Value Chain Analysis Focusing on Organizational Production Process : The Case of Wonji/Shoa Sugar Factory

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By: Kedir Hussen Safeno

Main Advisor: Shimelse Zewde (PhD)
Co-advisor: Yonatan Yilma (MBA)

Jimma University
College of Business and Economics
Master of Business Administration Program

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DECLARATION

I, the undersigned declare that this Research report is my original work and has not been presented for a degree in any other university, and all the materials used for this study have been duly acknowledged.

Name _______________________________

Signature ____________________________

Date ________________________________

This Research report has been submitted for examination with our approval as a university advisor.

Main advisor

Name ____________________________

Signature _________________________

Date _____________________________

Co-Advisor

Name ____________________________

Signature __________________________

Date _____________________________

Board of Examiner Sheet

Jimma University

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Approved By Board of Examiners

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Main Advisor	Signature
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Co-Advisor	Signature
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Examiner (internal)	Signature

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ACRONYMS

- **BTW** Burning**,** Tilling, and Weighing
- **GIS** Geographic Information System
- **HTCD** Harvest-to-Crush-Delay
- **HVA:** HandlessVerging Amsterdam
- **ICUMSA** International Committee Uniform Method for Sugar
- **TCD** Trushing Capacity per Day
- **WSSF** WonjiShoa Sugar Factory

Abstract

The purpose of this study was to assess the value chain analysis in organization production process at Wonji/ Shoa sugar Factory. Therefore, cross sectional case study in both qualitative and quantitative approach was used in order to minimize weaknesses and reach a deeper understanding of the area. The sample of 127 upper level management staff and supervisors engaged in 5 sectors was taken for the study. A stratified random sampling technique was employed; in which the target population is stratified and then, simple random sampling was adopted to select the required sample from each stratum. In addition to these techniques, purposive sampling was applied for the interview of the key informant. Here, both primary and secondary sources of data were used for addressing the stated research questions according to their nature. Comprehensive research instruments, which are structured questionnaire and interview, were developed and used to gather data for analysis. A descriptive analysis was used for discussion of the results. The rate of sugar extraction decreases as the processing of cane is delayed. The findings reviled that the value adding activities were not adopted and performed properly. In line with findings the sugar extraction process in the factory has above desired loss of sugar through bagasse and molasses and that the expected maximum sugar cane yield is not achieved.

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

Value chain is the linked set of value creating activities all the way from basic raw materials sources for component supplies through to the ultimate end – use product or service delivered to the customer (Drury, 2008: 15).

The concept of value chain analysis was developed in the 1980s by Michael porter in his book "Competitive Advantage: Creating and Sustaining Superior Performance" (Porter, 1985).

Value chain analysis describes the activities within and around an organization, and relates them to an analysis of the competitive strength of the organization. Therefore, it evaluates which value each particular activity adds to the organizations products or services. This idea was built upon the insight that an organization is more than a random compilation of machinery, equipment, people and money. Only if these things are arranged into systems and systematic activates, it will become possible to produce something for which customers are willing to pay a price. Porter argues that the ability to perform particular activities and to manage the linkages between these activities is a source of competitive advantage (Recklies, D, 2001:1).

The manufacture of cane sugar from sugar cane is a distinctive industrial process. Sucrose comes into the factory in the cane, and, subject to some physical losses and some destruction, emerges in the product, crystal sugar. The process is essentially a combination of separation and concentration. The first step is the separation of sucrose and the impurities in solution from the insoluble impurities, together called fiber. This is the function of the milling plant, and the process is commonly called extraction. The second step is the treatment of the extracted juice for the removal of some insoluble and some dissolved impurities, and this is known as clarification. A considerable proportion of the water present is then removed in the process called evaporation. The further stages constitute the separation of impurities by crystallization of the sucrose. (Brisbane, 1971: 11)

As a unifying theme, value chain analysis presents organizations with an overarching tool for improving their strategic planning and resource allocation. The goal is to provide management with sufficient options to sustain its competitive advantage in an ever-changing business environment (Holst, 1996:28).

Sugar is produced in around 122 countries across the world. It is extracted from two different raw materials, sugarcane and sugar beet. Sugarcane is cultivated under tropical climates the choice of sugarcane or sugar beet for sugar production is influenced by weather conditions, crop diseases, soil quality, international trade agreements and domestic price support programmers. The cost of producing sugar from cane is less than the cost of producing from beet. Of the 122 sugar producing countries, 67 produce sugar from cane and 55 from beet (N.N.Bhostekar, 2012:71).

However, the researcher couldn’t find previous research on sugar production process of local sugar industry, conducting what problem exist in value chain analysis in Agricultural cultural practice and how does the technology affects sugar production in the factory operation.

Hence, this research tries to assess the value chain analysis with a special emphasis on organizational production process in sugar industry of Ethiopia by taking Wonji/Shoa Sugar factory as a case study.

1.2. Statement of the Problem

Sugar cane is the main raw material for sugar industry. The harvested cane need to be crushed within a few hours (8-12 hours to get a good recovery of sugar) to avoid loss of sucrose content, necessitating close coordination of harvesting and cane supply with cane crushing operations (N.N.Bhostekar, 2012:71).

The main determinant of factory efficiency is cane quality, represented by the pole percent which is the source contain in the juice; factory recovery rate, in turn the production of rates of mill house and boiler house extraction (R.S.Deshmukh 2012:72).

The harvesting and processing of sugarcane has to be well coordinated for the rate of sugar extraction decreases as the processing of cane is delayed. If cut cane is left unprocessed for more than 12 hours, biological decomposition sets in. When sugar is lost to fermentation, the sucrose content extracted from the cane is reduced. Management, like a machine is an indivisible input. The need for good management also gives rise to economies of scale (Ramsawak, 2006:27).

Having the above facts, the aim of this paper is to analyze WSSF value adding organizational production activities such as: sugar cane plantation, how does technology affects harvesting and crushing process of sugar cane production process, transportation time, waiting time at field, waiting time at mill yard, loading/un loading time, and how efficient is the flow of raw material in sugar production process, and How value adding activity can be performed and meet the organization goal by raising the following questions to address in the study of value chain analysis in organizational production process.

- How efficient is the flow of raw materials in sugar production?
- What problems exist in waiting time and transportation during sugar production?
- How does technology affects harvesting and crushing process of sugar production in the factory?
- What are the bottlenecks and weaknesses in the current value stream within the organization sugar production process?

1.3. Objective of the Study

1.3.1. General Objective

The general objective of this study is to analyze value chain activities; focus on organizational process in wenji/shoa sugar factory.

1.3.2. Specific Objectives are;

- To analyze the flow of raw material in sugar production of the factory.
- To identify the problems occurring in waiting time and transportation during the sugar production process.
- To examine the ways in which technology affects harvesting and crushing operation of sugar production in the factory.
- To identify bottlenecks and weakness in the current value stream, within organizations production process.

1.4 Significance of the Study

Since good performance of value chain analysis is one of the tools to enhance economic growth, the outcome of this paper will help:

- Firstly, the wonji/shoa sugar factory to identify major constraints and challenges in the value adding process and hence to device strategies to improve the operation.

- Secondly, the study will provide spring board for coming researchers and academician's who want to make a further investigation in the study area.

- Thirdly, this research will be important for concerned government bodies in a way that the policy makers will use the finding from this study and they will be aware of the practice of value chain analysis in sugar production process.

1.5 Scope of the Study

This study will be conducted in wonji/ shoa sugar Factory. The study area were selected on overall characteristics of a public sugar manufacturing enterprise, and the development of sugar industry in Ethiopia is connected to the establishment of wonji/ shoa sugar Factory historical background. The researcher is interested to assess the value added activities of wonji/ shoa sugar Factory organization process which focus on Harvesting operation, Transportation and sugar production process.

Above all, due to vast operation nature of the sugar industry activities, it is not possible to cover the analysis of value chain activities in down- stream of value chain analysis in this paper.

1.6 Limitation of the Study

Even though different efforts have been made, the researcher faced some challenges while doing this study. To begin with, the respondents' creates some negligence in filling the questionnaire. Some do not give values to the questionnaire and some others do not return it totally. Furthermore, since respondents have been in a tight work, some were not as such willing to fill the questionnaires. Therefore, these conditions might affect the quality of the paper to some extents.

Due to the vast operation nature of the sugar industry, the analysis of value chain activities in the downstream of the value chain analysis does not included.

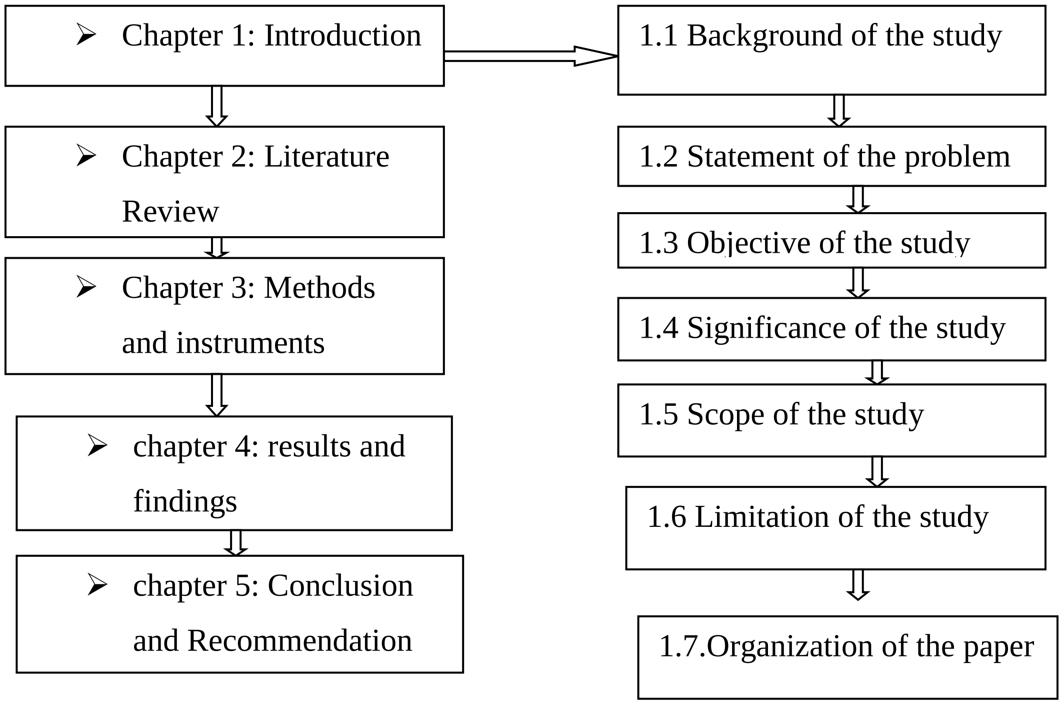
The agricultural parts of the research; land preparation, cultivation, and plantation need field experiments and laboratory test. But it was not available to do that, the researcher uses other researcher's findings as evidence.

The cost analysis of the research focus only on the area of: Harvesting, Haulage (transport), factory extractions process. It does not include other organization production process.

1.7 Organization of the Paper

The research is organized in five major parts. Firstly, the introductory part which contains the background of the organization, statement of the problem, objectives of the study, scope of the study, and other background information are presented. Next to this the review of literature with theoretical as well as empirical reviews are followed. The third part gives methodology used in the study. The fourth part Result and Discussion. The fifth part Conclusion and Recommendations.

Figure 1.1 Organization of the study



Source: Developed by researcher, Jimma 2013

CHAPTER TWO: LITERATURE REVIEW

This chapter revises the different literatures written in the area of value chain analysis in sugar industry and explores conceptual frame work, definitions, terminology and empirical studies. The literature review on sugar is broad and extensive. However, the literature review on the value chain analysis of sugar industry, especially in Ethiopia is not available. The existent research on sugar in Ethiopia concentrates on different issues such as irrigation, Bagasse usage, and scale formation on sugar industry.

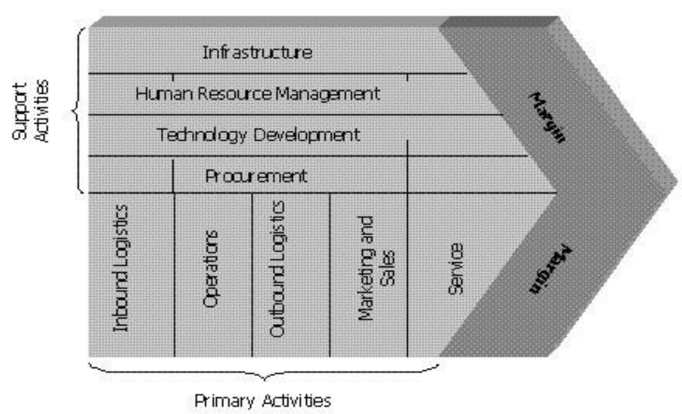
2.1. Theoretical literature

I. Concepts, Definition, and Terminology

What is a value chain?

The value chain describes the full range of activities which are required to bring a Product or service from conception, through the different phases of production (Involving a combination of physical transformation and the input of various producer and services), delivery to final consumers, and final disposal after use (Porter, 1985).

Figure 2.1 the Value Chain



Source: Porter (1985)

Why is value chain analysis important?

Value chain analysis is important both conceptually and practically. Conceptually, the value chain approach presents a good picture of the process of creating value (porter, 1985).

The sugar cane crop

Sugarcane is a hybrid of several species of the genus Saccharum. The word Saccharumseems to originate from the Sanskrit word Sarkara. Saccharumspontaneum describes the wild cane varieties and S. officinarum L. the developed varieties used for commercial sugar production. Saccharumofficinarum L. has long been considered the "noble" cane, as for centuries it has been the major source of commercial sugarcane. It originates in New Guinea, from where it spread due to migration (Blackburn, 1984:88).

Different breeding and selection techniques have been applied to sugarcane to improve sugar yield. Selections have been made based upon cane yield, sugar content, fiber content, habit, ratooning, disease resistance, insect resistance, and other characteristics such as flowering, spines, brittleness, and herbicide tolerance (Walker and Symonds, 1984).

Sugarcane is a perennial tropical grass that produce s un branched stalks. It consists of root, stalk (with nodes), flower, and leaves (Jones and Scared, 1921). Its stalks can be 3-4 m tall and 5 cm in diameter. Sugar is extracted from these stalks of cane, and it is contained in the fibro-vascular bundles. The composition of sugarcane (Saccharumofficinarum L.) varies depending on such factors as variety, soil condition, climate, and use of fertilizers (Ruter, 1975). The general composition of sugarcane is listed in Table 2.1.

The composition of cane

On a weigh basis, about three quarters of a sugar cane stem is water (Table1)

Table2.1. The composition of sugar cane

Component	%	Details
Water	74.50	$Sio_2k_2o,N_{a2}o$, others
Ash	0.50	Ceiiulose, pentosans, legume,
Fiber	10.00	Others sucrose, giucose, fructose
Sugars	14.00	Amino acids, others.
Nitrogen bodies	0.4	
Fat and Wax	0.20	
Pectin (gum)	0.20	
Free and combined acid	0.20	
Total	100.00	

Source: space and meade1948.

Process of sugarcane growing

Sugar cane is grown best in deep, well drained soils of medium fertility with loamy to loamy-sand soil textures, a pH range between 6.1-7.7 and an organic matter content of at least 1.5%. Clay-textured soils are unfavorable for sugarcane growth. Optimal temperatures are between 20 and 35 degrees Celsius. Under rain-fed conditions, good distribution of rainfall is required. The water requirement is 1.2-1.6 m/year. (Source wssf plantation document)

Planting seasons

Table2.2 Calendar of sugarcane planting and activities

Activities	Month																		
	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1.Plowing first time with green manures (Soy bean and other legumes)	■	■																	
2. Plowing second time, ripper			■	■															
3. Planting			■	■	■														
4. Harrowing				■	■														
5. Fertilizing							■	■											
6. Herbicide and weeding							■	■	■										
7. Soil cultivating															■	■			
8. Harvesting (1st stubble)																	■	■	■

Source: WSSF plantation

Note: The time period of sugarcane planting has to be adjusted. 1 = January, 2 = February, 3 = March, 4 = April… 12 = December

The following work process data was collected from WSSF sugar production process document and the work flow process in manufacturing sugar industries are internationally similar.

Step 1: Processing raw sugar from sugarcane

Approximately 10% of sugar cane can be processed into commercial sugar. Sugar cane consists of 70% of water, 14% of fiber, 13.3% of saccharose (about 10 to 15% sucrose) and 2.7% of soluble impurities.

Harvesting

Canes are cut at ground level, the leaves are removed and the top is trimmed by cutting off the last mature joint. Cane is then transported to a sugar factory. After cutting, cane deteriorates rapidly, so cane and beet cannot be stored for later processing without excessive deterioration of the sucrose content.

Juicing

The shredded sugarcane travels on a conveyer belt through a series of heavy-duty rollers, which extract juice from the pulp. The pulp that remains, or “bagasse”, is dried and used as fuel. The raw juice moves on through the mill to be clarified.

Clarifying:

Carbon dioxide and lime juice are added to the liquid sugar and heated to around 95 degrees Celsius. As the carbon dioxide travels through the liquid, it forms calcium carbonate, which precipitates non-sugar debris (fats, gums and wax) from the juice. This precipitate, called "mud," is then separated from the juice by centrifugation. The juice is then filtered to remove any remaining impurities.

Evaporation:

The filtered juice is evaporated under a vacuum, concentrated at a low temperature, and the sugar crystallized in vacuum pans.

Crystallization:

Inside a sterilized vacuum pan, pulverized sugar is fed into the pan as the liquid evaporates, causing the formation of a thick mass of crystals. The crystals are spun-dry in a centrifuge, producing raw, inedible sugar (Biz Dimension, 2006).

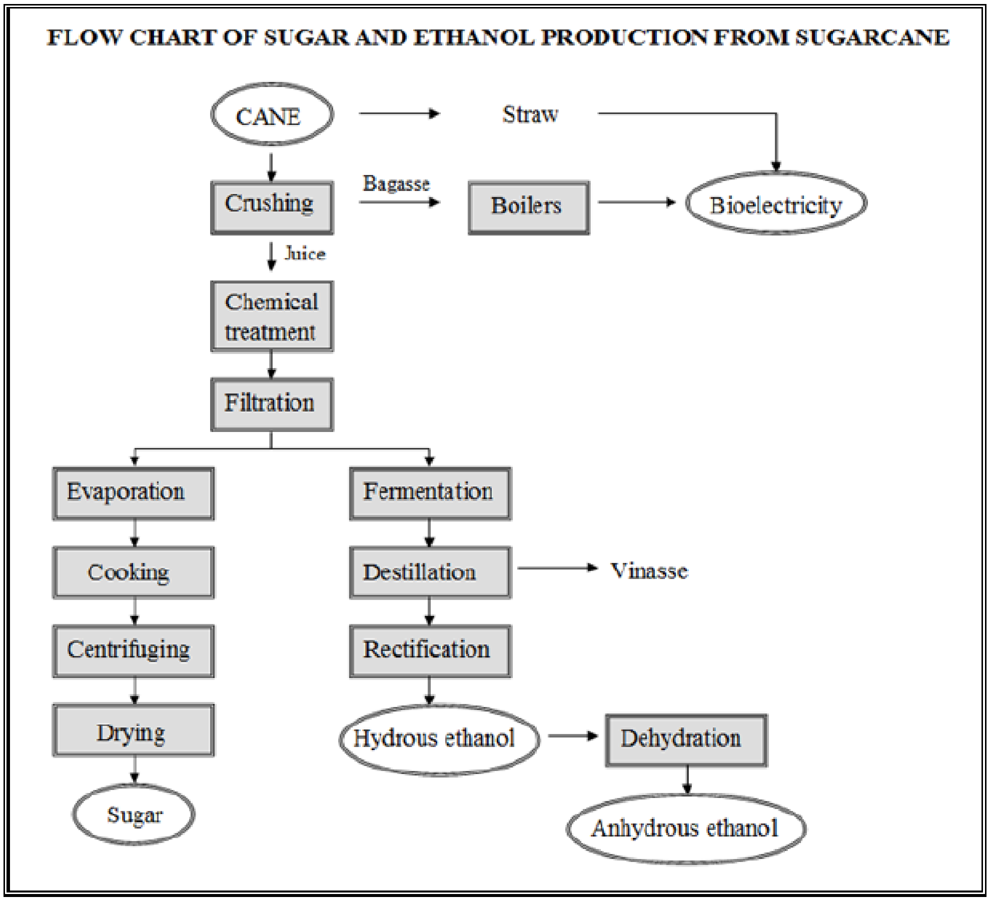
Step 2: Refined sugar production

A simplified process flow diagram from refined sugar production is shown in Figure 2 the raw sugar obtained from cane requires refining to remove the molasses film and inorganic matter that have not been removed during the clarification process. The inorganic matter gives some color to the raw sugar that must be eliminated to obtain white sugar. The refined sugar process has several steps:

Affination

The first step in sugar refining is affination. This is a mechanical process to remove the molasses film from raw sugar with warm, almost saturated, syrup. Crystals are separated from the syrup by centrifugal washing with hot water or a high purity solution of sugar. The syrup from the crystal washing, called affination syrup, is transferred to a remelt processing station and then to the clarification step. If the refinery is part of the raw sugar production facility, the cane sugar may be washed more heavily in previous steps and the affination step omitted.

Figure2.2. Flow chart of sugar and ethanol production from sugar cane



Source: The Brazilian Sugar Ethanol/ Sector

Clarification:

The main purpose of clarification is to eliminate the inorganic impurities present in raw sugar. Chemical clarification, using phosphatation and carbonation, is the preferred method, though pressure filtration is also used. The next step is decolorization, to remove soluble impurities by adsorption by granular activate carbon and bone char, manufactured from degreased cattle bones.

Evaporation:

After clarification, the syrup must again be concentrated by multiple effect evaporators and crystallized by vacuum pans. This is the same sequence used in the raw sugar process. Multiple-effect evaporators are used to raise the syrup to 70 Brix before final concentration to the crystallization point during the boiling process. In the multiple-effect process, the syrup moves through several inter-connected vacuum vessels. Every step (vessel) is called an effect.

Boiling step:

The syrup is further concentrated by boiling until sugar crystals are formed. Vacuum pans are used, requiring only small changes in operating conditions. A final mix of white sugar and residual molasses is obtained.

Crystallization step:

Refined sugar crystallizers, as used in raw sugar processing, cool the steam coming from the boilers to facilitate separation of white sugar from the molasses. Separation is carried out by centrifugation.

Drying and cooling:

The damp sugar from the centrifuges is then treated in a special piece of equipment usually consisting of 2 horizontal drums. In the first drum, the sugar is dried by hot air and in the second, known as the cooler, sugar crystals are dried in an ambient temperature. The sugar emerges from this stage with a water content of 0.03% and a temperature of 43-54 degree Celsius.

Screening:

The sugar from the dryer-cooler passes over vibrating screens, which separate out lumps that form when the sugar is sent to the bagging hopper.

Packaging:

The dried, cooled sugar is packed in 100 kilogram polyhten bags, stitched with cotton thread, and labeled as white, refined, sugar (Biz Dimension, 2006).

Bagasse Use

As mentioned before, the steam and electricity demands of a sugar factory are generally covered by the use of bagasse as fuel. Bagasse has a calorific value of 2,200 kcal/kg on wet basis. Factories use bagasse to produce high-pressure steam

By-products of Sugarcane Industry

A number of value-added products can be obtained from sugarcane in addition to sugar. Figure 3 shows some of the possible by-products from the sugarcane industry. The sugar industry can diversify to produce such product as glycerol, inositol, lactic acid, lysine, alcohol, baker's yeast, proteins, etc.

Blackstrap Molasses

Molasses is the main byproduct of the raw sugar process. It is a heavy viscous liquid from which no further sugar can be obtained by simple means. Per ton of cane, up to 8 gallons of molasses may be produced. Molasses contains about 50 to 60% total sugars, of which 16-17% is sucrose, the rest being glucose and fructose. The general composition of molasses is listed in Table 4.

The chemical composition basically determines the quality of molasses. In general good molasses should have a fresh and sweet aroma, and a pH value of 5-6. Molasses should be stored cooled as otherwise self- ignition becomes possible. Certain bacteria (exothermic) cause degradation reactions, which affect the quality of molasses. Molasses can be used for animal feed, for the production of alcohol, rum, compressed yeast, and other organic compounds such as citric acid, acetone, butanol, lactic acid, itaconic acid, kojic acid, aconite acid and aconitates (Chen and Chu, 1993).

Table2.3. Typical Compositions of Cane Molasses

Dry matter	80%
Total sugar	52-58%
Sucrose	16-17%
Reducing sugars	34-38%
Total nitrogen	2-3%
Organic acids	3%
Gums (insoluble in alcohol)	□2%
PH value	5-6
Ash	12-18%

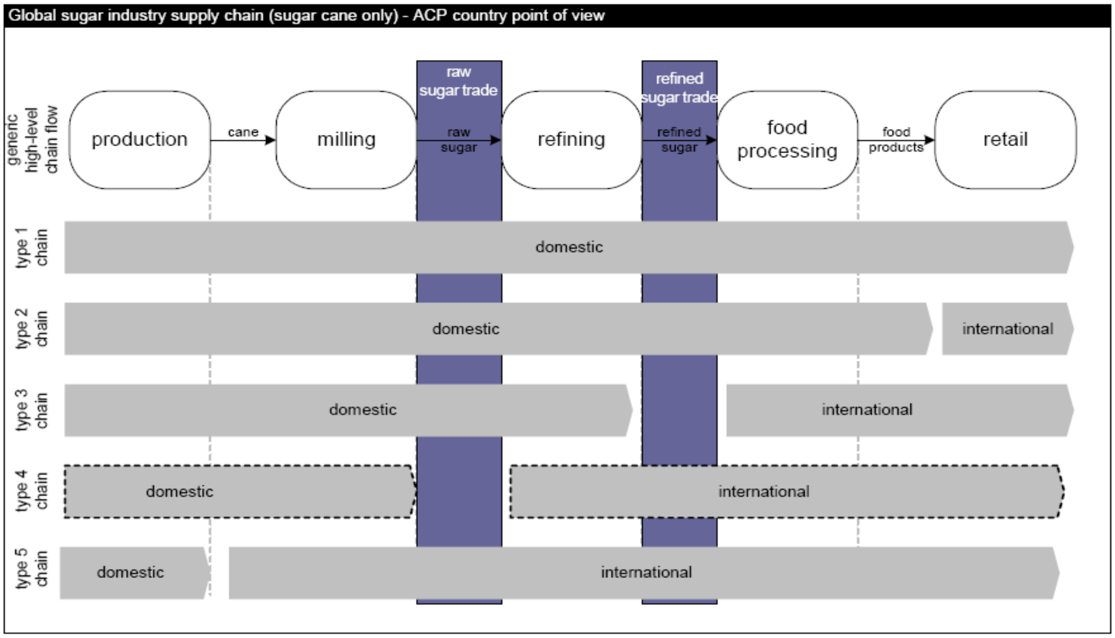
Source: ASI molasses survey (2000).

i. Outlook for the world sugar industry

Total world sugar trade is projected to increase by 6.0%, from 39.9 to 42.2 million metric tons over the 2011-2021 periods. Most exporting countries will increase their sugar exports for the same period. Exports will increase 9.7% for Brazil, and 31.0% for Australia. However, exports are expected to decrease for Cuba, Mexico, and Thailand during the same time period (Banerjee, 2004:27).

Global Value Chain

Figure2. 3. Global value chains



Source: Odi-lsedestin dv406 research project: who gains from sugar quot

Sugar Exports in Australia, Brazil, and India

Australia

Australian sugar exports were handling by the Queensland Sugar Corporation (QSC) until 2008 when it was dissolved and replaced by a public corporation, the Queensland Sugar Limited (QSL), established under the Sugar Industry Act 2008. The QSL is responsible for the domestic marketing and exports of 90% of the raw sugar produced in the state of Queensland, which produces 95% of the sugar produced in Australia. State trading enterprises (STEs) were not addressed in the URA. Other countries, including China and India, handle their sugar trade through STEs similar to the QSC.((Hildebrand, 2002:54)

Brazil

According to The Brazilian Sugarcane Industry Association (UNICA), the largest organization representing the sugar and bioethanol sectors, Brazil is the world's leading sugarcane producer.

The 2008/09 harvest year saw a record crop estimated at 569 million tonnes of sugarcane, processed at around 423 plants nationwide. Of these, 248 were combined mills and distilleries producing both sugar and ethanol, while 159 produced just ethanol. All mills are self-sufficient in producing their own electricity needs. Production grew 85% in the last ten years due to increased area and yield. sugarcane currently covers 8.49 million hectares in Brazil, or 2.3% of the country's total arable land.((takahashi, 2011:6)

India

India is the second largest sugar producer in the world (after Brazil), accounting for around 10-12% of world's sugar production. Sugar is Indians second largest agro-processing industry. Indians sugarcane cultivation area of 4-4.5 million hectares (ha) accounts for 2.7% of Indians cropped area. Sugar industry accounted for around 1% of GDP of the country during FY2005.(V.B.Sawantd, 30 Mar'12 :1)

Global and African Production of sugar

Total world production of sugar in 2007 was 149.7 million tons. Africa ranked in the fifth place among the other continents in the production of sugar. It produced about 10.6 million tons in 2007, equivalent to about 7 % of total world sugar production (Table 1).The distribution of sugar production in the various continents of the world in 2007 (FAO, 2008) is given in Table 2.4 and Fig. 2.4

Table2.4. Sugar production in various continents of the world.

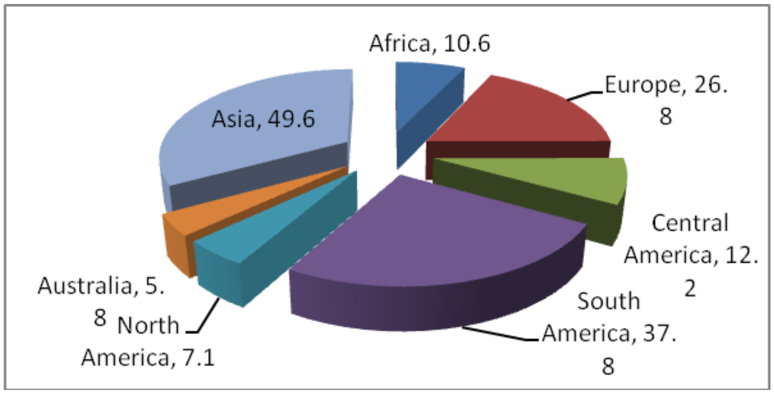
Continent	Production (million tons)	Relative contribution %
Asia	49.6	33.1
South America	37.8	25.2
Europe	26.8	17.9
Central America	12.2	8.1
Africa	10.6	7.1
North America	7.1	4.7
Australia	5.8	3.9
Total	149.9	100

Source: World Bank 2007

Development of sugar industry in Africa

Sugar industry depends on the raw material which damages quickly excessive weight (Ibrahim El-Deb, 1999). Cultivation of sugar cane in Africa depends largely on the rain-fed agriculture rather than on irrigated agriculture, however, higher productivity, is reported from the irrigated land. There is no doubt that Africa has a great potential to expand sugar cane cultivation and sugar industry, but it also need support from projects for dams to provide water for irrigated agriculture (FAO, 2007).

Figure 2.4 World sugar production



Source: FAO 2007

Figure 2.5 The main sugar producer countries in Africa

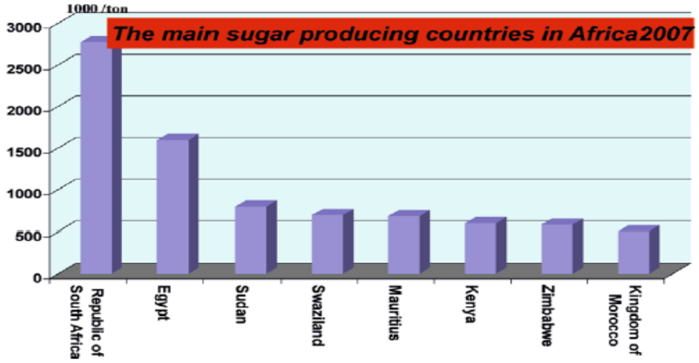


Fig. 2. The main sugar producer countries in Africa 2007

Source: FAO 2007

Table 2.5 The main sugar producer countries in Africa

No	Country	Production (thousands tons)	%
1	South Africa	2279	26
2	Egypt	1600	15
3	Sudan	800	7.5
4	Swaziland	700	6.6
5	Mauritius	685	6.4
6	Kenya	600	5.6
7	Zimbabwe	585	5.5
8	Morocco	505	4.7
	Total	8254	77.3

Source: FAO (2007)

Sugar production in africa concentrate mainly in eight states, which produced more than 77 % of the total production in the continent in 2007 (Table 6.)

Sugar production in the region of East Africa

Total sugar production in the region of East Africa was about 2.4 million tons in 2007 which is equivalent to approximately 22.3 % of the total sugar production in Africa.

Table2.6 Production of Sugar in East Africa

No	State	Production(thousands tons)	% of the region
1	Mauritius	685	32.8
2	Kenya	600	25.2
3	Ethiopia	287	14.1
4	Reunion	210	10.8
5	Somalia	200	8.4
6	Tanzania	187	12.9
7	Uganda	160	6.7
8	Madagascar	32	1.3
	Total	2361	100

Source: FAO (2007)

Sugar factories in Mauritius have advanced power co-gen facility from cane and provide electricity to sugar mills and sell rest of the electricity to the grid. Kenya comes the second place among East African countries. Its estimated production of sugar was 600,000 tons, equivalent to about a quarter of sugar production in East Africa region.

1. Sugar industry in Ethiopia

Sugar industry in Ethiopia started in the beginning of 1950's by a Holland company, and then in the sixties three other factories were established in Metahata, Wanji, and Shoa. Four factories were nationalized after the revolution in the early seventies, later they were merged to one company named the Ethiopian Sugar Company. Sugar cane in Ethiopia dependents on the large irrigated farms in sugar mills area.

2. Wonji/ Shoa sugar Factory

I. Overview of Wonji/Shoa Sugar Factory

WonjiShoa Sugar Factory is the first and the oldest Sugar estate in the country. It operates two sugar mills, a Confectionary plant, a Lime Kiln and 6000 hectares of plantation. It also has a cane supply from 1000 hectares of out grower's farm that constitutes 15-20% of the annual cane supply.

Wonji Factory was officially opened in 1954 G.C. The Factory has a crushing capacity of 1420 tons of cane per day (TCD), and an average production of 165 tons of Sugar per day. Except very few replacements, the Factory is still operating with the originally installed old machineries, but with low performance.

Shoa Sugar Factory was commissioned in 1962 G.C. it has a crushing capacity of 1650 TCD and an average production of 190 tons of Sugar per day. The wonji Confectionery has the capacity to produce 2400 tons of hard-boiled candy per year. Desta Candy is a popular brand in the country. The Lime kiln has the capacity to supply enough lime to Wonji, Shoa and Metahara factories. However, due to scarcity of lime stone, the lime kiln currently is not operational.

II. Major achievements and problems encountered in the last five years

Operational Performance

Achievements of the estate in production sectors are measured by key performance indicators and presented in the following table.

Table2.7 Operation performance of WSSF for the Past Five Years

Description	Unit	2004/05	2005/06	2006/07	2007/08	2008/09
Cane area harvested	Ha	4173	4094	4477	4181	4783.16
Cane production per hectare	Tons	152.7	150.3	135	116.73	124.4
Cane to be crushed	Tons	637,067	615,312	604,574	488,038	595,126
Sucrose content in cane	%	13.44	14.33	13.83	14.16	14.09
	%	13.96	14.27	14.09	14.07	14.13
Overall sucrose recovery	%	81.91	83.06	82.44	82.32	82.15
	%	83.3	83.87	83.45	83.35	84.53
Factory sugar yield	%	11.59	11.94	11.47	11.72	11.64
	%	11.67	12.01	11.82	11.79	12.03
Sugar production	Tons	32357	33482	33543	27201	34696
	Tons	41782	40240	36871	30175	35750
Overall time efficiency	%	75.67	84.47	77.47	81.38	82.03
	%	83.06	81.43	68.86	78.12	68.12
Factory down time	%	12.73	7.71	6.56	8.47	7.17
	%	4.66	9.33	8.96	14.6	12.18
Non-Factory down time	%	11.6	7.82	15.97	10.15	10.8
	%	12.28	9.24	22.18	7.28	19.7
Season days	days	251	224	247	187	233
	days	246	232	245	177	234
Gross Factory capacity	Tons/24 hrs	1474	1485	1525	1537	1558
	Tons/24 hrs	1745	1783	1850	1829	1856
Average net crushing rate per day	Tcd	1208	1234	1257	1251	1276
	Tcd	1453	1496	1544	1429	1269

Source: WSSF

2.2. EMPRICAL STUDY

2.2.1. Factors affecting sucrose yield

Long delays between the harvesting and crushing of sugarcane and the associated deterioration of cane quality have long been recognized as a major source of loss to the sugar industry.
Sucrose yield vary because of effects on the sugar cane plant of soil fertility, irrigation, varieties, cultural practices, fertilizer use, weed, pest and dieses control, harvesting to mill time and many other factors including the length of the crushing season (Humder, 1983).

India

The main concern of sugar industry in India is fluctuations in sugarcane Production. Sugarcane has to be crushed soon after it has been harvested. The time delay between harvest and inventory in the yard (for sugarcane to be crushed) cannot be more than 8-12 hours. Anything beyond that can lead to stock-out, and will lead to spoilage of sugar production as well as molasses production. Further, the complexity increases since cane is harvested continuously from a few hundred centers across various remote locations. (V.B.Sawantd, 2012:76)

Australia

One of the greatest changes in Australian cane growing has been the replacement of manual cane-cutters by mechanical harvesters by 1979. Field efficiency measures the time efficiency of harvesting and is defined as the time spent cutting cane over total harvester activity time. Turning at row ends is a large component of unproductive time, typically 15% to 30%. An area where farming changes can improve harvesting efficiency is farm layout. Planting along the longest dimension of paddocks, joining paddocks, or just continuing rows, e.g., on the other side of roads kept level with the paddock surface could reduce harvesting costs through better field efficiency (Sandell and Agnew 2002).

South Africa

All operations from burning or cutting up until the feeding of cane into the mill for crushing were included, since this is the time period in which deterioration of cane quality occurs. The harvest-to-crush delay simulated by the model for cane offloaded directly onto the spiller tables was of the order of 35 hours. This discrepancy was attributed to the fact that mill and harvesting and transport equipment breakdowns, weather stoppages. Under the existing situation in the Sezela Mill Supply area the average weekly harvest-to-crush delay was estimated by the model to be 38. 2 hours. The long delays incurred in the Night Burnt Cut and Burnt Cut (burnt cane waiting to be cut) stockpiles are due to the practice of only burning cane every second or third day that occurs on many farms in the Sezela mill area.(A BARNES , 1999:26)

Wonji/Shoa sugar Factory

However, The existing situation of Wonji/shoa sugar factory record showed that the average harvesting-to-millgate was 30 hours. This harvest-to-millgate delay would be very close to its harvest-to-crush delay.The harvest-to crush delay examined by interview with the harvesting Manager and four field super visors and field observation by researcher.

The result of the field observation performed with the interview that the longest delays occur where the cutting cane waiting to be load and transport. The delays in the result of differences in harvesting,delivery and milling cycle exceeded the normal, effective and economical time of between 8-12 hours.

The Indians and Australia performance is better than WSSF because Indians are highly utilize BTW (Burning, Tilling and Weighing efficiency within 8-12 hours). Australia uses mechanical harvesting they are capital intensifies.Whereas the WSSFislaborintensifies and fare from technology. The South Africa performance indicated in the literature and by simulation study they are using 35 and 38 hours. The reason is they are using night burning and that is why extended time was required.

Transport systems for the sugar industry

Australia

Designing better transport systems for the sugar industry, during the harvest season, sugar mills operate around the clock processing raw cane into sugar and other products. A high level of cooperation is required between farmers, harvest contractors, transport contractors and mill managers to make sure the mill receives a steady stream of fresh cane. The logistics of each field of cane is harvested, and how it is transported to the mill have to be carefully coordinated.

In 2005 in north Queensland redesign their cane transport systems in response to economic pressures for improved efficiency and diversification. The integrated supply chain model can now also be used by other sugar growing districts to improve their efficiency and cost-effectiveness.

Wonji/Shoa sugar factory are using 8 tractors 110-130 HP and driven carets with the loading capacity of 40 tons. The carts are purely designed and have high loss in the way from harvesting field-to- mill yard. From the field observation of the researcher, interview questionnaires with field super visors and record from the weigh bridge each track has 2-5 quintal loss when they get weighbridge.

Reference photo captured by researcher how the WSSF cart design is highly poor and have a big difference with the Australian train by loading capacity and efficiency.

2.2.2. Sugar cane factory

The proprietor of a sugar factory is naturally interested in knowing how much of the sucrose in the cane he purchases is present in the sugar he sells, and he also wishes to know how good or how bad is the achievement. This demands a series of measurements, analyses and calculations which constitute the system known as chemical control. (stutterheim, 2006:13)

The main purposes of chemical control are three fold

1. To ensure that the various unit operations in the process of manufacture are conducted at the highest efficiency.
2. To provide a quantitative account of materials and their components entering the process, in transit, in stock, and leaving the process

. 3. To assess the merits of performances achieved.

Australia

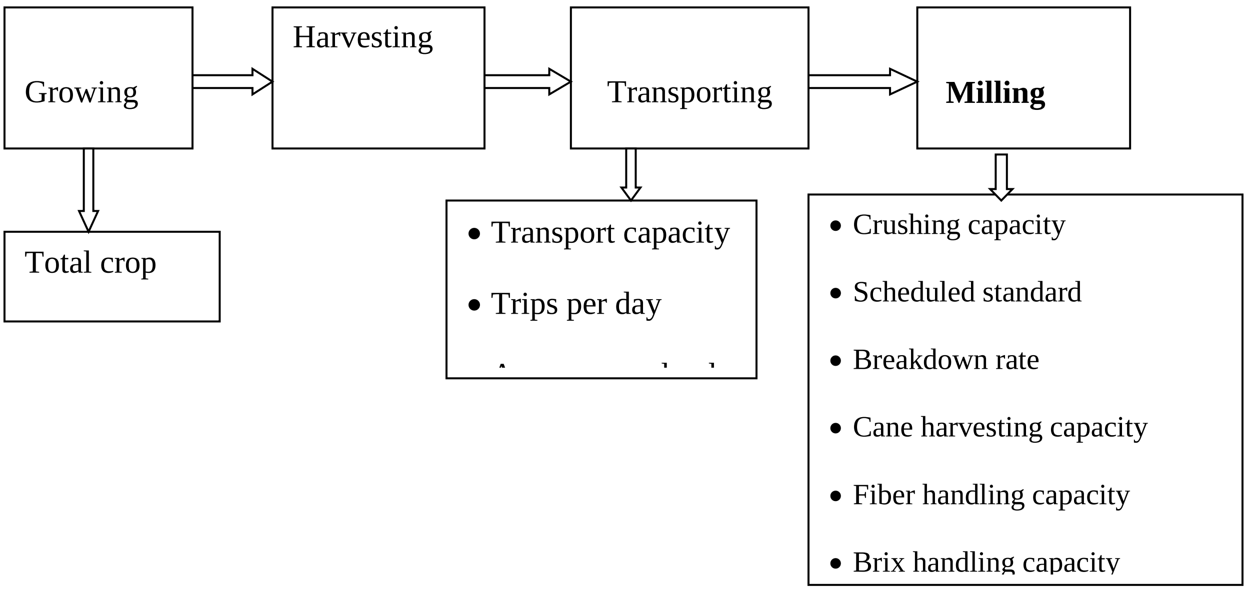
Technical competitiveness:

l.e. brennan1, 1999:4, wroteAustralia's high yields in the field and good factory recoveries are targets for other producers although the gap between Australia's performance and that in other countries has shrunk. In terms of the sucrose per hectare per year, Australia's yields are significantly higher than our major export competitors, Brazil and Thailand. Only four countries achieve overall factory sugar recoveries of over 85% and only Swaziland and Australia come close to breaching the 90% mark.

Whereas theWonji/ Shoa sugar factory monthly performance plane (Annex.) shows that over all time efficiency 71% and factory down time 29%. There is a big difference when compared with Australia which they can achieved 90% efficiency.

2.3. Conceptual Frame work

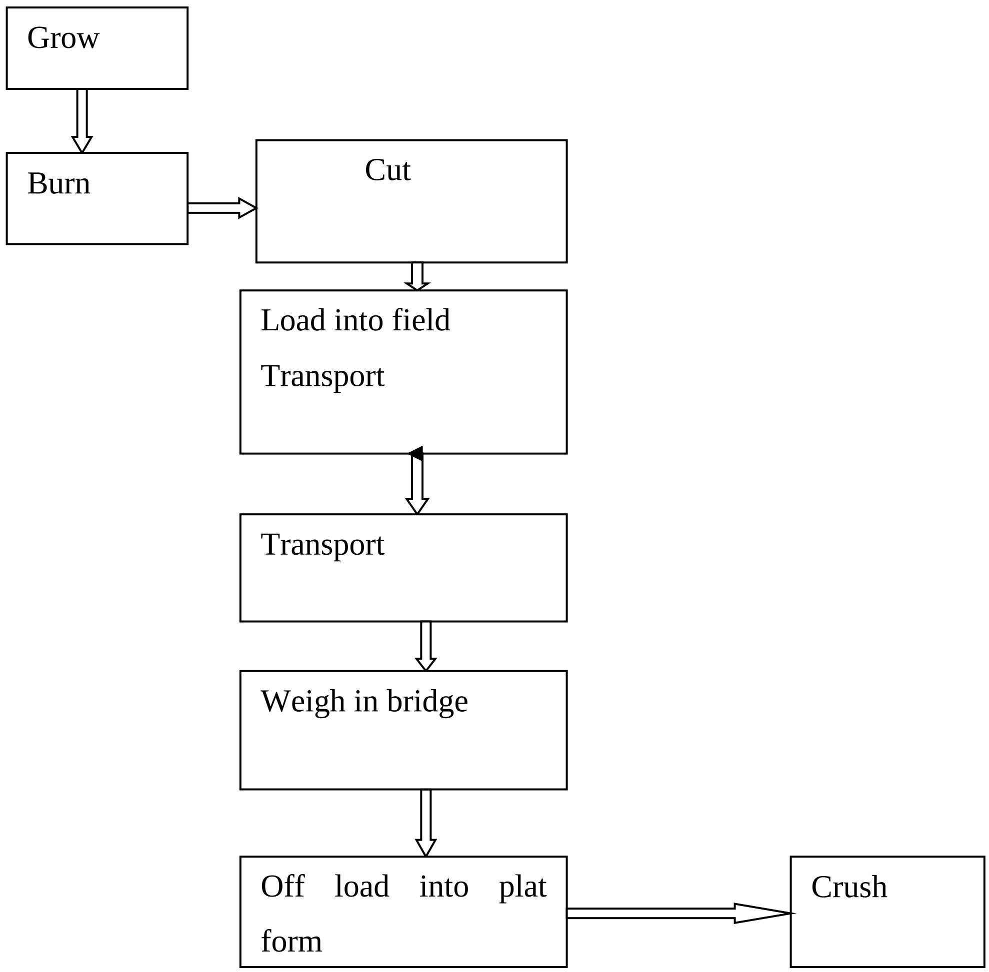
Figure 2.6 Model 1: Mill area profitability parameters and variables



Source: The model was validated by researcher's observed data, 2013

Value chain management in the sugar industry is concerned with co-coordinating stakeholders to regulate the quantity and quality of produce flow from the farmer to the miller and onto the consumer (Guilleman, 2003: 566-579).

Figure 2.7 Model 2: WSSF Harvest and Delivery System



Source: Adopted from Barnes et al., (2000)

The sugar supply chain essentially begins with the growing of sugarcane. Various sugarcane varieties are used depending on climate and soil condition.The composition of sugarcane varies throughout the plant life cycle, and also throughout the harvest season, which runs for roughly 10 months from April to December. Commercial sugarcane entering the mill is typically composed of soluble sucrose ±12%, non-sucrose ±2%, insoluble fiber ±14% and ash ±2% as well as water ±70%. Normally, fiber content is at its maximum in the early season (April - May), sucrose content peaks at midseason in winter (July - August), and non-sucrose peaks at the end of the season (November to December). The term ash refers to insoluble non carbon compounds of which the major component is usually on climate and soil condition.

It is, therefore, desirable to minimize the harvest to crush delay (HTCD). Deterioration is largely a function of time, temperature, humidity, variety and degree of sugarcane damage (billet or whole stalk) (Lionnet, 1998).ions. (Higgins *et al*, 2004).

Optimization of sugarcane harvesting

Sugarcane harvesting involves the cutting and removal of burned or green sugarcane. The harvesting method depends on the terrain, harvesting cost and whether the sugarcane is burned or trashed. The literature shows that mechanical harvesting (billeted and whole stalk) is the principal technology used by sugar producers such as The USA and Australia (Salassi, 1998:215-227) (Higgins, 2004:99-115).

Optimization of sugarcane transport

Sugarcane transport from field to mill is costly and involves many interlinked variables. According to Milan *et al.* (2005) sugarcane transport costs are the largest single component costs in raw sugar production. In the Australian and South African sugar industries transport costs amount to 25% and 20% of total production costs, respectively (Higgins A. a., 2003:623-638); (Giles, 2004). Infrastructure design addresses road network layout and zone positioning. Scheduling is concerned with finding the least cost combination of transport units, routes and departure times. A variety of commercial scheduling programs are available and various programs have been developed for specific industries. (Giles R. B., 2005:402-408)

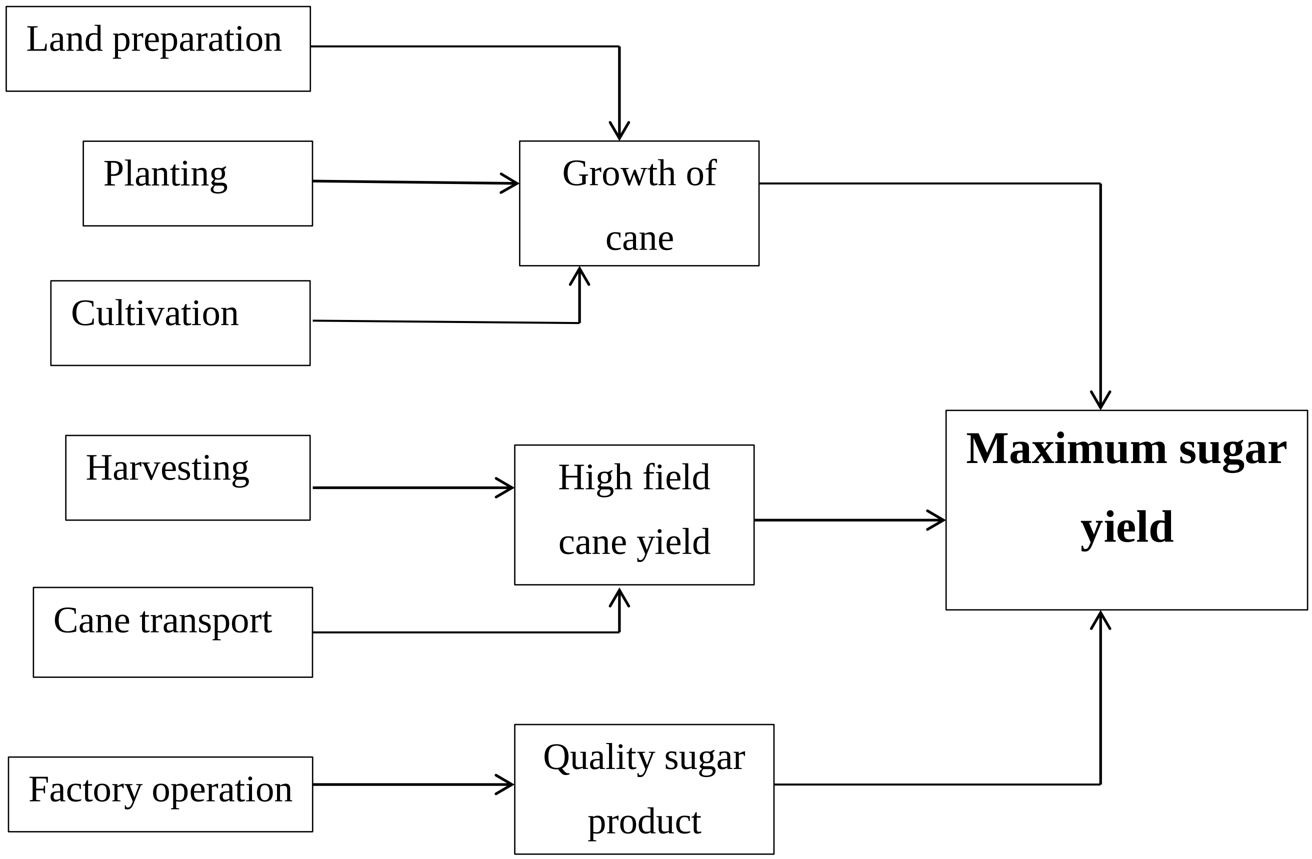
Symbol notation

For the purpose of simplicity, variables were represented by standardized symbols.

Table2.8 Notation for supply chain components

Component	**Symbol (Sym)**	
Harvest	H	
Loading	L	
Transport	T	
Offloading	OL	
Preparation	P	
Extraction	E	
Boiler	B	
Exhaustion	X	
Variable	**Sym**	**%**
Sucrose	S	%
No sucrose	NS	%
Fiber	F	%

Figure 2.8 Model developed by using Statement of the Problem, research questions, research objective and literatures



CHAPTER THREE: METHODS AND INSTRUMENTS

In this chapter the research design used, the data gathering methods and tools; sampling and sampling procedures and the methods of data analysis are discussed very well.

3.1. Data type and Sources

According to Kothari (2004:95) the researcher considers two types of data, primary and secondary. The primary data are those which are collected for the first time, and thus happen to be original in character. The secondary data, on the other hand, are those which have already been collected and analyzed by someone else. The researcher, hence, will use both primary and secondary sources of data in order to gather relevant information.

In order to answer the basic questions raised, a close ended and open ended questionnaire that has 4 parts was prepared. The first part consists of demographic profile of the respondents which is designed in a close ended format. The second part covers The Likert scale ranges from 'strongly agree' to 'strongly disagree' (1=strongly agree 2=agree 3=undecided 4=disagree 5=strongly disagree, see appendix A) so as to not limit the response of respondents to some limited ranges. The third part include 24 interview questionnaires for overhead/ management staff r respondents and 8 questioners for Harvesting operation respondents 7 questionnaires for Factory operation respondents . The fourth parts incorporates the analysis of the observed data.

3.2. Design of the study

A descriptive survey research design was employed in the study to assess the key factors of value chain analysis in organization production process of Wonji/ Shoa sugar factory. The reason for using this design is that it enables to describe the different factors and sugar production Performance of WSSF they exist.

3.3. Sampling design and procedure

As the numbers of respondents are finite the researcher was use survey from finite population. In this case, the sample size from total population calculated using the following formula which is presented in Kothari (2004:179).

$$n = \frac{z^2.\mathrm{p.q.N}}{e^2(\mathrm{N}-1) + Z^2.\mathrm{p.q}}$$

Where;

N = total population

n = number of supervisors and top management staff

P= sample proportion

q= 1-P

Z= Standardized normal variable and its value that corresponds to 95 % confidence interval equals 1.96

e = Allowable error (0.05)

Accordingly, the sample size is determined to be;

Therefore, the numbers of respondents was taken 127 plus 10% contingency (139 managers and super visors) to compensate invalid responses

Table3.1Proportional sample size from each stratum

NO	**Main category of the population**	**Total population**	**Proportion**	**Sample size**
1.	Agriculture operation	9	(9*127)/190	6
2.	Overhead	32	(32*127)/190	21
3.	Project	20	(20*127)/190	13
4.	Factory	10	(10*127)/190	7
5.	Field supervisors	119	(119*127)/190	80
Total		**190**	**%**	**127**

3.4. Data collection technique and instruments

For selecting these samples of super visors stratified sampling was used in which the 5 key sectors that super visors are engaged was taken as strata so as to give equal chance to each of the sectors. From each sector, super visors were selected randomly using lottery method by taking list of respondents from the WSSF office.

For Top Managers and Department Head, purposive sampling was used. Top officials of these institutions (WSSF) were purposely taken and interviewed since the researcher believes that they know the condition better than others because of their responsibility, knowledge, experience and day –to- day activities of organization performance.

3.5. Data processing and analysis

3.5.1. Data processing

After the data has been collected, it was coded and fed to excel sheet so as to simplify further tasks. The respondents' scores were summarized from the sheet and data editing, coding, data entry and data cleaning activity in order to check the consistency of the data which will be collected from the respondents and made ready for analysis.

3.5.2. Data analysis

In this section the researcher will employ both qualitative and quantitative methods of analysis. The demographic profiles and items related to characteristics of respondents were analyzed using simple statistical tools such as tables and percentages. Descriptive statistics (mean and standard deviations) of the respondent scores were computed for the Likert statements and analyzed by comparing these mean scores and deviations among respondents. The reason for using descriptive statistics is to compare the different factors that affect the performance of employees in WSSF by the means and standard deviations of scores. The interview questions were analyzed using descriptive narrations. Finally, all these were followed by the necessary interpretations and discussions so as to achieve the desired goals. In interpreting the results for the likert questions, the mean scores less than 2.45 implies respondents do not agree; scores 2.45-3.44 shows undecided and greater than 3.44 indicates agreement among respondents on the issues raised rounding results to the nearest two decimal places.

CHAPTER FOUR: RESULTS AND DISCUSSION

The purpose of this study was to assess the value chain analysis of sugar production in Wonji shoa sugar factory. Hence, response from 127 respondents was collected with 100% response rate. Additionally, results of interview and personal observation were included in the analysis.

This chapter presents the data analysis procedure and the findings based on the data obtained from the surveys. First, the overall demographic characteristics of the respondents are illustrated in detail. Then, the analysis is described using descriptive statistics to address the research questions and meet its objectives. Descriptive statistics was employed including frequencies and measures of central tendencies. It was found that descriptive statistics are the most appropriate statistics, since the nature of the study objectives and questions is to assess the value chain analysis rather than testing particular hypotheses or proving cause-effect relationships.

4.1. Demographic characteristics of the respondents

This part of the analysis discusses about the general demographic characteristics of the sample respondents. To provide information about the respondents, such as age, sex, educational background, salary, and experience, and work position, these questions were included in the questionnaire due to their potential value to probe similarities or differences in the responses to various sections of the questionnaire. The information obtained from the questions contained in Section A is presented and discussed below.

Table 4.1 Demographic characteristics of the respondents

			Frequency	Percentage
1	Sex	Male	76	59.8%
		Female	51	40.2%
		Total	127	100%
2	Age	18-30	34	26.7%
		31-40	48	38%
		41-50	34	26.7%
		51-60	11	8.6%
		Total	127	100%
3	Level of education	High school	2	1.6%
		Diploma	41	32.3%
		First degree	76	59.8%
		Master's degree and above	8	6.3%
		Total	127	100%
4	Level of salary	Below 1000	0	0
		1001-2000	38	30%
		2001-3000	28	22%
		3001-4000	39	30.7%
		Above 4000	22	17.3%
		Total	127	100%
5	Level of experience	1-5	48	38%
		6-10	27	21%
		11-15	27	21%
		Above 16	25	20%
		Total	127	100%
6	Position of work group	Non-management group	91	71.7%
		Management	36	25.3%
		Total	127	100%

Source: questioners, 2013

Analyzing the data obtained from the questionnaire the table above revealed that the Majority of the respondents76 (59.8%) are male and 51(40.2%) are females.

As it can be seen from the table above, majority of the respondents are within the age category of 31-40 years 48 (38%) followed by those with the same rank under the category of 18-30 years and 41-50 years respectively 34(26.7%). The remaining 11(8.6 %) of the respondents are under the age category of above 51-60 years.

It was learnt that the study tried to analyze educational level of respondents as that could determine the value chain analysis of the organization production how most appropriate. From the above table majority of the respondents which have 76 (59.8%) of first degree holders. Next to this the figure shows that 41 (32.3%) where Diploma holders. The third degree respondent 8(6.3%) where Master degree and above.

From the above description it can be seen that respondents hold a range of educational qualifications from diploma to Master's Degree and above. This suggests that people of different educational qualifications are present in the organization.

From the above figure, it can be seen that respondent's greatest number of group 39 (30.7%) had a basic salary of birr 3001- 4000. With one less number respondents 38(30%) had a basic salary of 1001-2000 birr. thirdly respondents 28(22%) hold a basic salary of 2001-30000 .In the same way 22(17.3%) hold above 4000 salary.

With regard to the respondents 91(71.7%) employees are from Non- Management group and the rest are respectively from Management group. The non-management groups are very close to the management group due to the characteristics of their job and immediate information flow.

4.2. Presentations of the Findings Related To Research Questions

Sections B of the questionnaire were developed according to a Likert-type scale and for each item, the respondents had to indicate whether they strongly agreed, agreed, were not sure, disagreed or strongly disagreed with each statement. Numerical values, ranging from 1 (strongly agree) to five (strongly disagree) were used to evaluate the quantitative analysis of the results. And this is presented below. The findings are presented in tabular form. These tables were compiled with the aid of computer print-outs generated by means of the SPSS version 16.0

The following research question is forwarded to the respondents to assure the degree to which the value adding activities in Agricultural operation of Sugar production, so that, the specific objectives of the study would be achieved.

Table4.2 Importance and objective of Value adding activities in sugar production process

No	Questionnaires	Response						SD
		SA	A	Und	D	SD	**Mean**	
		No (%)	N (%)	N (%)	N(%)	N (%)		
1	There is a value adding activity In Agr. Operation	37(29.1)	5(3.9)	3(2.4)	35(27.6)	47(37.0)	2.35	1.342
2	There is the use of precision farming approach	10(7.9)	32(25.2)	13(10.2)	57(44.9)	15(11.8)	3.28	1.193
3	There is always development of new cane varieties	12(9.4)	41(32.3)	15(11.8)	45(35.4)	14(11.0)	3.06	1.226
4	Raw materials(chemicals &seeds) are available on time	…….	53(41.7)	12(9.4)	44(34.6)	18(14.2)	3.21	1.138
5	The exact duration of land preparation Is practiced	3(2.4)	61(48.0)	11(8.7)	31(24.4)	21(16.5)	3.05	1.221
6	The exact duration of seeding date is Kept	……… ……	53(41.7)	11(8.7)	51(40.2)	12(9.4)	3.17	1.084
7	The exact duration of weed control is	6(4.7)	37(29.1)	9(7.1)	62(48.8)	13(10.2)	3.31	1.137

	Practiced							
8	The exact duration cultivation is kept	3(2.4)	60(47.2)	19(15.0)	33(26.0)	12(9.4)	2.93	1.100
9	There is a good irrigation facility		34(26.8)	44(34.6)	39(30.7)	10(7.9)	3.20	.926
10	Sugar cane plantation takes place on schedule exact time	8(6.3)	56(44.1)	17(13.4)	41(32.3)	5(3.9)	2.83	1.075

Source: WSSF survey data march, 2013

Table 4.2 item number 1 illustrates that, the value adding activity in Agriculture operation in the organization respondents (n=82, 64.6%) declared that they have disagreed; the mean value and standard deviation in which the mean varies are (2.35 ± 1.342). With less supervisors 42(33 %) participants which shows agreement.

On the main operations of Farm cultural practice 72(56.7 %), and cane varieties 59(46.4%), Row material in put 62(48%) disagree. Even though, in exact duration of Land preparation 72(56.7%), respectively on the exact duration of seeding date 64(50.4%) reply agree. And on Weed control operation 73(59%) disagree, with respect irrigation facility 49(38.6%) agree while plantation schedule kept on the exact time.

The sugar industry is concerned with coordinating Activities to regulate the quantity and quality of produce flow from the farm to the mille. As the researcher identified from the respondents reply, the organization farm cultural practice not integrated well.

Table 4.3 Item number 11-14 illustrate how waiting time and Transportation affect the Sugar value chain process, The respondents/ super visors on harvesting practice item No. 11 respond 56(44%) declared that they have agreed the mean value and standard deviation in which the mean varies are (3.15±1.279). with the same agree response 89(70%) Farm lay out harvesting that helps to get better efficiency.

Table4.3 How waiting time and Transportation affect the Sugar value chain process

No	Questionnaires	Respondents	Response						
			SA	A	Und	D	SD	**Mean**	SD
11	Harvesting of Sugar Cane is exact on ma turity time and scheduled period	Supervisors	4(3.1)	52(40.9)	23(18.1)	17(13.4)	31(24.4)	3.15	1.279
12	Farm lay out harvesting Ng helps to get better Efficiency	Supervisors	36(28.3)	53(41.7)	11(8.7)	21(16.5)	6(4.7)	2.28	1.180
13	Harvesting early in the Season results in gene Rally lower Sugar yield	Supervisors	32(25.2)	61(48.0)	11(8.7)	17(13.4)	6(4.7)	2.24	1.118
14	Late harvesting impact On the Farming system	Supervisors	61(48.0	19(15.0)	4(3.1)	25(19.7)	18(14.2)	3.22	1.397

Source: WSSF survey data march, 2013

Obviously ,Harvesting early in the Season results in generally lower sugar yield, with respect to Late harvesting impact On the Farming system have got the super visors reply of agree 93(73.2%) and 80(63%) respectively.

Sugarcane harvesting involves the cutting and removal of burned or green sugarcane. The harvesting method depends on the terrain, harvesting cost and whether the sugarcane is burned or trashed. The literature shows that mechanical harvesting (billeted and whole stalk) is the principal technology used by sugar producers such as The USA and Australia (Salassi and Champagne, 1998; Higgins et al, 2004).

Optimizing harvest schedules is a well-researched field. It involves a high level of interaction with transport schedules and mill operation (Higginset al., 1998).

Even though, the early and late harvesting have impact on farm operation have got generally agree response, the performance of wonji/shoa sugar factory is far from this. The supportive evidence for this idea elaborated on interview analysis section with top managers of the organization.

Table4.4 How major activities in production process adding value to the final out put

No	Questionnaires	Response						SD
		SA	A	Und	D	SD	**Mean**	
15	The expected maximum mum sugar cane Yield achieved	8(6.3)	20(20)	14(11.0)	67(52.8)	18(14.2)	3.53	1.111

Table 4.4 illustrate that the major activities in production process adding value to the final out put that is Sugar cane yield. The respondents 85(67%) declared that they have disagreed on the maximum sugar cane yield achievement, the mean value and standard deviation in which the mean varies are (3.53±1.111).

From the mentioned respondent the maximum yield of sugar cane is not achieved, this section strongly supported with top management interview handled with the researcher and elaborated on interview section.

Table 4.5 Bottlenecks and weakness in the current value stream within organizations production process

No	Questionnaires	Response						SD
		SA	A	Und	D	SD	**Mean**	
16	There is a quality of Raw material (sugar Cane) supply	3(2.4)	63(49.6)	19(15.0)	32(25.2)	10(7.9)	2.87	1.072
17	There is tailoring of Fertilizer application To specific soils and Cropping system	6(4.7)	48(37.8)	16(12.6)	37(29.1)	20(15.7	3.13	1.217
18	There is faster commu nication of cane yield And quality data from Mill to farm and harvest To enable rapid modification of the Harvesting operation	8(6.3)	26(20.5)	17(13.4)	57(44.9)	19(15.0)	3.42	1.158
19	There integrated models With GIS of the mill and Harvesting area to make The information more Readily usable	3(2.4)	22(17.3)	17(13.4)	65(51.2)	20(15.7)	3.61	1.025

As can be observed from the above table 4.5 Concerning the bottlenecks and weakness in the current value stream within organizations production process it was found that the respondent 69(52%) agree on the quality of Raw material (sugar Cane) supply. with respect to tailoring of Fertilizer application54(42.5%).

The rest respondents concerning faster communication on the harvesting operation 76(59.9%) declare disagree with respect to using integrated models of GIS(Geographic Information System) reply 85(66.9%) disagree on the provide questionnaires.

One can see from the analysis that the organization faced faster communication of cane yield and quality data from Mill to farm and harvest to enable rapid modification of the Harvesting operation and also lack of the mill and harvesting area to make the information more readily usable.

4.3. Qualitative Data Findings and Analysis

4.3.1. Result of Interviews

In the methodology chapter the rationale for the chosen data collection methods was provided. It was justified that, to achieve the objectives of this study, two data collection approaches were used; namely, a questionnaire and a semi-structured interview. The main aim of this part is to present and analyze the qualitative data produced from the semi-structured interviews from the top management staff. In addition, this part aims to present the analysis for other qualitative data resulting from the researcher's own observations when collecting the research data.

As per scheduled interview guide, the interview was conducted in 1, plantation and cultivation division. 2, land preparation division 3 harvesting division 4, Factory production process section and Mechanical Engineer section 5, Agricultural expansion project 6,Head office(WSSF). Interview participant was secured by personal contact, which is the best approach to build and establish a strong trust and good rapport with participant. This interview was expected to secure additional top and important data that may not be acquired through questionnaire. Accordingly, the result of the interview was indicated as follows.

Interview Discussion: No. 1

Harvesting operation respondents

A discussion with an interviewee regarding factors of harvesting, cane stayed in the field and cane transport to the mill the respondents state that: after cane burned the cutting operation starts one up two hours and the harvested cane stayed in the field for an average of 30 hours. Within this time gap the harvested cane transported to mill.

This indicate the BTW standards. The harvested cane stayed in the field more than the desired time limit; due to these factors the organization production decline for the last ten years and maximum sugar yield was not achieved.

As a whole process the big problem of the harvesting operations are loss of cane from the carts, less number of Tractors and Carts result harvested cane stayed in the field. Even the standards of cane to be stayed in the field described in the Literature not more than 12 hours(because it is faster to spoiled more than this time), but the WSSF operation make as a culture up to 30 hours.

Interview Discussion: No. 2

Factory operation respondents

The discussion with an interviewee focus on the factory operations: major problem of the factory is less efficiency that is the desired capacity of the factory is 2000 quintals of sugar per day but the output is an average of 1400 quintals per day. There is high down time (29%per day), due to the harvesting cane let to the mill % field yield (recoverable sugar % cane) decrease.

The other problem is the losses of sugar with bagasse, scientifically the desired is not more than 2.5% this means from 100kg of bagasse the expected loss is 2.5 kg. But hear it is 3.6%. And other issue is extraction of sucrose. In our case sugar yield of cane (sugar % cane) achieved 11.5 %(10 years average annex II) but internationally achieved up to 14% (Case of South Africa and Moriches).

This shows approximate 1.6% of sugar loss through bagasse and low recoverable sugar percentage achieved.

As final molasses contains one of the major losses of sucrose in process, its weight and analysis are important. The weight should be determined directly, the desired amounts of losses are not more than 8%. But WSSF achieved 10% .other losses are filter cake 2%, standards is 2.5%, world desired is 0.43%. Losses in undetermined achieved 3%, but the desired is 0.79%.

Interview Discussion: No. 3

Overhead (head office) management staff respondents

The discussion with interviewee over all organization operation and about value adding activities: starts their desiccation by describing no functional structure to identify value adding operational activities. The bottlenecks in the current value stream of the organizations are abnormal weather situation; and inefficient communication; and skill problem. The respondents agree for the past ten years the production decline and maximum sugar cane yield not achieved. Land productivity decline due to rise in underground water level, poor control of agricultural cultural practices, blending of both Man to Machine and Machine to Implements combination and also attitude problems.

This indicates that over all organization production process and factory operation there is no value adding activities and less productivity.

The whole process of the organization shows that long delays between harvesting, transporting and milling operation and the associated deterioration of cane quality had been recognized as major problem not to achieve maximum sugar cane yield.

4.3.2. Researcher field survey/ observation

The researcher investigates Wonji/ Shoa sugar factory's cane field area and observes that, the land preparation and irrigation system have water logging problem (refer annex) which have a big impact on plantation which leads to declines of production.

The road condition is gravel road and most area due to continuous flow of heavy duty machineries and load of cane tractor have bumping (deformed) that have a big impact for loss of cane from carts.

The desired loading capacity of carts are 40 quintals, but when the carts reach weighing plat form the researcher observes loss of cane from each cart and also losses in the mill yard plate form when the cane unloaded/transfer to the mill auger.

Waiting time at the field observed when the crawler tractor waits to transfer cane cart for the road tractor. In the factory mill yard also many tractors are waiting more than 12 hours to unload the cane to the mill plat form.

Seeds: after the seed cane treated it is recommended not to stay more than 12 hours (from the field super visor interviews) but the researcher observe due to lack of tractors the seed cane stayed more than 12 hours. And also some infected seed by pass the process.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the main findings, conclusions and recommendations reached throughout this study. It reviews the evidence assembled to meet the research objectives spelt out in Chapter one. Also, this chapter contains a presentation of the major contributions of this research to both academic and organization practices. Finally, this research forwarded possible recommendations, followed by some suggested future research directions.

Based on the analyses of the quantitative and qualitative data and discussions presented in Chapter four, the following summary of the main findings and conclusions were drawn out.

5.1. Summary of findings

- Overwhelming number of employees respondents were male; in generally this can be inferred that the Organization operations are highly dominated and involved by male than females.
- Majority of the participants fall in the age of between 18-30 which indicates that the Organization has small aged group and this can be concluded that, the recruited employees are the young generations who graduated recently.
- Education level of employee respondents 76(59.8%) of employees are first degree holder but 41 (32.3%) of employees had Diploma holders. Therefore, it indicates that there might be a skill and knowledge gap and there is a need in improving the skill and knowledge when the Organization passes through a change.
- The expected maximum sugar cane yield is not achieved due to poor agricultural practice activities don't perform as per standards.
- The organization apply old mode furrow irrigation and drainage problem, due to this fact the underground water table rises and creates production loss.
- Unbalanced blending of machines to agricultural equipment's and activities.
- The harvested cane stayed in the filed more than the required maximum time limit and due to this factor spoiled cane decrease the sugar production quality and quantity.

- Underutilization of cane transportation and losses of cane from the carts due to the usage of outdated carts.
- Experiencing high downtime more than the accepted and desired limit creates additional working days.
- Unwanted loss of bagges and molasses through the overall factory production process due to obsolescence factory components.
- Undetermined leakage of sugar juice from the old components of the operation process significantly decreases the total amount of final product.

5.2. Conclusion

From the forgoing discussion, the following conclusions were made.

- The expected maximum sugar cane yield is not achieved, this is because, agricultural practice activities don't perform as per standards because, the organization didn't change seed Verities for the last 15 years and the way of seed preparation is not as recommended (10-12 month aged cane is advisable but practically they are using 16 month aged cane).

- Regarding to land preparation, blending of machine to implement (heavy duty machine attached with less drawbar implement) and blending machine to activities (the same heavy duty machine perform less tillage, cultivation and fertilizer application activities) is not appropriately utilized.

- Regarding to Harvesting, BTW (Burning, Tilling and weighing) standards are not kept. This is, after cane burned the cutting operation starts immediately after one up to two hours and the harvested cane stayed in the field for an average of 25 hours within this time gap the harvested cane transported to mill. The standards of the sugar cane to be stayed in the field is described in literature review (not more than 12 hours) above this hours there is a big loss due to fast spoilage of cane in the field.

- Cane haulage (transport):

1. Using of old cart for a long year and underutilization (for 15 years trailed only 4 carts) but other countries like South Africa, Australia, Brazil and Mauritius are using trains and long bed trucks. Which have a big effect on production.
2. Losses from the carts with a minimum of two quintals from one cart per tripe, this implies that, one tractor have 4 carts and within one shift (8 hours) make 5trip from field to mill therefore:

   4 carts ×5 trip×8 tractor×2 quintals losses =320 quintals per shift×3 shift =960 quintals.

   Total campaign days of the factory are 239 ×960 quintals =229,440 quintals of cane loss.

   From 229,440quintal if 11% is sucrose = 25,238kg of sugar.

   In terms of factory production cost (5650 birr per ton), 25,238kg (25.38 ton) ×5650 birr per ton =**1,425,947 birr minimum profit the organization losses.**

- Concerning with Factory down time, over all time efficiency of the factory down time(from factory annual plan Annex II, and interview with mechanical engineers)

  On Wonji/ Shoa sugar factory top managers management plan s reviles that the accepted down time is 20%, but the real performances of the factory shows that 29% down time were achieved.

  - ✓ Campaign days = 239 days

    ×24 hours

    ×20 %

    1147.2 hours were expected to be stopped annually

    But, they achieved 239 days

    ×24 hours

    ×29%

    1663.44 hours stopped

Differences between the planed and achievement 1663.44 – 1147.20 = 516.24 hours. When 516.24 divided by 24 hours = 21.51 **days down time.**

Total manufacturing cost of the factory to produce 750,000 quintals per year= 275,358,183 birr (annex 4). This is equal to 1quintal (unit manufacturing) cost= 367.14birr.

If the factory works with minimum of 1200 quintals of sugar per day for 21.51days it produces 25,812 quintals of sugar.

The cost of production for unit quintals of sugar =367.14×25812 **= 9,476,617.14** birr losses annually from the factory down time.

- Concerning with Bagasse, annual bagasse production is 865,250 quintals (10 years average refer annex)

  In each quintal or 100 kg of bagasse production there is 1.6 kg of sugar loss. From 865,250 quintal × 1.6 kg = 1,384,400 kg of sugar losses or 13,844quintal (1384.4tons) losses. Production cost per ton = 5650 birr .So the cost of sugar which lost through Bagasse = 1384.4.tons×5650 birr = 7,821,860 birr of losses from the factory. This is the big unwanted loss the researcher observed. If certain adjustments are made or the problems are resolved it can create value for the Organization.

- Regarding to molasses, the factory's annual plan (annex1) shows 196,680 quintal. The accepted (desired) maximum losses are not more than 8% (from interview of chemical engineer) but the factory achieved 10%. Meaning from the total production, there is 19668 quintals losses through the process of sugar production. It indicates that the quality of factory sugar making process is unable to stop the big loss of sugar that escape with the molasses, which should have been converted in to crystal (white sugar).

In general the researcher investigates the non-value adding activities and big losses from the organization production process. Over all activities that are; from transporting **1,425,947 birr,** factory down time **9,476,617.14 birr**, bagasse losses **7,821,860birr**.Totaly **18,724,424.14 birr** losses per year. This figure indicates only in the areas where the researcher's objective focused.

5.3. Recommendations

Based on the statements of problem, research questions, major findings, analysis and the conclusions drawn, it was evidenced that the organization had problems in providing maximum sugar cane yield. Hence the researcher forwarded a recommendation that demands a great deal of attention to help improve the weaknesses identified in the existing Agricultural practice.

- ✓ For adding value of production the organization is advised to plant cane seed on time. It is also advised if the organization undertakes a study to identify the appropriate variety of seeds that meets the soil type and environment which gives high yield. It is also advised to maintain and keep the required cane crop cycle.

- ✓ To overcome the chronic problem of the raising of water table, it is recommended if the organization design new model of sprinkler irrigation system. It is also recommended, to use correct field layout for better irrigation. For example in wonji area of one block is 500m by 500m, but in Methara sugar factory the area of field layout is 100m by 100m this helps for better monitoring.

- ✓ For value adding activities and cost effectiveness, it is recommended to highly monitor and use blending of heavy duty machineries to the required and appropriate farm equipment and heavy duty machineries to the required activities.

- ✓ To overcome the problem of weighting time of the harvested cane in the farm, it is recommended if the factory modifies its farm layout. It is better if the organization uses circular mode layout, this will help to minimize the distance between the farms and the mill

- ✓ Losses are a big problem and will incur cost as well as effect on factory's performance and competitiveness, the first and burning issue is to change the design of carts or modifies by sieve to protect the down flow of loaded cane. It is also recommended to modernize the machine specially, on transportation long base truck or train or increase number of carts to be drawn.

- ✓ To overcome the problem of factory down time, it is recommended if the organization keep sufficient amount of spare parts in stock, as well as replace the old components of the factory by new and modern components.
- ✓ The other is the factory processes losses (molasses and baggas) which have impact on extraction of juice; this can be solved by changing the old component or modifying the existing component.
- ✓ Finally, further research on value adding activity or similar study areas are recommended to researchers.

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ANNEX I

Questionnaire

Jimma University

Master of business administration (MBA)

PART I: QUESTIONNAIRE TO BE FILLED BY RESPONDENTS

Dear participant:

I am currently studying for a Master's degree in business administration (MBA) at Jimma University I am undertaking a research project entitled ― VALUE CHAIN ANALYSIS (Focusing on organizational production process)on the context of Wonji/Shoa Sugar Factory.

This questionnaire is designed to solicit information for purely academic purpose. This is to enable the researcher complete the thesis in partial fulfillment of the requirement for the degree of master of business administration (MBA).

Your response is truly important to the success of this study. I would like to assure you that your response will be processed as `Strictly Confidential'. So please try to answer all questions included. I would like to thank you very much in anticipation for your kind cooperation.

I look forward to receive your reply

Sincerely yours,

Note:

- No need to write your name in this questionnaire.
- Respond to the statement/question in this questionnaire based on your current level of knowledge and expertise.
- As you read each statement tick a box that corresponds to your level of agreement.

Thank you

Section A: Basic demographic data (please tick where appropriate)

1. Sex Male ☐ Female ☐

2. Age

A) 18 – 30 ☐

B) 31 – 40 ☐

C) 41 – 50 ☐

D) 51 – 60 ☐

E) Above 61 ☐

3. Educational Back ground

A. High School ☐

B. Diploma ☐

C. First Degree ☐

D. Master Degree & above ☐

4. How much is your monthly basic salary?

A. Below 1000 ☐

B. 1001 – 2000 ☐

C. 2001 – 3000 ☐

D. 3001 – 4000 ☐

E. Above 4000 ☐

5. How long you have served in the organization? (In Year)

A. 1 -- 5 ☐ C. 11 – 1 5 ☐

B. 6 – 10 ☐ D. above16 ☐

6. What is your position or work group in the organization?

A. Management group ☐

B. Non management group ☐

SECTION B

Information Related to;

1. **Agri. Operation respondent**

Instruction: please put a tick mark (✓) at the appropriate box to show your level of agreement (on the response scale: 1 to 5) for every statement given.

Response scale:

1	2	3	4	5
Strongly agree	Agree	Undecided	Disagree	Strongly disa

No.	**Item**	**Response scale**				
		1	**2**	**3**	**4**	**5**
1.	There is value adding activity in agricultural operation					
2.	There is the use of precision farming approach					
3.	There is always development of new cane varieties					
4.	The exact duration of land preparation is practiced					
5.	The exact duration of seedling date is kept					
6.	The exact duration of weed control is practiced					
7.	The exact duration of cultivation is kept					
8.	There is a good irrigation facility					
9.	There is a quality of raw material (sugar cane) supply					
10.	Sugar cane plantation takes place on scheduled exact time					
11.	There is tailoring of fertilizer application to specific soils and cropping system					
12.	The expected maximum sugar cane yield is achived					
13.	Harvesting of sugar cane is exact on maturity time and scheduled period					
14.	Farm lay out harvesting helps to get better efficiency					
15.	Harvesting early in the season results in generally lower					

	sugar yield					
16.	Late harvesting has impact on the farming system					
17.	There is faster communication of cane yield and quality data from mill to farm and harvest to enable rapid modification of the harvesting operation					
18.	There is integrated models with GIS of the mill and harvesting area to make the information more readily usable					
19.	Raw materials (chemicals and seeds) are available on time					

2. **Harvesting operation respondents**

A. After burning sugarcane within what time gap cane is harvested?

Hours……….minutes………

B. How long is the harvested cane stayed in the field?

Hours……….minutes……….

C. At what time interval the harvested cane is transported to mill?

Hours………minutes………

D. How long it takes the harvested cane to load in the vehicles?

Hours………minutes……….

E. How long it takes the harvested cane to unload in the mill yard?

Hours……..minutes………..

F. How long is the minimum farm distance from the mill?

Kilometer…………meter……….

G. How long is the maximum farm distance from the mill?

Kilometer………meter

H. How much was the average sugar cane yield for the past ten years?

3. **Factory operation respondents**

A. How long is the sugarcane receiving time in the mill yard?

Hours…………minutes……….

B. How long it takes cane unloading time?

Hours………..minutes……….

C. How long it takes to cane temporary storage?

Hours………..minutes……….

D. Within what time gap the harvested cane crushed in the mill?

Hours…………minutes……….

E. How long it takes for cane extraction, sedimentation, crystallization, Centrifugation, drying and cooling?

Hours……….minutes……..

F. What was the required sucrose percentage?……………

G. What was the average sucrose percentage achieved?…….

SECTION C

An interview Guide

This scheduled interview guide is prepared to direct the interviews to be conducted with the Management staff of the organization. The purpose of the guide is to secure additional data that may not be acquired through the questionnaire to be filled by the respondents. It is also designed in such a way that it helps the interviewer & interviewee focus the discussion on issues realized which will contribute some fruitful and sound information.

Overhead/ management staff respondents

A. Is there functional structure to identify value adding operational activities?

B. Is the work force involved in decision making and improvement performance monitoring activity?

C .How can you select a Varity seed? Evaluate Yield and conduct R&D activity?

D. Is there actual performance in Agricultural Operation, (land preparation, seeding, cultivation harvesting and on time transportation?

E. How you are measuring a link of value chain analysis to organization goal, strategy and objective?

F. What is the bottlenecks and weakness in the current value stream, within organizations production process?

G. Have you got the maximum sugae cane yield for the past ten years?What is the avarage yield?

H. What is the factor/ responsible for the decline of yield?

I. How you optimize cane crop cycles?

J. What is your tillage and weed control practice?

K. What impact will product diversification have on variety selection? For example, will high fiber varieties be more desirable, if maximizing co-generation is a key objective?

L. Are you using further investigation of geographical harvesting (i.e. selecting high early localities and blocks within the mill area for preferential early harvest, thereby allowing other localities to be harvested closer to their optimum time)?

M. Do you have out growers/farmers cane suppliers? If yes How much and percent of total suppliers

N. How much is the annual turnover of the sugar company?

O. How much is the market share of the sugar factory?

P. How much cost of production per ton of sugar?

Q. How is the price of sugar cane determined (provide formula if possible)?

R. What was the price paid to farmers?

S. How much was supplied by the company's own cane production?

T. How much was supplied by the contracted farmers?

U. How is the price of sugar (sold to wholesalers) determined? (Provide formula if possible)

V. How much sugar exported for the past 10 years? To which counters?

W. How much supplier do you have?

X. What you're most supplied agricultural item?

SECTION D

RESEARCHERS FIELD SURVEY/OBSERVATION

1. Cane field area; focus on land preparation, investigate irrigation system and cultivation activity.

2. Field distance/sugar cane farm from mill

3. Road condition

4. Average crushing capacity (ton/day)

5. Loading capacity of vehicle

6. Harvesting rate/vehicle

7. Time study on harvesting and Transportation

8. Field harvesting rate

9. Waiting time at field and milling yard

10 Loading/un loading time

11. Agricultural practice

ANNEX II

N0	sugar plant description	Factory	Unit	Revised Annual Plan	*Actuals* Oct/ Nov.	Dec.	Jan	Feb (Estimate)	Total of 4 month Actual	*Revised Plan* Remaining Balance Revised Plan	Mar	Apr	May	June	By Cane Supply from MSF June
	MONTHLY PERFORMANCE PLAN														
1	Cane field to be cut		Ha	5243	587.35	594.7	714.35	653	2549.4	2693.2	708.42	710.27	814.68	459.83	328.57
2	Cane prod.Per/Ha/Month		Tons/ha/mon	8.4	6	7.2	8.8	7.5	7.38	7.53	7.8	7.5	7.4	7.4	7.4
	Cane prod.Per/Ha			122	136.65	145.83	118.69	113.47	128.66	106.5	115	111	100	100	100
3	Cane to crushed	Total	Tons	597823	80262.5	86725	84787	74095	325869.5	313,530	81468	78840	81468	45983	32857
		Wonji	Tons	271552	33,004	35094.3	38713.2	33495	140306.3	142,942	36828	35640	36828	21503	14137
		Shoa	Tons	326271	47258.7	51630.7	46073.8	40600	185563.2	170,588	44640	43200	44640	24480	18720
4	Sucrose content in cane	Wonji	%	14.2	13.43	14.14	14.41	14.2	14.05	13.88	14	14	14	13.5	12
		Shoa	%	14.25	12.95	14.34	13.8	14.25	13.84	14.03	14.2	14.2	14.2	13.5	12
5	Overall sucros recovery	Wonji	%	81.65	80.03	81.82	81	78.17	80.25	78.61	81.79	80	78.57	74.07	58.58
		Shoa	%	82.8	83.8	85.3	82.69	77.19	82.25	77.76	80.63	78.87	77.46	74.07	67.08
6	Factory sugar yield %cane	Wonji	%	11.6	11.02	12.18	11.45	11.1	11.44	10.91	11.45	11.2	11	10	7.03
		Shoa	%	11.8	11.41	12.04	11.43	11	11.47	10.91	11.45	11.2	11	10	8.05
7	Sugar Production	Total	Tons	70000	8651.1	10642	9613.5	6879.4	35786	34,214.00	9328.09	8830.08	8961.48	4598.28	2500.81
		Wonji	Tons	31500	3560.8	4335.7	4448.9	3556	15901.4	15,598.60	4216.81	3991.68	4051.08	2150.28	993.85
		Shoa	Tons	38500	5090.3	6306.3	5164.6	3323.4	19884.6	18,615.40	5111.28	4838.4	4910.4	2448	1506.96
8	Over all time efficiencv	Wonji	%	71	57.2	76.11	75.67	70	69.75	72	72	72	72	72	72
		Shoa	%	71	60.89	83.4	74.23	70	72.13	72	72	72	72	72	72
9	Factory Down time	Wonji	%	21	27	22.65	22.38	22	23.51	20	20	20	20	20	20
		Shoa	%	21	17.09	12.6	19.39	22	17.77	20	20	20	20	20	20
10	None factory down time	Wonji	%	8	15.8	1.24	1.95	8	6.75	8	8	8	8	8	8
		Shoa	%	8	22.02	4	6.38	8	10.1	8	8	8	8	8	8
11	Total Down time	Wonji	%	29	42.8	23.89	24.33	30	30.26	28	28	28	28	28	28
		Shoa	%	29	39.11	16.6	25.77	30	27.87	28	28	28	28	28	28

12	Season days	Wonji	Days	241	30	31	31	29	121	120	31	30	31	18	12
		Shoa	Days	239	30	31	31	29	121	118	31	30	31	17	13
13	Gross Factory Capacity	Wonji	Tons/ 24hrs	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650	1650
		Shoa	Tons/ 24hrs	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
14	Net crushing rate per day	Wonji	Tons/ 24hrs	1172	943.8	1255 .8	1248 .6	1155	1150. 8	1188	1188	1188	1188	1188	1188
		Shoa	Tons/ 24hrs	1420	1218	1668	1485	1400	1443	1440	1440	1440	1440	1440	1440
15	Mollasess production	Wonji	Tons	8,93 4	1,086	1,15 5	1,27 4	1,102	4,616	4,703	1,21 2	1,17 3	1,22 0	712	468
		Shoa		10,7 34	1,555	1,69 9	1,51 6	1,336	6,105	5,612	1,46 9	1,42 1	1,52 0	834	638
		Total		19,6 68	2,641	2,85 3	2,78 9	2,438	10,72 1	10,315	2,68 0	2,59 4	2,74 0	1,54 6	1,10 6

WSSF 57 year's plantation white sugar production

	WONJI / SHOA SUGAR FACTORY				
57 YEAR (1954/'55 U/I 2010/'11) CANE AND					
PLANTATION WHITE SUGAR PRODUCTION					
Sr No	*Milling Season*	*Average age (month)*	*Total Production in Qt*	*Production Per hectare*	**Production Per hectare**
			Plantation White Sugar	*Cane*	
1	*1954/'55*	*20.0*	*158,425*	*1,599*	
2	*1955/'56*	*17.5*	*140,646*	*1,321*	
3	*1956/'57*	*18.2*	*260,579*	*1,846*	
4	*1957/'58*	*17.8*	*325,046*	*1,832*	
5	*1958/'59*	*19.7*	*358,730*	*2,035*	
6	*1959/'60*	*20.4*	*398,401*	*2,090*	
7	*1960/'61*	*21.7*	*376,143*	*2,196*	
8	*1961/'62*	*23.3*	*374,022*	*2,217*	
9	*1962/'63*	*23.7*	*592,129*	*2,202*	
10	*1963/'64*	*18.3*	*627,498*	*1,793*	
11	*1964/'65*	*16.9*	*616,865*	*1,704*	
12	*1965/'66*	*17.5*	*712,854*	*1,795*	
13	*1966/'67*	*17.6*	*767,683*		

				1,866	
14	*1967/'68*	*17.9*	*677,525*	*1,758*	
15	*1968/'69*	*16.6*	*661,993*	*1,737*	
16	*1969/'70*	*16.7*	*674,280*	*1,787*	
17	*1970/'71*	*17.2*	*682,461*	*1,863*	
18	*1971/'72*	*17.6*	*704,787*	*1,893*	
19	*1972/'73*	*17.9*	*745,333*	*1,809*	
20	*1973/'74*	*18.2*	*716,660*	*1,760*	
21	*1974/'75*	*18.2*	*728,423*	*1,805*	
22	*1975/'76*	*17.1*	*706,362*	*1,716*	
23	*1976/'77*	*17.5*	*709,885*	*1,734*	
24	*1977/'78*	*18.5*	*764,635*	*1,969*	
25	*1978/'79*	*18.6*	*809,175*	*1,901*	
26	*1979/'80*	*17.2*	*831,484*	*1,801*	
27	*1980/'81*	*17.4*	*832,112*	*1,762*	
28	*1981/'82*	*16.7*	*805,679*	*1,600*	
29	*1982/'83*	*16.8*	*795,915*	*1,647*	
30	*1983/'84*	*16.7*	*802,535*	*1,523*	

31	*1984/'85*	*15.9*	*736,763*	*1,400*	
32	*1985/'86*	*16.2*	*743,548*	*1,565*	
33	*1986/'87*	*18.1*	*763,578*	*1,612*	
34	*1987/'88*	*18.4*	*793,787*	*1,757*	
35	*1988/'89*	*20.6*	*814,083*	*1,811*	
36	*1989/'90*	*21.6*	*739,294*	*1,841*	
37	*1990/'91*	*22.3*	*668,664*	*1,607*	
38	*1991/'92*	*20.1*	*643,411*	*1,115*	
39	*1992/'93*	*16.5*	*587,050*	*1,200*	
40	*1993/'94*	*15.9*	*479,238*	*1,137*	
41	*1994/'95*	*17.2*	*465,752*	*1,261*	
42	*1995/'96*	*19.4*	*725,510*	*1,699*	
43	*1996/'97*	*20.3*	*608,903*	*1,629*	
44	*1997/'98*	*16.6*	*607,933*	*1,362*	
45	*1998/'99*	*17.1*	*703,983*	*1,433*	
46	*1999/'00*	*18.0*	*703,394*	*1,381*	
47	*2000/'01*	*17.6*	*712,445*	*1,502*	
48	*2001/'02*	*18.6*	*731,633*		

				1,520	
49	***2002/'03***	***18.0***	***740,451***	***1,437***	
50	***2003/'04***	***17.3***	***725,158***	***1,528***	
51	***2004/'05***	***17.9***	***741,916***	***1,527***	
52	***2005/'06***	***18.3***	***737,217***	***1,503***	
53	***2006/'07***	***17.3***	***704,140***	***1,350***	
54	***2007/'08***	***15.8***	***573,758***	***1,167***	
55	***2008/'09***	***16.4***	***704,091***	***1,244***	
56	***2009/'10***	***16.4***	***603,947***	***1,166***	
57	***2010/'11***	***16.9***	***752,204***	***1,307***	
58	***2011/'12***	***15.6***	***701,238***	***1,132***	

Source: wssf document

PLAN FOR OPERATING COSTS & EXPENSES
FOR YEARS 2002-2006

Sugar plant description	Unit	2002	2003	2004	2005	2006
Agriculture	**Birr**					
(cost of Cane at Weigh Bridge)						
1.1. Material cost (Fertilizer, etc ..)	Birr	13,674,255	14,145,341	17,722,620	18,077,073	18,438,614
1.2. Labor cost	Birr	10,487,508	10,487,508	11,536,259	12,689,885	13,958,874
1.3. Mechanical operation cost (machine hour cost, fuel & Lubricant, etc ..)	Birr	21,466,471	22,110,465	28,743,605	37,366,686	41,103,355
1.4. Contract & Benefit cost	Birr	15,590,250	16,127,344	17,094,984	18,120,683	19,207,924
1.5. Sundry Expenses	Birr	2,432,346	2,492,404	2,741,645	3,106,283	3,416,912
1.6. Transport cost	Birr	2,878,946	3,117,208	3,905,533	4,850,911	5,541,223
1.7. Irrigation & drinking water Fee cost	Birr	386,118	409,876	503,462	613,069	686,581
1.8. Power cost	Birr	992,488	1,053,555	1,294,112	1,575,849	1,764,805
1.9. Depreciation	Birr	9,607,869	9,607,869	32,587,881	32,587,881	84,371,881
1.91 Amortization of deff. Exp,			0	29,080,461	29,080,461	86,830,661
1.10 Share of Building Cost	Birr	1,720,052	1,762,523	1,850,649	1,943,181	2,040,340
1.11 Share of Medical Cost	Birr	3,338,352	3,420,782	3,591,821	3,771,412	3,959,982
1.12. Total cost of Estate Cane	**Birr**	**82,574,654**	**84,734,875**	#########	##########	#########
1.13. Quantity of Estate Cane	Qts	5,001,419	5,149,200	5,222,760	5,220,000	5,400,000
1.14. Quantity of Out Growers Cane	Qts	1,328,239	1,735,500	3,234,000	4,947,000	6,015,900
1.15. Quantity of Total Cane	Qts	**6,329,658**	**6,884,700**	**8,456,760**	**10,167,000**	**11,415,900**
1.16. Unit cost of estate Cane	**Birr/qt**	***16.51***	***16.46***	***28.85***	***31.38***	***52.10***
1.17 Cost of Outgrowers cane	Birr	21,251,824	34,710,000	64,680,000	98,940,000	#########
1.18. Unit cost of Outgrowers Cane	**Birr/qt**	***16.00***	***20.00***	***20.00***	***20.00***	***25.00***
1.19 Total cost of Cane	Birr	#########	#########	#########	##########	#########
1.20 Unit cost of Cane	**Birr/qt**	***16.40***	***17.35***	***25.46***	***25.84***	***37.82***
Sugar Factory	Birr					
2.1. Indirect material(Lime, Sulfur, Caustic soda, etc, ...)	Birr	10,471,520	11,515,791	14,428,072	18,114,613	20,315,517
2.2. Direct labor	Birr	30,591,612	32,427,109	19,464,051	20,631,894	21,869,808
2.3. Contract & Benefit cost	Birr	4,745,594	5,375,413	3,226,539	2,383,869	2,526,902
2.4. Indirect labor	Birr	3,665,924	3,665,924	2,208,388	2,340,892	2,481,345
2.5. Maintenance & Lubrication cost	Birr	2,998,732	3,297,780	4,050,756	4,986,050	4,986,050
2.6. Fuel cost	Birr	987,884	1,086,401	1,601,347	1,971,089	1,971,089
2.7. Water cost	Birr	937,066	1,030,515	1,265,810	1,558,078	1,558,078

2.8. Transport cost	Birr	2,087,895	2,342,032	2,934,319	3,684,072	3,757,753
2.9. spare part cost	Birr	20,564,674	13,746,257	17,729,158	14,183,326	14,183,326
2.10. Depreciation	Birr	4,411,638	7,711,638	#########	##########	#########
2.11. Amortization of deff. Expenditure	Birr			20,729,400	20,729,400	20,729,400
2.11 Sundary Expenses	Birr	2,889,736	3,034,223	3,185,934	3,345,231	3,512,493
2.12 Power cost	Birr	2,000,000	2,199,450	2,701,646	3,325,439	3,656,349
2.13 Share of Building Cost	Birr	1,627,076	1,708,430	1,793,851	1,883,544	1,977,721
2.14 Share of Medical Cost	Birr	3,157,901	3,315,796	3,481,586	3,655,665	3,838,448
2.15. Total factory cost	**Birr**	**91,137,253**	**92,456,758**	**#########**	**##########**	**#########**
2.16. Total Manufacturing cost (1.19) + (2.15)	**Birr**	**#########**	**#########**	**#########**	**##########**	**#########**
2.17. Quantity of Sugar to be produced	Qts	745,000	839,364	978,008	1,238,730	1,394,000
2.18 Unit manufacturing cost before excise tax(2.16)/(2.17)	**Birr/qt**	***261.70***	***252.45***	***436.51***	***386.12***	***467.62***
2.19 Quantites of Sugar excluding Raw Sugar	Qts	745,000	839,364	978,008	1,238,730	1,394,000
2.20. Excise tax [2.19 x (2.18)]x 0.33	Birr	61,153,408	69,927,539	#########	##########	#########
2.21. Total manufacturing cost with excise tax (2.16) + (2.20)	Birr	#########	#########	#########	##########	#########
2.22. Unit manufacturing cost with excise tax (2.21/2.17)	**Birr/qt**	***343.78***	***335.76***	***580.56***	***513.54***	***621.93***
Administration & Overhead Expenses						
3.1. General administration expenses	Birr	42,996,132	46,005,861	49,226,272	52,672,111	56,359,158
3.2. Audit Fee	Birr	100,000	105,000	105,000	105,000	105,000
3.3. Board member allowance	Birr	138,720	145,656	145,656	145,656	145,656
3.4. Loss on Disposal of Plnat& Mach.	Birr				0	
3.5. a, Provision for doubtful debts	Birr					
b,Provision for stock Obsolescence	Birr			50,000,000	50,000,000	
3.6. Financial charges (Interest on long term loan & over draft)	Birr	1,500,000	2,000,000	42,000,000	42,000,000	42,000,000
3.8. Depreciation expense	Birr	3,053,423	3,206,094	3,206,094	3,206,094	3,206,094
3.9. Total administration & Overhead	**Birr**	**47,788,275**	**51,462,611**	**#########**	**##########**	**#########**
Selling & Administration expenses	**Birr**	**6,379,572**	**6,998,670**	**8,334,102**	**10,437,970**	**11,605,290**
Total cost of production & Expenses with out excise tax (2.16) +(3.9)+(4)	Birr	#########	#########	#########	##########	#########
Total cost of production & expenses with excise tax (2.20)+(5)	Birr	#########	#########	#########	##########	#########
Unit cost of production & expenses with out excise tax(5) / (2.17)	Birr/qt	***334.40***	***322.10***	***592.97***	***514.12***	***548.98***

Unit cost of production & expenses with excise tax (6) / (2.17)	Birr/qt	***416.49***	***405.41***	***737.02***	***641.54***	***703.30***
Add: finished goods inv.(begin of the year)	Birr	31,710,311	36,549,467	44,573,009	85,731,299	#########
Product Availabel for sale	Birr	#########	#########	#########	##########	#########
less: finished goods inventory (end of the year)	Birr	36,549,467	44,573,009	85,731,299	##########	#########
less: work in process	Birr	0	0	0	0	**0**
less: transferred to confectionery	Birr	5,405,208	7,005,561	12,735,692	11,486,356	12,152,984
Cost of goods sold	Birr	#########	#########	#########	##########	#########
Sales	Qts	728187	799896	954350	1180244	1341548
unit cost of goods sold	**Birr/qt**	***337.65***	***333.54***	***538.48***	***516.26***	***611.50***
Loss per quintal of sugar production as the result of providing provisions for stock obsolescence	**Birr/qt**			***52.39***	***42.36***	

SUMMARY OF COSTS AND EXPENSES

FOR YEARS 2002-2006

	2002	2003	2004	2005	2006
Cane cost / quintal	16.40	17.35	25.46	25.84	37.82
Process cost /quintal of sugar	122	110	216	174	158
Manufacturing cost /quintal of sugar	343.78	335.76	580.56	513.54	621.93
Administrative and overhead cost/quintal of sugar	64.15	61.31	95.54	77.22	73.04
Selling and Administrative expense /quintal of sugar	8.56	8.34	8.52	8.43	8.33
Operating cost /quintal of sugar	416.49	405.41	684.63	599.18	703.30

Source:wssf

Operational definition of variables

i. Key-Terms

Maximum sugar cane yield: According to Salassiet al. (1999), increasing input costs are narrowing profit margins and the future sustainability of sugar industries lies in finding ways to produce sugar more economically. Field to mill capacities are solely a function of sugarcane mass and volume and all the components involved were included as possible bottlenecks. These are the harvesting, loading, Trans loading and transport components. Only the components that could be potential bottlenecks in the mill were included. These are preparation, extraction, the boilers. Preparation and extraction are limited by fiber levels and boiler capacity is limited by soil levels. The pan capacities are limited by sucrose and non-sucrose contents, respectively. The researcher investigates all related factor which influence on maximum sugar cane yield.

This section recapitulates the terms invoked in the narrative text as defined by Clayton (1971, Pp 75-80). In some cases the explanations may be regarded as definitions, but in others the purpose has been to draw attention to the significance of terms in the peculiar parlance of the industry, or the implications which accompany their use.

1. Cane: The raw material delivered to the factory, including clean cane, field trash, water, e
2. Field Trash: Leaves, tops, dead stalks, roots, soil, etc. delivered as part of the cane.
3. Fiber: The dry water-insoluble matter in the cane. Terms such as “dry “and "water-insoluble" have, ofcourse, to be given practical interpretations. Note that the definition embraces not only fibrous matter but also any other insoluble such as soil and stones.
4. Absolute Juice All the dissolved solids in the cane plus all the water, that is, cane minus fiber. Absolute juice is a concept. It comprises all the real juice of the cane plus any hygroscopic water.To the extent that hygroscopic water may be neglected, absolute juice may be regarded as the average juice of the cane.
5. Undiluted Juice All the juice existing as such in the cane.

6. Undetermined Water Cane minus fiber minus undiluted juice.

7. Mixed Juice The mixture of primary and secondary juices which enters the boiling house.

8. Bagasse The residue of cane after crushing in one mill or a train of mills. Bagasse's are named successively as first mill bagasse, second mill bagasse and so on to last mill bagasse or final bagasse or simply bagasse

9. Imbition The process in which water or juice is applied to a bagasse to enhance the extraction of juice at the next mill. The term is also applied to the fluid used for the purpose.

10. Dilution The portion of imbibition's water which enters the mixed juice.

11. Extraction That proportion (usually percentage) of a component of cane which is removed by milling. Familiar components in this connection are juice, Brix, pol and sucrose, and the word extraction is qualified accordingly. Extraction alone normally signifies pol extraction. The term juice extraction needs an accompanying specification of the reference juice and the basis, e.g. absolute juice, Brix basis.

12. Clarified Juice The finished product of the clarification process. As it normally goes to the evaporators it is often referred to as supply juice.

13 Filtrates The liquid that has passed through the screens of the filters.May be characterized as first or second, cloudy or clear, or combined.

14. Filter Cake The material retained on the screens of the filters.

15. Syrup Concentrated juice, the product of the evaporators.

16. Massecuite The mixture of crystals and mother liquor discharged from a vacuum pan. Massecuites are classified according to descending purity as first, second, etc.

17. Molasses The mother liquor separated from a massecuite by mechanical means. It takes its designation from the massccuite, e.g. amassecuite yields a molasses.

18. Magma A suspension of crystals in saturated liquor made by mixing sugar with water, juice, syrup, molasses, etc.

19. Sugar crystals as produced in the factory by separation from a massecuite and any subsequent treatment. Many grades are recognized and designations are local.

20. Pol. The apparent concentration w/w per cent of sucrose in a material, derived by determining the optical rotation of a sample under standard conditions and attributing that rotation to sucrose. Pol issued in calculations as if it were a real substance.

21. Sucrose The chemical compound so named, also known as saccharose or cane sugar. In a quantitative connection the term "sucrose" should mean sucrose specifically, as distinct from pol. The term "cane sugar" is used to some extent, signifying pol, not sucrose.

22. Brix. The apparent concentration w/w per cent of dissolved solids in a solution, derived by determining the density of the solution and attributing that density to sucrose in aqueous solution at the same temperature.

The term Brix alone implies a densimetric basis of determination. It is possible to derive Brix alternatively by reference to the refractive index of the solution, in which case the result is to be designated Refractometer Brix.

Brix is used in calculations as if it was a real substance, and that substance may be referred to also as Gravity Solids.

23. Dry Substance The material remaining after drying the product examined.

24. Purity The percentage proportion of pol in the Brix. The percentage proportion of sucrose in the Brix. The percentage proportion of sucrose in the dry substance. The term purity alone normally signifies apparent purity.

25. Reducing Sugars Reducing substances in cane and its products interpreted as invert sugar. Invert sugar is the equal parts mixture of glucose or dextrose and fructose or levulose

resulting from the hydrolysis of sucrose. The term glucose should be reserved for the specific sugar of that name, and not used in reference to reducing sugars generally.

26. Ash The residue remaining after incinerating the product under specified conditions.

Observation photo by researcher, wssf 2013

Land preparation:

Deep plowing to at least 30 cm is recommended for conditions in Wonji.shoa, with sub soiling where hard pans have formed. In rain-fed conditions, a second plowing should be practiced to further break soil down into a fine tilth, so that it can maintain its moisture for a longer time, this being especially so when sugarcane is planted towards the end of the rainy season.

Land preparation WSSF 2013.

Planting method

Sugarcane is normally planted either as two- or three-budded sets in furrows, or as whole stalks cut into 30 cm lengths and covered with soil. Sugar cane is planted manually, but machine planting is also practiced. Row and plant spacing are 1.0-1.3 m x 0.5 m for manual planting. The row spacing is 1.4- 1.6 m for machine planting. In the case of double row planting, there is 30 cm spacing between double rows and 1.3 m (1.00-1.40 m) between rows. It is recommended that a variety with high tiller should be planted at the wider row spacing and vice versa.

Planting of sugar cane in wonji/ shoa

Pesticides

Pests and diseases insect pests: Major insect pests are shoot and stem borers, white fly and stem boring grubs.

a) Shoot and stem borers, include the early shoot borer (Chiloinfuscatellus), white top borer (Scirpophagaexceptalis) and stem borer (Sesamiainferens). They can be controlled by: (1) using a resistant variety, for example Uthong 3; (2) using chemicals, for example carbofuran 3 % G (30-60 kg/ha) for irrigated conditions, cypermethrin 15% W/V EC (13 ml/20 l of water) and deltamethrin 3 % W/V EC (10 ml/20 l of water) for rain-fed conditions, and; (3) leaving waste to cover the field after harvest.

b) White fly (Aleurololusbarodensis) can be controlled by: (1) an application of fertilizer at the rate of 300 kg/ha, making the use of chemical controls unnecessary; (2) weed control, and; (3) in the case of a severe outbreak,

Spraying chemicals, such as dimethoate 40 % W/V EC (40 ml/20 l of water) or carbofuran 20 % W/V EC (50 ml/20 l of water).

c) Stem-boring grub (Dorysthenasbugueti) can be controlled by: (1) hand picking one or two times before planting; (2) crop rotation with cassava or pineapple, and; (3) an application of endosulfan and BPMC 4.5% G (30 kg/ha) in the furrows during planting.

Cane chemical treatment WSSF 2013

Harvesting

Sugarcane cannot be stored without deterioration, thus manufacture is done immediately after harvesting. Sugarcane is commonly harvested during the cooler months in each hemisphere and before harvesting cane is commonly burnt to remove unwanted leaves (trash). Cane can be cut by hand using knifes, cutlass or machete. The advantage of cutting cane by hand is a reduction in trash entering sugar mills. Mechanical cut of cane reduces labor, therefore is a common practice in developed countries. There are different machines employed to cut cane. Whole stalk harvesters cut the stalks at the bottom and the top. The cane stalk is thickest at the bottom and thus contains the most sugar; hence one wants to cut it close to the soil. The topping of the cane is to remove top leaves (trash). The tops contain the most reducing sugars. Chop harvesters gather the stalks as the whole stalk method, but cut them into pieces of 6 to 9 inches. Extraction fans blow off most of the leaves. Different methods and machines have been developed forSpecific regions according to their needs (such as climate)(Blackburn, 1984).

Manual harvesting WSSF **Mechanical harvesting Brazil**

Brazil sugar factory train

WSSF cane transportation track highly exposed to losses