Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 4, Issue, 06, pp.094-098, June, 2012

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

THE IMPACT OF COST OF PRODUCTION ON SUSTAINABILITY AND GROWTH IN DISPERSED AND CONCENTRATED MANUFACTURING FIRMS: EVIDENCE FROM NIGERIA

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ARTICLE INFO

Article History:
Received 15th March, 2012
Received in revised form
25th April, 2012
Accepted 27th May, 2012
Published online 30th June, 2012

Key words:
Cost of Production,
Sustainability and Growth,
Dispersed firms,
Concentrated firms.

ABSTRACT

Nigeria's economic dynamics has been very challenging especially for some sectors. The manufacturing sector of the economy has been very hard hit, hence most firms in Nigeria experience low capacity utilization, high cost of inputs, rising prices of component parts and raw materials, inadequate public power supply which many of them use for their power generating sets, hike in price of diesel and transportation cost lack of capital etc. In a bid to survive, most manufacturing firms in Nigeria have adopted varying corporate strategies hinging on dispersion of production of component parts of material unlike the traditionally concentrated manufacturing system and even outsourcing of their activities. It is against this background that this paper seeks to empirically examine the impact of cost of production on sustainability and growth for dispersed and concentrated manufacturing firms in Nigeria from 1998 to 2007 adopting the two-variable linear regression model. We found that whether the firm is dispersed or concentrated, the cost reduction effect of having to either source raw material in separate places or concentrated places does not matter as with respect to the sustainability and growth of firms. The study accordingly recommends that for improved productivity in the manufacturing sector, government has a major role to play. Government must ensure that there is regular supply of power while providing some form of incentives such as tax holidays, moratorium periods for loan and advances, provision of subsidy to firms in the manufacturing sector of the Nigerian economy, etc. These will reduce the cost of production and increase real capital available to firms for productive purposes.

INTRODUCTION

Survival in business these days is a major challenge for business organizations all over the world. While this state of affairs has given rise to various forms of business combinations such as; mergers and acquisitions and reconstructions in some cases, it has made firms to resort to developing multilateral businesses approach to meet the challenges posed by hard economic realities on ground. The corporate strategy of most firms, therefore, is to diversify their businesses to avoid the high rate of business mortality and/or diversified production of component parts in different plants. Dispersed manufacturing system as corporate strategy is a solution designed to allow companies to outsource component parts from other manufacturing firms while concentrated firms do not outsource component parts. Component parts are manufactured in house at a single location. Through dispersed operation, companies' decrease their required amount of capital investment and respond more effectively to unexpected but inevitable changes in demand, hence, products are made available to consumers at all times within the year. Firms also diversify operations to take advantage of low-cost of labour and risk reduction opportunities. Since goods and services are produced elsewhere, the cost of producing, cost of machineries and cost of human labour are reduced. Nigeria's economic dynamics has been very challenging. The manufacturing sector of the economy has been very hard hit, hence most firms in Nigeria experience low capacity utilization, high cost of inputs, rising prices of component parts and raw materials, adequate public power supply, hike in price of diesel, and high transportation cost amongst other etc. Most businesses have struggled to remain afloat. Inadequate capital is a problem that has contributed to the dispersion of operations of firms. Therefore, dispersed manufacturing system unlike concentrated firms has been advocated in some quarters as a means of cost reduction. This paper thus seeks to empirically examine the impact of cost of production on sustainability and growth of dispersed and concentrated manufacturing firms in Nigeria from 1998 to 2007. It is organized into five sections. Section one is the introduction. Section two presents related literature. Section three contains the methodology. Section four shows the results/analysis. Finally, section five summarizes the work and includes our recommendations/conclusion.

Review of Related Literature

Capkun, Hameri and Weiss (2009) posit that the dominant theme of the operations management literature over the past

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century has been to improve operational performance and this can be achieved by reducing the lead time from raw materials to finished goods, reducing the amount of waste in the process and by reducing the quantity of physical units held by the firm. Performance management is increasingly seeking ways to meet with the demands of ever-critical customers who demand quality products at the cheapest possible price provided timely. In trying to optimize ways of manufacturing products in the most cost effective and timely manner, manufacturers are increasingly resorting to multilateral approach or dispersed manufacturing (see, Applebaum, Bailey, Berg and Kalleberg, 2000). This is particularly important for countries that do not have access to these goods, services and technologies or whose domestic industries do not produce them in sufficient scale or at affordable prices.

According to Palmieri and Africk, (1999) posit that in manufacturing a product, the idea that immediately sprang to mind was that everything would be done in-house – in one country and by the same company, before a product was exported or sold in another country. But times have changed and manufacturing a product carries a completely different meaning this days. The production processes are no longer manufactured in one factory and under one roof. Production is being dispersed across different factories in different countries and indeed it is being globalize. Therefore having an open manufacturing system or dispersed manufacturing system helps to create businesses, involving many countries and companies. Athey, and Stern (1998) posit that the primary focus of logistics management is in optimizing the delivery of service to customers, by managing complex trade-offs among customer service, transportation, warehousing and inventory. Attempts to overcome this problem have resulted in the creation of supply chain management (Ruijgrok, 2001). In other words, supply chain management extends the principles of logistics management to customers and suppliers, crossing geographical and organizational boundaries, with a view to satisfying customers.

Hendricks and Singhal (2001) were of the view that recent development in supply chain management offers the potential not just to cut costs, but also to generate new revenues and higher profits. Daskin, Snyder and Berger (2003) have argued that the mission of logistics management is to achieve the desired levels of customer service and quality at the lowest possible cost, mostly through outbound logistics. Simchilevi, Kaminsky and Simchi-Levi, (2003) and Palmieri and Africk, (1999) have also observed that in every step in the supply chain management process in any organization, there are costs involved and two of the major cost drivers in the supply chain, are inventory holding and transportation cost.

In other to improve supply chain management the Just-in-Time (JIT) manufacturing, also known as lean manufacturing, provides a strategy by which firms may improve their financial performance. Balakrishnan et al. (1996), testing the significance of changes in median ROA, for pre adoption vs. post-adoption JIT and non-treatment control firms, found that the ROA actually decreased after inventory management systems were implemented, as did the ROA of control firms. Testing the magnitude of the ROA decrease for treatment versus non-treatment firms yielded no significant differences. However, the ROA decrease was significantly less for firms with non concentrated customer bases, i.e., those not required to pass on JIT-related savings to their customers. Sakakibara, *et al*. (1997) define dispersed or lean manufacturing practices as the activities that provide support for the use of lean practices, such as employee involvement, design for manufacturability, mistake-proofing, work force development, proper organization, production pull, and quality management. Using canonical correlation analysis, focusing on the degree of statistical significance and the magnitude of the correlation coefficient, they set out to determine the interrelationship of lean practices, infrastructure practices, manufacturing performance and competitive advantage. While no significant relationship between dispersed practices and manufacturing performance was found, the relationship between lean infrastructure and dispersed practices was strong.

Eilon (1993), considering the framework for ratio analysis, highlights the effects of both external factors and ratio interdependence on the quality of historical and predictive analyses, noting that performance measures are not always compatible with each other, and an improvement in one measure may come at the expense of another. Such a case is exemplified by a demonstration of the relationship between the net profit margin, gross profit margin, fixed (cost-to-total) cost ratio, and the fixed cost-to-revenue proportion if two of these ratios are known, the remaining two are automatically determined. Management control, governed by strict attention to isolated performance metrics, can lead to conflicting performance ratios, as is the case when the return on capital employed is considered as the product of the net profit margin and the asset turnover It can be shown that it is possible for the return on capital employed to increase when a decrease is seen in one of the other two ratios. When the profit margin is expressed as a function of return on capital employed and asset turnover, it can also be shown that the appropriate decreases in both the independent variables can actually produce an increase in the profit margin.

So (1987) computed 11 financial ratios of manufacturing firms over a period of ten years, and assessed their normality by examining the skewness and kurtosis of the distributions. It was found that, even after the removal of outliers from the data, the distributions of many ratios were still non-normally and asymmetrically distributed. The most serious violations of normality were found in the cash flow-to-total debt and ROA metrics, while current assets-to-total assets and working capital-to-total assets ratios were the only ratios to have no outliers over all ten years. So (1987) concludes that the non-normal ratios are either nonlinear or that an intercept term exists in the regression of one variable on the other variable comprising the ratio, and the offset is the result of influences on the dependent variable that are not related to the independent variable.

METHODOLOGY

Our paper adopted the *ex-post facto* research design. The adoption of this research design hinges on the study relying on historic accounting data obtained from the financial statements and accounts of seven (7) manufacturing firms. These are secondary data and are thus ex post facto research design compliant (Onwumere, 2005). The data were extracted from the published financial statements and accounts for the period

Table 3.1: Summary of Aggregate for Dispersed and Concentrated Firms

Year	CPR for Dispersed Firms (%)	CPR for Concentrated Firms (%)	SG Dispersed Firms (%)	SG Concentrated Firms (%)
1998	1.465594	2.892014	5	5
1999	1.397926	3.002365	2.891674	6.462542
2000	1.477825	3.125885	2.748833	6.971108
2001	0.926684	3.373725	2.768617	6.75284
2002	1.251571	3.261195	3.194799	7.269575
2003	1.374614	3.302187	3.240058	6.845725
2004	1.289441	3.295712	2.602754	6.912184
2005	1.334236	3.554139	15.01531	7.608872
2006	1.418382	3.310598	3.117275	6.996536
2007	1.381637	3.261366	3.077368	8.236875

Source: Author's Computations

Table 4.2: Summary of SPSS Results for Dispersed and Concentrated Firms

Hypothesis	R	R^2	Beta	t-value	F	D.W
Dispersed Firms	0.418[a]	0.175	0.041	0.109	0.425	1.638
Concentrated Firms	0.480[a]	0.230	0.606	0.103	0.597	1.238

Source: Appendix

Model Equation for Dispersed firms SG = 1.028+ 0.002 CPR +μ

Model Equation for Concentrated firms SG = 1.660+ 0.229 CPR +μ

1998 to 2007. Relevant firms are: Flour Mills Nigeria Plc, Chemical and Allied Products Plc, Benue Cement Company Plc, Guinness Nigerian Plc, United Nigerian Textiles Plc, Alumaco, BETA Glass, Longman Plc, Aluminum Extrusion Industries and Vono Foams. Flour Mills Nigeria Plc, Chemical and Allied Products Plc, Benue Cement Company Plc, Guinness Nigerian Plc and United Nigerian Textiles Plc were categorized as concentrated firms (as these that had over 75% of raw materials in-house for production) and Alumaco, BETA Glass, Longman Plc, Aluminum Extrusion Industries and Vono Foams were categorized as dispersed firms (as these that had to source for over 75% of the raw materials)

Model Specification

We adopted the two-variable regression model and the general regression form is;

$$y = a + bx + \mu \quad \text{(1)}$$

where

y = Dependent variable
a = Constant
b = Coefficient of the Independent variable
x = Independent Variable and
μ = Error Term

However, in writing the model equation for the stated hypotheses, the following symbols were used to denote their respective variables. These are;

CPR = Cost of Production Rate
SG = Sustainability and Growth

Therefore rewriting the model in line with equation 1 above, we have:

$$SG = a + b\,CPR + \mu \quad \text{(ii)}$$

Explanatory Variables

Variables of the model are explained as follows:

Independent Variable - Cost of Production Rate

Companies that focus on flow with an emphasis on operational speed and variability reduction outperform companies emphasizing other goals. This conclusion is consistent with the principles of operations management. Thus, using cost of production rate as measure of efficiency in use of raw materials in dispersed (where raw materials are produced at different location) and concentrated (where raw materials are produced in house firms). This measure was represented as;

Cost of Production rate = Cost of Goods Sold/Turnover…… (iii)

Dependent Variables – Joint Sustainability and Growth Variable

Sustainability could be defined as the ability of firms to continue to exist while growth is measure as the ability of manufacturing firms to continually increase earnings attributable to share holders in the long run. In this research, the measure is adopted as performance measure which indicates continual existence and sustained increased profit (Lave, 1982). The measure is proxied by total asset growth rate and represented as:

SG = (Total Asset Year 2 - Total Asset Year 1) / Total Asset Year 1…… (iv)

The aggregate data of dispersed and concentrated firms as used in this study are presented in this section. Table 3.1 depicts the summary of aggregate data for dispersed and concentrated firms in Nigeria for the period 1998-2007. Table 3.1 indicates cost of production rate in percentage. This ratio indicates how the firms effectively and efficiently utilized raw materials. Thus, it had a direct bearing on their cost of production. On aggregate basis, the highest rate was observed in 2000 (1.4778%) and the lowest rate observed in 2001 (0.93%). Sustainability is the ability of firms to continue to exist and growth measure the ability of manufacturing firms to continually increase earnings attributable to share holders in the long run. As observed from the table for dispersed manufacturing firms, the highest was recorded in 2005 (15%) while the least rate was observed in 2004 (2.60%). Also on aggregate basis, the highest rate for concentrated firms was observed in 2005 where the cost of production rate was 3.55% while the lowest rate was observed in 1998 (2.89%). For

Sustainability and growth, as observed from the table for concentrated manufacturing firms, the highest was recorded in 2007 (8.236%) while the least rate was observed in 1998 (5%). As evident from table 4.1, the impact of cost of production on dispersed manufacturing firms was positive and non-significant as (t = 0.109; coefficient of cost of production (CPR) = 0.002 for dispersed firms). The coefficient of determination as indicated by R^2 was 17.3%, indicating that other variables apart from cost of production have an impact on sustainability and growth of dispersed firms in Nigeria. As also revealed from table 4.1, the impact of cost of production on sustainability and growth was also positive and non-significant (t = 0.103, coefficient of cost of production = 0.229). The coefficient of determination R^2 of 23% indicates that other factors not captured in the model have impacted on sustainability and growth of concentrated firms in Nigeria for the period.

Summary, Recommendations and Conclusion

As observed from the results, whether the firm is dispersed or concentrated, the cost reduction effect of having to source raw material in separate places or concentrated places does not matter as far as sustainability and growth of firms are concerned, it was observed that, for dispersed and concentrated firms examined, there was positive non-significant impact of cost of production rate (CPR) on sustainability and growth (SG). As could also be seen from the research, there was no clear cut difference between dispersed manufacturing systems and concentrated in terms of such indicators as sustainability and growth as both had positive impact. Results show that there are either extraneous variables that affect sustainability and growth However, factors such as globalization, deregulation of markets, changing demands and shorter product life cycles, not captured in the model appear to pose new challenges for most firms. In order to be competitive, firms must be able to continually improve their performance by responding to these factors. The ability to combine old and new knowledge in order to generate new products/services remains important to the prosperity of the modern firm. Thus, the identification of the most successful work practices either in dispersed or concentrated manufacturing setup in terms of their ability to facilitate the innovation of products/services is an important empirical challenge. Since the concentration of firms in a certain area attracts all the advantages of external economies of scale while it greatly strengthens internal economies, many companies would see reasons to liaise with others. The issue of industrialization of remote areas means that sometimes some companies blaze the trial of establishing their firms in the rural areas.

It is obvious that the firm would spend much putting so many logistics on ground. To avert this, the government usually puts all social capital on ground in the industrialized layouts so that the firms spend less in establishing estates or layouts. It is not, however, overheads that only hinder establishment of firms in dispersed areas, but also patronage and transportation. Concentrated manufacturing firms have to plan to overcome capital squeeze in order to operate alone. Many firms find this aspect very difficult, so, dispersal of firms paves way for improved firms only if the management has enough financial strength to do most of the things alone. This is where concentration of firms comes to play. Also, since the return on capital is higher in dispersed manufacturing firms, interested investors would want to be part of the stakeholders thereby increasing the market share, having greater turn over and increases profit earnings. Dispersed manufacturing firms have lots of advantages which benefit both the small and medium scale industries, and also the public who are the investors and the consumers, however giving opportunities to medium and small scale businesses to supply their product which will in turn form the component part for other product that are produced by a bigger company.

It is in line with these that this paper recommends that for improved productivity, government has a major role to play. Government must ensure there is regular supply of power while providing some form of incentives for manufacturers such as tax holidays, moratorium periods for loan and advances, provision of subsidy to firms in the manufacturing sector of the Nigerian economy etc. these will reduce the cost of production and increase real capital available to firms for productive purposes. Also, this study advocates the creation of industrial estates efficient infrastructure to encourage growth thereby reducing cost and increasing earnings. Firms must take advantage of economies of scale when they are located together as cost such as involving transportation, warehousing and labour are reduced. Firms in Nigeria and developing countries with similar economies must consider issues raised in this work if they must achieve sustainable growth and development.

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