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Full Length Research Paper

An assessment of the productivity of the Nigerian shipping industry using Saari productivity model

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This study focal point is the productivity of the Nigerian shipping industry with attention placed on selected twenty-two shipping firms (based on market share) that operate within the country as well as the main seaport in Lagos: the Apapa Port Complex. Data on productive inputs and outputs were collected via the administration of questionnaires to the selected shipping companies over two periods within a single year. The periods were: the trough season and the peak season. The outputs consist of throughputs in metric tonnes carried by the companies on their various routes while the inputs were labour, materials, energy and capital served. Saari productivity model, which is based on input/output analysis, was used for data analysis to know each firm's distribution index of input and output, productivity and productivity index, volume of index output, change of profitability, change of return, change of cost, capacity utilization and so on. It was noted that freight rates and ability to control cost of inputs were significant in the determination of firms' productivity over a period of time. It was also discovered that the type and mode of operations of shipping firms as well as the use of target marketing matters a lot in its ability to be productive.

Key words: Productivity model, productivity index, profitability, capacity utilization.

INTRODUCTION

Shipping is a global industry handling ninety percent of the global trade (in terms of volume). This makes the industry a lifeline of world trade. Due to the mobile nature of the asset, the ship, the freight rates available in any particular route is significantly different from what is charged in others. This makes the global shipping trade/market totally dependent on what is going on at the global stage. Depending on the nature of the cargo carried, shipping industry can be broadly classified into three main segments:

Dry bulk: Iron ore, steel, coal etc. are the consignments carried.

Wet bulk (tankers): Crude oil, petroleum product are the consignments carried.

Containerised: Here the consignments are finished manufacturing products and any other that can be handled by the container. In fact containerization has made it possible for a global door-to-door shipment of cargo possible enabling multimodal transportation.

Shipping has multiple meanings. It can be a physical process of transporting goods and cargo, by land, air and sea. It can also describe the movement of objects by ship. Land or "ground" shipping can be by train or by truck. In air and sea shipments, ground transportation is often still required to take the product from its origin to the

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airport or seaport and then to its destination. Ground transportation is typically more affordable than air shipments, but more expensive than shipping by sea (Bird, 1970).

The shipping industry is highly volatile. Due to the choppy revenue streams, shipping companies usually have some years of supernormal profits and some years of abnormal losses. The vessels and cargo handling equipments constitute about ninety percent of the fixed assets of the shipping companies and the setting up of seaports is usually capital intensive. The standardised nature of the shipping service and the industry makes it difficult for any single company to determine the prevailing market price (freight rate). The industry is globally regulated by the International Maritime Organisation (IMO) and other international agencies/bodies like United Nation Conference on Trade and development, UNCTAD as well as fiscal and legislatures governing the trade in different countries.

The shipping industry stabilises their earnings and revenues by deploying their vessels in a judicious mix of time charter, voyage charter, tramping and other contract arrangements. The fleet age too has an impact on the earnings: the higher the fleet age the higher the operating costs, the lower the charter earnings and the higher the insurance premium.

The demand for ships depends greatly on:

1. The state of global economy,
2. Prices of other goods and services,
3. Income,
4. Taste and fashion: It is now very fashionable to transport goods in containers making demand for general cargo carriage to fall.
5. Population: The higher the population of an area/region, the more likely will the demand for shipping be in that area/region,
6. Regional disparity in availability of natural resources and industrial production outputs,
7. Subsidies and taxation. Governments world-wide often attempt to boost demand for shipping by subsidising the shippers efforts and or by reducing taxes payable by the shipping companies.
8. Political events particularly in major exporting countries,
9. Natural disasters,
10. Terrorism and piracy.

Likewise the supply of shipping services depends on:

1. Global freight rates, the higher the freight rate the higher the supply.
2. Price expectation,
3. Technology,
4. Price of related good, shift in supply curve will also be seen when there are changes in complementary products. For example, in a hub-and-spoke operation one might expect any change in long-haul services to be accompanied by a complementary rise or fall in the supply of feeder services,
5. Global fleet size,
6. Taxes and subsidies,
7. Industry-wide vessel scrapping policies,
8. Delivery schedules of new vessels, which is subject to ship building capacities of shipbuilders.
9. Existing fleets' productivity

Productivity as a concept is the extent of output produced from an engaged input. Technically, productivity is the measure of the ratio of output (total services offered, usually measured in terms of throughput) against the input (total resources engaged to achieve the output, usually including labour, assets and machineries- vessels and cargo handling equipment, and entrepreneurship). Therefore, productivity can be expressed as the throughput handled per unit factor of production utilised. For example, total port gang hours (TPGH) as productivity indicator for labour (stevedore) showing the volume of cargo stevedore handled per hour. The point of view here is economic where productivity is seen as representing a technical relationship between input and output (Stephens, 2003). The performance and productivity of seaport (which is an integral part of the shipping industry) is largely tied to the performance and efficiency of the connecting land transport systems and infrastructures (Stephens et al., 2011).

The economic viewpoint avoids the conception in which productivity is limited only to related concept of efficiency, which refers to the nature of change in output as a result of employing one unit of input. Thus, efficiency may absolutely represent a critical segment of productivity, even though it is not as used in the normal concept. Productivity measurement could be seen in terms of the following:

A. Output changes
B. Factor opportunities.

The output of the shipping industry provides the means of exchanging commodities between land and maritime transport which can be measured in terms of 'Throughput'. This is regarded as a measure of port productivity and is expressed mathematically as:

Productivity, P = (Throughput, T) / Input, I)

$$P=T/I \quad (1)$$

The major problem for Nigeria's immediate and longer term economic welfare is a large and rapidly increasing foreign debt. Rather than continued reliance on commodity prices particularly for petroleum products, Nigeria must also increase its performance in the manufacturing and service industries to expand exports and replace imports. Transport can contribute, through productivity improvements, to improving the competitive

position of our products and also, more generally, by appropriately minimising the transport component of all production and commodity costs. Such productivity improvements are being sought through government policy and regulation, and the provision and management of infrastructure and transport services.

Every year, numerous factors of production are engaged in the supply of the shipping services in Nigeria. These production inputs are very expensive to put together and turned into the finished products/services. They could have been used for other purpose so that the actual cost of producing shipping services is the cost of other alternatives that the inputs could have been used to produce. However, it is glaring that the domestic shipping industry suffers economic losses and financial problems as it suffer loss of traffic to neighbouring ports; congestion at the ports; multiple documentation and poor performance of domestic carriers when compared with foreign owned carriers. To this end, there is the need to examine the productivity of the shipping industry so that we can, if possible, justify the huge inputs annually put into the industry. The industry is growing but at the same time its port are loosing traffic to neighbouring ports, the ports suffers from congestion and multiple documentations, the indigenous shipping companies are loosing traffic to foreign registered vessels, the continual loss of jobs by local seafarers to foreign seafarers particularly from the Southeast Asian states and the national shipping fleet is been depleted.

The main aim of the study is to examine the productivity of the Nigerian shipping industry. While specific objectives are:

1. To determine the impact of seasonal (periodic) demand variation on the productivity of the shipping industry.
2. To ascertain the impact, price (freight rate) variations on the productivity levels of shipping firms.
3. To determine the significance of type operation or services offered on level of productivity.
4. To determine the productivity variation occurring between indigenous and foreign owned shipping companies, if there is.
5. To determine if there is any undermining of the Nigerian cabotage act.
6. To achieve the objectives noted above, the following questions will be answered:
7. Does seasonal variation of demand have significant impact on productivity?
8. What does the indicators of performance of the Nigeria seaport reflects?
9. What factors affect the productivity of shipping companies?
10. How significant is the type of operation or service offered on the level of productivity of a shipping firm?
11. Is there any productivity variation occurring between indigenous and foreign owned shipping companies? If there is, what is the degree of variation?
12. Is there any undermining of the Nigerian cabotage act?

The shipping industry productivity performance can not be studied without adequate knowledge of the performance of the seaports and shipping companies in the industry. Why? The two groups are the productive engine in the industry. Therefore, for the purpose of this work, the productivity performance of the Nigerian seaports and shipping companies will form the basis of examining the productivity of the Nigerian shipping industry. This makes the study a nationwide study but focus will be limited to few shipping companies that a major players in the industry and all the Nigerian seaports. The relevance of the Nigerian Shippers' Council (NSC), Nigerian Maritime Administration and safety Agency, Nigerian Maritime Administration and Safety Agency (NIMASA) and Nigerian Port Authority (NPA), and their respective contributions to the productivity of the shipping industry will be examined.

LITERATURE REVIEW

Productivity refers to metrics and measures of output from production processes, per unit of input. Labour productivity, for example, is typically measured as a ratio of output per labour-hour input. Productivity may be conceived as a metrics of the technical or engineering efficiency of production. As such quantitative metrics of input and sometimes output are emphasized. Productivity is distinct from metrics of allocative efficiency, which take into account both the value of what is produced and the cost of inputs used, and also distinct from metrics of profitability, which address the difference between the revenues obtained from output and the expense associated with consumption of inputs (Courbois et al., 1975; Gollop, 1979; Kurosawa, 1975; Pineda, 1990; Saari 2006).

Activity can be identified with production and consumption. Production is a process of combining various immaterial and material inputs of production so as to produce tools for consumption. The methods of combining the inputs of production in the process of making output are called technology. Technology can be depicted mathematically by the production function which describes the function between input and output. The production function depicts production performance and productivity is the metrics for it. Measures may be applied, for example, different technology to improve productivity and to raise production output.

With the help of the production function, it is possible to describe simply the mechanism of economic growth. Economic growth is a production increase achieved by an economic entity or nation. It is usually expressed as an annual growth percentage depicting (real) growth of the

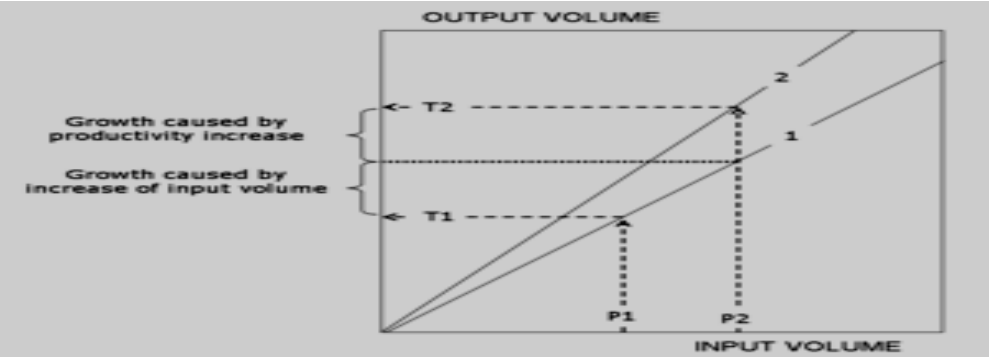

Figure 1. Economic growth and productivity. Source: Components of economic growth (Saari, 2006).

		Period 1			$Q_1 \times P_2$	Period 2		
		1	2	3	4	5	6	7
		Quantity	Price	Value		Quantity	Price	Value
a	Product 1	210.00	7.20	1512.00	1491.00	247.25	7.10	1755.48
b	Product 2	200.00	7.00	1400.00	1430.00	195.03	7.15	1394.46
c	Output			2912.00	2921.00			3149.94
d	Labour	100.00	7.50	750.00	770.00	115.00	7.70	885.50
e	Materials	80.00	8.60	688.00	680.00	79.20	8.50	673.20
f	Energy	400.00	1.50	600.00	620.00	428.00	1.55	663.40
g	Capital	160.00	3.80	608.00	624.00	164.80	3.90	642.72
h	Input			2646.00	2694.00			2864.82
i	Surplus value (abs.)			266.00	227.00			285.12
j	*Surplus value (rel.)*			*1.101*				*1.100*
k	Change of distribution (abs.); i4-i3				-39.00			
l	Distribution index of output; c4/c3				1.003			
m	Distribution index of input; h4/h3				1.018			
n	Distribution index; l4/m4				0.985			
	Distribution process							
p	Productivity; c4/h4, c7/h7				1.084			1.100
q	Productivity index; p7/p4							1.014
r	Change of productivity (abs.); (q7-1)×c4							41.12
s	Volume index of output; c7/c4							1.078
t	Volume index of input; h7/h4							1.063
u	Change of input volume (abs); (l7-1)×(i4+r7)							17.00
	Real process							
v	Change of profitability; j7/j3							0.999
x	Change of returns; c7/c3							1.082
z	Change of costs; h7/h3							1.083
	Production process							

Figure 2. Productivity model. Source: Saari (2006).

company output (per entity) or the national product (per nation). Economic growth is created by two factors so that it is appropriate to talk about the components of growth. These components are increase in production input and increase in productivity (Genesca et al, 1992, Saari 2006).

The Figure 1 presents an economic growth process. By way of illustration, the proportions shown in Figure 1 are exaggerated. Reviewing the process in subsequent years (periods), one and two, makes it evident that production has increased from Value T1 to Value T2. as depicted on Figure 2 Both years can be described by a graph of production functions, each function being named after the respective number of the year, that is, one and two. Two

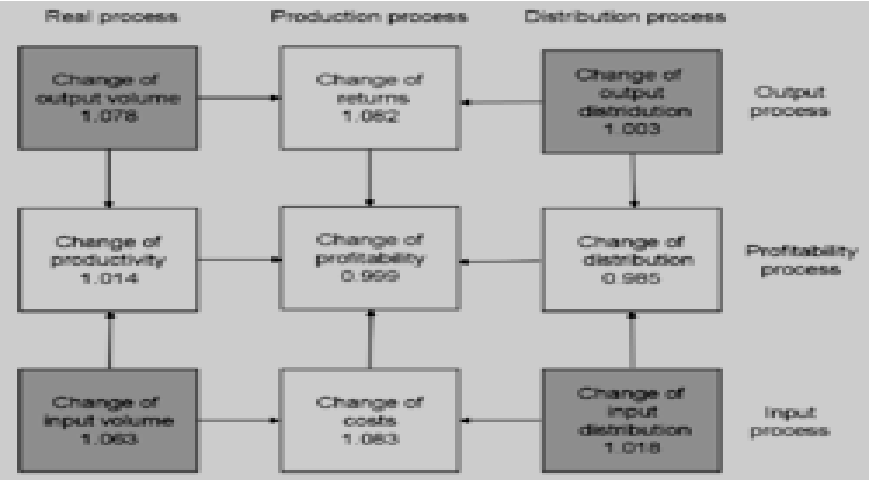

Figure 3. Illustration of the real and income distribution processes. Source: Saari (2006).

components are distinguishable in the output increase: the growth caused by an increase in production input and the growth caused by an increase in productivity. Characteristic of the growth effected by an input increase is that the relation between output and input remains unchanged. The output growth corresponding to a shift of the production function is generated by the increase in productivity.

Accordingly, an increase in productivity is characterised by a shift of the production function and a consequent change to the output/input relation. The formula of total productivity is normally written as follows:

Total productivity = Output quantity / Input quantity

According to this formula, Jorgenson et al. (1967) had that changes in input and output have to be measured inclusive of both quantitative and qualitative changes. In practice, quantitative and qualitative changes take place when relative quantities and relative prices of different input and output factors alter. In order to accentuate qualitative changes in output and input, the formula of total productivity shall be written as follows:

Total productivity = Output quality and quantity / Input quality and quantity

A company can be divided into sub-processes in different ways; yet, the following five are identified as main processes, each with a logic, objectives, theory and key figures of its own. It is important to examine each of them individually as part of the whole, in order to be able to measure and understand them. The main processes of a company are as follows:

1. Real process
2. Income distribution process
3. Production process
4. Monetary process
5. Market value process

Productivity is created in the real process, (Figure 3) it gains are distributed in the income distribution process and these two processes constitute the production process. The production process and its sub-processes, the real process and income distribution process occur simultaneously, and only the production process is identifiable and measurable by the traditional accounting practices. The real process and income distribution process can be identified and measured by extra calculation, this is why they need to be analysed separately in order to understand the logic of production performance.

Real process generates the production output from input, and it can be described by means of the production function. It refers to a series of events in production in which production inputs of different quality and quantity are combined into products of different quality and quantity. Products can be physical goods, immaterial services and most often combinations of both. The characteristics created into this product by the manufacturer imply surplus value to the consumer, and on the basis of the price this value is shared by the consumer and the producer in the marketplace. This is the mechanism through which surplus value originates to the consumer and the producer likewise. Surplus value to the producer is a result of the real process, and measured proportionally it means productivity.

Income distribution process of the production refers to a series of events in which the unit prices of constant-quality products and inputs alter causing a change in income distribution among those participating in the exchange. The magnitude of the change in income distribution is directly proportionate to the change in

prices of the output and inputs and to their quantities. Productivity gains are distributed, for example, to customers as lower product sales prices or to staff as higher income pay. Davis (1955) has deliberated the phenomenon of productivity, measurement of productivity, distribution of productivity gains and how to measure such gains. He refers to an article (Journal of Accountancy, 1947) suggesting that the measurement of productivity shall be developed so that it will "indicate increases or decreases in the productivity of the company and also the distribution of the fruits of production among all parties at interest". According to Davis (1955), the price system is a mechanism through which productivity gains are distributed, and besides the business enterprise, receiving parties may consist of its customers, staff and the suppliers of production inputs. In this article, the concept of "distribution of the fruits of production" by Davis (1955) is simply referred to as production income distribution or shorter still as distribution.

The production process consists of the real process and the income distribution process. A result and a criterion of success of the production process is profitability. The profitability of production is the share of the real process result the producer has been able to keep to himself in the income distribution process. Factors describing the production process are the components of profitability, that is, returns and costs. They differ from the factors of the real process in that the components of profitability are given at nominal prices whereas in the real process, the factors are at periodically fixed prices.

Monetary process refers to events related to financing the business. Market value process refers to a series of events in which investors determine the market value of the company in the investment markets.

The scale of success run by a going concern is manifold, and there are no criteria that might be universally applicable to success. Nevertheless, there is one criterion by which we can generalise the rate of success in production. This criterion is the ability to produce surplus value. As a criterion of profitability, surplus value refers to the difference between returns and costs, taking into consideration the costs of equity in addition to the costs included in the profit and loss statement as usual. Surplus value indicates that the output has more value than the sacrifice made for it, in other words, the output value is higher than the value(production costs) of the used inputs. If the surplus value is positive, the owner's profit expectation has been surpassed.

Both the absolute and relative surplus value have been calculated in the example. Absolute value is the difference of the output and input values and the relative value is their relation, respectively. The surplus value calculation in the example is at a nominal price, calculated at the market price of each period.

The next step is to describe a productivity model (Courbois and Temple, 1975; Gollop, 1979; Kurosawa, 1975; Saari, 1976, 2006) by help of which it is possible to calculate the results of the real process, income distribution process and production process. The starting point is a profitability calculation using surplus value as a criterion of profitability. The surplus value calculation is the only valid measure for understanding the connection between profitability and productivity or understanding the connection between real process and production process. A valid measurement of total productivity necessitates considering all production inputs, and the surplus value calculation is the only calculation to conform to the requirement.

The process of calculating is best understood by applying the clause of Ceteris paribus, that is "all other things being the same," stating that at a time only the impact of one changing factor can be introduced to the phenomenon being examined. Therefore, the calculation can be presented as a process advancing step by step. First, the impacts of the income distribution process are calculated, and then, the impacts of the real process on the profitability of the production.

The first step of the calculation is to separate the impacts of the real process and the income distribution process, respectively, from the change in profitability (285.12 - 266.00 = 19.12). This takes place by simply creating one auxiliary column (4) in which a surplus value calculation is compiled using the quantities of Period 1 and the prices of Period 2. In the resulting profitability calculation, Columns 3 and 4 depict the impact of a change in income distribution process on profitability, and in Columns 4 and 7, the impact of a change in real process on profitability.

Measurement results can be illustrated by models and graphic presentations. Figure 5 illustrates the connections between the processes by means of indexes describing the change. A presentation by means of an index is illustrative because the magnitudes of the changes are commensurate. Figures are from the above calculation example of the production model (Loggerenberg van et al., 1982; Saari, 2006).

The nine most central key figures depicting changes in production performance can be presented as shown in Figure 3. Vertical lines depict the key figures of the real process, production process and income distribution process. Key figures in the production process are a result of the real process and the income distribution process. Horizontal lines show the changes in input and output processes and their impact on profitability. The logic behind the figure is simple. Squares in the corners refer to initial calculation data. Profitability figures are obtained by dividing the output figures by the input figures in each process. After this, the production process figures are obtained by multiplying the figures of the real and income distribution processes.

Development in the real process, income distribution process and production process can be illustrated by means of time series (Kendrick, 1984; Saari, 2006). The

principle of a time series is to describe, for example, the profitability of production annually by means of a relative surplus value and also to explain how profitability was produced as a consequence of productivity development and income distribution. A time series can be composed using the chain indexes as seen in the following.

Now, the intention is to draw up the time series for the ten periods in order to express the annual profitability of production by help of productivity and income distribution development. With the time series, it is possible to prove that productivity of the real process is the distributable result of production, and profitability is the share remaining in the company after income distribution between the company and interested parties participating in the exchange.

The graph shows how profitability depends on the development of productivity and income distribution. Productivity figures are fictional but in practice they are perfectly feasible indicating an annual growth of 1.5% on average. Growth potentials in productivity vary greatly by industry, and as a whole, they are directly proportionate to the technical development in the branch. Fast-developing industries attain stronger growth in productivity. This is a traditional way of thinking. Today we understand that human and social capitals together with competition have a significant impact on productivity growth. In any case, productivity grows in small steps. By the accurate measurement of productivity, it is possible to appreciate these small changes and create an organisation culture where continuous improvement is a common value.

Measuring and interpreting partial productivity

Measurement of partial productivity refers to the measurement solutions which do not meet the requirements of total productivity measurement, yet, being practicable as indicators of total productivity. In practice, measurement in production means measures of partial productivity. In that case, the objects of measurement are components of total productivity and interpreted correctly, these components are indicative of productivity development. The term of partial productivity illustrates well the fact that total productivity is only measured partially – or approximately. In a way, measurements are defective, but by understanding the logic of total productivity, it is possible to interpret correctly the results of partial productivity and to benefit from them in practical situations. Typical solutions of partial productivity are:

1. Single-factor productivity
2. Value-added productivity
3. Unit cost accounting
4. Efficiency ratios
5. Managerial control ratio system

Single-factor productivity refers to the measurement of productivity, that is, a ratio of output and one input factor. A most well-known measure of single-factor productivity is the measure of output per work input, describing work productivity. Sometimes it is practical to employ the value added as output. Productivity measured in this way is called value-added productivity. Also, productivity can be examined in cost accounting using unit costs. Then it is mostly a question of exploiting data from standard cost accounting for productivity measurements. Efficiency ratios, which tell something about the ratio between the values produced and the sacrifices made for it, are available in large numbers. Managerial control ratio systems are composed of single measures which are interpreted in parallel with other measures related to the subject. Ratios may be related to any success factor of the area of responsibility, such as profitability, quality, position on the market, etc. Ratios may be combined to form one whole using simple rules, hence, creating a key figure system.

The measures of partial productivity are physical measures, nominal price value measures and fixed price value measures. These measures differ from one another by the variables they measure and by the variables excluded from measurements and are shown on Table 2. By excluding variables from measurement, makes it possible to better focus on the measurement on a given variable, yet, this means a more narrow approach. Table 1 was compiled to compare the basic types of measurement. The first column presents the measure types, the second the variables being measured, and the third column gives the variables excluded from measurement.

Productivity studies

Productivity studies analyze technical processes and engineering relationships such as how much of an output can be produced in a specified period of time (Gollop, 1979). It is related to the concept of efficiency. While productivity is the amount of output produced relative to the amount of resources (time and money) that go into the production, efficiency is the value of output relative to the cost of inputs used. Productivity improves when the quantity of output increases relative to the quantity of input. Efficiency improves, when the cost of inputs used is reduced relative the value of output.

A change in the price of inputs might lead a firm to change the mix of inputs used, in order to reduce the cost of inputs used, and improve efficiency without actually increasing the quantity of output relative the quantity of inputs. A change in technology, however, might allow a firm to increase output with a given quantity of inputs; such an increase in productivity would be more technically efficient, but might not reflect any change in allocative efficiency.

Table 1. Saari's productivity model for shipping company 1.

	Period 1 = March to August			Q1 x P2	Period 2 = September to February		
	1	2	3	4	5	6	7
	Quantity	Freight rate	Value		Quantity	Freight rate	Value
Route 1	23990	7.00	167930.00	239900.00	63563	10.00	635630.00
Route 2	34562	10.00	345620.00	449306.00	72652	13.00	944476.00
Route 3	65362	8.00	522896.00	718982.00	128718	11.00	1415898.00
Route 4	12722	12.00	152664.00	190830.00	13525	15.00	202875.00
Output	136636		1189110.00	1599018.00	278458		3198879.00
	Quantity	Freight rate			Quantity	freight rate	
Labour (steevdor)	100	8.70	870.00	870.00	112	8.70	974.40
Materials	89	8.60	765.40	765.40	93	8.60	799.80
Energy	400	18.00	7200.00	7200.00	689	18.00	12402.00
Capital	160000	3.40	544000.00	604800.00	198261	3.78	749426.58
Input			552835.40	613635.40			763602.78
Surplus value (absolute)			636274.60	985382.60			2435276.22
Surplus value (reference)			1.101				1.100
Change of distribution (absolute)				349108.00			
Distribution index of output				1.34			
Distribution index of input				1.109978485			
Distribution index				1.211481426			
Distribution process							
Productivity				2.605811203			4.189192449
Productivity index							1.607634676
Change of productivity (absolute)							971618.7841
Volume index of output							2.000527199
Volume index of input							1.24439167
Change of input volume (absolute)							478274.8359
Change of profitability							3.827398139
Change of returns							2.690145571
Change of costs							1.381247981
Utilised annual capacity			415094				
Available annual capacity			530000				
Utlisation ratio			0.783196226				

Table 2. Comparison of basic measure types. Source: Saari (2006).

Type of measure	Variables to be measured	Variables excluded
Physical	Quantity	Quality and distribution
Fixed price value	Quantity and quality	Distribution
Nominal price value	Quantity, quality and distribution	None

Increases in productivity

Companies can increase productivity in a variety of ways. The most obvious methods involve automation and computerization which minimize the tasks that must be performed by employees. Recently, less obvious techniques are being employed that involve ergonomic design and worker comfort. The theory maintains that, a comfortable employee can produce more than a counterpart who struggles through the day. In fact, some

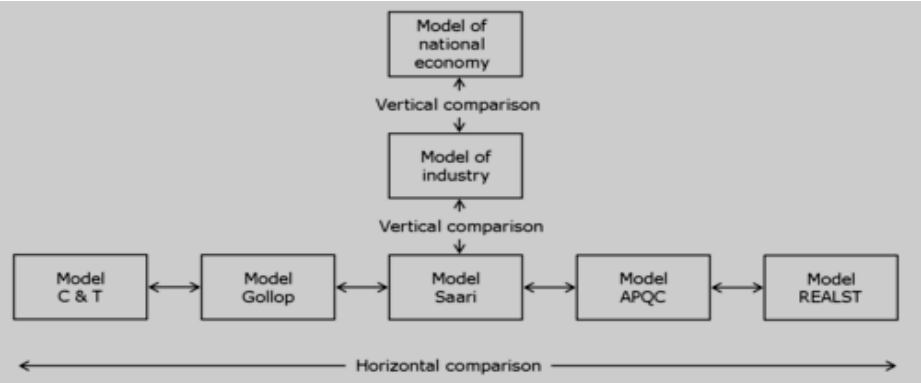

Figure 4. Dimensions of productivity model comparisons. Source: (Saari, 2006).

studies claim that measures such as raising workplace temperature can have a drastic effect on office productivity. Experiments done by the Japanese Shiseido Corporation also suggested that productivity could be increased by means of perfuming or deodorising the air conditioning system of workplaces. Increases in productivity also can influence society more broadly, by improving living standards and creating income. They are central to the process generating economic growth and capital accumulation. A new theory suggests that the increased contribution that productivity has on economic growth is largely due to the relatively high price of technology and its exportation via trade, as well as domestic use due to high demand, rather than attributing it to micro economic efficiency theories which tend to downsize economic growth and reduce labour productivity for the most part. Many economists see the economic expansion of the later 1990s in the United States as being allowed by the massive increase in worker productivity that occurred during that period. The growth in aggregate supply allowed increases in aggregate demand and decreases in unemployment at the same time that inflation remained stable. Others emphasize drastic changes in patterns of social behaviour resulting from new communication technologies and changed male-female relationships.

Labour (Stevedore) productivity

Labour productivity is generally speaking held to be the same as the "average product of labour" (average output per worker or per worker-hour, an output which could be measured in physical terms or in price terms). It is not the same as the marginal product of labour, which refers to the increase in output that result from a corresponding increase in labour (stevedore) input. The qualitative aspects of labour (stevedore) productivity such as creativity, innovation, teamwork, improved quality of work and the effects on other areas in a company are more difficult to measure.

Comparison of the productivity models

Productivity in economics is the ratio of what is produced to what is required to produce. Productivity is the measure on production efficiency. Productivity model is a measurement method which is used in practice for measuring productivity. Productivity model must be able to solve the formula *Output / Input* when there are many different outputs and inputs.

The principle of comparing productivity models is to identify the characteristics that are present in the models and to understand their differences. This task is alleviated by the fact that such characteristics can unmistakably be identified by their measurement formula. Based on the model comparison, it is possible to identify the models that are suited for measuring productivity. A criterion of this solution is the production theory and the production function. It is essential that the model is able to describe the production function.

The principle of model comparison becomes evident in Figure 4. Table 3 compares different productivity models. There are two dimensions in the comparison. Horizontal model comparison refers to a comparison between business models. Vertical model comparison refers to a comparison between economic levels of activity or between the levels of business, industry and national economy.

At all three levels of economy, that is, that of business, industry and national economy, a uniform understanding prevails of the phenomenon of productivity and of how it should be modelled and measured. The comparison reveals some differences that can mainly be seen to result from differences in measuring accuracy. It has been possible to develop the productivity model of business so as to be more accurate than that of national economy for the simple reason that in business the measuring data are much more accurate.

Business models

There are several different models available for

Table 3. Comparative summary of the models. Source: Saari (2006).

Choices	Saari	Kurosawa	Gollop	C & T
Variables used in the model	1) Distribution; 2) Productivity; 3) Volume.	1) Distribution; 2) Productivity; 3) Volume.	1) Distribution; 2) Productivity; 3) Volume.	1) Distribution; 2) Productivity; 3) Volume.
Theory and alternatives: 1) Production function 2) Cost function	Production function	Production function	Cost function	Cost function
Calculation order of variables	1) Distribution; 2) Productivity; 3) Volume.	1) Volume; 2) Productivity; 3) Distribution.	1) Volume; 2) Productivity; 3) Distribution.	1) Volume; 2) Productivity; 3) Distribution.
Accounting technique alternatives: 1) Variance accounting; 2) Ratio accounting; 3) Accounting form.	All changes; Variance accounting	All changes; Accounting form.	Distribution; Variance accounting productivity; Ratio accounting volume; Accounting form.	All changes; Accounting form.
Adjustability alternatives: Adjustable Fixed	Adjustable	Fixed	Fixed	Fixed

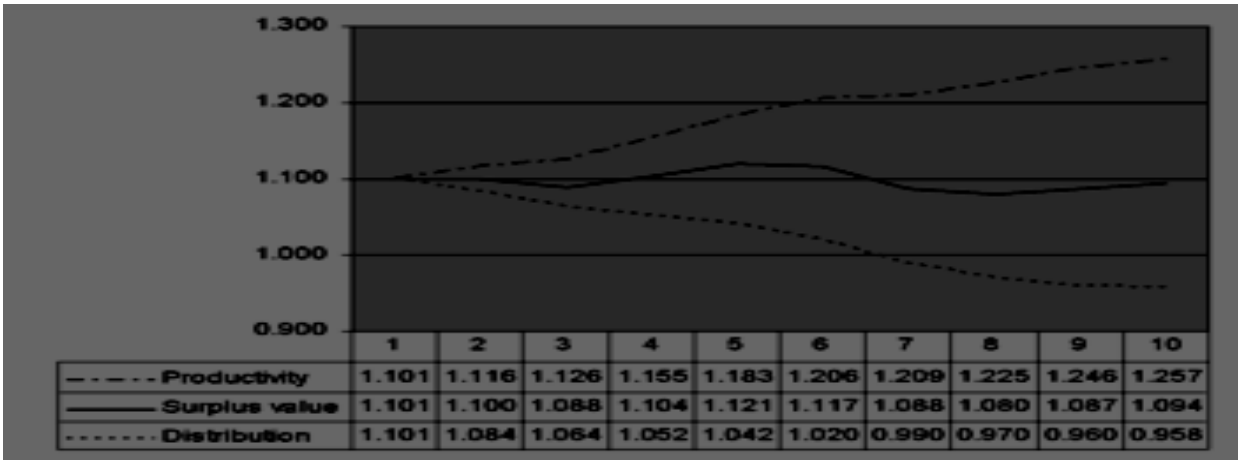

Figure 5. Productivity/Surplus Value/Distribution. Source: Saari (2006).

measuring productivity. Comparing the models systematically has proved most problematic. In terms of pure mathematics it has not been possible to establish the different and similar characteristics of them so as to be able to understand each model as such and in relation to another model. This kind of comparison is possible using the productivity model which is a model with adjustable characteristics. An adjustable model can be set with the characteristics of the model under review after which both differences and similarities are identifiable.

Models of national economy

In order to measure productivity of a nation or an industry, it is necessary to operationalize the same concept of productivity as in business, yet, the object of modelling is substantially wider and the information more aggregate. The calculations of total productivity of a nation or an industry are based on the time series of the System of National Accounts (SNA) formulated and developed for half a century. National accounting is a system based on the recommendations of the UN (SNA

93) to measure total production and total income of a nation and how they are used.

Measurement of productivity is most accurate in business because of the availability of all elementary data of the quantities and prices of the inputs and the output in production. The more comprehensive the entity we want to analyse by measurements, the more data need to be aggregated. In productivity measurement, combining and aggregating the data always involves reduced measurement accuracy.

Output measurement

Conceptually speaking, the amount of total production means the same in the national economy and in business but for practical reasons modelling the concept differs, respectively. In national economy, the total production is measured as the sum of value added whereas in business it is measured by the total output value. When the output is calculated by the value added, all purchase inputs and their productivity impacts are excluded from the examination. Consequently, the production function of national economy is written as follows:

Output = f (Capital, Labour)

In business, production is measured by the gross value of production and in addition to the producer's own inputs (capital and labour) productivity analysis comprises all purchase inputs such as raw-materials, outsourcing services, supplies, components, etc. Accordingly, it is possible to measure the total productivity in business which implies absolute consideration of all inputs. It is clear that productivity measurement in business gives a more accurate result because it analyses all the inputs used in production.

The productivity measurement based on national accounting has been under development recently. The method is known as KLEMS, and it takes all production inputs into consideration. KLEMS is an abbreviation for K = capital, L = labour, E = energy, M = materials, and S = services. In principle, all inputs are treated the same way. As for the capital input in particular this means that it is measured by capital services, not by the capital stock.

Combination or aggregation problem

The problem of aggregating or combining the output and inputs is purely measurement technical, and it is caused by the fixed grouping of the items. In national accounting, data need to be fed under fixed items resulting in large items of output and input which are not homogeneous as provided in the measurements but include qualitative changes. There is no fixed grouping of items in the business production model, neither for inputs nor for products (services), but both inputs and products (services) are present in calculations by their own names representing the elementary price (freight rate) and quantity of the calculation material.

Problem of the relative prices

For productivity analyses, the value of total production of the national economy [gross national product (GNP)] is calculated with fixed prices. The fixed price calculation principle means that the prices by which quantities are evaluated are hold fixed or unchanged for a given period. In the calculation complying with national accounting, a fixed price GNP is obtained by applying the so called basic year prices. Since the basic year is usually changed every 5th year, the evaluation of the output and input quantities remains unchanged for five years. When the new basic-year prices are introduced, relative prices will change in relation to the prices of the previous basic year, which has its certain impact on productivity.

Old basic-year prices entail inaccuracy in the production measurement. For reasons of market economy, relative values of output and inputs alter while the relative prices (freight) of the basic year do not react to these changes in any way. Structural changes like this will be wrongly evaluated. Short life-cycle products will not have any basis of evaluation because they are born and they die in between the two basic years. Obtaining good productivity by elasticity is ignored if old and long-term fixed prices are being used. In business models this problem does not exist, because the correct prices are available all the time.

METHODOLOGY

Data analytical tools

To analyze the data generated the MegaStat program (a Microsoft Excel add-in) was used to perform the Saari productivity model which is "an input-output model" using it.

Explanations of productivity model

A characteristic of the productivity measurement models that surpasses all the others is the ability to describe the production function. If the model can describe the production function, it is applicable to total productivity measurements. On the other hand, if it cannot describe the production function or if it can do so only partly, the model is not suitable for its task. The productivity models based on the production function form rather a coherent entity in which differences in models are fairly small. The differences play an insignificant role, and the solutions that are optional can be recommended for good reasons. Productivity measurement models can differ in characteristics from another in six ways.

1. First, it is necessary to examine and clarify the differences in the names of the concepts. Model developers have given different names to the same concepts, causing a lot of confusion. It goes without saying that differences in names do not affect the logic of modelling.

2. Model variables can differ; hence, the basic logic of the model is different. It is a question of which variables are used for the measurement. The most important characteristic of a model is its ability to describe the production function. This requirement is fulfilled in case the model has the production function variables of productivity and volume. Only the models that meet this criterion are worth a closer comparison.
3. Calculation order of the variables can differ. Calculation is based on the principle of Ceteris paribus stating that when calculating the impacts of change in one variable all other variables are hold constant. The order of calculating the variables has some effect on the calculation results, yet, the difference is not significant.
4. Theoretical framework of the model can be either cost theory or production theory. In a model based on the production theory, the volume of activity is measured by input volume. In a model based on the cost theory, the volume of activity is measured by output volume.
5. Accounting technique, that is how measurement results are produced, can differ. In calculation, three techniques apply: ratio accounting, variance accounting and accounting form. Differences in the accounting technique do not imply differences in accounting results but differences in clarity and intelligibility. Variance accounting gives the user most possibilities for an analysis.
6. Adjustability of the model. There are two kinds of models, fixed and adjustable. On an adjustable model, characteristics can be changed, and therefore, they can examine the characteristics of the other models. A fixed model can not be changed. It holds constant the characteristic that the developer has created in it.

Based on the variables used in the productivity model suggested for measuring business, such models can be grouped into three categories as follows:

A. Productivity index models
B. Profitability, Productivity, Prices, Volume (PPPV) models
C. Profitability, Productivity, Price Recovery (PPPR) models

In 1955, Davis published a book titled “Productivity of Accounting” in which he presented a productivity index model. Based on Davis’ model several versions have been developed, yet, the basic solution is always the same (Kendrick and Creamer, 1965; Craig and Harris, 1973; Mundel, 1983; Sumanth, 1979). The only variable in the index model is productivity, which implies that the model can not be used for describing the production function. Therefore, the model is not introduced in more detail here. PPPV is the abbreviation for the following variables, profitability being expressed as a function of them:

Profitability = f (Productivity, Prices(freight), Volume)

The model is linked to the profit and loss statement so that profitability is expressed as a function of productivity, volume and unit prices. Productivity and volume are the variables of a production function, and using them makes it is possible to describe the real process. A change in unit prices describes a change of production income distribution. PPPR is the abbreviation for the following function:

Profitability = f (Productivity, Price, Recovery)

In this model, the variables of profitability are productivity and price recovery. Only the productivity is a variable of the production function. The model lacks the variable of volume, and for this reason, the model can not describe the production function. The American models of REALST (Loggerenberg and Cucchiaro, 1982; Pineda, 1990) and APQC (Kendrick, 1984; Brayton, 1983; Genesca and Grifell, 1992; Pineda, 1990) belong to this category of models but since they do not apply to describing the production function (Saari, 2000) they are not reviewed here more closely. PPPV models measure profitability as a function of productivity, volume and income distribution (unit price). Such models are

1. Japanese Kurosawa (1975)
2. French Courbois and Temple (1975)
3. Finnish Saari (1976, 2000, 2004, 2006)
4. American Gollop (1979)

The Table 1 presents the characteristics of the PPPV models. All four models use the same variables by which a change in profitability is written into formulas to be used for measurement. These variables are income distribution (prices), productivity and volume. In conclusion, we can say that the basic logic of measurement is the same in all models. The method of implementing the measurements varies to a degree, depending on the fact that the models do not produce similar results from the same calculating material.

Even if the production function variables of profitability and volume were in the model, in practice the calculation can also be carried out in compliance with the cost function. This is the case in models C and T as well as Gollop. Calculating methods differ in the use of either output volume or input volume for measuring the volume of activity. The former solution complies with the cost function and the latter with the production function. It is obvious that the calculation produces different results from the same material. A recommendation is to apply calculation in accordance with the production function. According to the definition of the production function used in the productivity models by Saari and Kurosawa, productivity means the quantity and quality of output per one unit of input.

Models differ from one another significantly in their calculation techniques. Differences in calculation technique do not cause differences in calculation results but it is rather a question of differences in clarity and intelligibility between the models. From the comparison, it is evident that the models of Courbois and Temple and Kurosawa are purely based on calculation formulas. The calculation is based on the aggregates in the loss and profit account. Consequently, it does not suit any analysis. The productivity model by Saari is purely based on variance accounting known from the standard cost accounting. The variance accounting is applied to elementary variables, that is, to quantities and prices (freight) of different products and inputs. Variance accounting gives the user most possibilities for analysis. The model of Gollop is a mixed model by its calculation technique. Every variable is calculated using a different calculation technique.

The productivity model by Saari is the only model with alterable characteristics. Hence, it is an adjustable model. A comparison between other models has been feasible by exploiting this particular characteristic of this model.

Measurement of variables

The variables had already been measured by different respondents (companies and organisations) and their respective values were collated separately for each firm and aggregated for the industry. The variables are products (that is services of the companies), price (freight rate), output (throughput or tonnage carried), labour (stevedore), materials, energy and capital.
The hypotheses of this study are:

1. That the shipping industry is productive.
2. That the shipping company is profitable.

Decision rule

When the productivity index is greater than 1.0, we accept the

hypothesis I and reject it if when the value is less than 1.0, that is, productivity index>1 accept; when the change of profitability is greater than 0.5, we accept the hypothesis II and reject when the value is less than 0.5 which means rejected when productivity index<1.0.

RESULTS AND DISCUSSION

Impact of seasonal demand variation on productivity

The cost of inputs such as labour (stevedore), capital, materials, energy (fuel consumed and other energy utilised) varies with time. Fixed costs are even known to vary in the long run. The demand also fluctuates at with time and equilibrium price (freight rate) changes too. The matching of supply to equate demand is difficult in transport as the good is instantly perishable, indivisible and non-storable. Ability to meet surges in demand, bearing in mind all the cost implications, goes a long way in determining an operator's productivity and profitability.

The periods considered were March to August and September to February. The first period represents the time of low demand in shipping trade hence shipping activities are relatively low while the latter records high demand for shipping services. Freight rates are noticed to be generally low for all the firms during the low demand period (season) and high during the peak time. The firms are seen to be more productive at certain times/season of the year than at other. The September to February season recorded high throughputs and better surplus (absolute) values. Table 1 shows the Saari's productivity model analysis for the first shipping company (here referred to as shipping company 1). The Saari's productivity model analysis for the remaining twenty-one is available in Appendix 1.

Impact price of variations on the productivity levels

Price (freight rate) variation is a tool for competition for market share. It was noted that some shipping firms serving same route charge same freight rate while others uses price (freight rate) to attract traffic. Those that use non-price determinants of demand can be said to be avoiding price wars but uses quality of service; adverts and market promotions.

It was noted that most firms charges similar freight rate during the off-peak season so as not to lose existing market shares and disrupt their throughput trends. However, some alter freight rate during the peak seasons. Some are engaged in target marketing, enabling the enjoyment of consumer surplus.

Price (freight rate) variation does not necessarily affect the level of productivity of firms. Those that encourages consumer surplus are seen to be more, to have higher productivity ratios. Worthy of note is the fact that the firms that have very high productivity ratios were able to reduce greatly their employed capital during the peak season.

Factors that affects productivity of shipping companies

The study has shown that the factors that affect productivity are:

1. Labour (stevedoring) cost: Cost of operatives and workers associated with a particular vessel. This cost types is centred on the vessels (or fleet) and are therefore, direct costs.
2. Material cost: These are costs utilised in the process of providing the shipping services. They are common costs with no particular cost centres. Virtually all the departments in the shipping firms contribute to these costs.
3. Energy cost: These costs types have cost centres (that is, the ships) and buildings. For the ships, it covers cost of fuel and for the building (such as warehouses, sheds and administrative blocks) it includes electrical bills and cost of fuel for running power generating plants.
4. Capital cost: These are cost of borrowing money from banks. It includes interests on loans and other financially associated costs. Volume of traffic carried: this is the total volume of cargo and number of passengers carried within the periods under review. The volume of traffic carried is subject to the freight rate of the service in relation to the freight rate offered by rivals/competitors. The larger a firm's market share, the better one expects its productivity. Firms can equally use price (freight rate) discrimination to increase or sustain their market shares. The use of price discrimination is only possible if there is ability to exercise monopoly powers, the market can be segmented,
5. Capacity utilization: This is the rate of usage of the carrying capacity of the firms. The nearer the value of the ratio of capacity utilised over capacity available to unity the better the firm's capacity utilization. Over-utilisation occurs when the value is greater than unity. Values less than 0.6 is not desirable and it reflects under-utilisation of capacity.

Shipping capacity utilisation and productivity

It was observed that companies with high productivity index had good capacity utilisation ratios. Firms with poor productivity index recorded poor capacity utilisation ratio. This is illustrated on Table 4.

Worthy of note is the fact that over-capacity utilisation is counter-productive has the firms with capacity utilisation ratio greater than unity were not ranked in the first five firms on the productivity index ranking (Table 4). Ability to reduce costs of operation over time increases a firm's profitability as well as its productivity. This is shown in Table 4 as well. It was noted that firms that were able to reduce their second period cost from levels recorded in

Table 4. Capacity utilization and productivity.

Shipping firms	Capacity utilization ratio	Productivity index	Change of costs
16	0.9447	17.73937033	0.171949494
3	0.92679375	14.75249016	0.14015809
20	0.934190476	13.16119781	0.198848932
4	0.922431111	12.0332137	0.184519925
13	0.867068	10.76370736	0.126555547
5	1.039531373	2.632014172	1.826127277
15	0.880428846	2.494393232	1.3587491
2	0.818047826	2.227291063	1.039874931
6	0.85384	1.787463029	1.873341546
1	0.783196226	1.607634676	1.381247981
10	0.738253333	1.588960024	2.253356369
11	0.630389601	1.549358388	1.553079744
8	0.920225	1.526924646	1.329266643
7	0.826311111	1.471917681	1.468475044
12	0.798257692	1.380174503	1.998493172
9	0.628874603	1.315809531	1.592212403
22	1.70463	1.163223212	2.18602925
17	0.752765	1.097963902	1.128334867
14	0.706810938	0.982579621	3.697690414
19	0.545617857	0.899469943	2.124692921
18	0.747276921	0.77093173	1.459097419
21	1.160367347	0.127258931	20.14383927

the first period were at the long-run more productive.

It must be noted that maritime trade has foreign shipping playing a very strong role as they accounted for 41% of the total shipping companies in Nigeria and made up the first five firms on our productivity index rating.

The reason could be due to their greater use of economies of scales and the fact that they were better users of their available capacities than Nigerian firms, some of whom even recorded over-utilization of their capacities.

Productivity and mode of shipping operation

It was observed that shipping companies that does liner operations are more productive than those that do tramping. The same was noted for shipping firms that do charter services instead of voyage or scheduled services. It was also noted that those companies that do liner and charter services had better utilisations of their various capacities. All these can be seen in Table 5. Ability to use capacities optimally leads to productivity. One could therefore, deduce that, liner operations and charter services results to better capacity utilisation. In addition, liner operations and charter services enables the shipping firms to maximise revenue and profitability since services are tailored to the requirements of the shippers and this gives little or no room for waste. Profits are maximised because there are opportunities to collect consumer surplus from the customers. Consumer surplus is the additional values consumers' attach to a product or service over the prevailing market price. It is the excess consumers are willing to pay for a product.

Consumer surpluses can only be enjoyed when the product is monopolised and target marketing is employed. All this can be done when the market is segmented. Market segmentation can be done when the market has been studied. This in turn tells us that the liner shipping companies and those that offer charter services have great knowledge of the market (the needs of the shippers).

Routes and cabotage violations

We noted that Cabotage Act violations exists in Nigeria as many of the foreign owned vessels move traffic from one point to another within Nigeria's territorial waters undermining the efforts and capacity utilization of domestic carriers, this is shown on Table 6. Worthy of note is the fact that many Nigerian shipping companies do not ply international routes (Table 7). Most of those that do only do sub-regional trade along the Bight of Benin coastal ports of West and Central Africa.

Table 5. Capacity utilization and productivity showing ownership types.

Foreign shipping firms	Indigenous shipping firms	Capacity Utilization ratio	Productivity Index	Change of costs
16		0.9447	17.73937033	0.171949494
3		0.92679375	14.75249016	0.14015809
3		0.934190476	13.16119781	0.198848932
4		0.922431111	12.0332137	0.184519925
13		0.867068	10.76370736	0.126555547
	5	1.039531373	2.632014172	1.826127277
	15	0.880428846	2.494393232	1.3587491
	2	0.818047826	2.227291063	1.039874931
	6	0.85384	1.787463029	1.873341546
1		0.783196226	1.607634676	1.381247981
	10	0.738253333	1.588960024	2.253356369
	11	0.630389601	1.549358388	1.553079744
8		0.920225	1.526924646	1.329266643
	7	0.826311111	1.471917681	1.468475044
12		0.798257692	1.380174503	1.998493172
	6	0.628874603	1.315809531	1.592212403
	22	1.70463	1.163223212	2.18602925
	17	0.752765	1.097963902	1.128334867
	14	0.706810938	0.982579621	3.697690414
	19	0.545617857	0.899469943	2.124692921
18		0.747276921	0.77093173	1.459097419
	21	1.160367347	0.127258931	20.14383927
41%	59%	Percentage		

Indicators of seaport productivity

Indicators of port productivity (Tables 8 and 9) are port productivity, berth effectiveness and gang hour effectiveness. Mathematically they are shown below as:

1. Berth productivity = Total Tonnage/time spent in berth.
2. Port productivity = Total Tonnage/time spent in port.
3. Berth Effectiveness = Total Tonnage/time spent at berth.
4. Gang hours effectiveness = Total tonnage/gross gang hour.

The following are worthy of note:

a) Tonnage valve here are those handled by labour in gangs of 16 men each.
b) This means that port productivity and berth effectiveness here are functions of gang hours effectiveness.
c) Delays are in both days and hour, it berth working time lost where labour is schedule to work. It is similar to the idle time mentioned in indicators of utilization analysis, except that idleness' time (in indicators of utilization) included lost time even without the use of labour (for example, at the berth 1 where suction pumps and conveyor belts are used).

The productivity of labour at the LPC is not something to write home about. Its tonnage per net gang hour (TPNGH) rose by 20% in 2001 from 2000 level. Though, that same year witnessed an increase in delay by 277%. The TPNGH fell by 8% in 2002, improved greatly in 2003 and 2004 and it expected to decline by 13, 69 and 47% in 2005, 2006 and 2007 respectively.

This downturn can be linked to the internal wrangling within the folds of Maritime Workers Association of Nigeria and the subsequent change of the Nigerian Maritime Policy that allowed the port to be reformed making Nigerian Ports Authority to become landlords at the ports while private firms hold concessions to operate the berth. The berthing operation has undergone a great automation transformation. Machines now perform more of the tasks than before and less man-labour is being used.

SUMMARY

This study has considered the impact of seasonal demand on the productivity of Nigerian shipping companies and the followings were noted:

Table 6. Comparing productivity index and type of shipping operation.

Shipping firm		Nature of operation (liner = 0 Tramping = 1)	Types charter services offered (Voyage = 0 scheduled = 1)	productivity index	Available capacity (metric tonnes)	Capacity utilization ratio
Foreign shipping firms	Indigenous shipping firms					
16		0	0	17.73937033	300000	0.9447
3		0	0	14.75249016	480000	0.92679375
3		0	0	13.16119781	420000	0.934190476
4		1	1	12.0332137	450000	0.922431111
13		1	1	10.76370736	500000	0.867068
	5	0	0	2.632014172	510000	1.039531373
	15	1	0	2.494393232	520000	0.880428846
	2	1	1	2.227291063	460000	0.818047826
	6	1	0	1.787463029	487500	0.85384
1		1	0	1.607634676	530000	0.783196226
	10	0	0	1.588960024	450000	0.738253333
	11	1	1	1.549358388	560060	0.630389601
8		1	1	1.526924646	400000	0.920225
	7	0	1	1.471917681	450000	0.826311111
12		1	1	1.380174503	520000	0.798257692
	6	0	1	1.315809531	630000	0.628874603
	22	1	1	1.163223212	1000000	1.70463
	17	0	1	1.097963902	800000	0.752765
	14	0	0	0.982579621	640000	0.706810938
	19	1	1	0.899469943	560000	0.545617857
18		1	1	0.77093173	750070	0.747276921
	21	1	1	0.127258931	980000	1.160367347
41% of the firms offers liner services				41% of the firms offers voyage charter		
59% of them offer tramping services				59% of them offer scheduled services		
Of the 41% that does 66% of them are domestic carriers				Of the 41% that offer voyage services 56% of them are domestic carriers		

Table 7. Routes and cabotage act violations based ownership types.

Foreign shipping firms	Indigenous shipping firms	Routes served	
		International (yes = 1, No = 0)	Domestic (yes = 1, N0 = 0)
16		1	1
3		1	0
3		1	1
4		1	0
13		1	1
	5	1	1
	15	1	1
	2	1	1
	6	0	1
1		1	0
	10	1	1
	11	1	1
8		0	1
	7	1	1
12		1	0
	6	1	1

Table 7. Cont'd.

22	0	1
17	0	1
14	0	1
19	1	1
18	1	0
21	1	1
77% does international routes	77% does domestic routes	
23% does not do international routes	23% does not do domestic routes	
Of the 77% offering international routes only 41% are Nigerian firms	Of the 77% offering domestic routes 18% are foreign shipping firms	

1. Varying demands affects greatly the ability to plan, whether in the short, medium or long terms. The matching of supply to equate demand is difficult in transport as the good is instantly perishable, indivisible and non-storable and this further reduces adequate planning, hence productivity could be adversely affected, should the shipping firm be found to have slacked in its ability to meet its operational obligations.
2. Increased demands occasioned by seasonal variations are often accompanied by higher freight rate and revenues. Though, this does not guarantee better productivity of profitability if costs of inputs are not adequately monitored.
3. Freight rates variations for inputs and freight charges have significant impact on productivity levels.
4. Higher revenues can be achieved by allowing the usage of consumer surplus in price determination.
5. Non-freight determinants of demand can be used to improve revenue and consequently productivity. This leads to the avoidance of freight wars but encourages the use of quality of service, adverts and promotions to boost demand.
6. Ability to reduce cost of inputs particularly during peak seasons leads to very high productivity ratios for some firms.
7. The study showed that the followings are the factors that affect productivity: stevedoring cost, material cost, energy cost, capital cost and capacity utilization.
8. Good capacity utilisation leads to high productivity ratios. An underutilized facility bears the full expense of amortization, maintenance and operation {full input} while producing limited outputs. As facilities are fixed and the work to be processed often changes both in nature and volume, those facilities tend to be a factor in limiting productivity, machine and equipments as well as raw materials, frequently limit productivity.
9. The operation pattern and service type of shipping companies affects levels of productivity. Companies that offer liner operations are more productive than those that do tramping. The same was noted for shipping firms that do charter services instead of voyage or scheduled services.
10. Target marketing enables the shipping firms to maximise revenue and profitability, since services are tailored to the requirements of the shippers and this gives little or no room for waste.
11. Nigerian ports are seen to be more productive after the implementation of the port reforms and the concessions of the berths at the ports to private companies.

RECOMMENDATIONS

1. It is recommended that goods are properly palletized in order that more goods or cargoes could be carried to enhance full load capacities.
2. High tariff in the ports should be moderated to enhance and encourage shipper friendly patronage.
3. Efforts should be made to quicken the time spent in the wharf to avoid cost of demurrage on the part of shippers thus avoid diversions to nearby ports like Republic of Benin and Duala Port of Cameroun.
4. More efforts should be made by the maritime regulator to ensure the strict adherence to the Cabotage Act so that domestic carriers can be more productive and have better capacity utilization.
5. Indigenous shipping firms should be encouraged to participate more in the carriage of Nigeria's international seaborne trade.
6. The type of technology employed as well as the capacities utilization will determine the effectiveness, efficiency and productivity of shipping firms so efforts should be made at employing current technologies and practices.
7. The harsh economic situation makes it necessary for some form of governmental assistance to be required by the shipping companies and the ports. Why? The maritime industry is (though not alone) vital for the development of manufacturing industry and the economy at large. The continuous supply of needed materials can no longer be taken for granted. Shortages are common place; promised delivery dates stretch further into the future, and scarcity that precipitates surcharges are the

Table 8. Port productivity indicators.

Year	Gross gang hours	Gross gang days	Days at berth	Days in port	Delays		Net gang days	Net gang hours	Tonnage handled	Port productivity	Berth effectiveness	TPGGH	TPNGH
					Hours	Days							
2000	140121	5838	3367	3664	16296	679	123819	5159	2489070	679	739	18	20
2001	204572	8524	3401	3704	61392	2558	143187	5966	3500033	945	1029	17	24
2002	214542	8939	5136	5745	59400	2350	158127	6589	3503533	610	682	16	22
2003	181519	7563	5392	6853	54576	2274	126926	5289	3659556	534	679	20	29
2004	128521	5355	2974	3462	64152	3923	34380	1433	2450637	708	825	19	71
2005	29785	1241	2469	2705	7272	303	22515	938	1386450	513	562	47	62
2006	37618	1567	1953	2137	4896	204	32711	1363	623924	292	320	17	19
2007	103523	4313	2563	2818	9048	377	94456	3936	961464	342	375	9	10
2008	111983	4666	2694	2798	10680	445	101297	4221	105933	379	393	10	11
2009	149071	6211	3956	4139	14352	598	134706	5613	1672857	404	423	11	12
Total	301255	54217	33903	38025	329064	13711	972121	40507	21306887	5406	6027		

Source: (Nze, 2011).

Table 9. Percent change in productivity indicator.

Year	Percentage change in				Berth effectiveness	TPGGH	TPNGH
	Gross gang hour	Net gang hour	Delays	Port productivity			
2000	-	-	-	-	-	-	-
2001	46	16	277	39	39	-6	20
2002	5	10	-8	-35	-34	-6	-8
2003	-15	-20	-3	-13	-0.4	25	32
2004	-29	-73	73	33	22	-5	145
2005	-77	-35	-92	-28	-32	147	-13
2006	26	45	-33	-43	-43	-64	-69
2007	175	189	85	17	17	-89	-47
2008	16	7	18	11	5	11	10
2009	33	33	34	7	8	10	9

Source: (Nze, 2011).

norm. In some cases, businesses are forced to close, either temporarily or permanently. Money originally scheduled for new equipment and other aids to boost productivity is being diverted to pay the increased cost of materials. Productivity gains can be realized but only with new and creative approaches in our shortage economy. These approaches include better use of materials and improved lead-time planning.

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