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CASH BREAK-EVEN POINT ANALYSIS: EVIDENCE FROM BANGLADESH FERTILIZER INDUSTRY

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Abstract

[The importance of fertilizer in Bangladesh industrial structure becomes more evident as we consider the state owned component of the manufacturing sector. Most of the state owned fertilizer industrial units cannot reach break-even point because of subsidized selling price and huge burden of fixed costs especially large volume of non-cash expenses. So, as per the concept of cash break-even point by eliminating non-cash items (such as depreciation which are occurred for fixed cost) from revenues and costs, the break- even point on cash basis can be computed. Cash break-even point is a modification of the traditional accrual basis or profit break-even analysis. The present study aims to calculate the cash-breakeven point because as that point of sales, where cash revenues are equal to cash costs. In other words, if the authority can eliminate or reduce the non-cash items from revenues and costs, the factories can be reach break-even point. The study also tried to find out the influencing factors on the cash break-even point. It has been found that sales quantity, fixed cost and variable costs are the influencing factors on cash break-even point.]

1. Introduction

Agriculture is the largest employment sector in Bangladesh and as of 2016; it employs 47% of the total labor force and comprises 16% of the country's GDP. The performance of this sector has an overwhelming impact on major macroeconomic objectives like employment generation, poverty alleviation, human resources development and food security (Wikipedia.org/Agriculture_in_Bangladesh) and fertilizer plays an important role in increasing crop yields. In past few decades fertilizer has been a crucial component of agricultural sector as value added of Bangladesh agriculture which is 'overwhelmingly' dominated by crops. Urea dominates the fertilizer consumption in Bangladesh (Mahmood: 1995). A major share of fertilizer demand has meet from the local production of fertilizer and it is the 6th largest fertilizer producer in Asia and occupies 28th position in the world and understandably, this production industry occupies a prominent position in the manufacturing sector of Bangladesh. The sector has been recipient of substantial public investment in second half of 1980s. The importance of fertilizer in Bangladesh industrial structure becomes more evident as we consider the state owned component of the manufacturing sector (BCIC: 2005-06: 5). But during the last few years, this sector has been suffered huge operating losses. So it is necessary to find out the causes of such types chronic situation of operating losses of fertilizer industry. Every fertilizer factory has huge investment in fixed costs (Leyaket: 2013). Due to the huge burden of fixed cost most of the factory cannot reach at break-even level of production. The fixed and variable cost of various fertilizer factories are increased

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due to various causes. Such as fixed cost has an increasing tendency due to increase of salary and allowances, depreciation, payment of interest on loan, purchasing price of loose tools, overhauling of machinery, administrative cost and insurance. On the other hand various variable costs also increased day to day such as gas and electricity prices, packing materials, maintenance etc. (Leyaket: 2013). So an attempt has been made for analyzing cash break-even point of fertilizer industry because Cash break-even point is a modification of the traditional accrual basis or profit break-even analysis by which government can determine the level of sales to maintain solvency considering the various demands for cash placed upon the entity. In this connection it is mentioned that the price of fertilizer in the country have not fixed-up by adjusting the cost of production. It is fixed up by the government at a subsidized rate due to various social and economical reasons (Ahmed, 1997:45-61). So, it has found that most of the fertilizer factories are in the red, although the units would appear viable if they are allowed to sell at border price instead of administered sales price. As per subsidy policy of agriculture sectors government administered the selling price of fertilizer of state owned fertilizer factories. So long if there are sufficient cash flows, it may be optimal to continue the operations, even though there is an accounting loss. Here the break-even sales are expected to recover only cash outlays, and such depreciation will have to be deducted from total fixed costs (Nigam & Sharma, 1992:56).

2. Objectives of the Study

The main objective of the study is to analyzing the Cash Break-Even Point of the selected fertilizer factories of Bangladesh. The specific objectives of the study are given below:

i. to determine the Cash Break-even point of the sample fertilizer factories of during the study period in relation to sales in Taka, sales in units during the period of 2005 to 2015;

ii. to determine the influencing factors on the Cash Break-even point of the sample fertilizer factories; and

iii. to identify the major problems of the fertilizer industry to reach break-even point and make suggestions to overcome the problems.

3. Review of Related Literature

For the purpose of the study, a modest attempt has been made to review the relevant articles, research works etc. Some reviews are cited below:

M. Boopathy Raja et al. (2016) prepared a research paper on “Break-Even Analysis of Swine Farming in North-Eastern Tamil Nadu, India**”.** The research was conducted in north-eastern agro climatic zone of Tamil Nadu State, India with the objective of identifying Break-even point of output in swine farming. They have used the Break-even Analysis to identify the Break-even point in swine farming in study area.

Nakhoul, Safieddine (2016) conducted a study on "Carbon Break Even Analysis: Environmental Impact of Tablets in Higher Education". This paper looks at an important aspect of tablets; their carbon footprint. Studies have suggested that tablets have positive impact on the environment; especially since tablets use less energy than laptops or desktops. This study sets to answer a key question: What is the break-even analysis point when saving on printed paper offsets the carbon footprint of producing and running the tablet in higher education.

Hilaire, Krause et al. (2016) made a study on "Break-even analysis for a green crab fishery in PEI, Canada." They determined the break-even price that fishers would require for green crabs under different fishing scenarios.

Jones, Spain et al. (2015) made an article entitled "Improving Immunizations in Children: A Clinical Break-even Analysis." This article describes a resident-led continuous quality improvement project to improve the immunization rates of children less than 3 years of age at two urban family medicine residency clinics in Salt Lake City, Utah, as well as a break-even cost analysis to the clinics for the intervention.

Mayta, Popp, Dong (2014) in their research work "Break-Even Profitability for Food-Grade Specialty Soybeans" evaluated the profitability of small-seeded, large-seeded, and high-protein specialty soybeans using break-even (BE) analysis to establish guidelines for cultivar selection and adoption based on economic feasibility.

Meena, Sen et al. (2013) conducted study on "Economics of Garlic Production in Baran District of Rajasthan; Break Even Analysis." The study focuses on economic analysis of garlic production in the Baran District of Rajasthan. The study is carried out to determine break even analysis and constraints of garlic production in the study area.

Tarzia (2016), conducted a research work on "Properties of the Financial Break-Even Point in a Simple Investment Project As a Function of the Discount Rate." From their point of view, this result was the first time which is obtained by a simple invest-ment project being the cornerstone of our proof the explicit expression of the net present value and the corresponding financial break-even point value.

Yunker & Schofield (2005), conducted a study entitled "Pricing Training and Development Programs Using Stochastic CVP Analysis". They described and applied a CVP model under uncertainty which is specifically designed to deal with the price-setting problem and developed a simpler model than many of the CVP model under uncertainty in the extensive research literature.

Purohit & Bhattacharjee (1992) prepared a research paper on "Uses of CVP Analysis for Managerial Planning". They discussed the various uses of C-V-P analysis for managerial decision making.

Mohiuddin & Jahur (1992) made a study on "Cost-Volume-Profit analysis-A Case Study in a Selected Enterprise Under Bangladesh Chemical Industries Corporation". They examine the techniques used in the Cost-Volume-Profit analysis, purpose of CVP analysis and to evaluate the short term performance of the sample units.

Ahmed & Firozzaman (1994) in his article on "Cost-Volume-Profit Analysis: Mathematical Approach to Determine Suitable Combination of Business Activity" discussed the accountants approach and the economic approach to C-V-P model and found that in the accountants approach the C-V-P model is linear so its solution to obtain BEP is almost easy but in the economic approach the C-V-P model is curvilinear so the profit equation may be quadratic or cubic.

From the above study it has found that most of the researchers were conducted research activities on traditional break-even point analysis at home and abroad. But most of them were theoretical in nature. Few of the empirical studies in Bangladesh have been done based on secondary data without the detailed analysis of the industrial units. Sectoral coverage was also ignored in most cases. But the last decades, fertilizer sector has been suffered huge operating losses. This loss suffers due to severe inefficiencies. So it is necessary to find out the causes of such types chronic situation of operating losses.

4. Methodology of the Study

The study has been based on secondary data and information. In achieving the research objectives published materials were taken from various sources and evaluated them in the light of the purpose. The main source of secondary data is the annual reports of the concerned enterprises. The fertilizer industry in Bangladesh are mainly under the control of government, i.e., in the public sector. The study were covered 4 (four) nationalized fertilizer factory out of 7 (seven) under Bangladesh Chemical Industries Corporation (BCIC).The study has selected 4 (four) fertilizer factory on the basis purposive and stratified (according to production capacity) sampling technique, considering the easy accessibility of data. Research samples were covered 60% of the total nationalized fertilizer units and thus we can say that our sample units are the representative of the fertilizer industry. The study has not selected private sector companies because of non-availability of data. The sample fertilizer factories are: i) Chittagong Urea Fertilizer Factory Ltd. (CUFL); ii) Jamuna Fertilizer Company Ltd. (JFCL); iii) Zia Fertilizer Company Ltd. (ZFCL); iv) Urea Fertilizer Factory Ltd., Ghorasal (UFFL). To achieve the objectives of the study the Break-even analysis were presented mathematically by establishing algebraic relationship between cost, volume, and profit.

If, S = Sales price per unit

U = Total output units, i.e. volume of activity

F = Fixed cost

V = Variable cost per unit

P = Profit

Contribution Margin = $U \times S - U \times V$

Contribution Margin per Unit $= \dfrac{\text{Contribution}}{\text{Total Output Units}}$

$$= \frac{U \times S - U \times V}{U}$$

Contribution Margin Ratio (P/V ratio) $= \dfrac{\text{Contribution Margin}}{\text{Total Sales Revenue}}$

$$= \frac{U \times S - U \times V}{U \times S} = \frac{S - V}{S}$$

Sales = Total cost + Profit = (Fixed cost + Variable cost) + Profit

Or, U x S = (F+U) x (V+P)

At Break-even, P = 0,

So, U x S = F + U X V

$$\text{Or, } U = \frac{F}{S - V}$$

Thus, Break-even point (in units)

$$= \frac{\text{Fixed Cost}}{\text{Sales revenue per unit – Variable cost per uuit}}$$

$$= \frac{\text{Fixed cost}}{\text{Contribution margin per unit}} \qquad (1)$$

If the break-even point is required in Taka sales value (i.e. U X S), the calculation will be as follows:

$U = \dfrac{F}{S - V}$ (from above) or $U \times S = \dfrac{F \times S}{S - V} = \dfrac{F}{(S - V)/S}$

But $\dfrac{S - V}{S}$ = Contribution margin ratio or P/V

Thus, Break-even point in total (in Taka) = $\dfrac{\text{Fixed Expenses}}{\text{P/V}}$ (2)

It may be noted that break-even point in taka sales may also be obtained by multiplying the break-even units by the sales price.

Formula (1) may also be derived from the break-even chart as follows:

If y_1 = Sales revenue

y_2 = Total cost

a_1 = Sales per unit of volume (This represents the slope of the sales line)

a_2 = Variable cost per unit of volume (This represents the slope of the cost line)

x = Volume in units

F = Fixed cost.

The sales line in the break-even chart may be represented by the equation $y_1 = a_1x$, and the costs line may be represented by the equation, $y_2 = a_2 x + F$

When the business break-even,

Sales = Costs, i.e. $y_1 = y_2$ or $a_1x = a_2 x + F$

Or, $x = \frac{F}{a_1 - a_2}$

i.e., Break-even volume

$$\text{in unit} = \frac{\text{Fixed Cost}}{\text{Sales per unit of volume} - \text{Variable cost per unit of volume}}$$

$$= \frac{\text{Fixed Cost}}{\text{Contribution marging per unit}}$$

The cash break-even point has calculated by subtracting non cash outlays from fixed costs in the break-even formulas. The cash break-even formulas are given below (Polimoni & Fabozzi, 1991:685).

$$\text{Cash Break-even Point (in units)} = \frac{\text{Fixed cost} - \text{Non cash outlay}}{\text{Contribution margin per unit}}$$

$$\text{Cash Break-even Point (in Taka)} = \frac{\text{Fixed cost} - \text{Non cash outlay}}{\text{Contribution margin ratio}}$$

The data has analyzed through appropriate statistical tools i.e., mean, standard deviation, variance, multiple regression analysis, test of significance by ANOVA, factor analysis (SPSS-11), and other required techniques. To avoid multicollinearity problems transformation of variables, factor analysis and principal components, variance-inflating factors are worked out for the study. Factor analysis is a general name denoting a class of procedures primarily used for data reduction and summarization. The factor model may be represented as: (Malhotra, 2006: 560-74).

$$X_i = A_{ij} F_1 + A_{i2} F_2 + A_{i3} F_3 + \ldots\ldots\ldots\ldots + A_{im} F_m + V_i U_i$$

Where: X_i = ith standardized variable; A_{ij} = Standardized multiple regression coefficient of variable i on common factor j; F = Common factor; V_i = Standardized regression coefficient of variable i on factor i; U_i = the unique factor for variable i; m = Number of common factor.

5.1 Analysis of Cash Break-Even-Point of the Selected Fertilizer Factories

If a company cannot achieve BEP, the company suffers from losses and faces with the difficulties in mitigate its operating expenses. Not necessarily, the issue can be resolved by computing cash Break-even point. The following sections describe the descriptive statistics of BEP and issues related to cash break-even point analysis of sample fertilizer industry.

Table 1. Descriptive Statistics (Figures in lac)

Factories	Particulars	Average	Standard Deviation	Coefficient of Variation (CV)	AGR (%)	Maximum Level	Minimum Level
		Stat.	Stat.	Stat.	Stat.	Stat.	Stat.
CUFL	BEP (in Taka)	5440.86	2457.86	46.15	22.24	9620.20	2823.31
	BEP (in Units)	108,566.25	48652.35	47.25	25.36	196328.69	56328.98
	M/S (in Taka)	16258.37	4986.85	29.68	18.67	22589.62	4598.78
	M/S Ratio (in %)	72.58	14.25	17.59	(2.68)	87.57	57.69
JFCL	BEP (in Taka)	5807.36	2934.65	56.23	7.29	14286.26	3120.21
	BEP (in Units)	107635.27	52639.89	56.37	1.98	267524.25	69854.67
	M/S (in Taka)	19879.58	6587.25	38.97	114.58	23589.67	1758.45
	M/S Ratio (in %)	71.35	16.57	25.14	15.23	87.58	32.47
ZFCL	BEP (in Taka)	8265.30	6325.32	70.36	28.63	17625.32	2425.36
	BEP (in Units)	168965.68	115625.38	69.36	25.37	358694.89	45986.28
	M/S (in Taka)	12548.62	5897.54	54.69	1.12	17898.68	3546.58
	M/S Ratio (in %)	62.31	29.30	52.34	0.28	89.58	14.52
UFFL	BEP (in Taka)	8560.39	5625.34	62.35	41.26	106.25	3560.28
	BEP (in Units)	189659.58	142369.79	78.69	75.98	540811.25	61592.46
	M/S (in Taka)	8752.64	7002.35	98.67	(125.36)	148597.36	(5897.24)
	M/S Ratio (in %)	42.37	46.12	108.52	(78.5)	76.14	(57.62)

The cash break-even point of our sample units were calculated in terms taka of sales volume. The highest average value of sales volume required reaching break-even point were 8,560.39 lacks Taka in UFFL followed by 8,265.30 lacks Taka in ZFCL, 5,807.36 lacks Taka in JFCL and 5,440.86.36 lacks Taka in CUFL during the study period. The highest stable position in terms break-even point in value of sales volume were in CUFL (C.V 46.15 %) and more unstable position was in ZFCL (C.V 70.36 %) in our study period. The highest average growth to reach cash break-even point in terms of value of sales volume was 41.26 percent in UFFL followed by 28.63 percent in ZFCL, 22.24 percent in CUFL and 7.29 percent in JFCL.

The cash break-even point in terms of production units will be reached when units sold create sufficient revenue to cover their total costs-fixed and variable. The highest average units required to reach break-even point were 142,369.79 MT in UFFL followed by 115625.38 MT in ZFCL, 52639.89 MT in JFCL and 48,652.35 MT in CUFL during the study period. The highest stable position in terms cash break-even point in units were in CUFL (C.V 47.25 %) and more unstable position was in UFFL (C.V 78.69 %) in our study period. The highest average growth to reach break-even point in terms of units was 75.98 percent in UFFL followed by 25.36 percent in CUFL, 25.37 percent in ZFCL and 1.98 percent in JFCL. The index number indicated that the highest increase of units of required break-even quantity was 45.06 percent in ZFCL followed by 14.19 percent in CUFL, 12.87 percent in CUFL and the remaining sample unit have negative growth rate.

The excess of actual or budgeted sales over the break-even sales is known as the margin of safety. The margin of safety indicates the extent to which sales may fall before the firm suffers loss. The above table indicated that all sample units provides positive average margin of safety such as, 19879.58 lacks Taka in JFCL followed by 16,258.37 lacks Taka in CUFL, 12,548.62 lacks Taka in ZFCL and 8,752.64 in UFFL during the study period. The more stable position of margin of safety was in CUFL (C.V 29.68 %) and more unstable position was in UFFL (C.V 98.67 %) in the study period.

The margin of safety can be expressed as a percentage of sales. Table no. 01 indicated that all sample units provides positive average margin of safety ratio such as 72.58 times in CUFL followed by 71.35 times in JFCL and 32.31 times in ZFCL and 42.37 times in UFFL during the study period. The margin of safety ratio was more stable position in CUFL (C.V 17.59 %) and more unstable position was for UFFL (C.V 108.52 %) in our study period. The two sample units reveals average negative growth rate of margin of safety ratio such as (78.59) percent in UFFL followed by (2.68) percent in CUFL and the remaining sample units have positive growth.

5.2 Factor Analysis of Cash Break-Even-Point of the Selected Fertilizer Factories

Table 2. KMO and Bartlett's Test of All Factories Cash BEP on the Basis of Actual Figures.

Kaiser-Meyer-Olkin (KMO) Measure	Sampling Adequacy	0.614
Bartlett's Test of Sphericity	Approximate Chi-square	314.628
	Degree of freedom	30
	Significance	0.001

The results of Kaiser-Meyer-Olkin (KMO) and Bartlett's test of Cash Break-Even Point (BEP) of all factories for the study period shows in Table no. 02 Bartlett's test of sphericity reveals that the approximate chi-square is 314.628 with 30 degrees of freedom at 0.05 levels. KMO measures the adequacy of samples to examine the appropriateness of factor analysis. Higher values between' (0.5 to 1.0) indicate factor analysis is appropriate. Values below 0.5 imply that factor analysis may not be appropriate. KMO's value is 0.614 indicates that the factor analysis is an appropriate technique.

Table 3. Total Variance Explained of All Factories Cash BEP on the Basis of Actual Figures.

Variables	**Initial Eigen Values**		
	Total	**% of Variance**	**Cumulative %**
1	3.739	47.482	47.482
2	2.161	27.983	75.465
3	0.783	10.048	85.513
4	0.572	7.416	91.802
5	0.327	4.102	95.904
6	0.239	2.105	98.009
7	0.078	1.982	99.991
8	0.029	0.009	100.000

From the Table no. 03 we find that the eigen values are greater than 1 results two factors being extracted. It tells that the Cash Break-Even-point (BEP) of all factories depend on two major factors. From the cumulative percentage of variance accounted for 75.465 percent and the remaining variables collectively explain (100-75.465) 24.535 percent. Hence we can reduce the number of variables from 8 to 3 for all the factories of the study period.

Table 4. Rotated Component Matrix of All Factories Cash BEP on the Basis of Actual Figures

Variables	Components	
	1	2
X_1	0.932	
X_7	0.914	
X_5	0.869	
X_3	-0.631	
X_6	0.527	
X_2		0.774
Y		0.765
X_4		0758

(Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.)

To elaborate the fact that different variables are related to different dimension (factors), the Table no. 04 showed the rotated component matrix. In the table, we can see how rotation achieves simplicity and enhances interpretability. It was found that variable $X_{1,}$ $X_{7,}$ $X_{5,}$ X_3 and X_6 are correlated with factor 1. Remaining variable $X_{2,}$ X_4 and Y are correlates with factor 2 after correlate. Here rotated value less than 0.5 has been reduced with the help of the program.

5.3 Stepwise Multiple Regression Analysis for Measuring Influencing Factors on Cash Break-Even-Point

On the basis of factor analysis and to justify the value of KMO the following six (out of seven) explanatory variables were taken into consideration for stepwise multiple regression analysis.

1. Y = Break-Even Point (BEP);
2. X_1 = Actual sales quantity;
3. X_2 = Fixed Cost;
4. X_3 = Variable cost per unit;
5. X_4 = Variable cost;
6. X_5 = Contribution;
7. X_7 = Capacity utilization.

Table 5. Step Wise Regression Analysis of Cash BEP of CUFL

	Coefficient	X_7	X_3	X_2	R^2	R_a^2	F-Ratio	Sig.
Step-1	147887.2	-0.092			0.039	-0.066	0.324	0.585
T-Stat	2.027	-0.578						
Step-2	*-54335.7	*-0.023	*6765389		0.627	0.520	6.966	0.017
T-Stat	-0.690	-0.225	3.533					
Step-3	**-3480.33	**-0.174	**3220055	**49.07	0.854	0.880	15.160	0.001
T-Stat	-0.066	-1.996	1.836	3.439				

*Significance at 5% Level.
**Significance at 1% Level.

Table no.05 depicts the step-wise regression analysis of cash break-even point of CUFL for the study period. It reveals that X_7 (production quantity) appeared as the first explanatory variable to explain the cash break-even point of CUFL. Production quantities explain only 3.39 percent of variations in cash break-even point. One unit in actual production quantity will decrease 0.095 units of overall cash break-even point. With the introduction of next variable X_3 (variable cost per unit), value of R square (R^2) largely increased from 0.039 to 0.627 of previous steps and both the explanatory variables jointly explain 62.70 percent of variations in cash break-even point of CUFL. Finally the introduction of variable X_2 (fixed cost) the R square (R^2) is tremendously increased at 0.854 and the three variables collectively explain 85.4 percent (14.60 percent cannot explain) of variations in cash break-even point of CUFL. The adjusted Square (R_a^2) also reached 0.880 for the study period which indicates minimum error in the analysis. F-ratios revealed that the equations in steps 1 were insignificant but step 2 and 3 were significant. T-values disclosed that explanatory variable X_3 and X_2 was significant at 5 percent level and 1 percent respectively. The highest and the lowest VIF were 1.889 and 1.000 respectively. Thus we may conclude that there is no reason to suspect of multicollinearity for measuring cash break-even point of CUFL. This factory shows that variable X_2 (fixed cost) and variable X_7 (actual production quantity) and X_3 (variable cost per unit) is sufficient to explain the cash break-even point of the factory. So, it is said the equation is the best model for predicting the cash break-even point of CUFL during the study period.

Table 6. Step Wise Regression Analysis of Cash BEP of JFCL

	Coefficient	X_7	X_2	R^2	R_a^2	F-Ratio	Sig.
Step-1	79739.41	0.068		0.032	-0.078	0.222	0.648
T-Stat	1.313	0.571					
Step-2	**99484.6	**-0.016	**105.20	0.889	0.841	26.298	0.000
T-Stat	-2.759	-0.296	6.259				

*Significance at 5% Level.
**Significance at 1% Level.

Table no.06 indicates that the stepwise regression analysis of cash break-even point of JFCL for the study period. The table shows that the variable X_7 (actual production quantity) appeared as the first explanatory variable and the variable explained only 3.20 percent variations of cash break-even point. One unit increase in actual production quantity will lead to 0.066 units increase in cash break-even point. With the addition of next variable X_2 (fixed cost), both the explanatory variables jointly explain 88.9 percent (11.10 percent cannot explain due to constraints) of variations in cash break-even point of JFCL and one unit increase in X_2 (fixed cost) will lead to increase 112.30 units in cash break-even point with the association of variable X_7. The adjusted square (R_a^2) also reached 0.841 for the study period and at this stage there is no error in the analysis. F- Ratios revealed that the equations in step 1 were insignificant and 2 are significant. T-values disclosed that explanatory variable X_2 is significant at 1 percent level. The highest and the lowest VIF are 1.887 and 1.000 respectively. This factory shows that variable X_2 (fixed cost) is sufficient to explain the cash break-even point of the factory.

Table 7. Step Wise Regression Analysis of Cash BEP of ZFCL

	Coefficient	X_2	X_1	X_4	R^2	R_a^2	F-Ratio	Sig.
Step-1	**-5746.55	**61.82			0.887	0.889	89.443	0.000
T-Stat	-0.408	9.557						
Step-2	**73086.90	**59.726	**-0.171		0.926	0.886	43.79	0.000
T-Stat	0.758	9.009	-0.944					
Step-3	**-157911	**42.815	**-0.09	**22.979	0.980	0.968	85.679	0.000
T-Stat	-2.012	8.785	-0.815	4.076				

*Significance at 5% Level.

**Significance at 1% Level.

Table no.07 depicts the step-wise multiple regression analysis of cash break-even point of ZFCL for the study period. It reveals that X_2 (fixed cost) appeared as the first explanatory variable to explain the cash break-even point of ZFCL. Fixed cost explains 87.90 percent of variations in cash break-even point. One unit in fixed cost will increase 61.82 units of overall cash break-even point. With the introduction of variable X_1 (actual sales quantity), value of R square (R^2) slightly increase to 0.926 and after the introduction of variable X_4 (variable cost) the explanatory variables jointly explain 98.00 (only 3.00 percent cannot explain) percent of variations in cash break-even point of ZFCL. The adjusted Square (R_a^2) also reached 0.968 for the study period which indicates minimum error in the analysis. F- ratios revealed that the equations in steps 1,2 and 3 were significant. T-values disclosed that explanatory variable $X_{2,}$ X_1 and X_4 was significant 1 percent level. The highest and the lowest VIF were 1.815 and 1.000 respectively. Thus we may conclude that there is no reason to suspect of multicollinearity for measuring cash break-even point of ZFCL. This factory shows that variable X_4 (variable cost) and X_2 (fixed cost) is sufficient to explain the cash break-even point of the factory. So, it is said the equation is the best model for predicting the cash break-even point of ZFCL during the study period.

Table 8. Step Wise Regression Analysis of Cash BEP of UFFL

	Coefficient	X_2	X_1	X_3	X_4	R^2	R_a^2	F-Ratio	Sig.
Step-1	*-239364	*225.493				0.490	0.41	8.87	0.014
T-Stat	-1.67	2.989							
Step-2	*-45507.3	*237.37	*-0.617			0.509	0.376	4.31	0.049
T-Stat	-0.127	2.977	-0.574						
Step-3	-144999	196.918	-0.542	5233158		0.524	0.332	2.823	0.107
T-Stat	-0.368	1.843	0.587	0.740					
Step-4	-161086	234.980	-0.045	6695601	-23.92	0.587	0.239	2.116	0.182
T-Stat	-0.186	2.031	-0.032	0.760	-0.835				

*Significance at 5% Level.
**Significance at 1% Level.

The stepwise multiple regression analysis of cash break-even point of UFFL for the study period represents in the Table no.08. It reveals that variable X_2 (fixed cost) appeared as the first explanatory variable to explain the cash break-even point of UFFL. Variable X_1 (fixed cost) explains only 49.00 percent (a lion percent 51 cannot explain due to several constraints) of variations in cash break-even point. With the introduction of next variables X_1 (actual sales quantity), X_3 (variable cost per unit) and X_4 (variable cost), all the explanatory variables explain 58.70 percent of variations in cash break-even point. The adjusted Square (R_a^2) also reached 0.239 for the study period which indicates minimum error in the analysis. F- ratios revealed that the equations in step 1 and in step 2 were significant. T-values disclosed that explanatory variable X_2 and $X_1$was significant at were at 5% level. The highest and the lowest VIF were 1.986 and 1.000 respectively. Thus we may conclude that there is no reason to suspect of multicollinearity for measuring cash break-even point of UFFL. UFFL shows that if variables X_1 (actual sales quantity) and X_2 (fixed cost), X_4 (variable cost) were increased then the cash break-even point will reach the factory. So, it is said that equation in step 4 is the best model for predicting the cash break-even point of UFFL during the study period.

Table 9. Step Wise Regression Analysis of all Factories Cash BEP

	Coefficient	X_1	X_2	X_5	R^2	R_a^2	F-Ratio	Sig.
Step-1	229321.3	-0.316			0.048	0.020	1.981	0.166
T-Stat	3.671	-1.307						
Step-2	**120604.9	**-0.286	**62.564		0.552	0.489	23.523	0.000
T-Stat	2.312	-2.476	6.676					
Step-3	**54353.29	**0.302	**-21.9	**55.863	0.750	0.660	34.294	0.000
T-Stat	1.400	2.144	7.290	-5.373				

Table no.09 depicts the step-wise regression analysis of cash break-even point of all factories for the study period. It reveals that X_1 (actual sales quantity) appeared as the first explanatory variable to explain the cash break-even point of all factories.

Actual sales quantity explains only 4.80 percent of variations in cash break-even point. One unit in actual sales quantity will decrease 0.219 units of overall cash break-even point of all factories. With the introduction of variable X_2 (fixed cost), value of R square (R^2) increased from 0.048 to 0.552 of previous steps and both the explanatory variables jointly explain 52.20 percent (47.80 percent cannot explain due to constraints) of variations in cash break-even point of all factories. After the introduction of variable X_5(contribution), the three variables collectively explains 75.00 variations in cash break-even point of all factories. The adjusted Square (R_a^2) also reached 0.660 for the study period which indicates minimum error in the analysis. F- ratios revealed that the equations in steps 1 was insignificant and steps 2 and 3 were significant. T-values disclosed that explanatory variable $X_{1,}$ $X_{2,}$ and X_5 was significant 1 percent level in step 2 and 3. The highest and the lowest VIF were 1.655 and 1.00 respectively. Thus we may conclude that there is no reason to suspect of multicollinearity for measuring cash break-even point of all factories. This factory shows that variable X_5 (contribution) and X_2 (fixed cost) is sufficient to explain the cash break-even point of the factory. So, it is said the equation is the best model for predicting the cash break-even point of all factories during the study period.

6. Hypotheses Testing

Hypothesis No. 01

***H_o*: There is no significant difference of Cash Break-Even Point (BEP in Taka) among the selected fertilizer factories.**

ANOVA Single Factor analysis have been done to compare the cash Break-Even Point (BEP) in Taka among the selected fertilizer units and were tested the above hypothesis. The results of this analysis are shown by the following hypothesis.

Table 10. ANOVA: Single Factor

[**Cash Break-Even Point (in Tk.) of Selected Units**]

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	100273442	3	33427782	1.985	0.134	2.821
Within Groups	745500152	45	17920458			
Total	845773594	48				

Inference: Table 10 shows that there is no significant difference among the selected fertilizer factories in respect of cash Break-Even Point (BEP) in Taka since the calculated value F is lower than the table value i.e.; 1.985<2.821 of the study period.

Hypothesis No. 02

***H_o*: There is no significant difference of Cash Break-Even Point (BEP) in unit among the selected fertilizer factories.**

Table 11. ANOVA: Single Factor.

[**Cash Break-Even Point (in unit) of Selected Units**]

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	5.394E+10	3	1.8E+10	1.887	0.146	2.818
Within Groups	4.192E+12	45	9.54E+09			
Total	4.74E+12	48				

Inference: Since the calculated value F is smaller than the table/critical value i.e.; 1.887>2.818 with 3,44 degrees of freedom at 5 percent level of significance, the hypothesis is accepted and there is no significant difference among the selected fertilizer factories in respect of cash Break-Even Point (BEP) in units during the study period.

Hypothesis No. 03

***H_1*: There is a significant positive correlation of Cash Break-Even Point (BEP) with actual sales revenue and actual production units of the selected fertilizer factories.**

Multiple correlations have been done to test the above hypothesis of BEP with actual sales revenue and actual production units which are shown below.

Table 12. Correlation Coefficients of Cash Break-Even Point with Actual Sales Revenue and Actual Production Units

Items	CUFL	JFCL	ZFCL	UFFL
Actual Sales Revenue	-0.011	-0.217	0.272	*-0.496
Actual Production Units	-0.178	0.149	-0.473	**-0.637

* Significant at 5 percent level.
** Significant at 1 percent level.

Table no. 12 shows the correlation coefficients of Break-Even Point (BEP) with actual sales revenue and actual production units for the selected fertilizer factories for the study period. The CUFL, Break-Even Point (BEP) had negative correlation both sales revenue and actual production units, i.e.; (0.011) and (0.178). The correlation coefficients were insignificant.

In case of JFCL there have positive correlation of BEP with production units i.e.; 0.149 and negative correlation with sales revenue i.e.; (0.217) and in both cases correlation coefficients were insignificant.

In case of ZFCL it was found that there have positive correlation of BEP with sales revenue i.e.; 0.272 and negative correlation with production units i.e.; (0.473) and in both cases correlation coefficients were significant.

In the UFFL Break-Even Point (BEP) indicates negative correlation of with sales revenue and production units i.e.; (0.496) and (0.637) respectively for the study period.

This hypothesis is not accepted. As per business norms Break-Even Point (BEP) should be positively correlated with sales revenue and production units. But most of the factories fail to maintain these norms.

7. Conclusions and Recommendations

From the above analysis and findings it could be concluded that the all the fertilizer factories has reached the cash break-even point, although they have suffer huge operating losses. It has possible because by eliminating non-cash items from revenues and costs for calculating the cash break- even analysis point. By using the cash break-even point the management may desire to know the volume of sales that will equal the cash outflows during a particular period. This examination of the impact of the volume of activity on cash or marking capital enables the management to know if it is possible to operate at a loss and still generate positive cash flows. Stepwise regression analysis of all selected factories reveals that per unit selling price, variable cost per unit and fixed costs are the influencing factors of cash break-even point. From the understanding of the study we suggest the following measures to be undertaken to increase the performance of fertilizer industry in Bangladesh:

- Due to the huge burden of fixed cost most of the factory cannot reach at break-even level of production. This has proved by calculating cash break-even point where non cash outlays such as fixed depreciation costs were not considered. In case of cash break-even point all the factories reached at break-even point of production. So the authority should take initiative to reduce huge burden of fixed cost of fertilizer factories.
- The authority should take necessary initiative for increasing margin of safety. It can be increased in several ways, such as by increasing the selling price of fertilizer, reducing fixed and variable cost of fertilizer, increase the level of production etc.
- The management of fertilizer factories can be improved P/V ratio by increasing the selling price, reducing the marginal costs by effectively utilizing men, machines materials and other services.
- It was observed that the price of fertilizer in the country have not fixed-up by adjusting the cost of production. It is fixed up by the government at a subsidized rate due to various social and economical reasons. So, it has found that most of the fertilizer factories are in the red, although the units would appear viable if they are allowed to sell at border price instead of administered sales price.
- The basic raw material for fertilizer factories are natural gas. Due to the short supply of natural gas sometimes operation of the factories were stopped during our study period and cannot utilized their full capacity. So, it is necessary to continuous supply of gas.

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