ANALYSING THE CAUSES AND EFFECTS OF LINEAR PROGRAMMING PROBLEM (L.P.P) IN BUSINESS SET UP.
(A CASE STUDY OF SOME SELECTED COMPANIES IN EASTERN PROVINCE)

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Abstract
Linear programming is an important branch of operational research. Linear programming deals with optimization problems that can be modelled with a linear objective function subject to a set of linear constraints. The linear programming problem is a mathematical problem used in decision making in order to attain restrictions which are the results of limitations or resources. The objective of these problems is either to minimize resources for a fixed level of performance. This paper show how people can run a successful businesses whether as an individual or as a group without any stress. This study is based on a survey of some few selected companies in Chipata and how to run a successful business with little or no difficult. The most important, this topic gives a sight to individuals on how they can maximize and minimize their business. Through L.P.P pupils learn on how to be productive and independent which highlight the significance, application and its prominent relation to human life.

Key Words: Linear Programming, Nonlinear Programming, Mixed-Integer Programming.

Introduction
The development of linear programming problem has been ranked among the most important scientific advances in the current generation. Today is the tool that has saved many thousands or millions of money for most companies or businesses of even moderate size in the various industrialized countries.

Zambia being a developing country, various companies and industries have adopted the use of L.P.P in businesses. The progresses of the business depend upon the way L.P.P has been used or applied (i.e. the way they have maximized or minimized) in their business. This focuses on how they can achieve the goals that has been set by the company. This gives an idea to people on how they can develop in their respectively places where L.P.P is being applied.

Information attached to an uncertainty can be categorized into different interpretations. The interpretations of uncertainty information associated with this thesis are probability, belief, plausibility, necessity, possibility, random set, and probability interval, probability on sets, cloud, and interval-valued probability measure (IVPM). An expected recourse model is a paradigm to solve a stochastic programming problem. Stochastic programming is the study of practical procedures for decision making under uncertainty over time. Stochastic programs are mathematical programs (linear, integer, mixed-integer, nonlinear) where some of the data incorporated into the objective or constraints are uncertain with a probability interpretation. An expected recourse model requires that one makes one decision now and minimizes the expected costs (or evaluations) of the consequences of that decision.

A major issue regarding programmed decisions is how to develop a systematic approach to cope with routine situations companies faces on a repetitive basis. At the lower echelons of the company, most of the work assumes highly structured characteristics and, therefore, Can be delegated easily to relatively unskilled personnel.

. Managers, on the other hand, should formulate the basic questions to be addressed by the model, and then interpret the model's results in light of their own experience and intuition, recognizing the model's limitations. The complementarily between the superior computational capabilities provided by the model and the higher judgmental capabilities of the human decision-maker is the key to a successful management-science approach. Finally, it is the complexity of the decision under study, and not the tool being used to investigate the decision-making process, that should determine the amount of information needed to handle that decision effectively. Models have been criticized for creating unreasonable requirements for information. In fact, this is not necessary. Quite to the contrary, models can be constructed within the current state of available information and they can be used to evaluate whether or not it is economically desirable to gather additional information.

Importance of linear programming problem
1. **Agriculture Sector**. Linear Programming approach is being extensively used in agriculture also. It has been tried on a limited scale for the crop rotation mix of cash crops, food crops and to/ascertain the optimal fertilizer mix.

2. **Aviation Industry**. Our national airlines are also using Linear Programming in the selection of routes and allocation of air-crafts to various chosen routes. This has been made possible by the application of computer system located at the headquarters. Linear Programming has proved to be a very useful tool in solving such problems.
3. **Commercial Institutions**. The commercial institutions as well as the individual traders are also using Linear Programming techniques for cost reduction and profit maximization. The oil refineries are using this technique for making effective and optimal blending or mixing decisions and for the improvement of finished products
4. **Corporate Houses**. Big corporate houses such as Hindustan Lever employ these techniques for the distribution of consumer goods throughout the country. Linear Programming approach is also used for capital budgeting decisions such as the selection of one project from a number of different projects.
5. **Personnel Management**: LP technique enables the personnel manager to solve problems relating to recruitment, selection, training, and deployment of manpower to different departments of the firm. It is also used to determine the minimum number of employees required in various shifts to meet production schedule within a time schedule.
6. **Inventory Management**:A firm is faced with the problem of inventory management of raw materials and finished products. The objective function in inventory management is to minimise inven- tory cost and the constraints are space and demand for the product. LP technique is used to solve this problem.

Integer programs are much harder to solve than linear programs, but they have important business applications. CPLEX uses sophisticated mathematical techniques to solve very hard integer programs. These techniques involve systematically searching over possible combinations of the discrete decision variables, using linear or quadratic programming relaxations to compute bounds on the value of the optimal solution. They also use linear programming and other techniques to compute linear constraints that cut off possible solutions that violate the discreteness constraints. CPLEX's innovative technologies have made it possible to solve mixed-integer programs that were previously considered intractable, thus enabling use of optimization in important business applications

Linear Programming
The concept behind a linear programming problem is simple. It consists for four basic components:
1. **Decision variables** represent quantities to be determined.
2. **Objective function** represents how the decision variables affect the cost or value to be optimized (minimized or maximized).
3. **Constraints** represent how the decision variables use resources, which are available in limited quantities.
4. **Data** quantifies the relationships represented in the objective function and the constraints.

In a linear program, the objective function and the constraints are linear relationships, meaning that the effect of changing a decision variable is proportional to its magnitude. While this requirement may seem overly restrictive, many real-world business problems can be formulated in this manner. That provides a powerful and robust analytical methodology for supporting fact-based decision making.

Nature of Linear Programming Problem
The nature of Linear Programming is very remarkable in the sense that it brings analysis of problems in which a linear function of a number of variables is to be optimized (maximized or minimized) whose variables are subject to a number of constraints in the mathematical near inequalities.
1. It generates solutions based on the feature and characteristics of the actual problem or situation. Hence the scope of linear programming is very wide as it finds application in such diverse fields as marketing, production, finance & personnel etc.
2. Linear Programming has been highly successful in solving the following types of problems :
   a. Product-mix problems.
   b. Investment planning problems.
   c. Blending strategy formulations and.
   d. Marketing & Distribution management.

Literature Review
Graphical Method for solving problems with two variables
According to George Danzig in 1947, he said that to have a flexible, reliable and quality performance in business, one needs to be fully equipped with the knowledge of linear programming problem because of its nature of moving the business from one level to the other. He went further to say "it is constructive, productive, and progressive in nature." His views on the

application of the L.P.P in business were about reducing poverty levels in the world by using effective method to have mass development.

Two dimensional linear programming can be solved graphically. Problems with more than two variables (as is the case for most real world problems) can be solved by using a technique called the simplex method (Wood and Dantzig 1949, Dantzig 1949). The Simplex algorithm was one of the first Mathematical Programming algorithms to be developed and it provides a powerful computational tool, able to provide fast solutions to very large-scale applications, sometimes including hundreds of thousands of variables (i.e. decision factors). Its subsequent successful implementation in a series of applications significantly contributed to the acceptance of the broader field of Operational Research as a scientific approach to decision making. Linear optimisation is the problem of maximising a linear function over a convex polyhedron.

Research Design
Questionnaires, interviews and observation were used for collecting of data and Microsoft word for analysing of the data. By using these, the l.p.p problem is clarified on how to be optimized in business.

Universal: The entire world today, has been become a global village and is affected generally to some selected countries such as Zambia, Malawi, only to mention a few who are not familiar with the use of l.p.p in a business setup.

Sampling Areas: ZESCO limited company, water and Sewage Company, Shoprite, Kavulamungu, Airtel, Choppies and spur shopping mall are one of the biggest companies which are found in eastern province. For this reason, the research was done within these companies. During the research, individual customers and owners of the companies were used for collecting of data by interviewing them. Due to this, Chipata city and chadiza was our sampling area of study.

Research Instrument
The questionnaire was used to collect data from the managers of companies. The study used a linker scale to collect the responses from the managers. The responses were in percentage and figures. There were three responses which were rated 1 3. For each view point, or statement favouring the given statement of why managers lose interest and have negative attitude scores were given in the following way. For questionnaire or opinion ire with 14 statements, the outcomes were as follows: $14\times1=14$ most supporting response (Lack of interest or have negative attitude) $14\times3=42$ Neutral responses $14\times5=70$ Most opposing response. (Have interest and positive attitude). Therefore, the scores of all individuals on interest and attitude were between 14 and 70. For statements supporting the view point why managers lose interest and develop a negative attitude, the items of businesses.

Data Collection Procedure
The research used one questionnaire, for one manager when collecting data. The questionnaires were administered to the managers in various companies with the help of workers. The instructions of the questionnaire were ready to the manager and the purpose of the research was explained. The questionnaire had seven parts which were administered through the manager to answer the questions and collected them. Then later after collection of the questionnaires, a focus was group discussion, which was conducted. Responses were recorded as they were given on sheet of paper.

Analysis of Data
Data collected was analysed in one way which was qualitative data. Qualitative data from the questionnaire and group discussion were analysed by categorizing, describing and explaining. Therefore through qualitative, the analysis of data was successfully analysed.

Analysis: The presentation of the results was done question by question from managers, questionnaire responses and managers, questionnaire responses from the focus Group Discussion were written exactly as they were given by managers.

Results of Mangers Responses on Interest in Linear Programming Problem
The figure 4.0 shows the data collected from the questionnaire questions on the nature, interest from the manager toward the effect and causes of linear programming problem in a business set up from the three companies we visited.

Table 4.0: Managers Interest

Name of company	Interested	Not Interested
Airtel Zambia	3	0
ZESCO	1	0
NAPSA	2	0
WSCL	1	0
Choppies	5	0
Spur	2	0
Total	14	0

Responses of Managers on Attitude toward Linear Programming Problem
The figure 4.1 shows the manager's responses from the questionnaire questions on the attitudes of managers towards the effect and causes of linear programming problem in business set up. The figure shows those managers with negative attitudes and positive attitudes towards linear programming problem.

Table 4.1: Managers Attitudes

Name of company	Negative	Positive
Airtel Zambia	2	3
ZESCO	0	4
NAPSA	0	4
WSCL	1	3
Choppies	1	2
Spur	1	1
Total	5	17
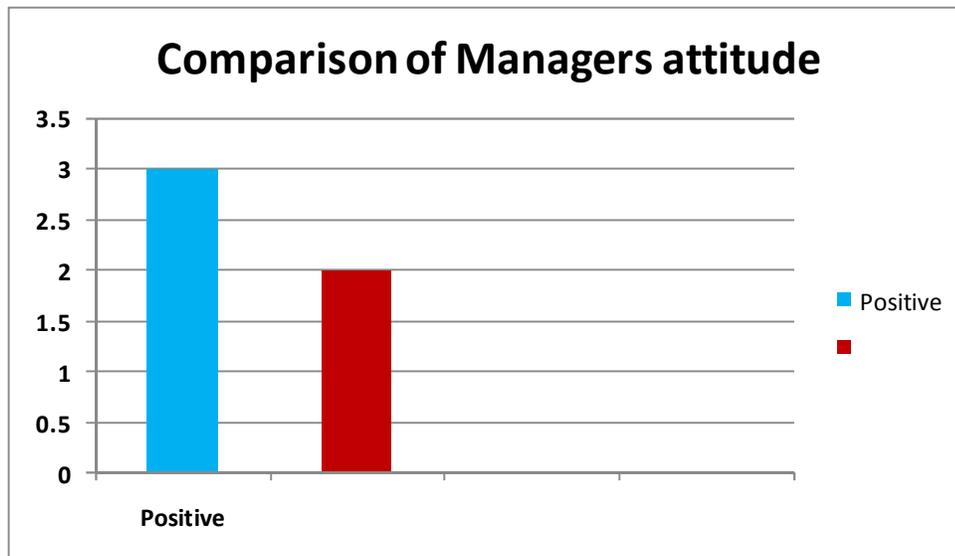
Figure 4.1. Comparison of Managers attitude

The comparison of managers was favourable in the sense that more than 50% showed positive attitude towards the aim of the research as compared to those with negative towards the research. This shows that managers have more positive attitudes towards on how are the effects and causes of L.P.P in a business set up.

According to the comparison of the three manager's responses of the questionnaire towards the effects of the environment to the business, it was found that for every successful business should be located where there is favourable climate.

Basically shopping Malls has been providing all house hold necessities including different variety of foods. Despite providing all these things, the main aim of these shopping malls is to optimise their businesses as well as providing sustainable to the country from the profits they make. According to the research which we carried out, all shopping malls have a great positive attitude toward the use of L.P.P in business. The findings from the questionnaires shows that all the shopping malls which we visited, they have being using L.P.P and it has been a corner stone to outstand their businesses due to its value and role in which it play in business especially in short terms policies. The following example shows on how L.P.P is being used when optimizing the business according to the research of the project.

Hours Required To Produce One Item			
Department	iPhones X_1	computers X_2	Available hours this week
Electronic	4	3	240
Assembly	2	1	100
Profit per unit	K7	K5	

X_1=number of iPhones to be produced
X_2=number of computers to be produced
Now we can create the LP objective function in terms of X_1 and X_2:
Maximize profit = $K7X_1 + K5X_2$
Our next step is to develop mathematical relationships to describe the two constraints in this problem. One general relationship is that the amount of a resource used is to be less than or equal to ( ) the amount of resource available.
First constraint: Electronic time used is Electronic time available.
$4X_1 + 3X_2$ 240 (hours of electronic time)
Second constraint: Assembly time used is Assembly time available.
$2X_1 + 1X_2$ 100 (hours of assembly time).

Both these constraints represent production capacity restrictions and, of course, affect the total profit. For example, mobile solution cannot produce 70 iPhones during the production period because if $X_1 = 70$, both constraints will be violated. It also cannot make $X_1 = 50$ iPhones and $X_2 = 10$ computers. This constraint brings out another important aspect of linear programming; that is, certain interactions will exist between variables. The more units of one product that a firm produces, the fewer it can make of other products.

To have a good and clean house demands a lot especially when all utility bills are settled. Therefore, linear programming problem has been a major tool which companies like ZESCO use to offer these utilities in order to keep their companies running. This is because of the nature of LPP in line with the policies which the company put in place. The findings according to ZESCO and water and sewage company, shows that L.P.P is one of the methods being used to optimise their businesses. The following tables show the tariffs of water bills according to levels.

Table 4.1 The Table Belowshows Tariffs For Domestic Customers For EWSC.

Metered Domestic Customers	
Tariff Bands [m^3]	Tariff [ZMK]
0 to 6	4.38
7 to 20	7.09
21 to 40	9.50
41 and above	10.67
Kiosk	5.00

Table 4.2 The Table Below Shows Tariffs For Commercial Customers For EWSC.

Metered Commercial Customers	
Tariff Bands [m^3]	Tariff [ZMK]
0 to 6	7.86
7 to 11	12.23
12 to 16	17.95
17 to 21	23.21
22 to 26	29.20
27 and above	36.07

Table 4.3 The Table Below Shows Tariffs For Institutional Customers For EWSC.

Metered Institutional Customers	
Tariff Bands [m3]	**Tariff [ZMK]**
O to 6	7.73
7 to 11	12.00
12 to 16	17.40
17 to 21	22.99
22 to 26	28.78
27 and above	35.10

Application of L.P.P in Investments.

The Linear Programming Problem is the tool which investors have been using in relation with their company policy in place in order to lay the foundation of business men and women around the country.

$x \quad 10$.

The third constraint is that at least one-third of the total financing must be for low-income housing.

Conclusion

The findings of the manager's responses in the effect of environment, population, and communication towards business with the use of linear programming problem. The over view between managers showed that the nature of the business should consider the population, environment and communication so that the optimization of the business can be of highest level.

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