Company history of performance

Table 1. Historical levels of cane and sugar production at Kenana Sugar Co, Sudan.

Year	TCF (t cane/feddan)	TSF (t sugar/feddan)
1997/98	43.5	4.43
1998/99	44.3	4.63
1999/2000	45.1	4.93
2000/01	48.0	5.20
2001/02	45.3	4.70
2002/03	48.2	5.02
2003/04	48.8	5.34
2004/05	46.0	4.95
2005/06	46.9	5.04
2006/07	47.2	5.15

1 feddan = 4200 m^2 = 1.05 acre.

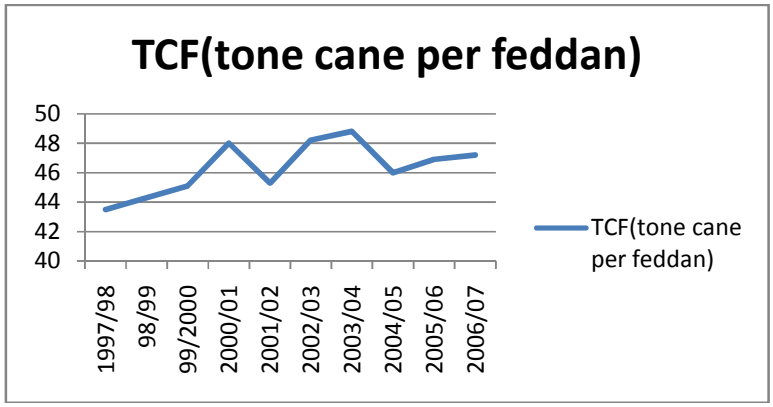

Figure 1. Historical levels of cane production at Kenana Sugar Co, Sudan.

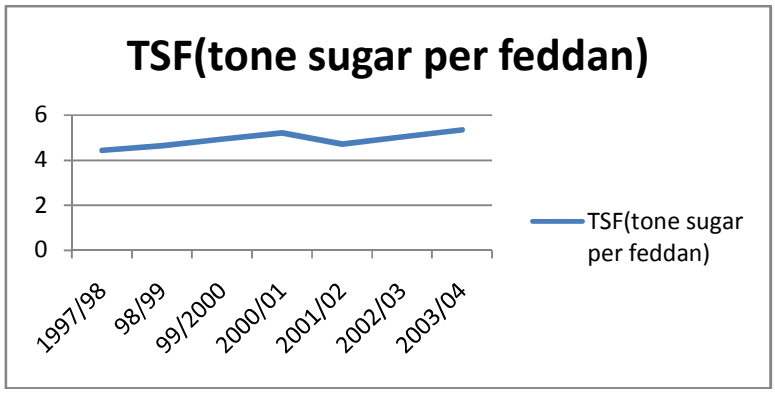

Figure 2. Historical levels of sugar production at Kenana Sugar Co, Sudan.

The challenges

Increasing cane production costs

Table 2. Cane production costs from 1999-20097.

Year	Cane produced (MT 000s)	Total cost (SDG 000s)	Cost per MT (SDG)	Remarks (% change)
1999-2000	3541	61 500	17.37	Base
2000-2001	3751	75 222	20.05	15.4
2001-2002	3615	84 755	23.45	16.9
2002-2003	3828	93 227	24.35	03.8
2003-2004	3905	96 445	24.70	01.4
2004-2005	3686	100 209	27.19	10.0
2005-2006	3792	115 913	30.57	12.4
2006-2007	3712	122 469	32.99	07.9

Source: KSC official records. SDG = Sudanese pound 1 US$ = 2.5 SDG

Despite the improvement in cane production yields the parallel cane production costs had kept escalating. Since the cane cost comprises about 60% of the sugar produced from that cane (Appendix A: Company records) the reduction of cane productions cost has become vital for KSC survival.

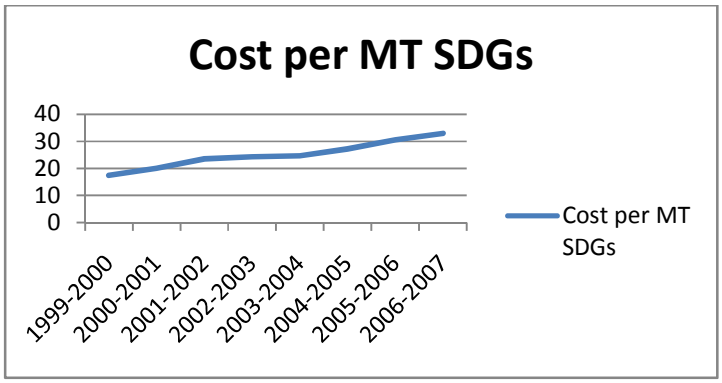

Figure 3. Ascending cost of production.

The increasing costs were attributed to causes well known to company management:

- External causes beyond the control of management. Examples of these are inflation rate in the national economy, prevailing exchange rate at the time of procurement of imported production inputs, fluctuations in prices, wages and salaries, and other national policy determined factors.
- Internal causes of increasing costs which are under the control of management and can be summarised in the following interrelated points:
  (a) Low output per unit resource (poor productivity).
  (b) Increased cost per unit product (inefficient control).
  (c) Inefficient resource utilisation (inefficient resource allocation).

The structural reform measures effected by KSC management with regard to cane production are value-based measures intended to positively affect the cane production, harvesting and transport processes by bringing down the cost of cane which will consequently reduce the cost of the end product – the sugar.

KSC end product competitiveness has become the stake
In 2000/2001 the cost of production of one metric ton of KSC sugar was about US$220 (Appendix B). By 2006/2007, that cost surged to US$580 and was expected to escalate, especially in view of the falling US$ value. In the same period, although the world market sugar price had steadily increased, it had not yet exceeded US$413 for London No. 5 (Appendix C), and US$220 for ISA (New York Sugar Exchange Contract No. 11 for Caribbean Ports – 2006) (Czranikow daily market report - www.czranikow.com).

Local consumer price implications
The local consumer price (which was composed of ex-factory price plus government fees, taxes and levies) had become very high end encouraged cheaper, smuggled sugar to infiltrate across borders country-wide. This situation dictated the necessity for corrective measures to be imposed immediately.

Management intervention

KSC being an export market oriented enterprise and in view of the WTO agreements and regulations has become concerned and realised the need to adjust and to modify its mode of production. Production cost reduction through more efficient operations is the key to survival in a competitive emerging free market. Hence the company management had embarked on exploring means and ways out. Consequently the management formulated and adopted a five-year regulatory plan (2007-2012), termed the Transformation and Re-structuring of the company, aiming to amend the situation and to transform Kenana into an internationally competitive enterprise. The five-year plan was intended to achieve a number of objectives among which are:

- The reduction of operational costs.
- The improvement of productivity levels.

The achievement of the above two objectives among others shall reduce the final product (sugar) price and qualify the company to become competitive in the world sugar market. Kenana needs to export part of its production to earn hard currency required for the procurement of imported inputs for both agriculture and processing plant.

Adoption of corrective measures
A number of re-structuring and reform measures have been effected in the context of the five year regulatory plan. They have affected agricultural plantation, the factory, administration and many other company subsidiaries. This work is concerned with the reform measures that have effects on cane cost which is the major component (60%) of the end product sugar (Appendix A). The following measures are the most relevant:

Redesign of processes
The entire business processes are subjected to thorough investigation with the ultimate goal of improving efficiency and introducing better techniques and technology. For example, cane harvesting by hand cutting has been phased out, since it has been confirmed that mechanical harvesting is much cheaper (70% less) and produces better quality cane. Moreover, the Harvest Department which used to be a separate department has now become part of the cane production department, enhancing more harmonious operations.

Centralisation of certain company activities
Activities of the same nature required by different departments should be provided by a specialised department or unit for other company departments. As an example, the transport service is now offered by the transport section for the entire company rather than as separate units in different departments. Now cane transport is not part of the cane production department. The service is procured on *ad hoc* basis from the concerned department and that contributes significantly to cane transport cost reductions.

Staff reform
The company staff and workers were carefully reviewed, then re-distributed with a new vision and the surplus has been redundant.

In the cane production department the following steps have been effected (see Table 3).

- The permanent farm employees have been reduced from 2189 to 1640.
- The seasonal farm employees have been reduced from 2755 (1 005 575 man days) to 2480 (905 219 man days).
- Irrigation application for the whole estate (about 85 000 feddans) is being carried by 1642 workers (554 permanent + 1088 outsourced/casual).
- Total manpower number in fields (cane production) has been reduced from 2022 to 1277.

More effective control measures in harvest and cane transport (see Tables 4 and 5)
- In cane harvesting, the average number of cane harvesters has increased from 17 to 19, and 6 mechanical cane loaders were phased out.
- Harvest permanent labour force has been reduced from 669 to 35 only.
- Harvest casual labour force has been reduced from 2623 to 234 workers only, and this situation has resulted mainly from the phasing out of hand cutting which used to be carried out by seasonal labour.

Cane transport is now not part of the cane production department, but renders a very vital service to the department. The recently more efficient and cost effective operation impact will be directly reflected in the final cost of cane at the factory mill yard. In this section the following points have been observed:

- Average number of trucks used for cane transport has been reduced from 115 to 83.
- Daily truck transporting capacity has increased from 190 to 252 metric tons.
- Fuel used/MT cane transported has reduced from 1.6 to 1.2 litres (from 0.35 to 0.266 gallon).

Table 3. Cane production efficiency assessment parameters.

Production season	Average for 1995-2007 (12 seasons) (172 days)	2007/2008 season average (179 days)	2008/2009 season average (168 days)	2009/2010 season average (141 days)
Area under cane in feddans	78742	78238	79766	80386
Production in TCF	44.6	48.4	42.5	36.7
Number of irrigators permanents	865	559	559	554
Number of irrigators P + Casuals	1953	1647	1647	1642
Number of Casual labour	2022	1640	1640	1277
P irrig.MD/Fed	3.6	2.35	2.31	2.27
Total irrigation man days/Fed	8.2 P = 3.6	6.9 P =2.3	6.8 P = 2.29	6.7 P =2.27
Casual man-days/Fed	12.80	11.60	11.30	11.26
TCF/irrigation man-day	P = 12.3 Total = 5.4	P = 20.6 Total = 7.0	P = 18.5 Total = 6.25	P = 16.16 Total = 5.5
TCF/man-day casual labour	3.5	4.2	3.8	3.3
Cost per MT cane in SDG	25.8-30.25	35.05	42.14	45.57 ??

Table 4. Harvest efficiency assessment parameters.

Production season	2000/2007 season ave	2007/2008 season ave	2008/2009 season ave	2009/2010 season ave
Crop days	172	179	168 (166) ?	141
Area harvested in feddans	78742	78238	79766	80386
Cane harvested in metric tons (MT)	3755379	3853047	3386067	2950172
Average sugar yield %	10.69	10.33	9.55	9.36
Number of harvesters	17 (+ 6 loaders)	19.71	19.22	19.0 ??
Number of cane loaders	6	00	00	00
Number of permanent labour	669 = 115 068 mds	35= 6265 mds	35 = 5880 mds	35 = 4935 mds
Number of casual labour	2623 = 451 156 mds	234 = 41 886	234 = 39 312	234 = 32 994
Man days P + Casual	566 224 mds	48 151	45 192	37 929
MT cane harvested/m-day	6.6	80 1212%	75 1136%	78 1181%
Cane harvested mechanically/M.T	2 357 665	3 853 047	3 386 067	2 950 172
Cane harvested manually MT	1 397 714	00	00	00

Average MT/harvester/day	806	1092	1049	1101
Av. MT/loader/day	1354	00	00	00
Av. MT/permanent man-day	32.6	615	576	598
Av. MT/casual man-day	8.3	92	86	89
Total cost/MT harvested in SDG	2.9/3.72 (10/3 yr av.)	4.24	3.60	4.48

Table 5. Cane transport efficiency assessment parameters.

Production season	2000/2007 season average	2007/2008 season average	2008/2009 season average	2009/2010 season average
Cane transported	3755379	3853047	3386067	2950172
Crop says	172	179	168	141
Cane transported/crop day in MT	21833.6	21525.4	20155.2	20923.2
Number of trucks used /crop day	115	92	69	83
Av. MT/truck/day	190	234	292	252
Fuel consumption/truck in gallons	66.5 gallons 299 litres	73 gallons 328.5 litres	75 gallons 337.5 litres	67 gallons 301.5 litres
Litres fuel/MT cane transported	1.6 litre	1.4 litre	1.087 litre	1.198 litre

Reforms impact assessment

Methodology

Data from pre- reforms period which covers the seasons from 1995/96 to 2006/07and data from post-reforms period which covers the period of seasons 2007/08, 2008/09 and 2009/10 are to be reviewed.

Data for the above two different periods have been collected from the following areas of cane production and cane handling:

- cane production department/fields.
- cane harvesting department/section.
- cane transport department/section.

Analysis of the collected data provides information on the following:

- Identification of the reform measures effects in each department or section and highlighting the magnitude of changes they have brought about in operations and/or processes.
- Measuring the variance in cost component of the process that has resulted from reforms implementation.
- Evaluation of the global effect of changes in the three production areas to assess how they affect the end product cost of production.
- Evaluation of the extent to which challenges are wavered and strategic objectives are achieved.

Results of reforms implementation

More effective resource use (Table 3)

1. Irrigation permanent manpower has been reduced by 36% from 2006/07 to 2009/10.
2. Casual labour has been reduced by 37% in the same period.
3. Irrigation man-days per feddan have been reduced by 18%.

The effect of reduced labour force on cane production cost:
The minimum reduction in labour input = 36 %.

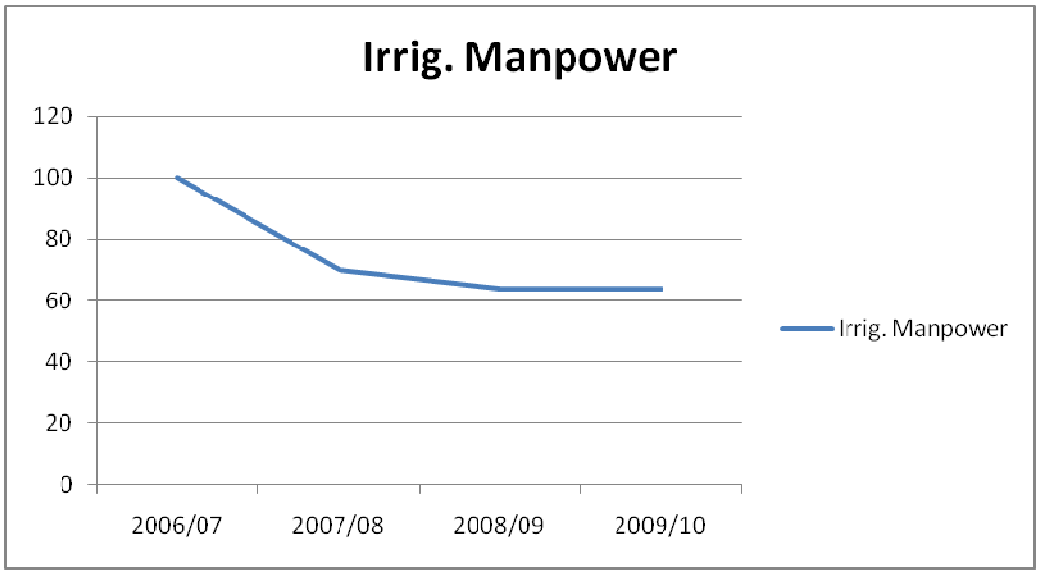

Figure 4: Irrigation manpower reduction.

It has been established (Mashkoor study, Appendix D) that labour input comprises 28% of cane production cost.

In the light of this study the cane cost is being reduced by 36% of the 28% (labour input component) which is 28x36/100 = 10.08%. Since KSC cane production cost at the farm gate is $15 per metric ton (Appendix E), then $1.5 has been saved (= 15/100x10.08 = 1.5).

Improved cane production yields-TCF (Table 3)
TCF/Irrigation man-day:
Increased by 67% in the first transformation year 2007/08.
Increased by 50% in the second transformation year 2008/09.
Increased by 50% in the third transformation year 2009/10.
Average increase in TCF = 55.6%.

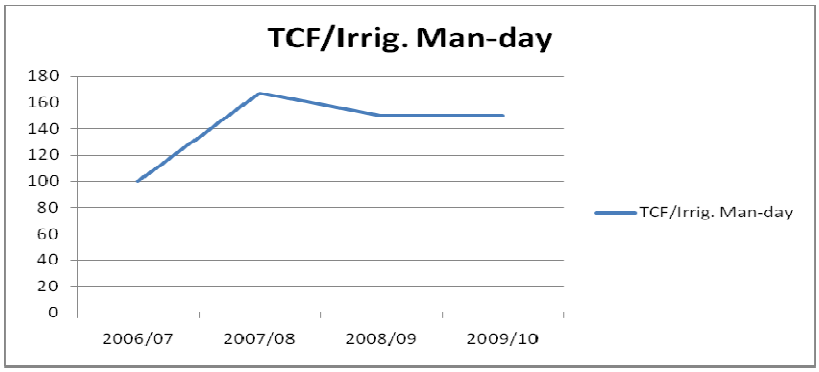

Figure 5: TCF/irrigation man-day increase.

The effect of increased TCF/irrigation man-day on cost:

- Irrigation labour input comprises 25% of irrigation cost and irrigation comprises 60% of cane production cost (Appendix D, Mashkoor study).
- Accordingly lower side estimate of 50% increase of TCF results in 34% reduction in labour cost. This will result in 8.5% of the irrigation cost.
- Since the 60% of cane cost is 15/100*60 = $9. This figure has now been reduced by 8.5%, so 9/100*8.5 = $8 has been saved.

Improved harvest operation (Table 4)

Average daily harvester output in metric TC
Increased by 36% in 2007/08.
Increased by 31% in 2008/09.
Increased by 37% in 2009/10.
Average increase = 35%.

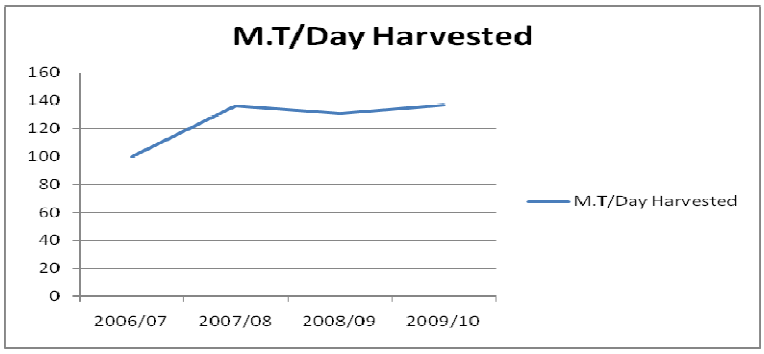

Figure 6: Daily harvester output increase.

The effect of the improved harvest on cost

- Harvest cost per metric ton cane (Appendix E) = $2. When the output is increased by 35% that means the cost of harvest for one ton is 2/1.35 = US$1.48, which means $0.52 reduction in cost for one ton of cane. Accordingly now at least $0.52 has been saved.

- Due to the elimination of hand cutting the total manpower in harvest section (now) has been reduced to the minimum from 3292 (566 224 mds) to 269 (45 192 to 37 929 mds).

The effect of the elimination of hand cutting on cost of production
Hand cutting used to cover about 40% of the cane harvested annually. Of the $2 harvest cost/MT cane, $1.26 is attributed to hand cutting cane cost. (Formula x+1.7x = $2), since hand cutting is 70% more expensive than mechanical harvesting (Table 6).

Table 6. Comparison of costs between hand cutting and mechanical harvesting at Kenana Sugar Company.

Crop season	Hand cutting cost per MT cane in US$	Mechanical harvesting cost per MT cane in US$	Remarks
1997/1998	1.36	0.76	
1998/1999	1.27	0.73	
1999/2000	1.40	0.88	
Three seasons total	4.03	2.37	
Three year average	1.34	0.79	
Difference	+1.34	-0.79	= 0.55 = 69.6 = 70%

Source: KSC annual statistical bulletin-2000 issue.

Accordingly, by the elimination of hand cutting the $1.26 element is reduced by 70%, i.e. 1.26/170*100 = $0.74. Now all the cane is harvested mechanically making a cost saving of $0.52.

Improved cane transport operation (Table 5)
Average metric tons cane transported per truck per day:
Increased by 23% in 2007/08.
Increased by 58% in 2008/09.
Increased by 33% in 2009/10.
Average increase = 38%.

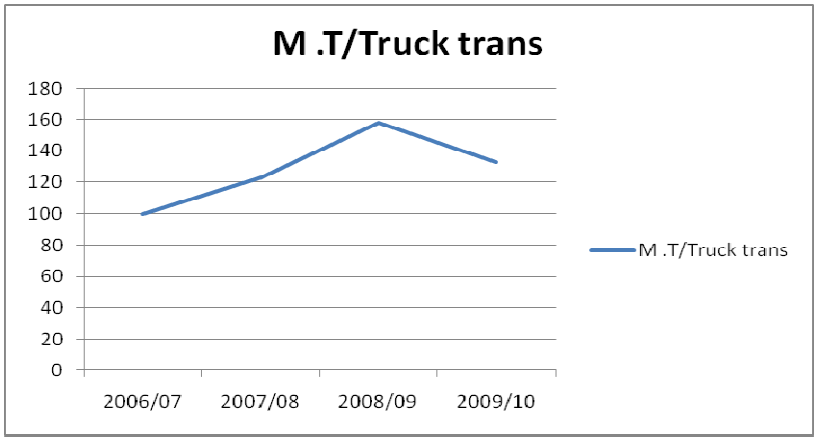

Figure 7: Transport truck output increase.

The effect of improved cane transport on cost of production:
Average increase in metric tons transported is 38%. Accordingly the metric tons that used to cost $2.5 shall now cost $1.8 (2.5/1.38 = 1.8).
This step saves $0.7 for every MT transported.

Fuel consumption per metric tons cane transported decreased by:
11% in 2007/08.
31% in 2008/09.
24% in 2009/10.
Average = 22%.

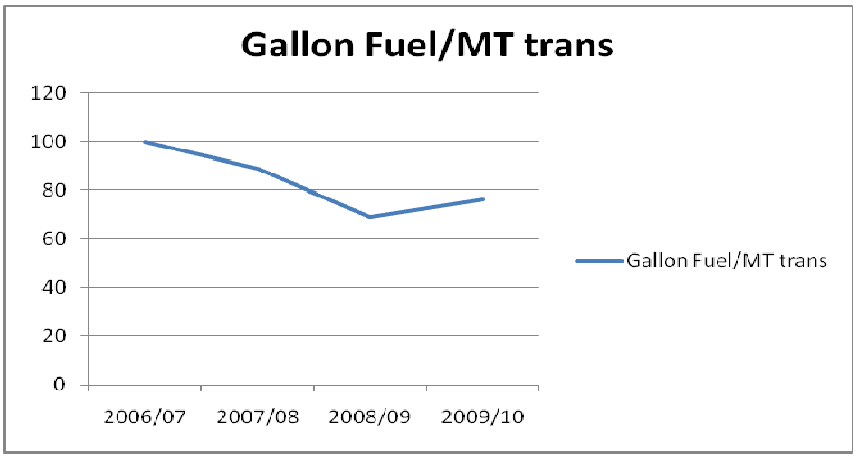

Figure 8: Fuel use decrease.

The effect of transport fuel saved on cost of production:
The average saving of fuel (diesel oil) is 22%. Actual fuel saved per metric tons = 0.084 gallons = 0.38 litres.

This reduction in fuel consumption makes the following saving: 0.084*5.5 sdg = sdg 0.462 = $0.185. This is a saving of $0.2.

The global effect on total cane cost at factory mill yard =(1.5 + 0.8 + 0.52 + 0.52 + 0.7 + 0.2) = US$ 4.24.

KSC cane cost at factory mill yard is $19.5 (3 year average, Appendix E). Hence the saving made is equivalent to 22% (valid for 2010/2011 sales).

Since cane comprises about 60% of the sugar cost (Appendix A), this reduction in its cost will cut about 13% of the final product cost, assuming that other factors remain equal) .In fact transformation impact in other production areas is expected to yield positive effects similar to the case in cane production areas . This means lower actual cost of production, i.e. less than US$ 609/MTC.

Table 7. Global effect on total cane cost at factory mill yard.

Impact	Magnitude	Saving (US$)	Base cost ($19.50) change
Reduced labour cost	-36%	1.50	18.0
Increased TCF/irrig. man-day	50-55%	0.80	17.2
Improved harvest output MT/day	35%	0.52	16.68
Elimination of hand cutting	40%	0.52	16.16
Improved cane transport MT/truck	38%	0.70	15.46
Reduced fuel cost gallon/MT transported	-22%	0.20	15.26
Cost saving range	22%	4.24	19.50 – 4.24 = 15.26

Deductions

The approach for results evaluation

KSC cost of production in season 2006/07 was estimated as $580. In the same season the ex-factory selling price was $687, adding $107 on the cost equivalent to about 18%, which can be viewed as company profit margin (plus marketing fixed expenses) for that season.

In the current season 2010/11 the declared ex-factory price is about $719 (Table 8).

Table 8: Kenana Sugar Company ex-factory refined sugar prices.

Season	MT price in SDG	US dollar equivalent	Est production cost in US$	Remarks
1996/97	507.04			
1997/98	670.53			
1998/99	837.71			
1999/00	980.00			
2000/01	1047.00	402		
2001/02	1130.76	426		
2002/03	1130.76	425		
2003/04	1132.26	482		
2004/05	1279.37	512		
2005/06	1322.92	630		
2006/07	1400.62	687	580	
2007/08	1400.62	680	576	
2008/09	1400.62	645-617	546	
2009/10	1520.00	661-633	560	
2010/11	1748.00	719.2 Exchange rate used: $1 = SDG 2.43 (2010 average)	$609	$682.97 for ISO (white) and $553.7 for ISA (raw) October 2010 ISO market report

Source: KSC official records (not published)

If we apply a reverse calculation to estimate KSC cost of production for season 2010/11 taking into consideration the 18% (company profit margin + marketing fixed expenses) derived from 2006/07 declared figures, we shall come to the following figure: 719/118*100 = $609.

The world market price for white sugar (ISO) for October 2010 was $683 .If KSC offers its product for this price, then it can make an extra margin of 683–609 = $74, equivalent to 12% profit margin (including marketing fees). Thus KSC sugar is maintaining a reasonable competitiveness in the international sugar market for this current season (2010/2011).

As stated above (global effects),the reforms in cane production sector must have contributed by 13% towards the lowering of production cost .This means that about $91 have been removed from cost of production leading to the maintenance of the product competiveness in the world market (609/87*100 = $700. and 700−609 = $91.

Had it not been for this cut the cost of production would have been $700 rather than $609.

If we take into account the inflation rate in Sudan economy during fiscal year 2010 which was about 11.20% (see Table 8), then we can conclude that despite that rate the commodity is still competitive. Any future control of inflation will be in favor of the product marketability.

Table 9: Sudan inflation rate (consumer prices).

Year	Inflation rate (consumer prices)	Rank	% change	Date of information
2003	9.20%	38		2002 est.
2004	8.80%	46	-4.35%	2003 est.
2005	9.00%	184	2.27%	2004 est.
2006	9.00%	182	nil	2005 est.
2007	9.00%	180	nil	2006 est.
2008	8.00%	167	-11.11%	2007 est.
2009	16.00%	194	100%	2008 est.
2010	11.20%	200	-30%	2009 est.

Source: CIA World Factbook (accurate as of 3 November 2010).

Discussion

Definition of transformation

Transformation is likely to be defined as a shift of strategy. Strategy is the selection of the fundamental path to reach goals; it breaks down into market strategy, product or service strategy, and organisation development strategy at a minimum. Transformation strategy deals with the required changes to the organisation along with the transformation of the product or service being brought to market (Morgan *et al*., 2010).

- Have the transformation measures effected at KSC satisfied the outcome of the above definition?
- Has the shift in strategy adopted fulfilled the achievement of goals, and what are those goals?

It must be emphasised that as far as cane production is concerned, the transformation impact is definitely positive. The deductions stated above and the approach used for results evaluation have highlighted gains brought about by the changes effected in the cane production sector.

Transformation strategy objectives that might have been achieved are:

- End product cost reduction.
- Marketability competence.
- Organisation survival.

The transformation adopted at KSC has been comprehensive, bringing changes aimed at satisfy the objectives quoted below from Morgan *et al*. (2010):

"To accomplish transformation, one must work at seven 'C' levels of the organization:
1. Core: the center of organisation definition.
2. Culture: the lens through which things get interpreted and accomplished.
3. Context: the framing of the organisation.
4. Capability: the fundamental mechanisms for making things happen.
5. Capacity: the level of demand that can be satisfied.
6. Competency: the level and type of organisational expertise.
7. Customer: the focus on outcomes for customers rather than on outputs."

The work at all above levels at KSC is still in progress, aiming at determining the fundamental path for the company's future. Positive conclusions are targeted in all departments and subsidiaries required to be achieved at the end of the day.

What has been achieved in the cane production sector is a starter; more is expected to bloom in the near future.

Conclusions

The effects produced in the cane production sector at KSC as a result of reform measures adopted there, underline the noticed reduction in cane production cost and the final product (sugar) cost. The steps taken maintain KSC competitiveness in the world sugar market, therefore further improvement of implementation should ensure future cost control and product marketability.

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Appendix A
Summary of Elgunied production relations proposed for RSP

Introduction

The relation was based historically on the idea of the company purchasing the cane from farmers after concluding a price for cane through negotiations between farmers union and the company management at the end of seasons. In 1991, the two sides arrived to a relation formula based on a profit margin calculation. In 1996 a committee was formed to revise the relation. That committee proposed a production relation taking into account the ratio between cane production and sugar production costs. The revenues were to be divided according to that ratio. The formula was accepted by the two partners, though its application was a bit complicated. In season 1999/2000 a committee was formed with the aim of revising the formula and facilitating its application. The committee accomplished its task successfully and prepared a package of agricultural duties and regulations that have to be observed by the two partners.

Inputs for fixing cane purchase prices from farmers

- The agricultural operations costs are negotiated and fixed prior to the start of planting season.
- The expected sugar sale prices are determined in the light of the adopted policies.
- Cane and sugar produced for the same season are endorsed.
- Cane production cost and sugar production cost ratio was fixed at 60:40% used as arbitration proposed ratio. The ultimate ratio, based on actual cost calculation, may slightly vary from this ratio from one season to another but found to be insignificant for practical purposes.
- Averages of production cost for both cane and sugar for two seasons are utilised. The last season and the current season averages help arriving to acceptable figures realising that the cane production operations are overlapping across seasons& through ratoon cycles.

Applying the production relations formula

- For the current season the sugar total sale value is calculated based on the declared sale price.
- Utilising the cane/sugar ratio already determined, the cane consumed value is calculated – equal to 60% of total sales value – this is cane revenues.
- Total cane production cost should be deducted from cane consumed value – or revenues in order to calculate farmers profits.

Source: KSC/KETS records-Elrahad Sugar Study Document (not published).

Appendix B
Kenana Sugar Company transformation and restructure processes

Objectives:

1) Cost of operations reduction.
2) Redesigning of operation processes to introduce advance technology.
3) Increase productivity.
4) Enhance the company image in the sugar industry in general and in Sudanese industry in particular.

It is known that the main cause of the transformation processes is the hyper increase of the production cost of a ton of sugar from US$220 just five years ago to US$580 in year 2006/07. This increase coincided with the appointment of a new Managing Director, who is known as a devotee of change. The new MD contracted PricewaterhouseCoopers, a famous British company in consultancy and auditing, to design the entire transformation. The transformation process comprised 15 work-streams that looked at all aspects of KSC business.

List of work-streams: sugar projects

- Project Management/Change Board
- Operations
- Site Management
- Supply Chain (Procurement)
- Finance
- Produce Farm
- Sales and Marketing
- Sifeia Iron Works and Agricultural Equipments Factory
- Human Resources
- Planning and Development
- Internal Audit
- Fleet Management
- Training
- Information Technology (IT)
- Animal Feed Plant

The work-stream plan includes three phases:

- Analysis of the current situation (as is analysis).
- Design of new set of work, procedures and activities.
- Implementation.

At the end of each phase a workshop is organized and presentation is offered to demonstrate the outcome of that phase. Moreover at the end of each phase MD should endorse the findings and recommendations of the work-stream.

Main concept fundamentals

Centralisation
It is agreed that all jobs should be done by one department only. Departments sharing the same jobs are subject to review to enable executing the job by only one department. For instance transport, previously all departments were providing the transport services to their respective staff. In view of the transformation process the transport services is offered only by the transport department for the entire company. Thus transport trucks and buses have come under the single management of the transport department. The philosophy of this rule is to strengthen departments through deepening specialisation which ultimately reduces cost.

Staff reform
A massive reform has been undertaken in view of the centralization fundamental and as result of the company restructure.

Redesign of process
The company entire business processes have come under thorough investigation to increase efficiency and to accommodate new technological developments.

Formation of businesses units
All businesses run by Kenana Sugar Company will be run through autonomous businesses. These businesses have to sell their respective services to other KSC departments. Likewise these businesses have to procure the services from other KSC departments. At the end all businesses should be in a position to calculate their respective profits/loses without incurring unnecessary cost on the sugar bag. Moreover, some businesses may be in a position to sell services/products to third parties in sugar industry or in Sudanese industry at large.

Business units
- Sugar
- Ethanol
- Produce farm
- Kenana Equipment Manufacturing Production (KEMP)
- Animal feed.

The results of the transformation processes have been:

- 1497 staff became redundant.
- Phasing out the entire manual harvesting and resort to 100% mechanical harvesting.
- The sole owner of all company cars, trucks, tractors, heavy equipments and harvesters is the Fleet Department.
- Light vehicles ownership shifted to staff on agreed upon prices paid through instalments in four years. The new ownership has contributed in raising staff morale and reducing cost of operation in the same time.
- Services, Education, Medical and Transport are wholly run by Site Management.
- All accounts clerks to consolidate with Accounts Department likewise all administrators to consolidate with Site Management.
- Major company restructuring
  - Creation of new Corporate Operations Director job.
  - Harvesting to consolidate with Agriculture.
  - Fuel distribution to join fleet department.
  - Fuel storage to join stores.
  - Domestic electricity maintenance and generator maintenance from Civil Maintenance Works to join factory.
  - Water treatment plant to join Civil Maintenance works.
  - Formation of Strategic Planning Department.

Appendix C: World Refined Sugar price

-World refined sugar price, monthly, quarterly, and by calendar and fiscal year 1/

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	1st Q	2nd Q	3rd Q	4th Q	Calendar	Fiscal
									Cents per pound									
1980	20.05	26.13	23.60	24.34	35.55	35.40	33.32	35.16	37.29	42.30	40.72	33.70	23.26	31.76	35.26	38.91	32.30	NA
1981	33.03	29.63	27.56	21.46	18.79	20.22	19.36	17.59	13.80	14.65	14.73	14.66	30.14	20.16	16.92	14.61	20.51	26.53
1982	14.77	14.94	13.60	13.05	11.83	10.60	11.38	9.14	8.58	8.54	9.64	10.35	14.44	11.79	9.70	9.51	11.36	12.68
1983	9.69	9.70	9.75	10.00	12.20	14.07	13.30	13.19	11.79	10.69	10.38	10.71	9.71	12.11	12.76	10.99	11.46	11.03
1984	9.61	8.76	8.27	7.89	7.40	7.62	6.88	6.95	7.48	7.79	7.36	6.51	8.88	7.64	7.10	7.22	7.71	8.65
1985	6.43	6.25	6.00	6.00	5.90	6.00	6.19	7.10	7.95	7.71	8.02	7.00	6.24	5.97	7.10	7.00	6.79	6.63
1986	7.83	7.97	8.36	10.10	9.49	8.45	8.11	8.51	8.03	8.16	8.26	8.15	8.18	9.34	8.22	8.16	8.42	8.48
1987	8.65	9.20	9.45	8.00	8.64	8.24	8.09	8.09	8.00	8.50	8.90	10.00	9.11	8.51	8.10	9.10	8.75	8.49
1988	11.41	10.51	10.67	10.86	11.25	12.39	14.35	12.48	11.62	11.96	12.76	13.39	10.86	11.50	12.98	12.20	12.01	11.13
1989	12.63	13.41	14.52	16.10	16.90	17.70	21.16	22.46	19.75	18.00	18.08	17.00	13.62	16.26	21.14	17.69	17.16	16.91
1990	19.01	19.55	20.03	20.31	20.33	18.39	17.42	15.54	14.39	13.99	14.01	13.69	19.53	19.67	16.12	13.95	17.32	18.25
1991	13.39	13.40	13.86	12.90	12.99	13.94	14.73	14.40	13.09	13.03	12.71	12.46	13.55	13.28	14.07	12.72	13.41	13.71
1992	12.18	11.92	12.19	12.54	12.69	13.41	13.41	12.90	12.29	11.94	11.66	11.20	12.10	12.93	12.68	11.03	12.09	12.07
1993	11.69	11.97	13.06	13.38	13.30	12.64	12.20	13.06	12.90	13.23	13.15	12.97	12.21	13.14	12.72	13.12	12.79	12.42
1994	13.14	14.11	15.46	14.92	15.77	16.05	15.54	15.62	15.42	15.46	17.77	16.65	14.24	15.58	15.53	17.29	15.66	14.02
1995	18.75	18.17	17.45	16.31	17.05	19.16	20.27	20.01	16.58	17.29	17.64	17.21	18.12	17.51	18.05	17.39	17.99	17.97
1996	17.36	17.90	18.14	18.02	17.79	18.00	16.99	16.81	15.74	14.87	14.09	13.95	17.80	17.94	16.51	14.30	16.64	17.41
1997	13.87	13.98	14.06	14.19	14.61	14.63	15.07	15.66	14.51	13.58	13.81	13.64	13.97	14.58	15.08	13.68	14.33	14.48
1998	13.52	12.78	12.23	11.65	12.00	11.60	11.65	11.62	10.05	10.00	10.76	10.97	12.84	11.81	11.11	10.58	11.59	12.30
1999	10.69	10.59	9.85	8.70	9.13	9.03	9.47	9.04	8.28	7.85	7.73	7.61	10.45	9.28	8.03	7.73	9.10	9.81
2000	7.70	7.67	7.83	8.60	9.06	10.63	11.38	11.29	11.74	11.76	11.02	10.95	7.73	9.43	11.47	11.24	9.97	9.10
2001	11.27	10.66	10.28	10.61	11.71	12.68	12.60	12.08	10.66	10.19	11.27	11.52	10.73	11.67	11.78	10.99	11.29	11.35
2002	11.68	10.60	10.61	10.09	10.28	10.02	10.23	10.33	9.66	9.72	10.16	10.25	11.16	10.13	10.08	10.04	10.35	10.59
2003	10.64	11.10	10.51	10.14	9.05	9.66	9.84	9.74	8.95	8.30	8.67	9.23	10.75	9.92	9.51	8.76	9.74	10.08
2004	9.19	9.54	10.59	11.19	10.78	10.73	11.61	11.60	11.12	11.21	11.27	11.23	9.76	10.90	11.58	11.24	10.87	10.25
2005	11.63	12.09	12.02	11.76	11.75	12.61	14.70	14.81	14.66	14.18	13.10	15.00	11.91	12.04	14.20	14.09	13.31	12.47
2006	16.92	19.99	20.45	21.35	21.81	20.93	20.95	18.16	17.32	17.92	16.41	15.86	19.12	21.36	18.81	16.73	19.01	18.36
2007	15.13	14.92	15.59	14.21	14.54	14.36	14.13	12.87	12.54	12.56	13.00	13.78	15.21	14.50	13.18	13.11	14.00	14.91
2008	16.17	16.61	16.79	15.87	14.02	16.35	17.06	17.02	17.52	16.07	15.00	14.27	16.86	16.21	17.60	14.78	16.04	15.56
2009	19.07	17.60	17.63	18.36	20.10	19.96	21.36	24.69	26.27	26.50			17.00	19.49	24.17			19.07

1/ Contract No. 5, London Daily Price, for refined sugar, f.o.b. Europe, spot, through June 2006. Starting in July 2006, spot price replaced by average of nearest futures month for which an entire month of prices is available.

Source: London International Financial Futures and Options Exchange (LIFFE).

Last updated: 11/2/2009

Appendix D
Mashkoor Study - labour percentage of total production cost

ITEM	COST/FEDDAN SDG	
LAND DEVELOPMENT		
Bush clearance	10	
Primary tillage	30	
Secondary tiilage	17	
Planing	13	
Survey work	38	
Automatic planning	35	
Ridging	17	
Canal and drain construction	100	
TOTAL (A)	260	
SEEDCANE		
Seedcane cutting	13.5	CL-1
Seedcane transportation	230	
Loading and offloading	2.3	
Seedcane price	100	
TOTAL	345.8	
PLANTING OPERATION	45	CL-2
FERTILISATION		
Urea 4 bags x90	360	
TSP 2x70	140	
Application	12	CL-3
HERBICIDES		
Gesapax + Gesaprim	11	
Stomp + Gesaprim	25	
Application	5	CL-5
INSECTICIDE	25	
TOTAL	578	
IRRIGATION		
Fuel cost		
Pump consumption/hour = 7 gallons		
gallon price = 5		
Cost irrigation/cycle 7gx10 hx5 sdg/25		
14x27	400	
Lubricant	22	
TOTAL(B)	422	
CULTIVATION OPERATION		
Rigid tine	15	

Onbarring		11	
TOTAL		26	
TOOLS		35	
TOTAL			1711.8
MANPOWER			
Section manager 700 x 12		8400	
Pump operator 600 x 12		7200	
Irrigators 10 x 350 x 12		42000	
Cane guards 2 x 350 x 12		16800	
Pump assistances 2 x 350		8400	
TOTAL(C)		82800	
82800/150 FEDDAN		552	PL-552
GRAND TOTAL COST/FEDDAN (GTC/F)			2263.8
RATOONING OF SEED FARM PHASE I			
FERTILIZATION		7854	
HERBICIDING		697	
CULTIVATION		442	
IRRIGATION		238	
			9231
TOTAL		578	
IRRIGATION			
Fuel cost			
Pump comsumption/hour = 7 gallons			
Gallon price = 5			
Cost irrigation/cycle 7gx10 hx5 SDG/25 fed.			
14x27 irrigation cycles/year		400	
Lubricant		22	
TOTAL		422	
COST OF TON CANE			
	Price of cane	30	
	Cane cutting	2.7	
	Loading andoffloading	2.3	
	Transportation		
	Truck rent/day 450 SDG		
	Ferry 100 SDG/trip		
A	Umjer ferry 4 trips 16 tons		
	450+ 400/16	53.1	
B	Edduem ferry 2 trips 8 tons		
	450+200/8 tons	81.25	
	Umjer (35+53.1) x 7500		660,750

	Edduem 116.25 x 7500		871,875
	RISK		
1	The risk of using trucks across the river is very high, which may extend the planting operation beyond the schedule		
2	Additional cost of seedcane		
2	USING EDDUEM BRIDGE		
	No trips 7500/4 1875		
	The cost/trip SDG 450/4 112.5		
	Ton transport cost 112.5/16	7	
	Total cost (35+7.03) x 7500		315225

Cost Percent Calculations: Maskoor Project Study (KETS):
Casual labour percent:
Add: cl-1 + cl-2 + cl-3 + cl-4 = 13.5 + 45 + 12 + 5 + 75.5 SDG per feddan.
Permanent labour PL = 552 SDG per feddan.
Total labour cost = 75.5 + 552 = 627.5.
Percentage labour cost = 627.5/2263.8 x 100 = 27.7 = 28% of GTC/F.

Irrigation labour cost/metric ton cane(PLC/MTC):
Estimated cane tield per feddan = 40 metric tons.
Cost for one metric ton =2263.8/40 = SDG 56.595 /2.5 (Exch. rate) = $22.638.
Cost for irrigation PL: 552/40 = 13.8/2.5 (Exch. Rate) = $5.52.
Irrigation labour (PL) percent per MTC = 5.52.22.638 = 24.4 = 25%.

Total irrigation cost percent:
Add totals: A + B + C = 260 + 422 + 552 = SDG 1234 x 110 (10% for system maintenance) = SDG 1357.4.
Total irrigation cost percent: 1357.4/2263.8 x 100 = 59.96 = 60%.

Appendix E
Cane production processes separate costs
Grand total cost = US$19.5/MTC.

1. Cane Production: Three year average = US$15/MTC.

Year	Cane harvested (MT000s)	Total cost (SDG000s)	Cost per MT (SDG)
1999 - 2000	3,541	61,500	17.37
2000 - 2001	3,751	75,222	20.05
2001 - 2002	3,615	84,755	23.45
2002 - 2003	3,828	93,227	24.35
2003 - 2004	3,905	96,445	24.70
2004 - 2005	3,686	100,209	27.19
2005 - 2006	3,792	115,913	30.57
2006 - 2007	3,712	122,469	32.99
2007 - 2008	3,787	132,747	35.05
2008 - 2009	3,386	142,696	42.14

2. Harvesting: Three years average = US$2/MTC.

Year	Cane harvested (MT000s)	Total cost (SDG000s)	Cost per MT (SDG)
1999 - 2000	3,541	6,872	1.94
2000 - 2001	3,751	8,153	2.17
2001 - 2002	3,615	7,787	2.15
2002 - 2003	3,828	8,666	2.26
2003 - 2004	3,905	10,642	2.73
2004 - 2005	3,686	11,622	3.15
2005 - 2006	3,792	14,278	3.77
2006 - 2007	3,712	15,750	4.24
2007 - 2008	3,787	13,641	3.60
2008 - 2009	3,386	15,166	4.48

3. Cane transport: Three years average = US$2.5/MTC.

Year	Cane harvested (MT000s)	Total Cost (SDG000s)	Cost per MT (SDG)
1999 - 2000	3,541	11,508	3.25
2000 - 2001	3,751	14,557	3.88
2001 - 2002	3,615	14,347	3.97
2002 - 2003	3,828	15,702	4.10
2003 - 2004	3,905	17,405	4.46
2004 - 2005	3,686	18,059	4.90
2005 - 2006	3,792	20,072	5.29
2006 - 2007	3,712	23,164	6.24
2007 - 2008	3,787	20,461	5.40
2008 - 2009	3,386	22,750	6.72