

# Appraisal of Management Performance of Small/Medium Sized Enterprise (SME's) in the Manufacturing Sector using Multiple Regressions (Yasimo Plastic Company a Case Study)

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## ABSTRACTS

The goal of any business enterprise is to make profit. Profit planning and profit maximization is measured based on certain key performance indicators and all these are considered in the budget. Management utilizes these essential factors to assess the effectiveness of the process and how decisions can be influenced in achieving the main objective of the company. In this study we appraised the performance of Yasimo Plastic Company limited using its total annual profit, total annual sales and total annual expenses. Multiple Regression analysis was run with SPSS to predict profit from sales and expenses. The result shows that these variables statistically insignificantly predicted profit.

**Keywords:** Small/Medium Sized Enterprise, Multiple Regression, Budget And Case Study.

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## 1. INTRODUCTION

The recent economic recession and financial difficulties has affected many small and medium sized business enterprises. This has reduced employment opportunities, lowered production, created inflation and imbalance of trade especially in Nigeria with a mono economy. Nigerian small and medium sized enterprises have experienced challenges associated with expenses as a result of operational costs, production costs and total sales shortcomings.

Nigeria is a developing economy and investors have learnt by experience to be very careful while investing their funds in business enterprise given the present economic situation. It becomes imperative for management of business establishment to convince possible investors of the profitability of their business venture that will guarantee growth and return on investments.

Although, there are different definitions of SME's, the World Bank defines SME's as enterprises having not less than 300 employees with total annual sales of 15 million US dollars (Brian 1991). The National council of Industries defined small/medium sized enterprises as business enterprise whose total costs excluding land is not more than two hundred million naira(#200,000,000.00) naira only ( Onugu etal, 2005).

Small and medium sized enterprises (SME's) play a vital role in the economic expansion and growth of any country. Recently, there has been aggressive market competition because many manufacturers are joining the global market (Li, 2000). Droge etal (1994), observed that the determinants of performance includes, market

promotion, quality effect and return on investments. In addition, the process of transaction and after sale service that satisfy customers desire will increase volume of sales and financial performance. When marketing competence is enhanced, it will lead to outperforming other competitors and development of strong and competitive advantage (George and Spiros, 1997).

To measure management performance and predict profit over the years we adopted a regression model. Multiple regressions is an extension of simple linear regression is defined as a statistical model for investigating the relationship between two or more variables and how one variable can be used to predict the other(s). Ogonna (2005).

A model is an abstract representation of real life situation. Anyanwu (1992) stated that in regression analysis, systems are represented by statistical models or regression models describing the relationship between the relevant compounds of the system being studied. A statistical model in general is designed to simulate the most effective evaluation of the influence of the various independent variables that affect the choice alternative response of the system being modeled.

In this study, the factors of interest are the predictor variables (total sales and total expenses) while the explanatory variable or the performance factor is the profit. The profit is evaluated using the parameter estimates or the coefficients which were tested for statistical significance.

**2. METHODOLOGY**

The data used for this study is the annual sales, annual profits and annual operating expenses of Yasimo Plastic Company limited for twelve years. It was basically a secondary data from the company’s financial records. This company embarks on production of shoe soles, PVC Pipes and fittings which are exported.

This work demonstrates the application of analytical statistical techniques in profit planning and management performance of the enterprise using the predictor and explanatory variables.

**2.1 Regression analysis**

The regression model is given as

$$Y_i = \beta_0 + \beta_1 x_{i,1} + \beta_2 x_{i,2} + \dots + \beta_k x_{i,k} + \epsilon_i$$

This can be represented in matrix form as

$$Y = X\beta + \epsilon$$

$$\begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{pmatrix} = \begin{pmatrix} 1 & x_{11} & x_{21} & \cdot & \cdot & \cdot & x_{k1} \\ 1 & x_{12} & x_{22} & \cdot & \cdot & \cdot & x_{k2} \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 1 & x_{1n} & x_{2n} & \cdot & \cdot & \cdot & x_{kn} \end{pmatrix} \begin{pmatrix} \beta_0 \\ \beta_1 \\ \cdot \\ \cdot \\ \beta_k \end{pmatrix} + \begin{pmatrix} \epsilon_1 \\ \epsilon_2 \\ \cdot \\ \cdot \\ \epsilon_n \end{pmatrix}$$

Least square estimates in matrix formulation

$$\beta = \begin{bmatrix} b_0 \\ b_1 \\ \cdot \\ \cdot \\ b_k \end{bmatrix} = (X'X)'X'Y$$

Where:

$$X'X = \begin{bmatrix} n & \sum x_1 & \sum x_2 \\ \sum x_1 & \sum x_1^2 & \sum x_1x_2 \\ \sum x_2 & \sum x_2x_1 & \sum x_2^2 \end{bmatrix}$$

$$X'Y = \begin{bmatrix} \sum y \\ \sum x_1y \\ \sum x_2y \end{bmatrix} \quad \beta = (X'X)'X'Y \text{ and} \quad (X'X)^{-1} = \frac{cof(X'X)'}{|X'X|}$$

Sums of squares

$$SST = Y'Y - n\bar{Y}^2$$

$$SSR = B'X'Y - n\bar{Y}^2$$

$$ESS = SST - RSS$$

**Coefficient of determination  $R^2$**

$$R^2 = \frac{SSR}{SST} = 1 - \frac{ESS}{SST}$$

Adjusted  $R^2$  ( $\bar{R}^2$ )

$$\bar{R}^2 = 1 - \frac{SSE}{SST} \cdot \frac{(n-1)}{(n-k-1)}$$

**Test of significance**

$$H_0 : \beta_1 = 0$$

$$H_1 : \beta_1 \neq 0$$

To carry out this test, statistical software will display p-values for all the coefficients in the model.

Table 1. The anova table

Source of variation	Degrees of freedom	Sum of squares	Mean square	F-ratio
Regression	K	SSR	$MSR = \frac{SSR}{K}$	$F = \frac{MSR}{MSE}$
Error	$n - 1 - k$	SSE	$MSE = \frac{SSE}{n - 1 - K}$	
Total	$n - 1$	SST		

### Data analysis

Table.1 a. Showing data for total annual sales (T.A.S), total operating expenses (T.O.E) and total annual profit (T.A.P) in millions of Naira

YEAR	T.A.P(Y)	T.A.S(X <sub>1</sub> )	T.O.E (X <sub>2</sub> )
2003	0.098	1.911	0.285
2004	0.156	2.350	0.520
2005	0.279	4.194	0.782
2006	0.384	4.675	1.426
2007	0.509	10.630	2.250
2008	0.409	10.634	4.410
2009	0.605	10.704	4.415
2010	1.246	10.093	4.299
2011	1.569	10.279	4.093
2012	1.296	11.309	5.309
2013	1.608	11.068	5.256
2014	1.242	11.221	5.038

Source: Published financial statement of Accounts for Yasimo Plastic Company limited

Application

Table 2. Application Table

Y	X <sub>1</sub>	X <sub>2</sub>	X <sub>1</sub> <sup>2</sup>	X <sub>2</sub> <sup>2</sup>	X <sub>1</sub> Y	X <sub>2</sub> Y	X <sub>1</sub> X <sub>2</sub>	Y <sup>2</sup>
0.098	1.911	0.285	3.652	0.081	0.187	0.028	0.545	0.01
0.156	2.35	0.521	5.523	0.27	0.367	0.081	1.196	0.024
0.279	4.194	0.782	17.59	0.612	1.17	0.218	3.28	0.078
0.384	4.675	1.426	21.86	2.033	1.795	0.548	6.667	0.147
0.509	10.63	2.25	113	5.063	5.411	1.145	23.92	0.259
0.409	10.63	4.41	113.1	19.45	4.349	1.804	46.9	0.167
0.605	10.7	4.415	114.6	19.49	6.476	2.671	47.26	0.366
1.246	10.09	4.299	101.9	18.41	12.58	5.357	43.39	1.553
1.569	10.28	4.093	105.7	16.75	16.13	6.422	42.07	2.462
1.296	11.31	5.309	127.9	28.19	14.66	6.88	60.04	1.68
1.068	11.07	5.256	122.5	27.63	11.82	5.613	58.17	1.141
1.242	11.22	5.038	125.9	25.38	13.94	6.257	56.53	1.543
8.861	99.07	38.08	937.1	163.4	88.87	37.02	390	9.429

$$X'X = \begin{bmatrix} n & \sum x_1 & \sum x_2 \\ \sum x_1 & \sum x_1^2 & \sum x_1x_2 \\ \sum x_2 & \sum x_2x_1 & \sum x_2^2 \end{bmatrix} = \begin{bmatrix} 12 & 99.068 & 38.083 \\ 99.068 & 973.1056 & 389.9645 \\ 38.083 & 389.9645 & 163.4260 \end{bmatrix}$$

$$X'X = 12 \begin{bmatrix} 973.1056 & 389.9645 \\ 389.9645 & 163.4260 \end{bmatrix} - 99.068 \begin{bmatrix} 99.068 & 389.9645 \\ 38.083 & 163.4260 \end{bmatrix} + 38.083 \begin{bmatrix} 99.068 & 973.1056 \\ 38.083 & 389.9645 \end{bmatrix}$$

$$= 12[6958.3784] - 99.068[1339.2638] + 38.083[1574.2253]$$

$$= 10773.6183$$

$$cof(X'X) = \begin{bmatrix} 973.1056 & 389.9645 \\ 389.9645 & 163.4260 \end{bmatrix} - \begin{bmatrix} 99.068 & 389.9645 \\ 38.083 & 163.4260 \end{bmatrix} + \begin{bmatrix} 99.068 & 973.1056 \\ 38.083 & 389.9645 \end{bmatrix}$$

$$- \begin{bmatrix} 99.068 & 38.083 \\ 389.9645 & 163.4260 \end{bmatrix} + \begin{bmatrix} 12 & 38.083 \\ 38.083 & 163.4260 \end{bmatrix} - \begin{bmatrix} 12 & 99.068 \\ 38.083 & 389.9645 \end{bmatrix}$$

$$+ \begin{bmatrix} 99.068 & 38.083 \\ 973.1056 & 389.9645 \end{bmatrix} - \begin{bmatrix} 12 & 38.083 \\ 99.068 & 389.9645 \end{bmatrix} + \begin{bmatrix} 12 & 99.068 \\ 99.068 & 973.1056 \end{bmatrix}$$

$$cof(X'X) = \begin{bmatrix} 6958.3784 & -1339.2638 & 1574.2263 \\ -1339.2638 & 510.7966 & -906.7678 \\ 1574.2263 & -906.7678 & 1862.7985 \end{bmatrix}$$

$$(X'X)^{-1} = \frac{cof(X'X)}{|X'X|}$$

$$(X'X)^{-1} = \frac{1}{10773.618} \begin{bmatrix} 6958.3784 & -1339.2638 & 1573.2263 \\ -1339.2638 & 510.7966 & -906.7678 \\ 1574.2263 & -906.7678 & 1862.7985 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6459 & -0.1243 & 0.1461 \\ -0.1243 & 0.0474 & -0.0842 \\ 0.1461 & 0-0.0842 & 0.1729 \end{bmatrix}$$

$$(X'Y) = \begin{bmatrix} \sum y \\ \sum x_1 y \\ \sum x_2 y \end{bmatrix} = \begin{bmatrix} 8.891 \\ 88.878723 \\ 37.0244 \end{bmatrix}$$

$$\beta = \begin{bmatrix} b_0 \\ b_1 \\ b_2 \end{bmatrix} = (X'X)^{-1}(X'Y) = \begin{bmatrix} 0.6459 & -0.1243 & 0.1461 \\ -0.1243 & 0.0474 & -0.0842 \\ 0.1461 & 0-0.0842 & 0.1729 \end{bmatrix} \begin{bmatrix} 8.891 \\ 88.8723 \\ 37.0247 \end{bmatrix} = \begin{bmatrix} 0.0853 \\ -0.0041 \\ 0.2164 \end{bmatrix}$$

**Computation of sum of squares**

$$SST = 0.098^2 + 0.156^2 + \dots + 1.242^2 - 12(0.707384166)^2 = 2.8856$$

$$SSR = \beta(X'Y) - n\bar{y}^2 = (0.0853, -0.0041, 0.2164) \begin{bmatrix} 8.861 \\ 88.8724 \\ 37.0247 \end{bmatrix} - 12(0.73641667)^2 = 1.8604$$

$$SSE = 2.8856 - 1.8604 = 1.0252$$

**Table 3: Anova table**

Source of variation	Sum of squares	Degree of freedom	MS	Fcal
Regression	SSR=1.8604	2	0.9302	8.17

<b>Residual</b>	SSE=1.0252	9	0.1139	
<b>Total</b>	SST=2.8856	11		

**Critical value**

$$F_{tab} = F_{\alpha,k,n-1-k}$$

$$F_{(0.05,2,9)} = 4.26$$

**Decision Rule:** Reject  $H_0$  if  $F_{cal} > F_{tab}$ , accept otherwise.

**Conclusion:** Since  $F_{cal} = 8.17 > F_{tab} = 4.26$ , we reject  $H_0$  at 0.05 level of significance and conclude that, there is a linear relationship between total annual sales, total annual operating expenses and total annual profit.

**Regression analysis using SPSS**

**Table 4. Descriptive Statistics**

	Mean	Std. Deviation	N
T.A.P	.73842	.512178	12
T.A.S	8.25567	3.756609	12
T.O.E	3.17358	1.967148	12

**Table .5 Correlations**

		T.A.P	T.A.S	T.O.E
Pearson Correlation	T.A.P	1.000	.743	.803
	T.A.S	.743	1.000	.930
	T.O.E	.803	.930	1.000
Sig. (1-tailed)	T.A.P	.	.003	.001
	T.A.S	.003	.	.000
	T.O.E	.001	.000	.
N	T.A.P	12	12	12
	T.A.S	12	12	12
	T.O.E	12	12	12

**Table 6. Variables Entered/Removed<sup>a</sup>**

Model	Variables Entered	Variables Removed	Method
1	T.O.E, T.A.S <sup>b</sup>	.	Enter

a. Dependent Variable: T.A.P

b. All requested variables entered.

**Table 7. Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.803 <sup>a</sup>	.645	.567	.337142

a. Predictors: (Constant), T.O.E, T.A.S

**Table 8. ANOVA<sup>a</sup>**

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	1.863	2	.931	8.193	.009 <sup>b</sup>
Residual	1.023	9	.114		
Total	2.886	11			

a. Dependent Variable: T.A.P

b. Predictors: (Constant), T.O.E, T.A.S

**Table 9. Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.086	.271		.317	.758
1 T.A.S	-.004	.074	-.032	-.059	.954
T.O.E	.217	.140	.833	1.544	.157

a. Dependent Variable: T.A.P

### 3. DISCURSION / SUMMARY

In **table 7**, the model summary displays R,  $R^2$  and adjusted  $R^2$  and standard error of estimate. We used these values to estimate how well the regression model fits the data. The multiple correlation coefficient  $R = 0.803$  shows that the prediction is good. The coefficient of determination  $R^2 = 0.645$  is the proportion of the total variation in the independent variable (TAP) that is attributed to TAP on all the independent variables TAS and TOE in the regression. The independent variables explain 64.5% of the variation in the dependent variable.

In **table 8**, the ANOVA table indicates that the independent variables  $F_{(2,9)} = 8.193$ ,  $P = 0.009 > P = 0.005$  is not statistically significant.

The coefficients table (see **table 9**) shows the estimated model coefficients, the regression equation that predicts profit from sales and expenses. This can be stated as Profit = 0.086 - 0.004(TAS) + 0.217(TOE).

Unstandardized coefficients indicate how much the dependent variable varies with the independent variable when the other variable is kept constant. The unstandardized coefficient  $B_1 = TAS = -0.004$  implies that for each one year increase in sales, there is a decrease in profit of -0.004 in millions of naira. Besides, for  $B_2 = TOE = 0.217$ , implies that for each one year increase in expenses there is an increase in profit of 0.217 in millions of naira.



#### 4. CONCLUSION

We ran a multiple regression to predict profit based on total sales and total expenses. These variables statistically insignificantly predicted profit  $F_{(2,9)} = 8.193$ ,  $p = 0.009 < 0.05$ ,  $R^2 = 0.645$ . The two variables added statistically insignificantly to the prediction,  $p = 0.05$ .

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