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LINEAR PROGRAMMING AND BUSINESS DECISION MAKING AMONG QUOTED FIRMS IN NIGERIA

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ABSTRACT

It has become apt to evaluate the linearity that exists between linear programming technique and business decision making among quoted firms in Nigeria to be able to know how effective it has become over the years in the allocation of organisations available scarce resources. The objectives of this study is to find out the correlation between linear programming and business decision making among quoted firms in Nigeria; and to determine the effect of linear programming on business decision making among quoted firms in Nigeria. The population was drawn from quoted firms traded on the floor of the Nigeria Stock Exchange, which are from real sector of the Nigerian economy, andare recorded byCentral Securities Clearing System – CSCS as at 21st June, 2017. Hypotheses were tested using both Pearson Product Moment Correlationand Regression Analysis with the aid of SPSS version 21. The result of the analysis showed that there is a strong positive relationship between linear programming and business decision making. The study therefore concluded that linearprogramming is most effective in business decision making.

Keywords: *Linear Programming, Business-decision, Linearity.*

INTRODUCTION

In the face of numerous difficulties faced by organisations as a result of the contemporary economic challenges of the 21st century, businesses must continue to thrive and managers must continue to make optimal decisions that optimize firm's values. This simply means that when alternative courses of action are available, the decision that produces the best result that is most consistent with the management objective-function becomes the optimal decision.

According to Aimiuwu (2012), the truest fact is, the global economy is in the midst of a steep recession, and every business is confronting challenging and turbulent economic conditions not just in Nigeria but the world-over. Since 2008, "a new normality" has been a state of heightened turbulence that challenges leaders in business and in government. In these turbulent times, decision makers need to abandon the traditional data-intensive, research-heavy operations and marketing plan and begin creating plans that are tight, compelling and relentlessly focused on actions that will optimize shareholders return on investments. Indeed also, business is rarely easy; customers can be demanding and competitors are almost always hard to deal with. Economic and Technological changes mean that companies cannot stand still; the only way to succeed is to constantly look for the next available innovation.

Decision makers that are saddled with these daunting-challenges such as; allocation of scarcely available resources to the various competing-need areas of the organisation; maximizing shareholders contribution and minimization of cost per unit to the barest minimum are almost always under the gun, and have to balance the operations optimization; driving sales in the short run with building strong

businesses and brands that will thrive in the long run with recourse to the firm's objective function. (Aimiuwu, 2012)

According to Kotler and Caslione (2009), during turbulent times, businesses should be pro-active and correct weaknesses while spotting and seizing new opportunities. One of these proactive measures is adopting linear programming approach in business decision making. Linear Programming is a mathematical modeling approach designed specifically to allocate the available scarce resources of a firm among the various competing product lines in order to achieve the economic objective of the firm under multiple constraining situations.

With this linear programming model, optimization is at the fingertips of the decision makers. It is on this premise that this study seeks to find out the effectiveness of linear programming in business decision making among quoted firms in Nigeria.

OBJECTIVE OF THE STUDY

- To determinethe significant linearity between linear programming and business decision making

- To find out the significant effect of linear programming model on decision making

HYPOTHESIS

H_{01}: there is no significant linearity between linear programming and business decision making

H_{02}: linear programming does not have any significant effect on business decision making

LITERATURE REVIEW

CONCEPTUAL FRAMEWORK

Concept of Linear Programming

The concept of Linear Programming is a concept that implies the application of specific operations research techniques to determine the choice among several courses of action, so as to get an optimal value of the measures of effectiveness (objective), requiring formulating a mathematical model. Such a model helps to represent the essence of a system that is required for decision making. The structure of linear programming includes: ***theDecision Variable***, ***the objective function,*** and ***the constraint***. Linear programming can be applied in variety of places such as: agriculture, industry, military, ministries, etc., adopting either graphical or simplex methodological approaches. (Sharma, 2014)

The underlying ***Assumptions***of linear programming include: certainty of decision variables,additivity of the scarce resources, non-negativity of the decision variables, linearity of the objective function, divisibility of factors of production (man, machine, material)

Concept of Decision Making

Every business no matter its size has limited available resource. This makes decision making about allocation of those limited resources to the various units in which they are needed sacrosanct. In fact, one of the most important tasks of management is to allocate these resources effectively and efficiently in order to achieve the company's goals and objectives.

According to Bhandari (2015), Decision making can be defined as making choice between future uncertain alternatives. A short term practical decision making consists of choosing among alternatives with an immediate or limited end in view. It must be emphasis that all decision making relates to the future and that a decision is a choice between alternatives in pursuit of objectives. Where no alternatives exist no decision can be made and nothing can be done now that will alter the past. Therefore, decision making is concerned with the future and involves the act of selecting one course of action from various courses of action.

The importance of decision making in an organisation cannot be overemphasized. Decision making is considered as the backbone for the business management because without taking the right decision at right time, nothing can be performed. (Pokhrel, 2014)

Poudyal, (2015) opines that for the

rationality, reliability, and enforceability of decisions, managers should follow a sequential set of steps. It is said that a decision is rational if appropriate means are chosen to reach desired ends. In this regards, various management authorities have recognized and described different steps in the process of decision-making. Ricky W. Griffin in Poudyal (2015) has suggested six steps in the process of decision making. Accordingly, the steps are:

Identification of problem: The initial stage of the decision-making process is to identify the exact problem. The problem may occur due to the gap between thinking and do the process. The reason of problems may be internal or external. Decision makers should identify the correct problems before taking any decision. It is not an easy job or task. Therefore, he/she may use his own knowledge, skills, experience and collect information from internal and external sources. It is believed that identification of the correct problem is almost half part of the decision-making process.

Analysis of problem: After identification of the correct problem decision maker should analyze the problem systematically and scientifically in terms of cost, time, legality, organizational resources, and short-term as well as the long-term impact of the problem. While analyzing the problem he/she may use various financial, accounting and statistical tools or techniques.

Developing an alternative course of action: As we know that a problem has multiple solutions. Therefore, the decision maker should develop the various possible alternatives for a better decision. While developing the alternative course of action he/she may use their own knowledge, skills, experiences and technical support from the professional planner and experts as well.

Evaluating alternative course of action: After developing various possible alternatives, the decision maker should evaluate all alternatives one by one for a better decision. In this step he/she should try to search the answers to the following questions:whether the alternative is feasible in terms of cost, time, legality and other organizational resources or not? whether the alternative is satisfactory to solve the organizational problems or not? whether the features of alternatives are matched with the objectives of the business or not?

Selecting the best alternative: After analyzing the various alternatives, the decision maker has to select the best alternative among the various alternative by considering the short-term as well as long-term impact. For this purpose, he/she may use his/her knowledge, skills and experiences. He/she may also concern with other stakeholders for a better decision.

Implementation of decision: After selecting the best alternative, the manager or superior should convert decision into action. For this purpose, he/she should communicate with their subordinate and manage the various additional resources for the implementation of the organizational decision.

Review of decision: The last step of the decision-making process is to get response or feedback from other stakeholders of the organization. If the response is positive then the decision-making process is successfully completed. It the response is negative then he/she

must go through the first step to take a new organizational decision.

EMPIRICAL FRAMEWORK

In their work entitled "Optimizing profit with the linear programming model: A focus on Golden Plastic Industry Limited, Enugu – Nigeria", Ezema and Amakom (2012) opine that *Linear programming as an operations research technique is widely used in finding solutions to complex managerial decision problems, but firms at Emene Industrial Layout make more use of the trial-and-error method. As such, firms at the Layout have been finding it difficult in allocating scarce resources in a manner that will ensure profit maximization or cost minimization. The study was carried out to seek and arrive at the optimal product-mix of a productive firm-the Golden Plastic Industry Limited- in the layout. The production problem of the firm was formulated as a linear programming problem and estimated as such. The result shows that only two sizes of the total eight "PVC" pipes should be produced. The study succeeded in establishing that Golden Plastic Industry Limited, Emene should produce 114,317.2 pieces of 25mm by 5.4m conduit pipes and 7,136.564 pieces of 20mm by 5.4m thick pressure pipes, and zero quantities of the rest sizes of pressure pipes per month in order to obtain a maximum profit of N1, 964,537 given the present level of available funds and the technical coefficients of the products. The study also shows that only two of the raw materials –tio 2 and labour time- were surplus, while the other six-resin, calcium carbonate, stabilizer, cast, carbon black and blend-were scarce in relation to the formulated model. The shadow prices of the raw materials obtained showed their unit contribution to the objective function (profits) and suggests to management the prices at which they should either be bought or sold. The finding of this study goes a long way to show how effective the company would have been, if they were using linear programming model in the allocation of their scarce resources and optimizing their objective-function.*

Adeyemo and Otiero (2009) demonstrated that the linear programming model can be extended beyond the realms of Management Sciences and organizational decision departments to other areas such as Physical and Environmental Sciences. They used the application of Differential Evolution (DE) and Linear Programming (LP) to maximize total income (in South African Rand ZAR) of 2500 ha planting area where 16 crops are planted and constrained by water availability (using only 10mm3 of irrigation water). It is found that a total income of ZAR 46,060,200 can be derived using linear programming. Ten strategies of DE are tested with this problem varying the population size (NP), crossover constant (CR) and weighing factor (F). It is found that strategy 1, DE/rand-1-bin, with values of NP, CR and F of 160, 0.95 and 0.5 respectively obtains the best solution most efficiently.

Kareem and Aderoba (2008) discovered the effectiveness of adopting the linear programming model in manpower planning and maintenance, using data from a cocoa processing industry in Akure, Ondo State of Nigeria. The result shows that only four maintenance crew out of the 19 employees are needed in that section to effectively carry out maintenance jobs in the industry.

METHODOLOGY

RESEARCH DESIGN

The study adopted survey design.

POPULATION

The population was drawn from four quoted firms, traded on the floor of the Nigeria Stock Exchange, which are from real sector of the Nigerian economy, and are recorded byCentral Securities Clearing System – CSCS as at 21st June, 2017. (See list @ www.cscsnigeriaplc.com).The population of the staff of the four firms (both contract for employment staff and contract for employment staff) stood at **198,130.**

SAMPLING METHOD AND SAMPLE SIZE

The study adopted random sampling method and the sample size which was

determined using YaroYameni formula was approximately 400.

Reliability Test of the Scales Using Cronbach's Alpha

Reliability Statistics for linear Programming scale

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.746	.753	15

Scale Statistics for Linear Programming scale

Mean	Variance	Std. Deviation	N of Items
60.53	65.162	8.072	15

The table marked "***Reliability Statistics for linear Programming scale***" simply shows that fifteen items were constructively designed in the scale which was administered and the reliability test for the scale shows a Cronbach's Alpha coefficient of 0.746. The table marked ***"Scale Statistics for Linear Programming scale"*** shows a mean of 60.53, for the 15 items in the scale.

Reliability Statistics for Decision Making

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.875	.873	15

Scale Statistics for Decision Making

Mean	Variance	Std. Deviation	N of Items
62.32	110.544	10.514	15

The table marked "***Reliability Statistics for Decision making scale***" simply shows that fifteen items were constructively designed in the scale which was administered and the reliability test for the scale shows a Cronbach's Alpha coefficient of 0.875. The table marked ***"Scale Statistics for Decision Making scale"*** shows a mean of 62.32, for the 15 items in the scale.

SAMPLE SELECTION PROCEDURE

400 randomly selected respondents drawn from 4 quoted firms which include: Nigeria Breweries Plc; Unilever NigPlc;GuinnessNigPlc and 7-UP Bottling Plcwerechosen and equal number of 100 copies of questionnaire was distributed to respondents in each of these four firms, making a total of 400 in all.

SOURCES OF DATA

Primary source

DATA COLLECTION

The total numbers of 400 copies of questionnaire distributed to the members of the staff of the four firms were all collected, representing 100% return rate.

STATISTICAL TECHNIQUE

In order to assess the level of relationship that exist between linear programming and business decision making, correlation analysis was adopted using SPSS version 21.

DECISION RULE:

+1 = Perfect Positive Correlation between Linear Programming and Decision making

+0.5 to 0.9 = Strong Positive Correlation between Linear Programming and Decision making

+0.1 to 0.4 = Linear Programming and Decision making are fairly correlated

+0.01 = Weak correlation between Linear Programming and Decision making

-1 = Perfect Negative Correlation between Linear Programming and Decision making

0 (zero) = Nullor Zero correlation

DATA ANALYSIS AND RESULT PRESENTATION

TESTING OF HYPOTHESIS

HYPOTHESIS ONE

H_{01}: there is no significant relationship between linear programming and business decision making

H_{a1}: there is significant relationship between linear programming and business decision making

Descriptive Statistics

	Mean	Std. Deviation	N
Linear Programming	60.5300	8.07230	400
Decision Making	62.3200	10.51399	400

Correlations: Linear Programming and Business Decision Making

		Linear Programming	Decision Making
Linear Programming	Pearson Correlation	1	.840**
	Sig. (2-tailed)		.000
	N	400	400
Decision Making	Pearson Correlation	.840**	1
	Sig. (2-tailed)	.000	
	N	400	400

**. Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

The SPSS correlation table above shows correlation strength of 0.840 (Pearson Correlation) which depicts a very strong positive relationship between linear programming and business decision making. The table also shows that the correlation is significant at 0.01 level (2-tailed). The N represents 400 respondents. **That is,** $r = .840, n = 400, p < 0.01$

DECISION

On the above premise, going by our decision rule, we therefore reject $\mathbf{H_{01}}$which states that there is no significant relationship between linear programming and business decision makingand accept $\mathbf{H_{a1}}$which states that there issignificant relationship between linear programming and business decision making and therefore concludes that linear programming is most effective in business decision making.

HYPOTHESIS TWO

$\mathbf{H_{02}}$**:** linear programming does not have any significant effect on business decision making

$\mathbf{H_{a2}}$**:** linear programming has a significant effect on business decision making

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.840[a]	.705	.705	5.71458	.705	952.637	1	398	.000

a. Predictors: (Constant), Linear Programming

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	31109.765	1	31109.765	952.637	.000[b]
	Residual	12997.275	398	32.656		
	Total	44107.040	399			

a. Dependent Variable: Decision Making

b. Predictors: (Constant), Linear Programming

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3.892	2.164		-1.798	.073
	Linear Programming	1.094	.035	.840	30.865	.000

a. Dependent Variable: Decision Making

DISCUSSION

The regression analysis conducted above shows that linear programming contributes about 70.5% effectiveness in the allocation of scarce resources among various units of the firms, that is, r-square = 0.705 x 100 = 70.5%. (See the table labeled model summary above to see the R-square)

DECISION

On the above premise, going by our decision rule, we therefore reject H_{02} which states that linear programming does not have any significant effect on business decision makingand accept H_{a2} which states that linear programming has a significant effect on business decision making. This is so because the study has shown that Linear Programming contributes significantly to the effective allocation of limited available resources.

CONCLUSION

Having looked at the findings of the study and its analysis, the study concludes that Linear Programming Model is keyin Business Decision Making process. This is so because the study has shown that linear programming model helps firms to reach optimality a great deal where all objectives are attained. The study has also shown a significant contribution of about 70.5% effectiveness in the distribution of the organizational available scarce resources to the various units of the organisation for optimum utilization.

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