Afro Asian Journal of Social Sciences
Volume 3, No. 3.4 Quarter IV 2012
ISSN: 2229 – 5313

THE ECONOMIC ANALYSIS OF THE PROFITABILITY OF SMALL-SCALE PURE WATER PRODUCTION IN NIGERIA (A CASE STUDY OF JABU PACKAGED WATER FACTORY)

Omoniyi, Benjamin Badeji
Economics Department, Joseph Ayo Babalola University, Ikeji Arakeji, Nigeria
Abu, Zekeri
Entrepreneurship Department, Joseph Ayo Babalola University, Ikeji Arakeji, Nigeria

ABSTRACT

The paper examines the profitability or viability of small-scale packaged water factory in Nigeria using JABU packaged water factory as a case study. The paper uses a combination of descriptive analysis and simple mathematical formulae to compute the profitability and the degree of operating leverage of the factory. The result reveals that the firm is able to make some profit at the end of the first year from which the entrepreneurship dividend could shared showing that the firm is able to break-even. This suggests that the packaged water business is a viable business in Nigeria if the same scenario operates in other packaged water factories in Nigeria while the break-even analysis supports the production of bottled water. This therefore suggest that the packaged water production should be encouraged in Nigeria under a guided atmosphere such that non-registered packaged water factories are not allowed to produce untreated water for human consumption, that the water source be subjected to periodic test by analysts and that packaged water should be produced under hygienic condition that conforms with the standard required by the World Health Organization.

Keywords: Profitability, Pure Water, Viability, Mathematical Formulae and Operating Leverage.

1.0 INTRODUCTION

Water has been identified to be very important to human existence because it is very necessary for survival. Water ranked second to oxygen. A reliable supply of clean wholesome water is crucial in an attempt to promote healthy living amongst the inhabitants of a well defined geographical region (Mustapha and Adam, 1999). In an attempt to proffer solution to water problem, it was estimated that 1.2 billion people around the world does not have access to clean safe water and about 2.5 billion people are not provided with adequate sanitation (Third World Water Forum, 2003). Majority of the affected people that lack access to clean safe water and adequate sanitation are located in the developing countries because the standard industrialized global model for safe water delivery and sanitation technology is not affordable (Gadgil and Derby, 2003).

Narrowing down to Nigeria, the supply or provision of public drinking water is not reliable (Egwari and Aboaba, 2002). As a result, this has adversely affected the good health of Nigerians most especially during the dry season (Adesunkanmi and Ajao, 1986). In Nigeria, ground water and pipe borne (tap) water are the major sources of drinking water. These sources are said to be unsafe sources of drinking water because findings indicated that ground water sources contain trace elements, dissolved solids and pathogens in excessive quantities that may be dangerous to the health of the people. Consequently, most of the investigations carried out on ground water samples from different parts of Nigeria revealed that most of the available sources of water or water types are polluted or contaminated hence, were not fit for drinking purpose (Ogunbanjo, 2004 and Tijani, 2003) cited in Olaposi (2009) unpublished PhD Thesis. In addition, physical assessment of many public supplied pipe-borne water samples also testified to their poor quality.

The achievement or realization of the renewed global Commitments toward the Millennium Development Goals (MDGs) by 2015 required the development of locally sourced alternative low cost drinking water schemes that will provide sustainable access to safe drinking water in both rural and urban settings (areas) in developing countries (UNDESA, 2004). An example of locally developed alternative of safe water provision in Nigeria is the drinking water sold in polythene sachets and plastic bottles. In carrying out this business, some small and medium scale enterprises use various production techniques and technologies to purify and package water sourced from springs, bore holes and public water main or points in sachets and plastic bottles that are sealed electrically. A sachet contains 50cl and a medium plastic bottle contains 75cl while the big plastic bottle contains 1 litre of water. The products are popularly known as pure water and bottled water. Many small and medium scale enterprises are now set up with each of them producing a particular brand hence, the availability of several brands of these types of packaged water in Nigeria and other developing Countries (Ogan, 1992; and Kasenga, 2007).

Pure water factories were established for the purpose of making profits by the provider or owners of the enterprise. To this end, water in sachets are readily available at affordable prices but, the concern is the nature of its wholesomeness, the integrity of the hygienic environment and the conditions of the places where majority of the sachet and bottled water are produced (Dada, 2009). However, there are traces of outbreak of water borne diseases that has been linked with the consumption of polluted water in sachets in the past even though there is no national evidence (Dada, 2009). To protect the individual and maintain good health for the people, the Nigerian Government set up National Agency for Food and Drug Administration Control (NAFDAC) to develop standard production procedure that must be adhered to by promoters of pure water factories before their enterprises are approved by NAFDAC. Despite control by NAFDAC, complaints abound on the unwholesomeness of sachet water in Nigeria (C.A.M.O.N 2004). Thus, a gradual nationwide ban was proposed by the national regulator on package water but the pure water market continued to grow. It is therefore worthy to note that there is need to improve the quality of sachet and bottled water in Nigeria because the quality of some brands of sachet water has been taking, assessed and condemned by previous studies as opined by Ogunfowokan, et al, 2000, Dada, 2009 etc.

It is as a result of these identified problems that were attributed to some brands of sachet or packaged water that arouse the interest of Joseph Ayo Babalola University in, Ikeji- Arakeji which operate a fully residential private university to establish, a packaged water factory in November, 2009 as a joint venture with ministers wives council of Christ Apostolic Church to cater for its teeming number of students, staff, towns and villages around its location so that it could prevent the outbreak of diseases around its location which could pose threat or danger to the students and staff such that good, health is maintained. Consequently, JABU packaged water factory was established in October, 2009 by council of ministers wives of the Christ Apostolic

Church in a joint venture with the University authority and commenced operation on 3rd November, 2009.

The promoters provided thirty-two million naira (N32million) divided into fixed capital of Twenty million naira (N20m) and working capital of twelve million naira (N12m). The factory uses integrated water treatment of ozonization / continuous production functions. It has fourteen employees out of which two are management staff and twelve factory workers. This shown that the factory has only been in existence for one year. It operate with NAFDAC registration number and use borehole water as its raw- water source. This philosophy is quite different from other providers whose interest is profit making. However, one cannot rule out the fact that the factory could still be used as an internally means of generating income if it is able to make profit. The factory therefore produces sachet water and medium size bottled water presently.

A great deal of research has been carried out on (pure) sachet and bottled water production testing how safe the water is, the determinants and the technologies employed but, non has ever been interested in testing whether it is a profitable venture or not in Nigeria hence this paper intends to fill this gap.

The objective of the paper is to investigate whether JABU pure water factory is making profit from the production of sachet and bottled water or not as a means of determining the viability of the packaged water business. The paper will also determine the degree of operating leverage for both sachet and bottled water. The paper is divided into five sections. Section one introduces the study, two presents review of literature. Section three discusses the methodology. Section four contains presentation of data and discussion of results while section five concludes the study.

2.0 REVIEW OF LITERATURE

The processing of water into sachets and bottled water involved the use of capital intensive technology. Technology is a technical term of transforming inputs into outputs at any particular time. It therefore connects factor inputs and outputs. The production function represents the technology of firms in an industry or in the economy as a whole. In essence, the production function encompasses all efficient technical methods of production. A production process is considered to be better than another when it uses less of at least one factor than all other alternative methods. This tends to explain that there are efficient and inefficient technical methods of production. However, basic theory of production concentrates only on efficient methods because rational entrepreneurs will only engage efficient methods (Olayemi, 2004).

The selection of an efficient production method among all technically efficient production techniques is an economic decision which depends on the prices of factors of production such as capital, labour etc (Koutsoyiannis, 1983; Henderson and Quandt, 2003; and Oyeniyi, 2005). All the technically efficient methods or combination of the factors of production for producing a given level of output involves the use of the production isoquants which assume various shapes depending on the degree of substitutability of the factors.

2.1 **Packaged Water Production System**

Packaged water production System transforms or convert raw, contaminated or polluted water into a packaged portable water. The direct inputs are water from public mains, springs and boreholes, machines for purification and labour. The resulting output is the treated potable water known as “Pure water” and packaged bottled water. The transformation process involves various purification technologies and techniques of production, skill, equipment and facilities which combined to form technological processes. Presented below is the input-output transformation diagram.

Figure 1: Input-Output Transformation Diagram.

Input	**Transformation process**	**Output**
Water Chemical Machines Labour → Power/ energy Sachet / Bottle	Various water treatment techniques → Managerial practices and procedures	Packaged potable water in sachets and bottles

Source: Adapted from Buffa and Sarin (2003).

The above table shows the raw materials or inputs required for the production of packaged water, the transformation techniques and managerial procedure required in the transformations process and the output which is the sachet pure water and bottled water. The arrows shows the directions of the movement of inputs been transformed into output. The transformation process is the technical core of the manufacturing system (Buffa and Sarin, 2003 cited in Olaposi, 2009). The important role of the operation management function is to measure and control the transformations process by monitoring the output in terms of quality and quantity and use information as feedback to make necessary adjustments toward improvement of the process (Buffa and Sarin, 2003). Improvement in the production process is essential to permit the achievement of operations management objective while customer satisfaction may be ensured through the production of high quality product. In addition, high quality products are essential to maintain customer loyalty and long-term customer relationship that may eventually increase profitability of the firm. Hence, provision of high quality products is a mandatory requirement if the organization would succeed in the long-run (Davis, Aquilano and Chase, 2003).

2.2 **Standard for Potable Drinking Water**

The major concern for drinking water is the presence and absence of pathogenic organisms. Water comes from faecal contaminant. Hence water to be used is tested against Escherichia Coli an indicator organism for faecal contamination (Mendie, 2005). To guide against contamination, WHO (2006) provide guidelines for quality drinking water. The guideline opined that water that is provided for direct drinking must not contain E-Coli or thermotolerant coliform bacteria, giardia worms, viruses, cryptosporidium spp, legionella pneumophila entamoeba hystolitical and other opportunistic pathogens such as clostridium spp, kiebsiella spp and pseudomonas. The guideline stated further that the water should be tested against the presence of notorious pathogens such as salmonella typhi, shigella dysenteriae and vibrio Cholerae that are responsible for typhoid, bacillary dysentery and Cholera diseases which arises due to high level of organic decay and fermentation on tropical waters. All these bacteria must not exist in water that are meant for drinking hence sources of water for packaged water are subjected to laboratory test by public analyst in which any of the bacteria must not be found or detected in any 100ml water sample.

2.3 Quality Issues in Packaged Water Production

The quality of a product determines its market share. Market share of a product could increase or decrease based on issues concerning the quality of the product. Hence quality is the competitive priority of the promoters or managers (Buffa and Sarin, 2003). Issues bordering quality is a vital one in packaged water production because it affects human health directly and may cause death if compromised. Quality is therefore defined as "the degree to which a set of inherent characteristics fulfils requirements (BS EN ISO 9000, 2000). The quality of any packaged water is therefore determined by the degree of compliance with the guideline set by regulatory bodies or agencies. Determination of the quality of any drinking water must satisfy customer ratings by assessment in terms of physical parameter such as colour, taste, odour and presence of particles in the water (Mendie, 2005) and quality assessment which certify that the water is safe for drinking by meeting physical, chemical and microbiological parameter (Wikipedia, 2007d). Thus, potable water for drinking must meet acceptable standard set by world Health Organization.

2.4 Packaged Water Production in Nigeria

Package water is the water that is sealed in plastic bottles and sachets provided for human consumption (Mendie, 2005). Packaged water is an alternative water source to public water supply in Nigeria. This arises because of the inadequacies and poor quality of public water supply for drinking purpose. The packaged water in sachets are common everywhere in Nigeria because it has become the product of middle class entrepreneurs and small scale business ventures.

A Study opined that people demand for packaged water because they thought that packaged water taste better and safer in quality than water from public main (tap or pipe borne water) (World Wildlife Commissioned study, 2003). However a great deal of studies have revealed that packaged water may not be as safe as consumers perceived because there are mixed reports, while some showed that packaged water are safe, a couple of others found abnormalies in packaged water produced for human consumption (Adekunle, Sridhar, Ajayi, Oluwande and Olawuyi 2004, Dada, 2009, Mendie, 2005, and Viessman and Mark, 2005). One striking piece of information provided by mendie (2005) is that the magnitude of physical, chemical and microbiological impurities present in packaged water may be due to poor level of control to all factors influencing packaged water production.

2.5 Procedures for Packaged Water Production

Packaged water production procedure encompasses water sources and purification technologies. Sources of water are generally classified into surface and ground water. National agency for food, Drugs, Administration and control (NAFDAC) approved tap water (surface water), bore hole (ground water) and spring water as sources of raw water for packaged water production (Abati, 2005). Surface water is exposed to contamination from animal wastes, pesticides insecticides industrial wastes and many other organic materials and as such should be treated before they are fit for drinking. On the other hand, underground water from boreholes and springs are subject to many sources of recharge such that they may contain contaminants found in surface water and dissolved minerals that was picked due to its long stay underground. This is why it was discovered that water contain high calcium content in areas where rocks like limestone, magnetite, gypsum, fluorspar etc are commonly located. To this end, all sources of water should be tested to identify the type of treatment it required before becoming safe for human consumption.

Purification technologies are process of freeing water from any kind of impurity it contained such as contaminants or micro organism (Viessman and Mark, 2005). The purification steps to be followed depend on the type of impurities found in the source of water to be used. A wide variety of technologies could be adopted in providing safe water for drinking but the adoption of a particular technology depend on source of water, contaminant found to be present in the water source, the standard set which must be met by packaged water factories and available finances (Bionesoline, 2007). It must be noted that there is no single water treatment technique or devise that treat all problems because they are subject to limitations (Geo insight, 2003). However, an effective treatment process must try to eliminate all contaminants identified during chemical and microbiological analyses. At this juncture, a well designed purification system must use a combination of purification technologies to achieve the best quality for drinking water and must be used in appropriate sequence that will optimize particles removal capabilities (Water Education, 2006).

3.0 METHODOLOGY

A combination of descriptive and mathematical approach to research in which data received are calculated or computed, arranged and analyzed for output, total variable cost of production and total revenue is employed. In addition, mathematical computation of profit realized and degree of operating leverage is also included. The authors then applied the profit formula to determine profit or loss for the factory. The authors also carried out a break-even analysis of both pure and bottled water produced by the factory in which the degree of operating leverage is determined.

3.1 Optimizing Behaviours

In determining the optimizing behaviour, the entrepreneur purchase inputs such as X_1 and X_2 in perfect competitive market at constant prices and his total cost of production (TC) is assumed to be linear in the form:

$$C = r_1q_1 + r_2q_2 + b \qquad (1)$$

Where

r_1 = price of q_1 input, r_2 = price of q_2 input and b = cost of fixed inputs. At this stage, the isocost line which is the locus of input combinations that may be purchase at a specified total cost is introduced and given as:

$$C^0 = r_1q_1 + r_2q_2 + b \qquad (2)$$

Where

C^0 is a parameter while other variables are as explained earlier. At this point we mention that the farther an isocost line lies from the origin, the higher the cost of production. With an array of isoquants and isocosts lines, the tangency of the respective isoquants and isocosts determines the minimum cost of producing a given level of output. Drawing a straight line passing through the origin at the points of the respective tangencies of the different isoquants and isocosts is called the expansion path. The entrepreneur can therefore maximize output subject to cost constraint or minimize the cost of producing a prescribed level of output since price is given (Anderson and

Quandt, 2003). Resources are therefore re-directed to the production of the product with greater demand.

3.2 The Total Revenue Curve

To permit the application of the theory of cost to the production of packaged water in JABU packaged water factory, it requires the introduction of the total revenue curve. This will assist in our investigation into the determination of the profitability of the project which is the same as considering the equilibrium of the firm in a perfect competitive industry. The total revenue curve is a Straight line passing through the origin and increases as sales increases. It is therefore the total income or proceeds earned from the sale of the products of the firm. The total revenue is simply given as TR = P.Q.

In determining the equilibrium or the profitability of the firm, the total revenue curve is superimposed on the total cost curve.

3.3 Determination of the Profitability of the Firm

The profitability of the industry can be determined from two major approaches depending on the number of the firms in the industry. If there is only one firm in the industry, the total cost /total revenue approach is engaged while the Marginal revenue / Marginal cost approach is employed when there are many firms in the industry (Jhingan, 2007). However, this paper employs the Total revenue/Total cost approach because a single firm is considered in the study.

JABU pure water is assumed at this stage to have its objective as profit maximization which is mathematically presented as:

$$\pi = TR - TC \quad or \quad \pi = P.q - TC \tag{3}$$

Where

Π = Profit, TR = Total Revenue and TC = Total cost.

From the above, it is clear that both revenue and cost are related to output that is, TR= $F_1(Q)$ and TC = $f_2(Q)$, with the price given as P. However, the condition of profit maximization must satisfy the first and second order condition of differentiation or derivatives in theory.

The profit of the entrepreneur or the firm (π) is the difference between his total revenue (TR) and his total cost (TC).

Hence $\pi = pf(q_2, q_2) - r_1q_1 - r_2q_2 - b$ (4)

Profit is therefore maximized with respect to q_1 and q_2. When the partial derivatives of π is set with respect to q_1 and q_2 equal to zero we have

$$\frac{\partial \pi}{\partial q_1} = pf_1 - r_1 = 0 \quad and \quad \frac{\partial \pi}{\partial q_2} = pf_2 - r_2 = 0 \qquad (5)$$

By re – arranging input – price terms we have $pf_1 = r_1$ and $Pf_2 = r_2$

The partial derivatives of production function as presented above with respect to the inputs are the marginal products (MP) of the inputs while the value of the marginal products (MP) of Xi (pfi) is the rate at which the firm's or entrepreneur's revenue will change or increase with further application of X_1. The same goes for X_2. First order condition of profit maximization stipulate that each input should be employed or utilized up to a point where the value of its (MP) marginal product equals its price. Further increase in profit is subject to the fact that addition to revenue from the employment of an additional unit of X exceeds its cost. Hence, the maximum profit – input combination lies on the expansion path.

The second order condition is that the principal minor of the relevant Hessian determinant must alternate in sign that is,

$$\frac{\partial^2 \pi}{\partial q_1^2} = pf_{11} < 0 \quad \frac{\partial^2 \pi}{\partial q_2^2} = pf_{22} < 0 \qquad (6)$$

The above condition implies that profit is decreasing as a result of further application of either q_1 or q_2 because marginal products (MP) of both inputs are decreasing.

Also

$$\begin{vmatrix} \frac{\partial^2 \pi}{\partial q_1^2} & \frac{\partial^2 \pi}{\partial q_1 \partial q_2} \\ \frac{\partial^2 \pi}{\partial q_2 \partial q_1} & \frac{\partial^2 \pi}{\partial q_2^2} \end{vmatrix} = p^2 \begin{vmatrix} f_{11} & f_{12} \\ f_{21} & f_{22} \end{vmatrix} > 0 \qquad (7)$$

Afro Asian Journal of Social Sciences
Volume 3, No. 3.4 Quarter IV 2012
ISSN: 2229 – 5313

The above conditions ensure that profit is decreasing with further application of both q_1 and q_2 because P is greater than zero ($p > 0$). Given the entire second order condition, the production function is strictly concave when first order condition is satisfied. Hence, that point is a unique profit maximizing solution.

3.4 Determination of Profit or Loss

The profit or loss of the factory is determined by applying the profit formula

$$\pi = TR - TC \qquad (8)$$

3.5 The Break-even Analysis of Pure Water Production

The break-even analysis helps to analyse how total costs and profits vary with output with respect to the degree of automation or mechanization of the installed plant of a factory such that the factory can withstand competition more effectively and give top level managers the opportunity to make comparisons. This is done to enable the factory choose between high mechanized technology than other competitors such that it maintains high fixed costs and low average variable costs. This is because the firm has substituted capital for labour and materials.

The break-even analysis is important because it provides the opportunity to compute the degree of operating leverage which is defined as "the percentage change in profit resulting from a one (1) percent change in the number of units of product sold" (Mansfield, 1990).

The degree of operating leverage can be computed in two ways: method I uses percentage change in profit divided by percentage change in quantity sold. Given as:

$$\text{Degree operating leverage} = \frac{\Delta\%\ in\ Profit}{\Delta\%\ in\ quantity\ sold} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9).$$

$$= \frac{\Delta\Pi/\Pi}{\Delta Q/Q} = \frac{\Delta\Pi}{\Delta Q}\frac{Q}{\Pi} \text{ or } \frac{\partial\Pi}{\partial Q}\cdot\frac{Q}{\Pi}$$

Where: Π= profit and Q = Quantity sold.

Alternatively, the degree of operating leverage can be calculated with the formula stated below.

Degree of operating leverage $= \frac{Q[P-AVC]}{Q[P-AVC]-TFC}$..............................(10)

Where:

P = Selling Price, AVC = Average Variable Cost and TFC = Total Fixed Cost.

The second formula will be employed in the calculation of the degree of operating leverage.

3.5 Sources of Data

The paper used primary data collected from JABU packaged water factory from November, 2009 – October, 2010 based on the interview granted by the factory manager and the answered questionnaire sent to the factory by the author.

4.0 PRESENTATION AND DISCUSSION OF DATA

Table 4.1: Production of Sachet and Bottled Water (Output

Production	**Bags of Sachet Water**	**Packs of Bottled water**
November	20,000	400
December	23,000	500
January	22,000	400
February	20,000	400
March	22,000	400
April	22,000	450
May	21,000	400
June	22,000	450
July	23,000	420
August	21,000	400
September	22,000	450
0ctober	22,000	400

Source: response to interview conducted by author (2010).

Table 4.1 above shows that JABU Pure water factory produces water in sachets that ranged between twenty thousand bags of sachets and twenty three thousand bags of sachet water per month as indicated on the respective months of the year from November 2009 to October 2010.

A total of 260,000 bags of sachet water were produced. The production of bottled water ranged from 400 to 450 per month as shown on the table. Response to interview revealed that the average variable cost of producing a bag of sachet water is thirty-eight naira (N38.00) while the average variable cost of producing a pack of 12 bottles of bottled water was two hundred and sixty- eight naira (N268.00) and a total of 5070 packs of bottled water were produced during the period. The unit price of producing a sachet of pure water is one naira ninety kobo (N1.90) while the unit cost of producing a bottle of packaged water is twenty-two naira thirty-three kobo (22.33).

Table 4.2: Monthly Variable Cost of Production in (N) Thousand

Product	**Sachet water (N38.00 per bag)**	**Bottled water (N268.00 per pack)**
November	760,000	107,200
December	874,000	134,000
January	836,000	107,200
February	760,000	107,200
March	836,000	107,200
April	836,000	120,600
May	798,000	107,200
June	836,000	120,600
July	874,000	112,500
August	798,000	107,200
September	836,000	120,600
October	836,000	107,200
Total	**9,880,000**	**1,358,760**
Grand Total		**11,238,760**

Sources: Author's Computation (2010).

Table 4.2 shows the total variable cost of producing bags of sachet water as indicated in the table from November 2009 to October 2010. Total variable cost for sachet water ranged from (N760,000.00) seven hundred and sixty thousand naira and Eight hundred and seventy-four thousand naira (874,000.00) per month. On the other hand total variable cost of producing bottled water ranged from One hundred and seven thousand two hundred naira (N107, 200.00) and one hundred and thirty-four thousand naira (N134,000.00) per month. Total variable cost of producing sachet pure water is Nine million, eight hundred and eighty thousand naira (N9,880,000.00) and One million, three hundred and fifty-eight thousand seven hundred and sixty naira (1,358,760.00) for bottled water. Combination of both sachet and bottled water amounts to Eleven million, two hundred and thirty-eight thousand, seven hundred and sixty naira (N11238760.00)

In addition to total variable cost (TVC), the fixed cost will also be added to the TVC to determine total cost of producing both sachet and bottled water by JABU packaged water factory. This is done to conform to theory. However, information received revealed that the total fixed cost is Twenty million naira (N20m) to be depreciated on fixed depreciation method for five years. Thus, depreciation per annum amounts to four million naira (N4m). Also salaries of two management staff of the factory amount to one million, two hundred thousand naira (N1.2m) per annum which is part of the fixed cost of the factory since their salaries must be paid whether production take place or not. Furthermore, the wages of the twelve factory workers amounted to one million two hundred thousand naira (N1.2m) per annum but it is assumed that it has been added to the cost of producing the two products. Other routine expenses amounted to three million, eight hundred and twenty-three thousand naira (N3823000.00)

Table 4.3: Selling Price and Monthly Revenue of the Factory

Month	**Revenue from sachet water N 70 per bag**	**Revenue from Bottled water N450 per pack**
November	1,400,000	180,000
December	1,610,000	225,000
January	1,540,000	180,000
February	1,400,000	180,000
March	1,540,000	180,000
April	1,540,000	202, 500
May	1,470,000	180,000
June	1,540,000	202,500
July	1,610,000	189,000
August	1,470,000	180,000
September	1,540,000	202,500
October	1,540,000	180,000
Total	**N18,200,000.00**	**N2,281,000.00**

Sources: Author's computation (2010).

Table 4.3 shows the monthly revenue from sales of the factory's sachet water and bottled water. Sales ranged from N1.4m to N1.6lm as indicated on the table on monthly basis for sachet water. On the other hand revenue from the sale of bottled water ranged from N180,000 to N225,000 as depicted on the table. The table revealed that concentration of production favoured the production of sachet water. Total revenue from sachet water amounted to N18,200,000.00 and N2,281,500.00 from bottled water.

Table 4.4: Monthly Profitability of Packaged Water Production

Month	Revenue (N)	Cost of Production	Gross Prtofit
November	1,580,000	867,200	712,800
December	1,835,000	1,008,000	827,000
January	1,720,000	943,200	776,800
February	1,580,000	867,200	712,800
March	1,720,000	943,200	776,800
April	1,742,500	956,600	785,900
May	1,650,000	905,200	744,800
June	1,742,500	956,600	785,900
July	1,799,000	986,500	812,500
August	1,650,000	905,200	744,800
September	1,742,500	956,600	785,900
October	1,720,000	943,200	776,800
Total	20,481,000	11,238,760	9,242,240

Source: Author's Computation (2010)

Table 4.4 shows monthly revenue from the sale of sachet and bottled water. Monthly sales proceeds ranged from one million, five hundred and eighty thousand (N1580000) naira to one million eight hundred and thirty-five thousand (1,835,000) naira during the period under consideration, On the other hand, monthly variable cost of producing both products ranged from eight hundred and sixty-seven thousand two hundred naira (N867,200) and one million and eight thousand naira (N1,008,000) during the period. This resulted into monthly gross profit that ranged from seven hundred and twelve thousand eight hundred naira (N712,800) to seven hundred and eighty-five thousand nine hundred naira (N785,900) as shown on the table. Addition of the sums shows that total revenue amounted to twenty million, four hundred and eighty-one thousand naira (N20,481,000) and total variable cost of eleven million, two hundred and thirty-eight thousand seven hundred and sixty naira(N11,238,760). This resulted in a gross profit of nine million, two hundred and forty-two thousand two hundred and forty naira (N9,242,240).

Total revenue N20,481,500 while total cost is TVC + Depreciation of fixed cost and other routine costs that are not involved in the production process. TC therefore is:

4.1 Presentation and Discussion of Result

TC= 11,238,760 + 4,000,000 + 1,200,000 + 3,823,000

TC = N 20,261,760.00

Π = 20,481,500 – 20,261,760.00

π = N219,740.00

This shows that at the end of first year in operation, the factory was able to realize a profit as stated above. However, the entrepreneurial allowances are yet to be deducted from the profit which invariably meant that the factory at the end would have made a loss. This finding therefore corroborate or confirmed the information received from the factory management that the firm cannot be said to be making any profit at the end of the first year in operation.

Table 4.5: Break-even Analysis for Pure Water (Sachet Water)

Total Fixed Costs = 20m

Average Variable Cost = N38

Selling Price = N70

Month	Sold	Total Revenue (N)	Total Variable Cost (N)	Total Profit (N)
Nov	20, 000	1, 400, 000	760, 000	640, 000
Dec	23, 000	1, 610, 000	874, 000	736, 000
Jan	22, 000	1, 540, 000	836, 000	704, 000
Feb	20, 000	1, 400, 000	760, 000	640, 000
Mar	22, 000	1, 540, 000	836, 000	704, 000
Apr	22, 000	1, 540, 000	836, 000	704, 000
May	21, 000	1, 470, 000	798, 000	672, 000
June	22, 000	1, 540, 000	836, 000	704, 000
July	23, 000	1, 610, 000	874, 000	736, 000
Aug	21, 000	1, 470, 000	798, 000	672, 000
Sept	22, 000	1, 540, 000	836, 000	704, 000
Oct	22, 000	1, 540, 000	836, 000	704, 000
	260, 000	18, 200, 000	9, 880, 000	8, 320, 000

Source: Author's Computation (2010)

Table 4.5 above presents the break-even analysis for bags of pure water sold, total revenue, total variable cost and total profit earned from November, 2009 to October, 2010. The table also shows the total fixed cost, average variable cost and selling price of a bag of pure water. The figures are therefore employed to compute the degree of operating leverage for pure water with the formula stated below in order to compare the profitability of sachet pure water and bottled water produced by the factory.

Applying the formula,

Degree of operating leverage $= \frac{Q[P - AVC]}{Q[P - AVC] - TFC}$

$$= \frac{260,000\ [70-38]}{260,000\ [70-38] - 20m}$$

$$= \frac{260,000\ (32)}{260,000\ [32] - 20m}$$

$$= \frac{8,320,000}{8,320,000 - 20,000,000}$$

$$= \frac{8,320,000}{-11,680,000} = -\ 0.71$$

The calculated degree of operating leverage shows that a 1 percent increase in sales leads to a less than 1 percent decrease in profits of the factory in sachet water production.

Table 4.6: Break-even Analysis for Bottled Water

TFC = N20m, AVC = N248, Selling Price = N450

Month	Quantity Sold	Total Revenue	Total Variable Cost (N)	Total Profit (N)
Nov	400	180, 000	107, 000	72, 800
Dec	500	225, 000	134, 000	91, 000
Jan	400	180, 000	107, 000	72, 800
Feb	400	180, 000	107, 000	72, 800
Mar	400	180, 000	107, 000	72, 800
Apr	450	202, 000	120, 000	81, 900
May	400	180, 000	107, 000	72, 000
June	450	202, 000	120, 000	81, 900
July	420	180, 000	107, 000	72, 800
Aug	400	180, 000	107, 000	72, 800
Sept	450	202, 000	120, 000	81, 900
Oct	400	180, 000	107, 000	72, 800
Total	5, 070	2, 272, 500	1, 353, 460	919, 100

Source: Author's Computation (2010)

Table 4.6 above show the break-even analysis for quantities of bottled water sold, total revenue, total variable cost and total profit earned from bottled water from November 2009 to October 2010. The table also shows the total fixed cost, average variable cost and selling price of a pack of bottled water. The figures are therefore used to calculate the degree of operating leverage for bottled water with the formula stated below as:

Degree of operating leverage $= \frac{Q[P-AVC]}{Q[P-AVC]-TFC}$

$$= \frac{5070[450-268]}{5070\ [450-268]-N20m}$$

$$= \frac{5070[182]}{5070\ [182]-N20{,}000{,}000}$$

$$= \frac{922740}{922740-20{,}000{,}000}$$

$$= \frac{922740}{-19077260} = -\ 0.0483686$$

The result shows that 1 percent increase in the sales of bottled water leads to 0.048 percent decrease in the profits earned by the factory from the sale of bottled water. The result therefore revealed that increases in the sale of bottled water should be encouraged than pure water because the degree of operating leverage performed better for bottled water than pure water.

5.0. CONCLUSION

Based on the findings through the use of primary data received from the factory, it was revealed that revenue amounted to N20, 481,500 and total cost summed up to N20, 261,760 leaving a profit of N219,740. However, entrepreneurial and partnership remuneration are yet to be deducted since the factory was a joint venture. Hence, the factory cannot be considered to have made any profit but a loss. However the factory has been able to breakeven at the end of first year in operation. This therefore suggests that the packaged water business is a viable one in Nigeria viz-a-viz JABU and if this scenario continued, the factory would become a project that will generate internal revenue to the university. Hence there is better prospect for packaged water enterprises in Nigeria. However, the break-even analysis which is used to calculate the degree of operating leverage favoured the production and sale of bottled water rather than pure water based on the result of calculated degree of operating leverage via the break-even analysis.

5.1 RECOMMENDATIONS

Based on the conclusion, the study recommends that the pure water business should be allowed to thrive. This is because it provides employment for labour and profitable to the owners. Hence it is a viable business in Nigeria. However, the business should be properly guided so that non registered enterprises are not allowed to produce untreated water for human consumption in Nigeria. Above all, NAFDAC should ensure that the sources of water used by packaged water factories are subjected to periodic test by public analysts to test the safety of such sources of water. Finally, the environment and condition in which the products are been produced should be hygienic and conformed with the standard required by World Health Organization. The break-even analysis which is used to determine the degree of operating leverage should be improved so that increased product sales would lead to increased profitability rather than a loss or a declining profitability.

REFERENCES

Abati, T. (2005) Water Sources and Treatments: Food Forum, Nigerian Institute of Food Science and Technology, September (2005) Pp.10

Adekunle, L.V., Sridhar, M.K.C., Ajayi, A.A., Adesunkanmi, A.R.K. and Ajao, O.O. (1986) Typhoid Heal Perforation: the value of Delayed Primary Closure of Abdominal Wound, *African Journal of Medicine and Sciences,* Vol. 25, Pp 311 – 315.

Biones Online (2007) What is Water Purification? http://www. Bionesoline. Com /s/ what – is Water Purification. Htm

Buffa, E.S. and Sarin, R.K. (2003) *Modern Production /Operations Management*, Eighth Edition, John Wiley and Sons, Singapore, Pp. 631-642.

Dada, A.C. (2009). Sachet Water Phenomenon in Nigeria: Assessment of the Potential Health Impacts. *Journal of Microbiology Research,* Vol.3, No.1, Pp. 015 – 021.

Davis, M.M., Aquilano, N.J. and Chase, R.B. (2003), Fundamentals of Operations Management, McGraw –Hill, Irwin, Pp. 3-12.

Egwari, L. and Aboaba, O. (2002) Environmental Impact on the Bacteriological Quality of Domestic Water Supplies in Lagos Nigeria, *Rev. Saude Publications*, vol. 36 no. 4, Pp. 513 – 520.

Gadgil, A and Derby, E. (2003), Providing Safe Drinking Water to 1.1 Billion Unserved People, paper No 70492.

Geo Insight (2003). A Primer on Small Water Treatment Method, Point of Entry and Point of Use System *infor@geo inc.com*

Water Education (2006), Free Drinking Water. *http://www.fao.org/waucent/faoinfo /economic/esn /codex* 23rd February

Henderson, J.M. and Quandt, R.E. (2003), *Microeconomic Theory: A Mathematical Approach*, Third Edition, Tata McGraw–Hill Publishing Company Limited, New Delhi, Pp. 64 -104.

Kassanga, G.R. (2007). The Health Related Microbiological Quality of Bottled Drinking Water Sold in Dares Salaam, Tanzania, *Journal of water Health,* Vol.5, No.1, 179 -186.

Koutsoyiannis, A. (1983). *A Modern Microeconomics,* Second Edition, Macmillan Press Ltd., London, Pp. 67 – 160.

Mansfied, E. (1990). *Managerial Economics* www.Norton&company, New York, London, Pp. 300-302.

Mendie, U.E. (2005). *The Theory and Practices of Clean Water Production for Domestic and Industrial Use*. Purified and Packaged Water, Lactomedals Publishers, pp. 51 – 104.

Mustapha, S. and Adam, E.A. (1991) Discussion on Water Problems in Nigeria: Focus on Bauchi State, *National Water Resource Institute.*

Ogan, M.T. (1992). Microbiological Quality of Bottled Water sold in Retail Outlets in Nigeria, *Journal of Applied Bacteriol,* Vol. 73, Pp.175 -181.

Ogunbanjo, M.I. (2004). The Geochemical Evaluation of Water Resources in and Around Ijebu-Ode Town, Southwestern Nigeria and its Environmental Implications, in Water Resources, *Journal of the Nigerian Association of Hydrogeologists*, 20.

C.A.M.O.N. (2004) Consumer Affairs Movement in Nigeria, NAFDAC to Ban Pure Sachet Water, *Consumer Link* 1:1.

Olaposi T.O (2009). Technology Assessment of Packaged Water Production in Osun State, *Ph.D Thesis,* Unpublished.

Olayemi, J.K. (2004). *Principles of Microeconomics for Applied Economic Analysis* Siko Publishers, Ibadan, Nigeria, Pp. 67 – 123.

Oluwande, P.A. and Olawuyi, J.F. (2004) An Assessment of Health and Social Economic Imlications of Sachet Water in Ibadan, Nigeria: A Public Health Challenge, *African Journal of Biochemical Research,* Ibadan Biomedical Communication Group, vol.7, No.1, Pp. 5-8.

Oyeniyi, T.A. (2005). *Microeconomic Theory and Application,* Third Edition, Cedar Publishers (Nig) Ltd. Nigeria, Pp. 296 – 409**.**

Third World Water Forum on Water (2003) Blockade Myth, Illusions in Development and Cooperation, January, 2003, Vol. 30, No. 1

Tijani M.N. (2004). Bacteriological, Chemical and Lithogic Controls on Water Quality, Sagamu Area, Southwestern Nigeria, Water Resources 73

United Nations Department of Economic and Social Affairs (UNDESA, 2004) Urban Agglomerations, Population, Division of the Department of Economic and Social Affairs,

United Nations, In Gandy, M 2006 Planning Anti – Planning and the Infrastructure, Crisis facing Metropolitan Lagos, *Urban Studies,* Vol. 43, No. 2, Pp. 371 – 396.

Viessman, W. and Mark, J.H. (2005) *Water Supply and Pollution Control*. Seventh Edition, Upper Saddle River, Prentice Hall, New Jersey

World Wide life Commissioned Study (2003) Bottled Water: Understanding a Social Phenomenon, *http./ www.Water year 2003.Org/en/ev.Phe urlid.*