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AN OVERVIEW AND ECONOMIC ASSESSMENT OF THE INDEGENEOUS BROWN SUGAR PROCESSING PLANT AT SARA, NIGERIA

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ABSTRACT

An indegeneous 10 tons per day cane crushing capacity Brown Sugar Processing plant was designed and fabricated by the National Cereals Research Institute, Badeggi for the Jigawa State Government in Nigeria. The plant which was installed at Sara has two (2) cane Juice extractors, two (2) sets of evaporation system, one (1) crystalizer, one (1) centrifuge and one (1) dryer.The product of the factory was found to be very acceptable by Consumers. Economically, the plant was assessed to be viable as the net profit after tax rises from 5.1% in the second year to 34% in the fifth year. The payback period of the plant is four (4) years while the sensitivity analysis assuming an unexpected 5% rise in production cost shows favourable result.

Keywords: *Indegeneous, Brown Sugar, Processing, Payback period and Sensitivity analysis.*

INTRODUCTION

A brown sugar processing plant, having capacity to crush 10 tons of sugarcane per day was established by the National Cereals Research Institute, Badeggi for the Jigawa State Government in 1988. It has an overall sugar recovery of 0.6 tons per day.

The plant was established with a view to assisting the nation in augmenting the nations huge short fall in sugar production of about 99% (Amosu et al 2000). It was also meant to enhance the capability of local sugar cane growing communities to process their canes into brown sugar thereby increasing their income, provide rural employment and contribute to rural development. It was also expected to be economically sustainable and viable.

The sustainability of these types of Small Scale Sugar factories in developing countries like India was made possible by protective government fiscal policies on both vacuum pan (VP) and Open pan System (OPS) (Baron 1975 and Guerin et al 1977). The intervention of the government into the sugar industry politics was to save the OPS (Small Sugar Factories) from economic frustration due to it's low initial sugar recovery rate of 7.0 to 7.3% compared to 9.5 – 11.0% in VP (Large Scale) mills. This support encouraged the existence of the small Scale Industries until the advent of new technologies like the Shell furnace and expeller model cane juice extractors (Forsyth 1977 and 1990 and Alpine 1980).

The introduction of the expeller to replace roller juice extractors and application of the shell furnace to evaporate cane juice in the OPS increased sugar recovery from about 7.0 to 8.0 thereby reducing the sugar recovery differential between the VP and OPS from about 4.0 to 2.1 (Garg and Mc. Cherney 1980). However tribe and Alpine (1982) asserted that the unit cost of sugar production are less for larger (VP) mills than small (OPS) mills. This effort has actually encouraged the establishment of over 313 VP mills with 27 under construction, 6,000 – 8,000 medium plants and about 100,000 *jaggary* (local) sugar plants as at 1982 (Kaplinsky 1984).

Although government protection policies of OPS were commendable, Bell (1982) cautioned that protection alone is not a sufficient condition for the OPS to have rapid economic viability.

In Africa, Kenya is the only country where the sugar industry has thrived well. The eight (8) large scale (VP) and three (3) small scale (OPS) plants established in that country between 1980 and 1981 have been economically viable and able to satisfy the domestic consumption requirement (Blankhart

1983). In Nigeria, the two major sugar factories. The Nigeria Sugar Company Ltd. (NISUCO), and Savana Sugar Company at Bacita and Nurman respectively have been operating at huge losses and now, they have even stopped production. Perhaps, the only hope for self sufficiency in domestic sugar production is to encourage the establishment of the indegeneous cottage plants that can easily be managed and requires less running cost. Therefore a general overview and economic viability assessment on the Jigawa Sugar Company which is the first client to adopt the indegeneous sugar processing plant developed at the National Cereals Research Institute becomes very pertinent.

The Factory

The Mini Sugar Plant factory layout at Sara – Jigawa State provides for four (4) main work areas. These are as follows.

Cane Off-loading Area

This is the area where harvested canes are unloaded. They are brought by carts, trolleys and trucks and off-loaded on to cleaned space adjacent to the cane milling area.

A 100 kg capacity weighing balance chained to the rafter was provided within the cane off loading area to determine the weight of sugarcane stalks.

Milling Bay

The milling bay consists of a raised concrete platform on which the juice extractors are placed and from which pipes conveying the extracted juice are run into the boiling area after passing through a screen (muslin cloth) to remove debris and bagacillo. The raised platform enables the baggasse produced during cane milling to fall by gravity on the floor and are collected later for drying on a large field measuring 200m x 150m adjacent to the milling area.

Boiling Area

The boiling area houses the boiling pans arranged in two rows over a furnace, which is sunk in the ground and linked to the chimney.

The furnace as well as the chimney is built with burnt bricks. A sandcrete wall separates the boiling pan area from the firing point. This wall protects the pan area from smoke and ensures the passage of heat and hot air through the furnace as well as the escape of flue gas to the atmosphere.

Finishing Section

This is located in the main factory building which houses the crystallizer, centrifuge, drying slab, rotary dryer, packaging room and store. The factory building also has office spaces for both the factory supervisor and skilled artisans.

PRODUCTION PROCESS

Cane processing in the mini plant follows series of steps as indicated in the flowchart (Fig. 1).

Cane stalks tied in bundles are first weighed using a weighing balance. Three (3) to four (4) cane stalks, which have a milling capacity of 5 tons per day, are next fed into the mills at a time. The stalks which are fed into the mills at one end then comes out as bagasse through the opposite end and falls into an area where they are later collected, spread out to dry and used as fuel for the open pan evaporation system. The extracted juice is collected by a tray and runs through a muslin cloth screen into the pipes through which it is conveyed to the boiler pans.

The extracted juice is evaporated in two (2) sets of open pans. Each of these sets is composed of three (3) boiler pans and is filled one after the other. Each pan takes about 400 L of juice but the first pan, which directly receives the fire, is only half filled in order to prevent loss of juice through frothing over. While boiling, okra *(Abelmuschus esculentus)* stem extract is added to the juice and the scum floating on the surface is removed periodically to yield a clear juice. When the contents of the first pan are boiled down and evacuated, that of the second (middle) pan are transferred into it and, those of the third pan transferred into the second pan while the third pan is filled with fresh juice. This procedure is repeated until the whole extracted juice is total boiled down.

The concentrated juice or syrup is evacuated manually using large long-handled spoons once the brix content reaches 80°. These are first discharged into large plastic drums before being transferred into the crystalizer.

REVENUE

Revenue is generated from the sale of factory products: brown sugar, liquid sugar (syrup) and *bagasse* feed.

From 10 tons of cane per day, 450 kg of brown sugar, 650 kg of syrup and 500kg of *bagasse* feed are generated daily. These translate into 67.5 tons of brown sugar, 97.5 tons of syrup and 75 tons of *bagasse* feed per annum.

The factory price of sugar is currently N45,000 per tonne. Thus for this estimation the price per tonne of brown sugar is N40,000, N35,000/tonne for syrup and N5,000/tonne for *baggase* feed. Using these figures, estimated revenue per annum is:

Brown sugar - 67.5 x N40,000 = 2,700,000
Syrup - 97.5 x N35,000 = 3,412,500
Bagasse Feed - 75.0 x N5,000 = 375,000
Total Revenue - N6,487,500

Six million, four hundred and eighty-seven thousand, five hundred naira

EXPENDITURE

i. Personnel Wages and Allowances

The personnel wages and allowances for the 31 staff is computed as follows:

1 No. Factory Manager - N5,000 x 1 x 12 months= 60,000
1 No. Factory Supervisor - 3,000 x 1 x 12 months = 36,000
1 No. Accts/Sales Clerk - 3,000 x 1 x 12 months = 36,000
5 Nos. Machine Operators (Unskilled Artisans) - 2,000 x 5 x 12 months =120,000
2 Nos. Security Guards - 1,500 x 2 x 12 months= 36,000
1 No. Messenger/Cleaner - 1,200 x 1 x 12 months = 18,000
20 Nos Labourers -1,200 x 20 x 5 months= 120,000

Sub-Total = 426,000
Add Staff Welfare 12% = **63,900**
Total = 489,000

The total annual personnel wages, including 15% welfare provision is four hundred and eighty-nine thousand naira.

ii. Utilities

The major utilities that are considered include electricity, water supply and fuel. A water supply system comprising an underground well, pumps and storage tank are installed. However financial provision is made for water from public water supply system. For electricity, the factory is connected to the national grid but in view of possible disruption of electric power supply, a stand-by generator is provided. It is observed that 75% of the annual power supply comes from the grid while the generator supplies the balance. Finally, a provision is made for fueling of the factory pick-up van. The computation for all the above are as follows:

Electricity - ₦125 x 30 days x 12 months = 45,000.00
Water - ₦100 x 30 days x 12 months = 36,000.00
Fuel - ₦1000 x 30 days x 12 months = 360,000.00

Total = 459,000.00

Four hundred and fifty-nine thousand naira (N459,000.00) only.

iii. Raw and Packaging Materials

The major raw material is sugarcane. Ten tones of the material is delivered daily for 150 days. Brown sugar and the bagasse feed are packed in polythene packages, while the syrup is sold in plastic jars. A lump sum of N100,000 each is estimated for these while another lump sum of N150,000 is also provided for labeling the different packages. Other inputs required are okra and firewood for fueling the boilers. A lump sum of N50,000 is also provided for this. Estimates are therefore as follows:

Sugarcane -10 tonnes x 150 days x N17090./tonne = 2,550,000
Polythene packages and plastic – lump sum = 200,000
Labeling (logo printing in packages) – lump sum = 150,000
Firewood, Okra etc – lump sum = 50,000
Total = 2,950,000

iv. Maintenance

An annual provision of N100,000 is made for maintenance of machineries and equipment, refurbishing of open pan boilers etc.

v. Miscellaneous Expenses

An annual provision of N50,000 is also made for sundry expenses such as stationery, entertainment etc.

Total Annual Expenditure

The total annual expenditure projection as analysed above is summarized as follows:

Personnel wages and allowances	= 489,000
Utilities	= 459,000
Raw materials, packaging and other inputs	= 2,950,000
Maintenance	= 100,000
Miscellaneous	= 50,000
Total =	**4,048,000**

The total annual expenditure is estimated at four million and forty-eight thousand naira (N4,048,000) only.

OPERATING PROFIT

This is determined by subtracting the total annual expenditure from the total annual revenue i.e. 6,487,500 – 4,048,000 = N2,439,500 (two million, four hundred and thirty-nine thousand, five hundred naira).

PROJECT COST

Project Establishment

The major cost components in establishing the project are summarized as follows:

Land, Building and External works	= 1,259,000
Machinery and Equipment	= 2,750,000
Pipe Network and other Accessories	= 150,000
Stand-by Generator (80KVA)	= 250,000
Installation, Commissioning and Training	= 400,000
Contingency	= 150,000
Total	**= 4,952,000**

The initial capital cost of establishing the project therefore is four million, nine hundred and fifty-two thousand naira (N4,952,000) only, while total running cost for the first year is estimated at N4,048,000. Hence, the total project cost is therefore nine million naira (N9,000,000) only.

ECONOMIC ASSESSMENT OF PLANT PERFORMANCE

Finance Appraisal Parameters

These parameters are discussed as follows:

Profit And Loss Account Projection

As shown in table 1, The individual components of this account include:

Long Term Loan

The profit and loss account projection is based on an assumption that a maximum loan of N9,000,000 which was secured from an investment bank to be repaid over an 11 years period at 10% interest rate per annum although this fund was jointly provided by the National Cereals Research Institute, Badeggi and the Jigawa State government.

Depreciation

Provision is made for annual depreciation using the straight-line method, as follows;

Land, buildings and external work	- 20 years = 62,600
Machinery and equipment etc.	- 10 years = 370,000
Total	**= 432,600**

Total annual provision for depreciation is four hundred and thirty-two thousand, six hundred naira (N432,600) only.

Corporate Tax

We expect the project would enjoy Pioneer Status and should therefore pay no tax for the first 5 years.

Cost and Price of Project

For the purpose of this financial analysis, all prices and costs are assumed constant during the 5-year projection period, although as part of the viability and sensitivity analysis, a 5% increase in production cost has been used as previously highlighted to confirm the project's viability.

Revenue