

TECHNO-ECONOMIC EVALUATION OF COMMERCIAL PRODUCTION OF ZOBORODO DRINK

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ABSTRACT

Techno-economic evaluation of commercial production of Zoborodo drink was carried out. The production was found to be technically and economically feasible. The process technology is simple and the equipment are locally fabricated. Raw materials survey indicated that there is abundant roselle calyces in Nigeria (especially in the northern part) to support commercial production of Zoborodo drink. The total demand estimate for Zoborodo drink was estimated at 45.9million L/annum while the supply estimate is 19.1million L/annum. The economic evaluation was based on maximum annual production capacity of 360,000L/annum. The Return on Investment (ROI) and Return on Equity (ROE) in year one are 25.1% and 51.9% respectively while the Internal Rate of Return (IRR) is above 40%. The Net Present Value (NPV) at 25% is N1,662,260.00 while the Profitability Index (PI) is 1.5. The project payback period is about two and half years and the discounted payback period is about seven years. The breakeven point in year one is 64.6% while the Debt Services Coverage Ratio (DSCR) increases from 1.97 to 4.18 from year one to year five. All the financial and economic indices show that investment in commercial production of Zoborodo drink is viable.

INTRODUCTION

Flowers, leaves, fruits and other parts of plants have been used to prepare drinks and beverages from time immemorial. Roselle flower (*Hibiscus sabdariffa*, a member of the family malvaceae) is not an exception (Oke, 2006). The drink popularly called "Zobo" or "Zoborodo" is extracted from the dry calyces of roselle (Charles et al, 1992). Many researchers have worked on different aspects of Zoborodo drink. It was reported that the drink is composed of 8% water, 1.4% fibre, 114mg calcium, 18mg phosphorous, 110mg β -carotene, 10mg niacin, 14mg ascorbic acid and 38mg iron (FAO, 1972). Onwuka and Omeire (2001) investigated the effects of different treatment on the shelf life of Zobo drinks while Abdulahi et al (2001) studied and reported the microbiological profile of Zoborodo drinks sold in a polytechnic community in Nigeria. Literature on economic evaluation of commercial production of Zoborodo drink is scanty. This paper reports the techno-economic evaluation of a small scale production of Zoborodo drink to assist interested investors in making investment decision.

MATERIALS AND METHODS

Materials

Dry roselle calyces were obtained from Agege market – a major depot of roselle calyces in Lagos. The preservatives (i.e sodium benzoate, citric acid and sodium metabisulphite), sugar and flavours were obtained from chemical stores and open markets in Lagos and were used without further purification. The packaging materials were obtained from some packaging industries in Lagos. Glass bottle is probably the best form of packaging for Zoborodo drink but when plastic bottle is to be used, brown shade is preferable because of its ability to shade the colour of the product against irradiation from the sun and hence retain its colour for a longer time.

METHOD

Zoborodo Drink Production

The drink was prepared at FIRO pilot plant. The roselle calyces were thoroughly sorted to remove dirt. The calyces and other additives were weighed in accordance to the formulation (Table 1). The weighed calyces were thoroughly washed and allowed to drain before extraction in boiling water for about 25 minutes. The filtrate was strained after extraction and the additives were added appropriately. After thorough mixing of the additives, the drink was filtered and transferred to a holding tank from where it was filled into plastic or glass bottles. The filled drinks were pasteurized at appropriate temperature over a period of time followed by cooling, labeling and cartoning. The production flow chart is shown on figure 1.

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Table 1: Formulation for 100L Roselle Drink

Item	Quantity
Treated Water	100L
Roselle Calyces	3.5 – 4.0Kg
Sugar	9 – 10Kg
Sodium Benzoate	0.025 - 0.03Kg
Citric Acid	0.05 – 0.1Kg
Sodium Metabisulphite	0.025 – 0.03Kg
Flavour	0.15 – 0.2L



Fig. 1: Production flowchart for Zoborodo Drink.

Raw Materials Survey

The major raw material for Zoborodo drink production is roselle calyces from roselle plant. The survey for roselle calyces was carried out in the northern Nigeria where it is mainly cultivated. Some states Ministry of Agriculture in the northern Nigeria were contacted during the survey conducted mainly by the Institute's zonal office in Kano, Nigeria. Survey of other additives i.e preservatives, sugar and flavours was carried out in Lagos.

Market Survey

Market survey for Zoborodo drink was carried out in Lagos with a view to estimate the demand – supply gap for Zoborodo drink in Lagos state. Demand questionnaires were personally administered to some consumers with a view to establish the average consumption/person /annum. Open market survey was also carried out in major markets in Lagos state.

Equipment Identification Survey

Equipment identification survey was carried out in Lagos where about 60% of the local equipment fabricators in Nigeria are based (Oyeku et al, 2001). Sixteen major fabricators who claimed competency in drinks and beverages production equipment fabrication were randomly selected from a list of forty fabricators. Those selected were personally visited with a view to assemble an array of data on equipment (including equipment cost, equipment capacity, maintainability, ease of operation, materials of construction, competitive advantage and so on) for interested investors. The survey was also carried out to assess the

capability of the fabricators as claimed. Face-to-face interview as well as structured questionnaire was used for this purpose.

Economic Analysis

Financial and economic performance indicators such as NPV, IRR, ROI, ROE, PI, payback period, breakeven point, DSCR, Capital Turnover Ratio, Net Profit to Sales Ratio and Discounted payback period were used in determining the economic viability of the project. NPV was determined by the model specified by Adeoti et al (1999) while IRR was determined by the model of DeGarmo et al (1979). In determining the payback period, the method described by Adeoti et al (1999) was used. Discounted payback period was taken as the ratio of initial investment to average present value while profitability index was expressed as the ratio of the total PV of cash flow to initial investment. DSCR was calculated as the summation of the profit after tax, depreciation and interest on loan to the summation of interest on loan and loan repayment (Oyeku, 2002).

RESULTS AND DISCUSSION

Availability of Raw Materials

Raw material survey carried out on availability of roselle calyces showed that large quantities of roselle calyces are found in some northern states in Nigeria. Table 2 shows five major states in Nigeria and the local government areas in each state where roselle plant is cultivated. Although there were no published data on output of roselle calyces in the states Ministry of Agriculture visited as well as in the publications of the Federal Office of Statistics (FOS), indications are that roselle calyces are available in commercial quantity in Nigeria.

Table 2: States and Local Government Areas in Nigeria where Roselle Plant is Grown.

STATE	LOCAL GOVERNMENT AREA
Adamawa	Demasa, Ganye, Girei, Gombi, Guyuk, Jada, Jimeta, Lamurde, Madagali, Maiha, Mayo- Belwa, Michica, Mubi, song.
Borno	Adadam, Askira,/Uba, Bama, Gamboru/Ngala, Bayo, Biu, Chibok, Bikwa, Gubia, Guzamala, Hawul, Jere, Kaga, Kala/Balge, Konduga, Kukawa, Kwaya-Kusar, Mafa, Madumberi, Maiduguri, Marte, Mobbar, Monguno, Nganzai, Shani.
Katsina	Batagarawa, Daura, Ingawa, Jibia, Kaita, Katsina, Mai'Aduwa, Safana, Zango.
Taraba	Ardo-Kola, Bali, Donga, Gassol, Ibi, Jalinga, Karim-Lamido, Kurmi, Lau, Sardana, Takumi, Ussa, Wukari, Yorro, Zing.
Yobe	Bade, Bursari, Damaturu, Fika, Fune, Geidam, Gulani, Gujba, Jakusko, Karasuwa, Machina, Nangere, Nguru, Pokiskum, Tarmuwa, Yunusari, Yusufari.

Slight price variation was observed for roselle calyces in different markets in Lagos but average price per Kg of N350.00 was used for the economic analysis. The additives are readily available at chemical stores in Ojota and Ilasa areas of Lagos while sugar and flavours are also available in the open markets as well as through some direct importers based in Lagos. The price /25Kg of sodium benzoate and sodium metabisulphite is N7,500.00 while a-25Kg bag of citric acid cost N4,500.00. The price/L of flavour depends on the type of flavour. However, for common flavours such as vanilla and strawberry, the average price/L is N20,000.00

Market Survey

Market survey for zoborodo drink carried out in Lagos state indicated a large market for the product. The demand for zoborodo drink like any other drinks and beverages is increasing daily due to some factors like growth in per capita income, increase in population, increase in number of hotels, restaurants, fast food outfits, increase in cost of other drinks like coca cola and the overall economic growth. In estimating the demand for zoborodo drink, the 15 million estimated population of lagos state was a dominant factor and it

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represents the catchment market size for the product. The demand was estimated using the derived per capita consumption figure. Based on the responses to the demand questionnaires, the results of the face-to-face interview with consumers and hawkers of zoborodo drink, it was estimated that about 6% (i.e 900,000) of the population of Lagos state would consume one bottle of zoborodo drink/week or 52 bottles/person/annum or 46.8million bottles/annum. It was also deduced that another 25% (i.e 3,750,000) of the population would consume one bottle/month/person or 12 bottles/annum/person or 45million bottles/annum. The total demand estimate is therefore, 91.8million bottles/annum or 45.9 million L/annum or about 3.1L/person/annum. Zoborodo drink supply into Lagos state market is met through domestic production mainly by cottage based producers. Only few commercial outfits were found in Lagos state. Five small scale production outfits were identified in Lagos state during the producers's identification survey, each with an average production capacity of 980L/day. This implies that the supply estimate from this sector of producers is about 1,470,000L or 2,940,000 bottles/annum. Based on the survey report, it is estimated that the level of supply from the organized producers is about five times that of the cottage -based producers. This implies that the estimated supply from the organized producers is 7,350,000L/annum or 14,700,000 bottles/annum. The total supply estimate is therefore, 8,820,000 L/annum or 17,640,000 Bottles/annum. The demand and supply estimates indicate an obvious demand-supply gap of about 37.1million liters/annum.

Equipment Identification

Equipment identification survey carried out in Lagos showed that all the equipment for a small scale production of Zoborodo drink can be produced locally. Twelve out of the sixteen fabricators assessed vis-a-vis equipment quality, equipment cost, ease of operation and equipment maintainability were found to be okay. The local equipment fabricators are thereby warmly recommended to interested investors. The list of equipment and the estimated cost is shown on table 3.

Table 3: Equipment for Small Scale Production of Zoborodo Drink (1,500L Capacity/Day)

Item	Cost N
Extractor	40,000.00
Mixer (500L/Batch)	150,000.00
Stainless steel filter	75,000.00
Holding Tank with filling points (1000L)	225,000.00
Locking Head Machine for plastic Bottles (5)	75,000.00
Pasteurizer (250L/Batch)	250,000.00
Others including weighing scale,	95,000.00
Sugar Refractometer, pump and other accessories)	
Installation(5% of above sum)	45,500.00
TOTAL	955,500.00

ECONOMIC EVALUATION

The economic evaluation was carried out based on the following assumptions:

Production Volume/Day: 1,200L or 2,400 Bottles of 50cl
 Production Days/Annum; 300
 Max. Production Volume/Annum: 360,000L or 720,000 Bottle of 50cl

Based on the above assumptions, a-five year projected production programme is shown on table 4.

Table 4: 5- Year Projected Production Programme

Year	1	2	3	4	5
Capacity utilization %	65	70	75	80	85
Output (L)	234,000	252,000	270,000	288,000	306,000
Output (Bottles)	468,000	504,000	540,000	576,000	612,000

The estimated initial capital investment cost is N7,341,980.00 out of which initial fixed capital is N4,797,660.00 and pre-production expenses are N358,580.00 while the initial working capital is N2,185,740.00. The estimated revenue in year 1 is N25,740,000.00 while same is N33,660,000.00 in year 5 at recommended factory selling price of N55/50cl Bottle. The production cost decreases from N48.8 in year one to N46.90 in year five. The net profit also varies between N1,842,410.00 and N3,261,610.00 within the first five years of operation. The projected cash flow in year one is positive i.e N962,470.00, an indication that the project will be able to meet its financial obligations from the first year. The NPV at 25% is also positive i.e N1,662,260.00. This shows that the project has a good economic potential (Adeoti et al, 2001). Also, since the project NPV > 0, the project is acceptable (DeGarmo et al, 1979 and Adeoti et al, 1999). The IRR is above 40%. This is considered good for the its is greater than the cost of fund i.e 20% The profitability index is 1.5. The rule is to accept a project with PI > 1. Therefore, the project is acceptable. The payback period for the project is about one year while the discounted payback period is one and half years. The breakeven analysis for the project shows that the project will breakeven in the first year with a breakeven point of about 64.6% or breakeven value of N16,637,221.00. The return on investment in year one is 25.1% in the first year. Commercial banks in Nigeria accept a project with over 15% return on investment in the first year. Other financial ratios are summarized in table 5. The ratios show that the project is viable.

Table 5: Financial Ratios

Year	Net Profit To sales	Return on Equity %	Return on Investment	Capital Turn- over Ratio
1	7.2	51.9	25.1	3.5
2	8.0	62.7	30.3	3.8
3	8.9	74.6	36.1	4.0
4	9.4	83.6	40.4	4.3
5	9.7	91.9	44.4	4.6

Debt Service Coverage Ratio increases from 1.97 to 4.18 indicating the increasing capacity of the project to payback. This is an indication of project viability.

CONCLUSION AND RECOMMENDATION

Zoborodo drink is becoming a household product in Nigeria. It is very rich in essential vitamins and minerals. But despite these facts, its unhygienic traditional method of preparation coupled with poor packaging and low shelf life makes it unacceptable to many people especially the elites. The process technology developed at FIIRO for production and preservation of Sobered drink brings succor to Zoborodo consumers and potential investors as the fear of unhygienic production (by consumers) and low shelf life (by investors) are allayed. The commercial production is also financially rewarding. It is recommended that a detailed bankable techno-economic feasibility report on commercial production of Zoborodo drink be carried out before embarking on commercial production. FIIRO offers technical assistance services on Zoborodo drink production. This includes process technology transfer, equipment fabrication/sourcing and installation, personnel recruitment and training. The Institute also prepares bankable feasibility report for interested investors.

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