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Mathematical Solution to the Problems of Productivity in Nigeria

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Abstract

This study unveils how linear programming techniques (a mathematical optimization strategy) can be used to improve productivity. When productivity improves, profit appreciates, hence employment opportunities will naturally be created. Linear programming technique as portrayed in this paper, is a veritable tool for facilitating critical and rational decision making. Undoubtedly, managers of Nigeria's and other nations' economies at various stages are faced with daily challenges to choose between competing alternatives. Decision making process becomes more technical when certain constraints pose as obstacles. Incidentally, that is when linear programming techniques become more useful. It was recommended in this paper therefore that mangers, administrators and leaders generally should be trained in the use of linear programming techniques or at least they should be encouraged to employ mathematicians who are good at modeling linear programming techniques and other mathematical optimization strategies as special advisers.

1.0 Introduction

Many applications in business and economics involve a process called optimization, in which you are asked to find the minimum cost, the maximum profit, or the minimum use of resources. This paper is based on an optimization strategy called Linear Programming. According to Aka [1] Linear Programming is a means of finding maximum and minimum values of a linear expression over a region (feasibility region) which satisfies a system of inequalities (constraints). A two-dimensional linear programming problem consist of a linear objective function and a system of linear inequalities called constraints. The objective function gives the quality that is to be maximized (or minimized), and the constraints determined the set of feasible solution.

The nature of mathematics almost defies definition. The apparently simple question 'what is mathematics?' has defeated many. Characteristically Banjo [2] supplied an answer when he wrote that the whole of mathematics can be summed up in the phrase 'if p then q', implying that either not-p or q is always true, where p and q are logical propositions. Even if we cannot actually pursue his elegant and involved arguments, we can at least admire the pungency of his declaration; it probably comes as close to revealing the workings of a mathematician's mind as any statement is ever likely to. No one, least of all a mathematician, can exactly explain the creative act in mathematics.

According to Sendal [3] two unarguable facts about mathematicians stand out; To them, mathematics is an aesthetic and creative activity; and, like musical flair, mathematical talent is one of the plainest, most specific of human gifts-and, incidentally, is classless and raceless. Mathematicians just know who has a mathematical bent and who has not. Godfrey Harold Hardy, the British pure mathematician, knew that Srinivasa Ramanjuan, a young, unknown, self-taught Indian, was a mathematical genius merely from reading a catalogue of his results. The real difficulty in answering the basic question becomes evident when we realize that mathematics is not about anything at all. It is often, mistakenly, assumed that mathematics is nothing more than 'another language'; and this is about as true as saying that the words in which we describe an event, a description of a holiday or a horse-race commentary, for instance, comprise the actual happening itself. The words do no more than evoke the happening; and so it is with the symbolic 'language' of mathematics. The symbols recall to the mathematician whatever it is that the symbols symbolize.

In the words of Mang [4],all too common a fault is to confuse the symbol with the thing it represents. Commercial advertisers actually make it their job to promote this misapprehension: the advertiser's stock-in-trade is the irrationally fascinating symbol which he knows how to deploy to his commercial benefit. Simple-minded people tend to equate the symbol with what it stands for.' Mathematicians, at least, are not naïve in that respect.

Another myth about the nature of mathematics also concerns symbolism: the erroneous notion that symbols of themselves are abstract. Quite the contrary, symbols cannot of themselves be abstract: they can only symbolize, recall to mind, or

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represent an abstraction. Of course some symbols, notably Japanese characters, are more reminiscent of what they represent than are, say, the Graeco-Roman letters in which this work is printed. However crude, a picture of a cat will call to mind the idea of cat iconically, whereas the letters c-a-t do the job effectively by being symbolic. Perversely, a mathematician could, if he chose, work with symbols formed by coloured cubes or even rocks. However, the problem of first moving heavy 'symbol objects' around and then scanning the completed strings of symbols might defeat a major object of mathematical symbolization, to lighten the load on the mathematician's short-term memory. The reader need but think of doing a long multiplication 'sum' in his head. Granted the simplicity of the mathematics, he is unlikely to be able to recall the sequence of steps in the calculation without an aide-memoire, and written (or printed) mathematical symbols as we know them are the most effective kind devised to date. Far more cumbersome were the Roman symbols, still seen on clocks and, anachronistically, on the credit titles of films. The reader has but to attempt a simple, short multiplication such as XXLIV times XIV to see the point! (Though historians claim that the Roman method was, to the Romans, an extremely efficient one of rapid calculation). In a nutshell, the difference between Roman numerals and our Hindu-Arabic numerals lies in the use of zero and of the place-value relations concealed within them. It is the deployment of such relations that epitomizes the day-to-day work of a mathematician. His concern over zero, in particular, shows just how far in the realms of abstraction he works. For, as Alfred North Whitehead in Cozby [5] once noted, nobody deliberately 'goes out to buy zero fish'. Zero is not a very natural concept; indeed it is a highly artificial one.

Mathematical relations involve, obviously, how numbers in a series are related; but less obviously, they can be about relations (family ties) that exist between members of a human family, ties that are usually symbolized by a genealogical 'tree', though they can be treated more algebraically. The surprise in mathematics comes when we learn that we can also handle relations between relations, at one, more abstract, stage removed. To take an absurdly simple example: we could state the relation between each of the neighbouring numbers in the sequence 2,4,6,8, and so on. Each number-after the first-is two more than its predecessor. (For instance, 8 is two more than 6.) Now we have established a serial relation between adjacent numbers which we might call the 'two more than' relation. Not satisfied with that, a mathematician might want to establish a more generalized, and at the same time more abstract, relation between all such numbers. And he would say that they are all even numbers and suggest an operational test-that we divide any such number by two and find no remainder. Perhaps the most fruitful relations-that is, fruitful from the point of view of reading a mathematician's mind-are logical relations and more particularly time relations, or consequences as we call them in real life, for they underscore our ideas on causality. To say that a mathematician thinks logically is true only up to a point, as we shall see; nevertheless, closer attention to the logical processes involved in pure reasoning will be repaid.

According to Lask [6],to anyone who knows a little of the working of a mathematician's mind, it may come as something of a shock to realize that rarely does he create new mathematics simply by juggling axioms. Axioms are those self-evident truths which may be chosen arbitrarily but which thereafter must serve as rules of the game. The most celebrated, almost notorious, of such axioms is Euclid's fifth postulate that parallel lines never meet. (Modern interpretations suggest otherwise but then the game of mathematics has changed somewhat since Euclid played it.)

In logic, we might take the following simple scheme of statements, admittedly trivial, but which aptly demonstrates the rules:

'if it rains, the road gets wet.' 'it is raining'.

By the logical rules of inference, we can link these statements and by inference reach the conclusion:

'The road is wet.'

A common but mistaken impression is that we may deduce from these statements their converse;

'if the road is wet, then it is raining.'

Nanka [7] observes that a moment's thought will show why logic, for once like life, does not permit this irrational conclusion, for the road might have been hosed to keep down dust during a dry spell. None of this looks remotely like the traditional mathematics. Nor is it-as yet. But if we dispense with the substance and retain the form, the very essence of abstraction, we arrive at this sentence scheme:

'If A, then B' is true.
A holds.
So B holds.

Whatever we care to put in place of A or B, provided it is not nonsense, the scheme remains valid. The mathematician's craft is to construct an interesting theory from such relationships. The Greeks were the first to develop this art, epitomized for most by Euclid's Elements.

Undoubtedly, critical and creative decision making is an indispensable tool for improving National productivity at all levels of Nigerian economy and mathematics is a viable and veritable tool for facilitating not just creative decision making but also viable job creation which is a panacea for unemployment and its associated problems. Generally, ability to decide creatively, according to Kiz [8] could be defined by a set of other abilities such as;

(i) ability to analyze
(ii) ability to apply past experiences
(iii) ability to reason critically

(iv) ability to evaluate ideas and information
(v) ability to identify problems
(vi) ability to find creative approaches and articulate good ideas
(vii) ability to draw rational inferences or conclusions.

This work therefore x-rays the potentials of linear programming technique for facilitating the kind of creative decision making needed for meaningful productivity, job creation and poverty alleviation in our society. To do this, an example of the application of linear programming technique is given below.

2.0 Application of linear programming technique

Maximization of Profit

Ede Nig. Ltd. wants to maximize the profit for two products. The first product yields a profit of N1.50 per unit, and the second product yields a profit of N2.00 per unit. Market tests and available resources have indicated the following constraints.

1. The combined production level should not exceed 1200 units per month.
2. The demand for product **B** is no more than half the demand for product **A**.
3. The production level of product **A** is less than or equal to 600 units plus three times the production level of product **B**.

Solution

If you let x be the number of units of product **A** and y be the number of units of product **B**, the objective function (for the combined profit) is given by

$P = 1.5x + 2y$…..(1)

The three constraints translate into the following linear inequalities:

i. $x + y \leq 1200$
ii. $y \leq \frac{1}{2}x$ OR $-x + 2y \leq 0$
iii. $x \leq 3y + 600$ OR $x - 3y \leq 600$

Because neither x nor y can be negative, you also have the two additional constraints of $x \geq 0$ and $y \geq 0$. These are called non – negativity constrains Because the manufacturer would normally utilized all available resources ,the three inequalities can be translated to equations as follows;

i. $x + y \leq 1200 \rightarrow x + y = 1200$ . . . . . (2)
ii. $-x + 2y \leq 0 \rightarrow -x + 2y = 0$ . . . . . (3)
iii. $x - 3y \leq 600 \rightarrow x - 3y = 600$ . . . . . (4)

Using equations (2),(3) and (4) the graph in figure 1is obtained:

Graph of number of units (x and y) of the two products (A and B):

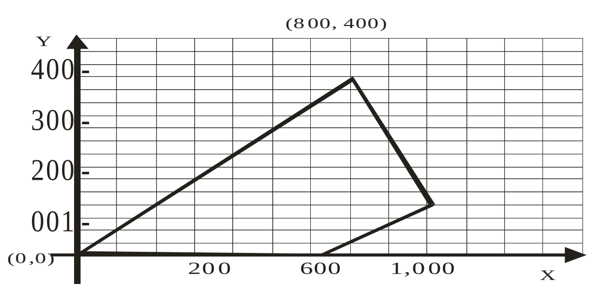

Figure.1

The graph shows the region determined by the constraints. To find the maximum profit, test the value of P at the vertices of the region.

Table.1: Values of P at the vertices of the bounded region in the graph.

Corner	**X (N1.5)**	**Y (N2)**	**P (1.5x + 2y) (N)**
0,0	1.5 (0)	2(0)	0
800,400	1.5 (800)	2(400)	**2000 - Maximum profit**
1050, 150	1.5 (1050)	2 (150)	1875
600, 0	1.5 (600)	2 (0)	900

From table 1 above,the combinations of products A and B gave four options.The first option (0,0) gave a P value of 0. The second option (800,400) gave a P value of 2000. The third option (1050,150) yielded a P value 1875 while the fourth option (600,0) gave a P value of 900.So, the maximum profit is N2000, and it occurs when the monthly production consists of 800 units of product **A** and 400 units of product **B**.This shows that mathematical optimization techniques can be used to profer workable solutions to the problems of productivity as propounded by Hookes [9] and other research evidences.

3.0 Implications for solving problems of unemployment

The above application of linear programming technique clearly shows that linear programming can aids effective decision especially in situations where there are computing alternatives. No doubt the production manager in the example illustrated above would have made wrong combinations in the production of products **A** and **B** but the right and most rewarding combination can be determined mathematically as proved. It is most likely that when profit making increases, job opportunities will ensue because there will be higher demand of product and subsequent need for more hands (workers) to meet up with the positive change in demand and supply of the products.

Yashe [10] opinied that unemployment is associated with so many problems ranging from social and societal vices, crimes, hunger, poverty to death in extreme cases. Whyte [11] submitted therefore that there is need for any responsive government, managers and leaders to adopt realistic measures towards solving the problems of unemployment if we hope to attain the much desired idea society. Since corruption has almost conquered all efforts to revive our industries shut down for various reasons, there is need to ensure that the surviving industries do not collapse due to low profit making or being run at deficit. This necessitates the discourse on the applications of mathematical optimization strategies which will lead to high profit making, high productivity and consequently more job opportunities for our youths.

4.0 Conclusion

The following observations are made from the study:

1. Managers at various levels of the national economy should be trained in linear programming technique or any other mathematical optimization strategy.
2. Manufacturers and business proprietors should consider employing mathematicians as managers and or administrators.
3. Mathematical optimization strategies such as linear programming technique should be incorporated into all management and business administrative courses in various tertiary institutions and should be made compulsory.

References

[1] Aka A.T. (2009) Effect of self-regulated learning on students' Interest and Achievement in Mathematics. Journal of *Mathematical Sciences. 7 (1)pages* 20-23 http://www.maths.prg.com. Retrieved 10/2/2012

[2] Banjo, J. I. (2004) *Methodology in Tertiary Institutions.* Enugu: Celex Printers & Publishers (Nig).

[3] Sendal, J. D. (2008). A rationale for using computer in Science teaching. *Journal of Research in Science Teaching. 2*(1) pages 34-37. http://ww3.interscience,wiley.com/cgi-bin/abstract/ 12608291/ABSTRACT. Retrieved 15/01/2012

[4] Mang, G. (2007) Discourse on Optimization Strategies. *Journal of Mathematical Sciences. 7 (1)pages* 40-43 http://www.maths. org.com. Retrieved 15/01/2012

[5] Cozby, K.A. (2006) Learner Autonomy Strategies in Universities. *Journal of Research in Science Teaching. 50*(1) pages 50-53. http://ww3.interscience, wiley.com/cgi-bin/abstract/112608296/ABSTRACT. Retrieved 15/01/2012

[6] Lask, E.E. (2011) Freedom to Learn. *Journal of Technology Education 14 (2) pages 9-12* http://www.scholar/ib.vt.edui/ejour/ ijev/1472 /haynie /.html Retrieved 02/02/2012

[7] Nanka, O. (2010) A Case for Mathematics Laboratory techniques. *Journal of Mathematical Sciences. 5 (3)pages* 16-19 maths.org.com. Retrieved 15/01/2012

[8] Kiz, C.K. (2010) Simulation software vs. expository text: A comparison of retention across two instructional tools. *Reading, Research and Instruction, 28 (2), pages 41-49.*

[9] Hookes W.J. (2010) Effects of learner autonomy strategy on students' Retention and Learning in Mathematic. *Journal of Technology Education 14 (2)* page 17-21 http://www.scholar/ib.vt. edui/ejour/ijev/1472/haynie/.html Retrieved 02/02/2012

[10] Yashe, B. (2009) *Methodology Issues in Mathematics Education.* Katsina: Kofar Marusa publishing co.

[11] Umar, M. A. Y. (2007). School Enrolment and Teaching Strategy in South Western Nigeria. *http://www.scholar/ib.vt /ej.ng/sc/45/Rahji/.html*. Retrieved 11/01/2012

[12] Whyte, H. K. (2011) promoting understanding of chemical representation: students' use of a visualization tool in the classroom. *Journal of Mathematical Sciences.* 3(1) page 11-14 http:// www.sciencesedu.org.com. Retrieved 02/02/2012.