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**CVP and sensitive analysis of Ntow Poultry farm.**

Layers production

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## Thesis abstract

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This thesis is written to analyse the cost, volume of activities and profit of Ntow Samuel, a poultry farmer to aid in making some strategic decisions regarding his new business area of raising 1000 poultry birds for eggs. This analysis would enable the enterprise in determining the units to sell to breakeven, How to gain the expected income as well as how to adjust cost structure to meet up with changing budgeted data.

Also the effect of income tax in this analysis is also examined .In doing this, the CVP and sensitivity analysis technique is used in examining these relationships. The three related ways of modelling CVP relationships namely, the equation method, contribution margin and graph methods are varied in these analysis. A simple excel tool is also created for the enterprise to help manage these components of CVP and sensitivity analysis.

The results obtained indicate that the enterprise breaks even at units of 13838 eggs and starts making profit after the third month of egg production. The venture is thus profitable coupled with the final sale of the spent layers.

Keywords: volume, unit selling price, contribution margin, breakeven, targeted income, variable cost, fixed cost.

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## Abbreviations

<b>CVP</b>	Cost volume profit
<b>CM</b>	Contribution Margin
<b>DOCS</b>	Day old chicks
<b>FAO</b>	Food and Agriculture Organization
<b>GAIN</b>	Global Agricultural Information Network
<b>OP</b>	Operating profit
<b>UNS</b>	Unit selling price
<b>USDA</b>	United States Department of Agriculture.
<b>UVC</b>	unit variable cost

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## **1 INTRODUCTION**

### **1.1 Background of studies**

Poultry production, especially layer production is a big business in Ghana today. It has emerge as one of the provider of the most affordable source of protein (egg) in the Ghanaian community today. As the population continue to grow coupled with chnages in economic and social factors like urbanization, earnings of workers and diversity of life styles and diet, the country has its goal of expanding the size of the economy so as to increase employmentt and income of its citizens as well as other social and infrastructural development for the general welfare of her people and Agriculture is a key to realize this goal.

Ghana's importation of poultry products especially broiler meat has increased four times than in the previous years and the domestic production has also decreased supplying about 10% of the total demand in the Country (GAIN, 2013). This has been as a result of high cost of production (feed, drugs), poor techniques in production and lack of newest technical know-how to effectively manage the poultry business as well as modern equipment. High cost of energy and other resources are also factors in this decline. This has made domestic production of broilers unattractive as imported products are cheaper and there is stiff competition.

This is however not in the case of layer production, in the current years, due to government protection of the industry; the raising of layer birds for egg production has increase with little competition. This has cause a shift in the broiler production to the layer production because of its profitability, making 90% of poultry farmers in Ghana layer producers. Notwithstanding this, the high cost of inputs, increase in the cost of utilities and energy and lack of credit facilities to producers threatens the profitability of the business and this makes producers ask some questions and

analyses of costs of production and profitability before going into this venture. The breakeven point and the expected profit is very important analyses done by producers who wants to know how much they have to produce to cover cost and make profits thereafter. Previous related studies conducted gives mixed conclusions about the performance and the profitability of the layer production in Ghana. A study conducted to find the profitability of layer production in three farms in the Brong Ahafo region of Ghana with 1000 layer birds each showed an average profit of GH ₵ 5928 per farm. This however included the final sale of the spent layers and its associated cost. The study showed that feed, labour and drugs account for the highest cost in layer production (Anang, Yeboah & Agboloso 2013, 427).

Table 1. Expected revenue and expenses from layer production from three farms

Items	Stew X Farm	A. M. Unity Farm	Richtomprince Three Brothers Farm
Revenue from disposed birds	900 birds x 8.00 = 7200	875 birds x 8.00 = 7000	925 birds x 8.00 = 7400
Revenue from sale of eggs	8916 x 6 = 53508	8400 x 6 = 50,400	8830 x 6 = 52980
Total Revenue (GH₵)	60700	57400	60380

Cost item	Average cost of production	Percentage (%)
Feed cost	47, 600	88.8
Chick cost	1, 600	3.00
Vaccine	530	1.00
Utility	199	0.40
Labour	2, 520	4.70
Depreciation	1, 015	1.90
Tax	100	0.20
<b>Total</b>	53, 565	100

The spent layers at the time of sale costed Gh ₵ 8 per bird and that resulted in the different revenue levels for the farms. The mortality rates among the farms were also different causing the differences in the number of birds remaining at the end of the production cycle.

## 1.2 Industry Description

For the past years, Ghana has experienced quite even economic growth figures and is among one of the quick growing countries in Africa. One of the areas that has contributed to this growth is the poultry sector. It has played a significant role in promotion of domestic food security (RVO Report 2014, 5). The production of layer birds has been growing fast with relatively no competition. Between 2011 and 2012, the number of layer birds in Ghana increased by 10 percent, from 21 million to 23 million and Currently, over 90 percent of poultry farmers are raising layer birds for eggs (GAIN, 2013).

Commercial poultry farms in Ghana are mostly located in the Greater Accra, Ashanti and Brong Afoho regions and these farms can be categorized in three groups: large-scale (over 10,000 birds), medium-scale (5,000-10,000 birds) and small-scale (50-5,000 birds) (GAIN, 2013). Presently, there are less than twenty large-scale poultry enterprises in Ghana, producing egg. These farms are privately owned and some operate their own feed mills and hatchery. There are very few government farms in the country. The common one is the university of Ghana poultry farm which is mainly for research purposes for the students. There are more people producing on the small scale because of the capital involvement as well as the cumbersome nature of the management of large scale enterprise

Majority of Poultry farmers in Ghana use the deep litter system of poultry keeping because its quiet simple and cheap to operate as compared to the battery cage system used by few farmers especially for large scale producing farmers. Moreover there are vast area of land allocated for Agricultural production in the country. However, people don't use free range to keep layers for fear of theft and lack of proper monitoring and management.

According to (FAO report, 2014), it takes 16 weeks, approximately 4 months for layers to start laying and the average number of eggs per layer is about 250 in a year.

### 1.2.1 Feeding and other inclusiveness

Due to the large production of layers in Ghana, most of the poultry feed production industry focuses on producing layer feeds and thus produces on a very large scale for higher returns. This makes the layers feeds quiet affordable than the broiler feeds because few industries are into its production. Some important components of layer feeds are maize, fishmeal, premix, concentrates and soybean but apart from maize most of the other components are being replace by locally made alternates from agriculture by products . The reason is that these components are imported and quiet expensive so local products like palm kernel, soyabean cake, beans, ovals of fish and others that serve the same purpose of the imported ingredients are used but vaccination drugs used are mainly imported and though expensive, its prices are stable over a long period of time. The high cost of the imported components make the total variable cost of production very high.

Maize typically forms a larger percentage of the layer feed formulation. Studies show that , the poultry industry consumes about 30 percent of all white maize in Ghana. Because maize is an indispensable component of poultry feed, its price is a key determinant of prices of poultry products. Despite Ghana is almost self-sufficient in its production of maize, the rescent vision of the government to expand poultry production so as to increase employment has warranted the need to increase production to meet this impending needs since there has been a cut down of the importation of maize into the country to give the local farmers opportunity. RVO Report (2014, 3) explains that between 2011 and 2013 imports dropped with 70 percent. Poultry farmers usually buy and store maize in the christmas festive period because there are usully plenty of maize in that period and the prices are cheap . It is the period of harvesting of maize in the country and farmers who don't buy at that time , stands the risk of buying the maize at a higher price in the following year thus increasing the variable cost and profit as well. One problem of the local maize is that it can go bad easily if not properly stored and its easily attacked by pest of maize.

Wienco Ghana Ltd. Has been named as the largest producer of maize in the Ghana and the company has achieved this through its farmers association called Masara N'Arziki, which is located in the three Northern regions. Wienco is noted for production of quality local maize as well as large scale producer and therefore highly recommended by poultry farmers (Seminar 2014).

### **1.2.2 Consumption and trade**

"The annual per capita consumption of eggs was 0.6 kg in 1995 and 0.8 kg in 2005 with an annual growth rate of 4 percent" (FAO 2009, 145-149). Consumption of both chicken and eggs continues to increase, even though prices continue to rise. The price of a kilo of imported chicken legs is currently \$6, compared to \$2 in 2012.

Larger part of poultry importation are day old chicks (layers) and they are mainly from the United States, European Union and Brazil (GAIN, 2013). The veterinary service of Ghana are saddled with the task of ensuring that birds that arrive in the country are safe for consumption by requiring health certificate attached by the importer that guarantees safety. The DOCS and hatching eggs that arrive in the country are quarantine at the Kotoka International Airport before they are dispersed to the farmers.

The Government of Ghana in 2014 brought forward a strict poultry products import policy that is meant to cut down the level of the importation of eggs and DOCS into the country in order to encourage and protect the local production (News desk, 2014). By this, importation has been reduced to 60% implying that, importers have to buy 40% of the local produce.

### **1.3 Company Introduction**

Ntow's farm was established in 2010 by Samuel Ntow who is currently an Agricultural student at the University of Development Studies in Ghana. The farm is situated at Oyoko- Koforidua in the eastern part of Ghana and the enterprise at the beginning comprised of tomatoes, cereals and orange production but in 2013, Ntow introduced poultry as part of its product portfolio because he saw the poultry business as very lucrative. Notwithstanding that, he has kept very few numbers of poultry birds in the deep litter system due to his school activities and coupled with the delicate nature of running the enterprise especially with day old chicks which needs extra attention due to the high mortality rate.

According to Ntow, His production has always been targeted for the Christmas season in Ghana where there are large demand for the broiler meat as well as in the first quarter of the year. Currently, Ntow wants to go in for layer production and he wants to start with 1000 birds : this production will enable him sell eggs throughout the year and his main markets will be B2B (restaurants, hotels, wholesalers) as well as to B2C customers which comprise of individuals buying eggs straight from the farm's store.

Ntow has a five (5) year plan of acquiring an Incubator so that he can build hatchery in his farm house and produce his own day old chicks instead of buying them from other sources including imported day old chicks. He also wants that the capacity will be large enough to supply day old chicks as well as growers to other farmers and individuals. He will also provide consulting and poultry management services to new farmers.

### 1.3.1 Competition

According to Ntow, there are very few people producing eggs in the area, most of the farmers are into broiler production: thus production for meat purposes only. This gives him a great opportunity to produce eggs because the people in the area have been buying eggs from other sources far from where they live.

### 1.4 Problem statement

In businesses, managers and entrepreneurs are faced with a lot of questions regarding how sales revenues and cost will be affected by producing certain number of units as well as what will happen if they should raise or lower the price of the products. Also how can they achieve their expected profit: how will all these factors affect the output of production.

Answering these questions are very important before starting production as it gives managers and entrepreneurs fore hand knowledge of the production and sales as well as the cost issues. Equally important, the business would like to know how much to sell to earn a given amount of income or how much to sell to avoid loss. All these are important decisions to be made as it affects production and planning of resources so as to avoid waste and ensure efficient production.

Ntow as an Agricultural science student is not familiar with accounting issues and faces the same problem of finding out:

- The number of units (eggs) to sell to breakeven
- How he can achieve his expected profit (Number of units)
- How income tax will affect his profit.

## 2 MANAGEMENT ACCOUNTING

In business organizations and enterprises, two separate financial information are kept for different reporting purposes, one for internal decisions and the other for external decisions. As a result of this, there is always a distinction drawn between financial accounting and management accounting. Financial accounting generally reports information of the business to the external environment and enterprises are required by law to follow laid down guidelines in this reporting standards. Stakeholders like shareholders, suppliers, government and other financial institutions are very much interested by the activities of financial accountants.

Information and activities of management accounting are however kept for internal business operations. Bhimani, Horngren, Datar & Foster (2008, 6) explain management accounting as measuring, analyzing and reporting financial information which will help managers to achieve the overall goals of the Organization. Management accounting information are therefore needed for internal users in the firm or enterprise for the day to day running of its operation . People saddled with the task of operating the affairs of the business are the main users and they varied from production, sales, marketing, distribution and all other departments within the enterprise.

Pandey (2009, 6) explains management accounting as a systematic method that help management in its planning and controlling functions as well as providing a system of setting standards, goals or targets and comparing actual results with budgeted ones as well as the reporting of variances in order to take corrective measures to ensure high productivity.

An important concept in management accounting is cost accounting and it's a method in which cost in businesses are classified and allocated to the products and or activities of the business and this makes it easy to measure profitability. Cost accounting and management accounting are inter used when analyzing managers internal operations.



From their explanation: Hansen, Mowen and Guan (2009, 5), management accounting has two main aspects : Cost accounting system and operational control system. While the former helps managers to allocate cost to products, activities and services, the latter is designed to provide correct and timely feedback about the performance of managers and other interested people within the enterprise with regards to set plans and target . Thus identifying areas to be improved as well as the set of activities to be undertaken to bring this improvement. Drury (2006,19) highlights some functions of cost and management accounting information.

Cost accounting information reporting helps managers in the area of decision making this is because most decisions of businesses are affected by cost as such managers have to weigh the alternative of choosing one course of action over other alternatives by comparing costing figures and data of different operation models of the firm. Decision to outsource or self-production, continue or stop the production of a particular product , quantity to produce, setting of selling price and others are examples of decisions made in the firm by management accountants using cost information.

When right decisions are made, there is effective and efficient use of resources. Managers know exactly how much to produce and how to achieve their profitability when the cost of producing a particular product is analyzed. Good knowledge of likely cost in addition with accurate records of past cost gives management confidence in setting price, producing a certain level of quantity that will enable the business to cover cost and make profit.

Managers of businesses always set plans which serve as a guide in its operations and this is done before any activity or production is undertaken. It is based on this plan that the enterprise sets its short term and long term goals .Planning and formulating of business strategies and its execution are based on accurate

information of different cost elements and give courage to managers to put plans into action.

Also, controlling business operations by comparing budget with actual activities helps to identify the cause of variances and the appropriate way to handle such difference. Also, department or level that there is overspending or inefficient in its activity is known. Managers are able to improve business performance and value of products and services as well.

## 2.1 Theory concepts and tool used

The questions raised in 1.4 is as a result of the effects of costs and revenues to changing business activities and in finding solutions to the problems faced by managers and entrepreneurs above, an analytical technique is used by managerial accountants and this is called **CVP analysis**. This technique sums the effects of the volume of a business or an enterprise activity on its cost, revenue and profit. Generally, it serves as a comprehensive guide for managers to examine the overall effects on cost and revenues due to short run financial changes.

Bhimani, Horngren, Datar and Foster (2008, 240) explain it that, CVP analysis examines the behavioural relationship of total revenues, total cost as well as operating income as a result to the changes of the fixed and variable cost of the business. It is one of the most basic tools available to managers of businesses

Cost-volume-profit analysis expresses the relationships among costs, volume and the company's profit. Entrepreneurs and managers use CVP analysis to determine the sales volume that will be needed just to breakeven, or cover costs. They also use CVP to determine the sales volume that will be needed to earn a target profit. And because business conditions are always changing, CVP can help managers prepare for and respond to economic changes, such as increases in costs from suppliers (Braun & Tietz 2014, 396).

Apart from using CVP to calculate how many units to be sold, achieve breakeven or to achieve targeted operating income, it also helps managers of businesses to make effective decisions such as adding additional features to an already existing product because the different choices can affect selling prices, fixed costs, variable cost per unit, units sold as well as profits. Managers are well informed with the help of the CVP.

Crosson and Needles (2013, 178) explains the role CVP analysis plays in budgeting and how its been used to measure the performance of various departments in an organisation by comparing the sales volume with its accompanying actual cost to find the actual net income within a production period. Departments performance are also measured by comparing actual cost with with budgeted cost which have been calculated by using CVP analysis to actual sales volume. This is of great help to management to know causes of variances and the appropriate measures to put in place incase there is a deficit budget and also for the general control of cost in the business.

Rajasekaran and Lalitha (2011, 747) Identified the following objectives of CVP analysis in frims and business: Determination of selling price, profit planning, exercising control, forecasting profit, deciding alternative cause of action, planning for cash requirement ,making new product decisions and setting up flexible budget. All these objectives are in the domain of the functions of managers in the day to day running of the business and the overall effeciency of its profitability.

A study explains that (Albrecht, Stice, Stice & Swain 2008, 1011) CVP analysis involves critically studying interrelationships among the components .(revenues, costs, levels of activities as well as profits). However, the quality of the goods produced or the services rendered as well as the production efficiency, coupled with effective time management resulting in timely production and sales must be carefully taken into consideration when analysing the elements to make decisions

of price, the appropriate marketing mix, marketing strategy, appropriate sales commissions and production budgets.

Sometimes, management want to know if they should produce the whole products or out source some of them and this calls for the analysis and comparison of the cost to be incurred if outsourced or produced in the business. CVP can also play tremendous role in analysing the costs, volume and profit in both alternatives and thus making appropriate decision.

CVP also helps in making strategic decisions regarding how operating income is affected if the estimated or budgeted figures change is important to managers to enable them make effective decisions in the form of changing the cost structure so as not to run at a loss.

**Revenues** according to (Bhimani et al 2008, 241), are inflows of assets managers receive in exchange for the products or services given to consumers or customers. Important concepts in revenue generation are revenue and cost drivers. These are factors that have direct relationship with total revenue and total cost. A change in a cost driver will cause a change in the total cost and examples are units of output sold and number of sales visits. A change in a revenue driver affects the revenue. There are however many revenue and cost drivers but with regards to CVP, the units of output is the sole driver of revenue or cost is in its analysis as such any change in the revenue or cost arises only as a result of the changes in the level of output.

## **2.2 Assumptions of CVP**

In using this tool by managers, there are some assumptions that make the analysis work. Certain defined assumptions put definite limitations on the use of CVP analysis. It is therefore important that anyone preparing CVP information should be aware of the underlying assumptions on which the information is to be derived. Because failure to take these assumptions into consideration would lead to wrong

results in the analysis and this will affect management decisions at large. In other words, CVP analysis can only be used within certain defined conditions and these conditions are described below.

- Total cost can be grouped into two main components. Fixed cost, which does not vary with the level of units sold and a variable components which responds to the changes in the different units sold. In other words the fixed cost is constant no matter how much units is sold and the variable cost changes with change in the units sold or manufactured.
- If we present CVP graphically, the behaviours of the total revenue and the total cost are linear in the sense that they are illustrated as straight line in relation to the number of units produced over a period of time.
- As discusses earlier, it is only the changes in the levels of units sold that causes variation in the levels of revenue and cost. The number of units is the only important revenue and cost driver. Just as cost driver is a factor that affects cost, revenue driver is a variable such as volume that mostly affects revenues.
- There is addition and comparison of revenues and cost without taking into consideration the time value of money. This means that we are only concern about the present value of money and not thinking about how much the value will change in the near future.
- In other to effectively use the CVP tool, the selling price, variable cost per unit and total fixed cost within some range and a period of time must be known and constant. These variables should be estimated or accurately known beforehand.

- The analysis is for single products or multiple products with the assumption on the later that multiple products sold will remain constant as the total units sold changes (walther & Skousen 2010, 62).

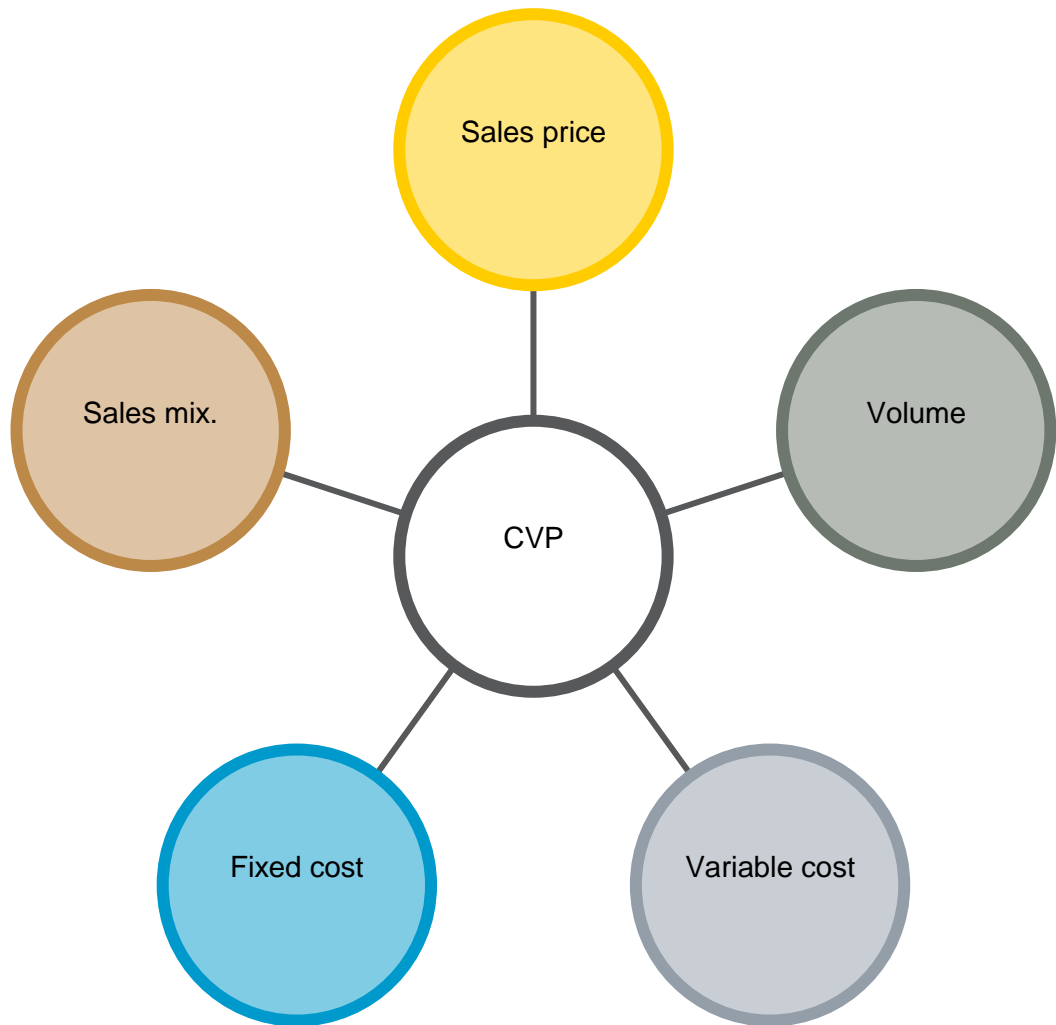
### **2.3 Relevant Range**

In the assumptions explained above, the concept of relevant range plays an important role in the CVP analysis because it specifies the activity or production range over which the stated fixed cost remain constant and also the range over which the values of the selling price and the variable cost per unit are used. Hansen et al (2009, 51) propose relevant range as the range over which the estimated cost of the relationship is valid . This means the maximum limit in which the assumptions of the various components of the CVP will be valid. Fixed cost is the main component in this concept where firms enterprise expect not to change within a given level of production and capacity. It is unwise by managers of enterprises to make assumptions of costs outside the relevant range.

### **2.4 Components of CVP**

To conduct a CVP analysis, 5 Main components are needed: sales price, volume, variable costs, fixed costs and sales mix (Atkinson , kaplan ,Matsumura & Young 2007, 38) . Without any of these elements , it will be difficult to calculate the values of their relationship as they are interrelated in one way or the other. The values for these components must therefore be available for managers to do the CVP analysis.

Figure1. Components of CVP analysis



### 2.4.1 Sales mix

Most companies sell multiple products and some of these products are jointly used together while others are separately used but in both cases, management has to know the sales mix of the different products they sell. Weygandt, Kimmel, and Kieso (2010, 250) explain sales mix as the proportion or the percentage which a company sells its multiple products.

For instance if Company A has 60% of its units sales on laptops, 30% on printers and 10% on mouse, then the sales mix is 60 to 30 to 10 or 60% to 30% to 10%. Management is keen about sales mix because the multiple products have different contribution margins due to the different pricing and the different variable costs. Here again, fixed cost does not change in the relevant range so all the multiple products are produced with the stated fixed cost.

They can thus compute breakeven and other CVP elements for the multiple products by finding out the weighted average unit contribution margin for all the products and this is done by finding the unit contribution margin and the sales mix percentage of the different multiple products and after that adding the products together.

$(UCM \times \text{Sales mix \%})$  of product A +  $(UCM \times \text{Sales mix \%})$  of product B. Fixed cost is then divided by the weighted contribution margin to get the breakeven point in units. Since the units obtained are for the different products, we apply the sales mix percentage of each product on the breakeven units to find the exact unit of each product to be sold in order for total revenues to be equal to total cost.



## 2.4.2 Cost behaviour analysis

In analysing the components of CVP, costs of the operation of the business are grouped into two main groups by management to aid in calculating the values of all the different elements: which are fixed and variable cost and these costs behave differently in totals and in units. (Weygandt et al 2010,12).

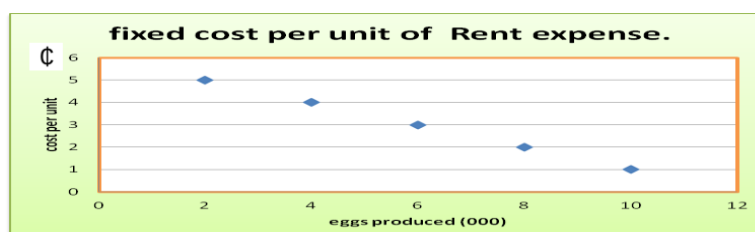
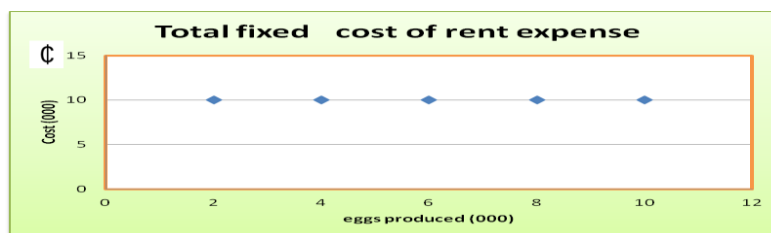
## 2.4.3 Fixed cost

It remains the same in total regardless of the volume of activity. However, the unit cost behaves inversely to the volume of production so that it decreases as volume increases and increases as volume of production decreases. Whether there is production or not, fixed cost is incurred in the business.

### Illustration

At a total fixed cost of 10 cedis,, different volumes of eggs are produced . that is 2000, 4000, 6000, 8000 and 10000 respectively .

Figure 2. Total and the per unit fixed cost of rent expense



The total fixed cost did not change but in the second chart, it is seen that the fixed cost per unit changes as the volume of egg production increases . At the different

fixed cost per unit of 5,4,3,2 and 1, egg production varied (2000,4000,6000,8000). In this case the fixed cost per unit decreased as production increased.

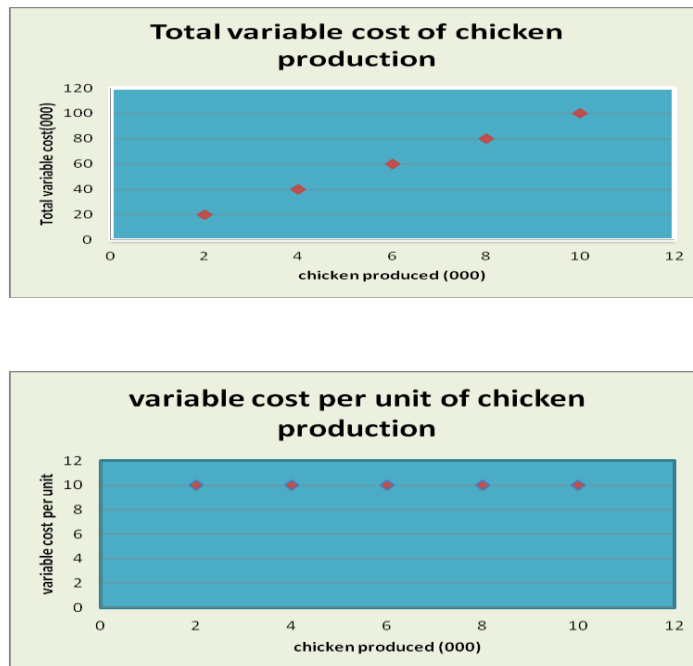
#### **2.4.4 Variable cost**

Variable cost on the other side has its total, changing with the volume of activities but the variable cost per unit remaining unchanged. The total variable cost has a direct relationship with sales revenue. If sales revenue increases by 20%, total variable cost also increases by the same percent. (20%). With different volume of activities the unit variable cost remains unchanged a Figure 3 illustrate that.

Illustration.

Peg Ltd produces chicken for sale. As the company increases production, the total variable cost increases by 20, thus (40-20), (60-40), (80-60) and it continues in that trend. In any additional production, there will be a proportionate change in the total variable cost. When 2000 birds were produced total Variable cost was ₪ 20000, then at 4000 birds, ₪ 40000, 6000 birds, ₪ 60000 , 8000 birds ₪ 80000 . However, the unit cost of 10 is the same regardless of how much chicken are produced. That is, if 2000 chickens are produced, the variable cost per one is 10 cedis.  $(20000/2000)$  and it applies to other successive productions.

Figure 3. Total and per unit variable cost of chicken production



### 2.4.5 Volume of Sales

This is the total quantity of goods and services produced with a given resources. The volume of sales in a firm most often depends on the costs behaviours as such , it has a direct relationship with cost. But this is not always the same since market forces also determine how much a firm has to produce and sell. Example when consumption of a particular product is low due to its seasonality or the introduction of a substitute products ,costs does not play much role in the volume of sales. This however account for smaller percentage in the whole production process with regards to what influence the volume of sales. Naturally, Firms sells more if cost of production is low but sells less if the cost of production is high.

The Sales volume also has a direct relationship with the profit. Ideally, given that fixed cost remains the same in a given production period ,Increasing the volume of production will increase the profit of the business and vic versal.

## 2.5 Sensitive analysis and Margin of safety

Managers always weigh their strategic plans to changing circumstances before implementing them. In the current business world coupled with going into egg production in Ghana, most of management decisions are sensitive to change especially with cost of utilities and energy. Recently Ghana has experienced changes in fuel and utilities and road transport about five times and all these changes are in the form of an increase in cost and this has affected businesses (Ghana web, 2016)

Not only that, price of consumable products is changing regularly so due to this Owners of business make sensitive analysis on their business strategies. (Horngren, Datar and Rajan, 2012 .95) explains sensitive analysis as a “ what if” technique that managers employ to evaluate how an outcome will change if the nominal budgeted data deviates or are not achieved or an assumption does not come through.

So in the jurisdiction of CVP analysis, sensitivity analysis will answer the question such as,” what will operating profit be, if variable cost increases by 5%?” Or “what will operating profit be if units sold decreases by 10%?” This is an important concept in CVP analysis especially in this state of the economy of Ghana when there have been price hikes on some product and low returns on producers. (Ghana web, 2015)

Sensitivity analysis widens the scope of managers’ ideas to enable them position themselves for possible outcomes that might occur before costs are committed and this is very important for Ntow to make different decisions regarding this analysis.

Another important aspect of the sensitivity analysis is the margin of safety. Horngren et al (2012, 97) present it as a concept that answers “what if” question: How far budgeted revenues above breakeven can drop before the breakeven is reached or the amount by which targeted sales volume exceeds or drop behind

the breakeven point. This is important because sales of eggs might decrease due to high competition or ineffective marketing campaign as well as other economic factors.

In case there is high margin of safety, then it boost the morale of the manager that he is unlikely to suffer loss at least in short period of time but if the margin of safety is low , then he is open to loss and that means putting up appropriate measures to avoid such a situation. When a business entity wants to measure how close it is to making loss, then margin of safety is measured.

According to Periasamy ( 2010, 552), the following are ways of improving the margin of safety in a firm's production activities.

Increasing the selling price

Reducing the variable cost

Reducing fixed cost

Increasing output

However, all these factors must not affect the sales of the products as it will mar the purpose for which management made such decisions and that means that looking at the marketing and promotion point of view on these decisions to see it worth. It is a strategic decision by managers after series of market research and analysis of consumer behaviour in a particular industry especially when they are very sensitive to price.

### 3 METHODS OF EXPRESSING CVP RELATIONSHIPS

There are three main methods of expressing or modelling CVP relationships open to managers of businesses as such, cost, volume and profits could be illustrated using different dimensions.

#### 3.1 Mathematical or equation method

As the name suggests, cost, volume and profits are expressed in mathematical form. Drury (2006, 246) explains that the mathematical or equation approach is a fast and flexible method of producing appropriate information and it is also appropriate for computer financial model. With this method the income statement is expressed as

$$\begin{aligned} \text{Revenues} - \text{variable cost} - \text{fixed cost} &= \text{operating profit} \\ (\text{USP} \times \text{Q}) - (\text{UVC} \times \text{Q}) - \text{FC} &= \text{OP} \quad (1) \end{aligned}$$

This equation method is the most general and easy way to remember an approach to CVP situation. Revenue is computed as the price per unit multiply by the total number of units and the total variable cost is given as the unit variable cost, multiply by the total number of units. After taking away variable and fixed cost from revenues, we arrive at the operating profit. Total Variable cost is expressed as a percentage of total revenues as such; Variable cost per unit is also expressed as a percentage of selling price per unit.

Revenues = unit selling price x quantity of units sold.

Variable cost = variable cost per unit x quantity of units sold.

### 3.2 Contribution margin Approach

Ramagopal ( 2009, 433) explains contribution margin as the excess of selling price over the variable cost per unit. The total contribution is therefore excess sales revenue over the total variable cost. (Cost that change with the level of activities). The contribution margin is the amount that covers fixed cost and if possible profit after variable cost is deducted from sales. Firms and enterprises are keen at covering their fixed cost in the business operations as such putting much strategy in place to yield this result.

The contribution margin is therefore calculated as;

$$\text{Contribution} = \text{sales revenue} - \text{Variable cost} \quad (2)$$

$$\text{Contribution per unit} = \text{Selling price per unit} - \text{Variable cost per unit}$$

$$\text{Contribution per unit} \times \text{Number of units sold} = \text{Total Contribution}$$

$$\text{Profit} = \text{Total Contribution} - \text{Total fixed costs}$$

$$\text{Loss} = \text{Total fixed costs} - \text{Total contribution}$$

The contribution margin is explained also using the contribution income statement and it is illustrated below.

Revenues (1000 units)	₱ 5000	5 per unit
Less variable cost	(2800)	2.8 per unit
<b>Contribution margin</b>	<b>2200</b>	2.2 per unit
Less fixed cost	(1400)	
<b>Profit</b>	<b>₱ 800</b>	

From the analyses above, after taking variable cost from sales, the amount remaining that will cover the fixed cost is the contribution margin and the amount is 2200 and this is good enough to cover the fixed cost of the business which was 1400 and yield a profit of 800. However these amounts are in totals so to find the cost per unit, we divide by the 1000 units products.

### 3.3 PV ratio or contribution margin ratio

With the main aim of businesses to make profit, management most often measure the profitability of their operations in the business and the PV ratio is an important instrument or concept in this analysis. The P stands for profit which is equal to contribution margin and the V volume of sales activities. The ratio expresses the relationship between the contribution margin and the sales revenue. Thus PV or contribution margin ratio is represented as:

$$\frac{\text{Selling price per unit}}{\text{Contribution margin per unit}} \quad (3)$$

The PV ratio is useful in calculating the BEP as well as the level of sales to yield an expected or targeted profit.

According to Madegowda (2007, 672), contribution margin ratio could be expressed in these ways;

So long as the unit selling price and the unit variable cost remain constant, P/v Ratio can be computed by the following formula.

$$\text{P/V Ratio} = \frac{\text{Change in Total Contribution}}{\text{Change in Sales Revenue}} \quad (3) \quad \times 100$$

As long as the unit selling price and unit variable cost remain constant, P/V Ratio can also be computed by dividing the changes in profit by the changes in sales revenue.



$$\text{P/V Ratio} = \frac{\text{Changes in Profit}}{\text{Changes in Sales Revenue}} \times 100 \quad (3)$$

While dealing with Contribution and P/V Ratio, Madegowda, explains important points that are to be kept in mind:

As long as the unit selling price and the unit variable cost remain constant, the unit contribution can also be computed by dividing the changes in the total contribution by the changes in the sales quantity as presented below.

$$\text{Unit contribution} = \frac{\text{Changes in total contribution}}{\text{Changes in sales quantity}} \quad (2)$$

With unit selling price, unit variable cost and total fixed cost remaining constant, any amount changed in the contribution margin causes a proportionate change in the amount of profit therefore change in contribution equals to change of profit.

If the business enterprise operates above breakeven and makes profits, then the increase in contribution is the same as the increase in profits provided fixed cost remain constant.

However if an enterprise operates below the breakeven and is making a loss, an increase in the contribution reduces the amount of loss or bring the business operation to no profit and loss thus breakeven provided the fixed cost remains constant.

### 3.3.1 Improving PV ratio

Since management of every business aims at improving profit, the attention is focused on improving the PV ratio and since two main factors namely the selling

price and the variable cost affect the ratio, management of these factors are important to for its improvement.

The strategy lies in increasing the selling price while maintaining the variable cost per unit. Also, reducing the variable cost without reducing the selling price is an important way to improve the PV ratio. Management strategy in increasing price at a higher rate than the rate of increase in the unit variable cost can be of great importance in improving the PV ratio.

### **3.4 Graphical Method**

The graphical approach is the visual presentation of the relationships among the elements of CVP i.e. cost, sales and profit. Using graph is one of the most effective and better means of explaining the CVP relationships and also helping managers to manage and communicate information for decisions in the various departments of a business. It gives a visibility of the relationships and interactions of the various elements to changing situations. The graph method also enables managers to analyse and interpret data of CVP values over a wide range of volume of activities than a single volume.

The chart shows the fixed cost, the variable cost, breakeven points, profit or loss, margin of safety as well as sales. The graphical method shows not only the break-even point but also the assumed cost as well as the profit or loss at every level of production. The named components of the graph are represented on the graph as shown below.

The sales revenue is represented on the vertical axis, y-axis and it starts from point zero.

The volume or units of production is plotted on the horizontal axis, x – axis

The fixed cost line is drawn parallel to the x- axis

The variable cost is drawn above the fixed cost at different levels of production and it is joined to the fixed cost line at zero level of activity.

The point where the total cost intersects the total revenue is the breakeven point where no profit or loss is incurred.

Margin of safety is the distance between the breakeven point and the total revenues.

The area above or to the right of the breakeven is the profit zone whereas below or left of the breakeven is the loss.

As more units are produced in the relevant range, the breakeven point is achieved quickly and this makes the breakeven point on the graph to shift downwards but with few units produced, breakeven is not achieved early so breakeven point on the graph shifts upwards.

### **3.4.1 Breakeven point**

The breakeven point is a point in production where neither profit nor loss is made. In other words the sales revenue is equal to the total cost. Agrawal (2010, 208) presents that it is the level of production at which total sales revenue is exactly the same as the variable and the fixed cost put together i.e. total cost. When a firm or a business gets to this point, extra production is attained at a relatively lower cost because it is only variable cost per unit that is incurred within a given capacity range of production in producing additional unit.

The fixed cost remains unchanged. However, when production is reduced, fixed cost is still incurred. Only per unit variable cost is reduced thus there is a low proportionate fall in the cost of production. The idea that fixed cost does not change the volume of production within certain range of capacity makes it easy to calculate breakeven point.

From his definition, Arora (2009, 202), explains breakeven analysis as commonly used technique for examining the relationship among the CVP elements. Here, it is analysed by looking at its narrow and broader view. In its narrow application, break-even analysis is used in determining the level of production, where the busi-

ness makes neither profit nor loss i.e. Total sales revenue is equal to total cost. Looking at its broader view, the emphasis is on how breakeven analyses determine the expected profit or loss at a given level of sales in the business.

Cafferky (2010,1) explains that breakeven is applicable not only by managerial accountants but throughout all the departments in a business organization. when they think of how much external resources are needed in other to give the maximum satisfaction customer desire.

In this sense, breakeven is not only representation of numeric values but also a thinking process in both individuals and potential people in an organisational set as they make different decisions. Breakeven can be the comparison between a change we want to make in the future and the present situation we have now.

Thus breakeven analysis can be applied in quantified values as well as to situations that require mental comparison.

In calculating the breakeven point, Bhimani et al (2008, 243) explain how the three approaches of CVP analysis namely equation, contribution margin and graph are used. Using the equation method, the formula (1) used is

$$\begin{aligned} \text{Revenues} - \text{variable cost} - \text{Fixed cost} &= 0 \\ (\text{USP} \times \text{Q}) - (\text{UVC} \times \text{Q}) - \text{FC} &= 0 \end{aligned}$$

This means that at what sales value will the company neither make profit or loss thus after taking the variable and the fixed cost away from the sales value, the remainder should be zero. Here the unknown figure to find out is Q. which is the quantity to be sold to breakeven. Using selling price per unit of ₱ 200 , variable cost per unit of 120 and total fixed cost of 1800 as an example, the equation is thus shown as;

$$\begin{aligned} (200 \times \text{Q}) - (120 \times \text{Q}) - 1800 &= 0 \\ 200\text{Q} - 120\text{Q} &= 1800 \\ 80\text{Q} &= 1800 \\ \text{Q} &= 22.5 \end{aligned}$$

Therefore with the prevailing selling price, variable cost and fixed cost, 23 units would have to be sold in order to neither make profit or loss. To find the sales in value to breakeven, we multiply the units by the selling price per unit so putting the quantity obtained into the equation, we have

$$200 \times 22.5 - 120 \times 22.5 - 1800 = 0$$

$$4500 - 2700 - 1800 = 0$$

This proves the breakeven equation to be true

The contribution margin method is similar to the equation method. Here, there is an algebraic change of the equation method that results in the formula (2).

$$(\text{USP} - \text{UVC}) \times (Q) - \text{FC} = \text{OP}$$

$$(\text{UCM}) \times Q - \text{FC} = \text{OP}$$

$$(\text{UCM}) Q = \text{OP} + \text{FC}$$

So to find the quantity to be sold to breakeven, where there is neither profit nor loss, operating profit becomes zero. Thus the formula: (2)

$$Q = \frac{\text{FC} + 0}{\text{UCM}}$$

The unit selling price minus the unit variable cost gives the contribution margin per unit and so to find the quantity, the unit contribution margin by the quantities sold is equalled to the fixed cost so by dividing the FC by the UCM, we get the breakeven in units. To find the breakeven in sales revenue, we multiply the breakeven units by the selling price thus breakeven in sales revenues become:

$$\text{Breakeven revenue} = \text{breakeven units} \times \text{selling price. (1)}$$

Contribution margin ratio or percentage can be also used to compute the breakeven point. By this formula (3), we find the percentage that contribution margin per unit covers in the selling price by dividing the UCM by the USP. The result gained is expressed in percentage.

Breakeven revenues =

$$\frac{\text{Fixed cost}}{\text{Contribution margin \%}}$$

We can also calculate breakeven with the formula (1). Here, we omit the operation profit since we know that the value is zero. Thus, there is no profit at breakeven point.  $S = FC + VC$ . Total sales is equal to fixed and variable cost put together. This means that how much sales value that will cover exactly the cost in producing a product. Using the same values, the breakeven equation will look like this.

$$S = FC + VC$$

$$S = 1800 + 0,60S.$$

$$0,40S = 1800$$

$$S = \text{₱} 4500$$

It is recalled earlier that the VC is a percentage of the total revenue as such it has a direct relationship with the sales revenue. If sales volume increases, variable cost also increases proportionate to the sales and vice versa. It applies similarly to the selling price per unit and the variable cost per unit also in the same manner. The sales volume in the formula is 100 or 1 in decimal form and the VC is 0,60 of 1 or 60% of 100%. The ₱ 4500 is the total sales revenue, so to get the quantity that yielded the outcome we divide the 4500 by the selling price of the products which is  $4500 / 200 = 22.5$

### 3.4.2 Expected or Target Operating Profit

Every business has one of its main aims of making profit. Managers often budget the profit they would like to get in their operations so as to be able to target their production and cost to this profit. The question here becomes the quantity to be sold in order to achieve an expected profit. Both the three main methods for finding the breakeven are applied to find the operating profit.

The only difference is that there is a profit to be earned so operating profit will no longer be zero.

The equation formula (1) thus becomes

$$(USP \times Q) - (UVC \times Q) - FC = OP$$

So assuming the enterprise wants to earn a target profit of ₦ 1000 and using the previous information on the breakeven, Q is calculated as

$$\begin{aligned}(200 \times Q) - (120 \times Q) - 1800 &= 1000 \\ 80Q &= 2800 \\ Q &= 35\end{aligned}$$

This means that 35 units must be sold to earn a target net profit of ₦ 1000. In this regard, the total sales revenue to yield this result is obtained by multiplying the quantities to be sold by the selling price.

Alternatively using the contribution margin (2), we add the operating profit value to the fixed cost. Thus quantity to be sold to earn a profit of ₦ 1000 becomes

$$Q = \frac{FC + OP}{UCM}$$

In this case OP is 1000. Similarly, using contribution margin ratio or percentage, the formula (3) becomes

$$\text{Breakeven revenues} = \frac{\text{Fixed cost} + \text{Operating profit}}{\text{Contribution margin \%}}$$

### 3.4.3 Impact of income taxes

Enterprises earning profits are obliged by law to pay some level of income tax. Because of this, managers often end their income statement with a net profit rather than operating profit. Also, managers would like to have appealing net income after tax so as to be able to attract investors and improve shareholders dividends and returns. Because of this, they are keen on the impact of income tax on net income.

Hilton (1999, 317) writes that a firm's residual income (income after taxes) is less than before the taxes were subtracted. There is therefore an impact of income taxes on the CVP calculations. The question is therefore the number of units to sell to earn a target net income after income tax is deducted from operating profit.

Also Horngren et al (2012, 93) state that CVP calculation for expected income must be based in terms of the target net income rather than on the basis of the target operating income. Thus the formula deduced below.

$$\text{Target net income} = \text{Target OP} - (\text{Target OP} \times \text{Tax rate}) \quad (4)$$

$$\text{Target net income} = (\text{Target OP}) \times (1 - \text{Tax rate})$$

$$\text{Target OP} =$$

$$\frac{\text{Target net income}}{1 - \text{Tax rate}}$$

The 1 in this case can be treated as 100 % so assuming the income tax rate is 12 % then target operating profit will be the target net income / 100 -12 or in decimals, Target OP = Target net income / (1-0.082)



## **4 ACTUAL PROBLEM SOLVING PROCESS WITH PRACTICAL SOLUTION**

It takes approximately 12 to 15 months for poultry layers to complete their production (FAO Report, 2003). But for the purpose of this thesis, 12 months is taken into account and due to the nature of the poultry enterprise, there are some costs that occur at the beginning of the production period and then either diminish, decrease or increase.

### **4.1 Data and methods of analysing cost**

The study was conducted in December 2015 across 5 major farms within the District of which information was obtained from each farmer based on layer production. Each farm had been in operation at least for the past 7 years with the oldest farm being 25 years in operation. The data collected included information reported in the income and expenditure statements or the profit and loss accounts, production accounts; and general information on the assets of the farm. Some secondary data collected included the bank's lending rates.

Financial analysis requires identification of all revenues and costs streams over the production cycle. For the present study, the costs include the fixed and variable costs. The fixed costs constitute the capital outlay of the firms. The fixed costs include structures and buildings, equipment, payment on interest, utility and transport cost. Due to the fact that fixed inputs decline in use, depreciation is charged on its use throughout the production cycle and the total are summed and added to the total fixed cost.

## 4.2 Monthly income

The monthly income is mainly through the sales of the eggs either direct to individual customers or wholesalers and it's calculated by multiplying the unit price by the number of units sold to get the sales revenue. Formula has already been fixed into the excel spread sheet that, the manager will only have to put the right figure and it automatically bring the results. Also in the event that unit price or units produced change due to inflation or rising cost of production, the only thing is to change the amount accordingly in the excel to give you the correct value.

Unit price	Units	Sales	
0.6	0	GHC	-
	4000	GHC	2,400

## 4.3 Monthly Expenses

The monthly expenses to be incurred are grouped into fixed and variable cost and The price per unit, the variable cost per unit and the total fixed cost are referenced to the breakeven sheet so in future if there is any additional cost or changes in the variable cost, the manager has to only insert new cells and or put in the new amount, and the whole sheet will be updated. Upon investigation with other poultry entrepreneurs, current market research of cost associated with poultry production and cost analysis of previous production, Ntow presents the table below that shows the interim monthly cost of production as well as the selling price of 1000 birds.

Figure 4. Budgeted monthly expenses of layer production

<b>Monthly expenses of producing eggs</b>	
<b>Fixed expenses per month</b>	<b>Amount</b>
Utility cost	115
Depreciation of Poultry house	142
Depreciation of poultry equipments	83
Interest on loan	67
Casual labour	300
Transportation cost	400
<b>Total fixed expenses per month</b>	<b>1107</b>
<b>Variable expenses per month</b>	
Poultry feed	0.27
Vaccination	0.25
<b>Total variable cost per unit</b>	<b>0.52</b>

The selling price of an egg is GH ₵ 0.60 and this price is constant in the analysis. If Ntow wants to advertise his products so as to improve sales, then he will treat it as a fixed cost and that means that the fixed cost is going to increase in the business and it is going to require more units of eggs in order to breakeven and to make profit than before. This will be inserted in the excel sheet by adding to the total of the fixed cost.

The highest cost in the enterprise is feeding and this is treated as a variable cost. According to Ntow, the estimated current price of layer feed is 90 cedis and 2.5 bags are consumed by the birds daily hence in the week, about 18 bags are

consumed thus 72 bages monthly. So the 72 by the 90 cedis per price is 6480 cedis.

#### 4.3.1 Feed conversion and efficiency

Feed conversion is an important concept in egg production. (Damerow, 2010 .214) Explains the concept as the pounds or kilograms of feed needed to produce a dozen eggs .The indicator is obtained by dividing the total number of feed eaten within a period by the number of dozen eggs produced in that period. This indicator is improved by reducing pest that destroys the feeds in stock as well as removing the unproductive birds from the flock by selling them out. This will ensure that there is increased productivity.

The total kilograms of feed in this case is 3600kg thus a feed weighs 50kg so by multiplying by the number of feeds per months which is 72, we get the total . Based on data collected from five different farms on production laying efficiency, Ntow expects to get approximately 24000 eggs monthly so the feed conversion rate is calculated as

$$\frac{3600}{24000} = 1.8\text{kg} \quad (5)$$

Feed efficiency measures the cost of feed per dozen eggs produced and it is derived by multiplying the feed conversion indicator by the cost per pound or kilogram of the feed. The lower the feed efficiency indicator, the better because it means that variable cost will reduce and that is good for the business. In egg production, feeding is the highest cost incurred.

The feed efficiency is  $1.8\text{kg} \times 1.8 = \text{C} 3.24$  . (50 kg of one sack of feed cost is  $\text{C} 90$  therefore 1kg cost  $\text{C} 1.8$ ), however this amount is for 12 eggs so the feed efficiency per egg is  $\text{C} 0.27$  (  $3.24 \div 12$  ).It must be noted that feeding and vaccination are treated as variable cost because , they vary with the number of birds produced, thus the larger the number of birds, the more feed to be bought as well as more vaccines.

All these expenses are estimated to be incurred in the enterprise within a relevant range of producing 1000 eggs . Any additional expenses incurred outside the relevant range will change the cost structure and the CVP analysis of the business. i.e. the breakeven point, the expected profit . Also mortality of the birds are not taken into consideration here,it is assumed in this analysis that all 1000 birds survive from the day they are hatched and are productive throughout the production cycle.

### **4.3.2 Depreciation**

Two main items are depreciated in the business and they are the equipment and the building itself. According to Ntow, the total estimated cost of the equipment is  $\text{C} 21000$  and this is depreciated yearly for 10 years with a salvage value of 4000 however, the yearly depreciation is spread over the 12 months. The straight line method of depreciation is used. The excel sheet named depreciation shows how a yearly depreciation of 1700 is obtained by subtracting the salvage value of 4000 from the original cost and dividing the results by the number of years. As shown below the yearly depreciation is spread monthly by dividing by 12 to get 142. This is a fixed cost incurred monthly.

Monthly depreciation of poultry equipment:

Duration	12	Months
Salvage value	0	
Monthly depreciation =	$\frac{1700}{12}$	= 142

The total estimated cost of the poultry equipment is ₦ 6000 and this is also depreciated annual for 6 year straight line method with no salvage value. The yearly depreciation is also spread throughout the month by dividing by 12 to get monthly depreciation figure of 83.

Monthly depreciation of poultry building:

Duration	12	Months
Salvage value	0	
Monthly depreciation =	$\frac{1000}{12}$	= 83

Ntow took plans to take an amount of ₦ 10000 from the Agricultural development bank with an annual interest rate of 12 %. This amount which is ₦ 800 per year is spread throughout the year with a monthly payment of ₦ 67 . He intends not to pay himself salary for the first production year as a result, salary does not form part of the expenses.

Since the layers are not yet sold, the cost of buying the day old chicks are not taken into consideration here. This CVP analysis is based on the production and sales of egg in the business . At the end of the production cycle a separate profit or loss can be done by the business and the variable cost of the day old chicks will be taken into consideration.

Appendix one is a table that shows the excel calculation of the various components of the CVP as well as the questions asked by Ntow. All the different formulas explained by managerial accounting authors could be used to answer these questions. The first column shows the units produced at every month and that corresponds to the cost and volume structure of the business. The sales value, the variable cost and the contribution margin are shown in total value. With the given number of units, it is easy to find the per unit variable cost or contribution margin per unit. Also Ntow is able to do some sensitive analysis regarding the future for instance what will happen if selling price increase by 5% due to market forces or increase in cost of production.

The only thing to be done is to add the increased amount to current price and excel updates. This applies to the variable cost and the fixed cost.

Starting from the breakeven, and using the formula (2) Fixed cost / contribution margin per unit, the total fixed cost of 1107 is used throughout and the contribution margin per unit is obtained by deducting the variable cost per unit of 0.52 from the unit price of 0.6 to get 0.08 Therefore

$$\frac{1107}{0.08}$$

This gives us approximately 13838 units. That means that Ntow, would have to get 13838 eggs monthly in order to cover both his fixed cost and the variable cost as well. At this point in production, he will neither make profit or loss. Selling below this units will mean making loss and above this units will mean profit. The breakeven value will be  $13838 \times 0.6$  (selling price per unit) = ₦ 8303. Earning this amount monthly will help him breakeven.

If the equation method is used: (1) we still arrive at the same point. The calculation thus becomes

$$(USP \times Q) - (UVC \times Q) - FC = 0$$

$$(0.6 \times Q) - (0.52 \times Q) - 1107 = 0$$

$$0.6Q - 0.52Q = 1107$$

$$0.08Q = 1107$$

$$Q = 13838$$

Using the contribution margin ratio percent: (3) the ratio is first calculated as

$$\frac{0.08}{0.60} \times 100 = 13.3\%$$

$$\begin{aligned} \text{Therefore, breakeven} &= \frac{1107}{13.3\%} \\ &= \text{₱ } 8303 \end{aligned}$$

This amount however is in value so by dividing by the unit price of ₱ 0.60, we get approximately 13838 units of eggs.

### 4.3.3 Operating income

In the excel sheet, target operating profit is obtained by deducting the total cost from the total sales value. It is noted that the business have negative operating income in the first 6 months when the laying of eggs began. So there is an operating loss at this stage. This however change from the seventh month and the business starts to make profit. The last column in the excel sheet of appendix 1 shows the operating profit and the operating loss at the various units of eggs produced in



the business. If Ntow wants to know how much to sell to reach a targeted profit then the excel sheet (targeted income) is used.

Figure 5. Targeted operating profit at various units of production with known CVP variables

		Number of units to be sold at		0.6 cedis	
		selling price to earn target operating income of;			
Fixed Cost	Variable cost	0	GHC	2,000	GHC 3,000
		Break even Point			
	per unit				
1107	0.52	13838	38838	51338	76338

Given the fixed cost, the selling price per unit and the variable cost per unit, we are able to find how much to sell to get the targeted profit. The target profit in the excel sheet is assumed, Ntow only has to change and put the right amount and the excel file automatically updates the right amount.

The formula (2) used is,

$$\frac{\text{Fixed cost} + \text{target operating profit}}{\text{Selling price per unit} - \text{variable cost}}$$

Selling price per unit – variable cost

The result obtained is in units so to change into sales value; we multiply by the selling price per unit which is ₵ 0.60. It must be noted that the denominator of the equation above is the same as the contribution margin per unit.

#### 4.3.4 Breakeven chart

Appendix 2 show the breakeven chart of Ntow egg production, basically it is the representation of the results obtained in the calculations made in the excel sheet of appendix 1. Any changes made in the calculations also automatically cause a change in the graph. The key at the top of the graph shows the fixed cost line which is in red, the total sales in blue and total cost in Green. Units produced are

in the x axis and the total sales in the y axis. It is assumed that units of eggs produced increases by 4000 monthly.

At 0 units of production, fixed cost still occurs and that means that before the birds start laying, utility, transportation and all the other cost are still occurring monthly. The breakeven point, denoted by the violet square is where the total fixed cost and the total sales revenue lines intersects and we trace the units from the x axis as the little violet square points.

Below this point on the graph or to the left, the business makes losses and above this point or to the right is the profit zone. Above approximately 13838 units, profits starts coming into the business.

The margin of safety is the distance between the breakeven profit and the total revenues and in this case the total revenues is approximately ₦ 26400 accounting for about 44000 units of eggs and the breakeven point as known already is 13838 which in value is ₦ 8303 so the margin of safety = ₦ 26400 - ₦ 8303 and the result is ₦ 18097. The margin of safety in units is therefore the budgeted sales in units – the breakeven in units which gives us  $44000 - 13838 = 30162$  units. This in percentage of the total sales is

18097

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26400

=68.5% and this means that revenues would have to decrease substantially by 68.5%, before it reaches breakeven revenue

Since the business is very much interested in net profit, It might want to know how much to sell to earn a targeted net income (after tax is deducted from OP). In this

case, we first find the target operating income including tax and then find the units that will enable the business to achieve the OP.

Figure 6. Target net income taking tax into consideration

Achieving target operating income		
Tax rate	Target net Income	Target operating income
0.4	3200	5333

The second calculation in the excel sheet, targeted operating profit, shows how targeted operating profit is obtained in value when given the tax rate and the net income the business wishes to achieve.

$$\begin{array}{r} 3200 \\ \hline 1 - 0.40 \\ = \text{₹ } 5333 \end{array}$$

We are able to find the equivalent units based on the given FC, VC and price per unit by using the equation method which is applied in the target operating profit excel sheet calculation. So we find how many units we can sell with the contribution margin formula (2), given fixed cost and variable cost, to be able to earn ₹ 5333.

Thus ;

$$\begin{array}{r} 1107 + 5333 \\ \hline 0.08 \\ = 80500 \text{ units} \end{array}$$

## 5 RECOMMENDATIONS AND CONCLUSION

With all the analysis and the results obtained, the following recommendations are important to take note of.

Not all cost maintains the same relationship with the volume of production over the entire production period and volume range. Due to the frequent change in prices of goods and services, it is possible that fixed cost could change twice or thrice in the production year therefore the business could open a new excel sheet where this change will be recorded.

This is because the format for the calculation is such that fixed cost remains the same throughout the production year as stated as one of the assumptions in the CVP analysis. So if fixed cost change in the 5<sup>th</sup> month and the change is applied on the excel sheet, the whole calculation including that of the previous months will reflect the new cost structure but with the new sheet, it will be easier to check the CVP analysis of the previous months.

Fixed cost such as electricity and transportation could be cut down to increase the profit margin. Most of the costs as identified in layers production are fixed so if the manager wants to cut down cost then it is a much focused area to look at. Buying poultry feed and other materials in bulk could help reduce monthly transportation cost. Also electricity cost could be reduced if there is plenty of sunshine in the poultry house during the day.

The margin of safety of 68.5% is very high and it's good for the business, Ntow should check proper feeding and good poultry management practice so that the business can maintain this standard.

It is important to note that the variable cost may not increase at the same constant cedi per unit and this due to the fact that at some point in the egg production, the units produced will remain approximately constant or even, throughout the rest of the production period (Yeboah, 2015). Because of this, the linear assumption must

be carefully looked into in other to avoid mistakes. Again fixed cost such as vaccination may reduce at the later part of the production cycle.

Even though the whole CVP analysis and calculations are based on the relevant range of producing 1000 birds, it is prudent if the manager can estimate or adjust the units to about 950 in the CVP analysis calculation; this is to make provisions for early birds mortality.

**In conclusion**, the result shows that this business is a profitable venture to go into and in case of variances from these calculations; it will not affect the profitability of the business so much. If proper management practices are kept, and production flows as planned, the business has lower risk of making losses but higher possibility of making wide margin of profit as shown by the margin of safety percentage. Ntow needs 13838 eggs monthly to breakeven and beyond this point profit will come into the business. With estimated monthly egg production of 24000, the enterprise is in a very good position to achieve higher profit.

## BIBLIOGRAPHY

- Agrawal, N. (2010). *Principles of Management Accounting*. . Delhi: Asian Books Pvt Ltd, .
- Albrecht et al. (2008). *Accounting concepts and Applications* (Tenth ed.). Mason - Ohio: Thomson learning Inc
- Anang, Yeboah and Agboloso. (2013). Profitability of broiler and layer production in the Brong Ahafo Region of Ghana. *Asian research Publishing network (ARPN)*, 430.
- Arora, M. (2009). *Management Accounting : Theory, Problems and Solutions*. . Mumbai: Himlaya Publishing house.
- Atkinson , kaplan ,Matsumura and Young. (2007). *Management Accounting 5th edition*. New Jersey: Pearson Education.
- Bhimani, Horngren, Datar and Foster. (2008). *Management and cost accounting fourth edition*. London: Pearson Education Limited.
- Braun and Tietz. (2014). *Managerial Accounting fourth edition*. New Hersey: Prentice hall.
- Cafferky, M. (2010). *Breakeven Analysis: The Definitive Guide to Cost-Volume-Profit Analysis*. New York: Business expert Press.
- Crosson & Needles. (2013). *Managerial accounting, 10th edition*. Mason- Ohio: Cengage learning.
- Damerow, G. (2010). *Storey's guide to raising chickens* (Third ed.). USA: Storey publishing.
- Desk Poultry Health today.URL:  
<http://www.thepoultrysite.com/poultrynews/32740/ghanas-broiler-sector-to-get-legup-from-revitalization-project/> .Accessed 10th December 2015.
- Drury. (2006). *Cost and Management accounting, an introduction*. London: Thomson learning.
- FAO. (2014). *Poultry Sector Ghana, FAO Animal Production and Health Livestock Country Reviews*, No.6, Accra.
- FAO. (2009), *The State of the Food and Agriculture Livestock in the Balance*, Rome.
- FAO.(2003). *Egg marketing: A guide for the production and sale of eggs*, Issue 150, Rome.

GAIN.2013.URL: <http://www.thepoultrysite.com/reports/?id=2585> . Accessed 14th January 2016

Ghana web.URL:

<http://www.ghanaweb.com/GhanaHomePage/business/Producer-price-inflation-falls-to-2-8-in-October-396881>. Accessed 27th November 2015

Ghana web.URL:

<http://www.ghanaweb.com/GhanaHomePage/business/Transport-fares-to-go-up-GPRTU-404908>. Accessed 3rd January 2016.

Hansen, Mowen, and Guan. (2009). *Cost Management, Accounting and control. Sixth edition*. Ohio - USA: Cengage learning Inc.

Index Mundi. URL:

<http://www.indexmundi.com/agriculture/?country=gh&commodity=corn&graph=imports>. Accessed 5th January 2016.

Hilton.(1999). *Managerial Accounting, fourth edition*.USA .McGraw-Hill companies.

Hornngren, Datar and Rajan. (2012). *Cost Accounting, A managerial Emphasis . fourteenth edition*. London: Pearson Education.

Madegowda, J. (2007). *Management Accounting*. Mumbai: Himalaya.

Pandey. (2009). *Management accountin: a planning and control approach* 3rd edition . Delhi: Vikas publishing house.

Periasamy. (2010). *Periasamy, P. Textbook of Financial Cost and Management Accounting*. Mumbai, IND: Himalaya Publishing. Mumbai: Himalaya Publishing.

Rajasekaran V and R.Lalitha. (2011). *Cost Accounting*. New Delhi: Dorling Kindersley.

Ramagopal, C. (2009). *Accounting for Managers*. Delhi: New age international.

RVO, (2014). URL:

<http://www.rvo.nl/sites/default/files/2014/10/Pluimveesector%20in%20Ghana.pdf>. Accessed 30th December 2015.

Seminar.(2014). *Poultry Farming in Ghana organised by Koudijs and Shyams*, Accra

walther, and J Skousen 2010. 62.). (2010). *Managerial and cost accounting*. Bookboon.

Weygandt, Kimmel, and Kieso. (2010). *Managerial Accounting: Tools for Business Decision Making,5th edition*. USA: R.R.Donnelley-JC.

Yeboah (15. December 2015). *Layer production. (Interview)*. Accra-Ghana.



## APPENDICES

### Appendix 1. CVP and breakeven Calculation

Assumptions							
Time	Unit start	Units increment	Unit price	Unit variable cost	Total fixed cost		
Month		0	4000	0.6	0.52	1107	
Units	Sales	Variable cost	contribution margin	Fixed cost	Total cost	Operating Income	
0	GHC -	0	0	1107	1107	GHC (1,107.00)	
4000	GHC 2,400	2080	320	1107	3187	GHC (787.00)	
8000	GHC 4,800	4160	640	1107	5267	GHC (467.00)	
12000	GHC 7,200	6240	960	1107	7347	GHC (147.00)	
16000	GHC 9,600	8320	1280	1107	9427	GHC 173.00	
20000	GHC 12,000	10400	1600	1107	11507	GHC 493.00	
24000	GHC 14,400	12480	1920	1107	13587	GHC 813.00	
28000	GHC 16,800	14560	2240	1107	15667	GHC 1,133.00	
32000	GHC 19,200	16640	2560	1107	17747	GHC 1,453.00	
36000	GHC 21,600	18720	2880	1107	19827	GHC 1,773.00	
40000	GHC 24,000	20800	3200	1107	21907	GHC 2,093.00	
44000	GHC 26,400	22880	3520	1107	23987	GHC 2,413.00	
	Break Even Units	Break even value	Label				
	13838	GHC 8,303	BEU approx.=13838				

## Appendix 2 breakeven Analysis

