SOUF Foundation for Flour's Production Planning using the Linear Programming Method

labsi ali[1*]

[1]University of Echahid Hamma Lakhdar, Eloued, (Algeria)

مؤسسة سوف لتخطيط إنتاج الدقيق باستخدام طريقة البرمجة الخطية

العبسي علي [1]

[1] جامعة الشهيد حمه لخضر-الوادي

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Abstract:

According to the decision assumed in Souf Foundation, different and contradictory goals of the productive foundation must be carefully reconciled, particularly in terms of deadlines, quality, production volumes, and costs. Typically, one of these goals is regarded as the sole primary goal, with the remaining goals regarded as constraints that must be considered. With successive technological developments and to meet this administration's increasing needs for information to make optimal decisions in the areas of production process planning and control, the development of mathematical and statistical sciences played a significant role in determining a quantitative method aimed at achieving the best possible use of economic resources available and limited in nature. As a result, this can be used on the Souf Foundation for flour.

Keywords: Production planning ; linear programming method.

Jel Classification Codes : E23 ; C50.

الملخص:

وفقاً للقرار المفترض في مؤسسة سوف يجب التوفيق بين الأهداف المختلفة والمتناقضة للمؤسسة الإنتاجية، لا سيما من حيث المواعيد النهائية والجودة وحجم الإنتاج وكذلك التكاليف. عادة ما يعتبر أحد هذه الأهداف هو الهدف الرئيسي الوحيد ويتم أخذ باقي الأهداف بعين الاعتبار كقيود يجب أخذها بعين الاعتبار، مع التطورات التكنولوجية المتلاحقة وتلبية الاحتياجات المتزايدة لهذه الإدارة للحصول على المعلومات لتحقيق الأمثل. القرارات في مجالات التخطيط لعملية الإنتاج والرقابة، كان لتطوير العلوم الرياضية والإحصائية دور كبير في إيجاد طريقة كمية تهدف إلى تحقيق أفضل استخدام ممكن للموارد الاقتصادية المتاحة والمحدودة بطبيعتها. هذا على مؤسسة سوف للدقيق.

الكلمات المفتاحية: تخطيط الإنتاج، طريقة البرمجة الخطية.

الترميز الاقتصادي(JEL): E23 ؛ C50.

* Corresponding author, e-mail: labsi-ali@univ-eloued.dz

I- Introduction :

Scientific research method is an aid for the administration in rationalizing the decision-making process and reaching an acceptable competitive level by maximizing the profits of SOUF Foundation for flour and improving the level of its performance while achieving the underlined goals, and one of the most widespread and used scientific research method is the linear programming method.

1. problematic

In an attempt by us to enrich scientific research with research that combines the field of production planning with scientific research, especially linear programming, and to show the importance of this combination with the national productive foundation. In order to achieve this goal, we have formulated the main question in this phenomenon as follows:

How effective is production planning by using Linear Programming in Souf foundation for flour?

2. Study hypotheses:

To answer the previous question, we formulated the following two hypotheses:
One of the quantitative methods that the foundation uses to achieve its goals is the linear programming method that guarantees the best use of its limited resources at the lowest possible cost and raising the level of its performance to obtain the greatest possible profit.
- The productive program that can be followed by Souf foundation enables it to reach the greatest profit, and this is through optimal utilization of its available resources as well as taking into account all the surrounding conditions.

II– Methods and Materials:

1. Previous studies

- Researcher **Ahmed Abado's** study, which was titled "**A study of the effectiveness of planning production operations based on the method of linear programming, a case study of the oasis mills unit in Touggourt, belonging to Riyad Setif Company**", in 2003.

Generally, through the results of this research the importance and the role of the planning process became clear with an avoidance of many difficulties in the productive process, as it was able to answer the study hypotheses as follows (Abado, 2003):
- Activating the production unit under the tutelage of the mother company, which determines the long-term and medium-term strategic goals as well, and thus limits the sharpness of the strategic and tactical decision-making in the productive unit, Theoretically, the medium-term strategy is adopted in the basis of cost and taking into account the conditions of application. Practically, Riad Sétif adopts a fixed strategy.
- Using resources in a good way leads to high value of stocks and lower costs of inputs without increasing production capacity, which results in benefits from additional financial resources. However, our study focuses on the optimal use of material resources, human efforts and funding sources available to the unit in order to improve the production and the competitive position of the unit.
- The results of solving the linear program proved that maximizing the production do not represent an economic goal, but rather the goal is to maximize production in light of the restrictions imposed.

- Researcher **Atallah Omar's** study under the title "**Total production planning by using the linear programming method, an applied study of the unit of industrial gases ,Ouargla** 2007 ''

We can sum up the study and its results as follows (Omar, 2007):

The importance of total production planning lies primarily in determining the possible and optimal level of production for each period in a manner that ensures that the required quantity is met at the lowest possible costs and this cannot be achieved without defining the optimal strategy or set of production strategies.
We concluded that the quantitative methods used in economics and management, which are the linear programming method, are the most used, and they are required to explain and know the total production planning.
- After applying the mentioned method, we reached the overall planning of production, its importance in the management and conduct of production , and the resort to such an approach was followed by institutions in developed countries in view of the importance they attach to this aspect.

- The researchers' study, **Bouchemin Ahmed and Zafir Zuhair**, which came under the title: "**The Effectiveness of Using Linear Programming Method in Business Foundation**", 2008.

Where it was concluded (Zuhair, 2008) that the linear programming technique, despite the difficulties encountered in some areas of application, whether these difficulties relate to the assumptions of the technology or the lack of data required or the difficulties related to its access in the organization, has begun to expand the scope of use in various areas for planning and decision-making The entry of computers helped a lot in developing the use of linear programming in the business administration sector.
This paper has shown that the mathematical nature of technology requires to put the problem to be solved in the form of a mathematical model that includes three main pillars (objective function, objective or structural constraints, and the condition of non-negativity), and is based on hypotheses that have been mentioned.
It is expected that the scope of technology applications in the various fields will continue to expand due to the time and effort it provides in addition to the accuracy in decision-making.

- A study by **Ismail Safar Farouq Abu Jadie** ', entitled "**Total Planning**", in **2009.**

Perhaps the importance of the overall estimates of the outputs (production, labor, stock) in light of this type of planning is due to the fact that the organization seeks to optimize the use of the resources available to it, to achieve the maximum possible profitability, and this goal cannot be achieved through a partial view, that is, for each product or department Separately, because this would mean lack of coordination in production, and the emergence of idle energies in labor, machinery and materials, and the study adopted the descriptive approach in the theoretical side and the mathematical analytical approach in the applied side.
The overall importance of total production planning is demonstrated by working to meet unsteady demand, by developing optimal strategies that help achieve this goal at the lowest possible cost, despite the difficulty of choosing a specific level of production in light of unsteady demand.

- The researcher **Khaled BOUCHAREB** study under the title **: the role of the multi-goals linear planning example in making the productive decision , a case study of the national foundation of industrial textile in Msila, 2014**

- Among the results reached in this study are summarized in the following points :
The percentage of the total production of the institution was weak compared to the proposed program, i.e. it can be said that the institution under study suffers from weakness or defficiency in production in other words that the institution does not take advantage of the total production capacity available and the reason for this is due to the limited available resources used in the production process.
- The percentage of exploitation of primary resources in the methods of the proposed mathematical program was better than the rate achieved by the foundation under study, due mainly to the sudden discontinuity in financing with the raw materials represented by natural cotton during the production process.

- The proposed mathematical model that we developed enabled us to obtain an increase in the value of annual revenues and profits by 244.16% over the revenues and profits achieved by the institution under study for the year 2012, in which it is possible to observe the effectiveness of the proposed program in improving revenues and profits for the institution at the same time.

Through the presentation of previous studies, we observe a number of differences with the current study, which can be presented as follows:

- It differs from other studies in which it dealt with the issue of production planning using the method of linear programming, through the application study of Souf foundation for flour under the study.

- This study is also concerned with focusing on two aspects. The first aspect is to highlight the important and fundamental planning function in production planning, and the second aspect is about the transfer of mathematical knowledge centered on quantitative methods specifically represented in linear programming.

1. the study letirature

1.1. The concept of planning

There have been many definitions and concepts about planning, and according to multiple views, it means research and selection for what is to be achieved.

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We can define planning as the process by which it is possible to determine how the organization can reach what it wants and desires in the future, as it is defined as a "rational process, aimed at achieving specific purposes while identifying the means necessary to achieve those established goals, with the utmost efficiency"

(Murjan, 2002,p59).

As George Terry defines it as follows: "Planning is the choice related to the facts and the development and use of assumptions related to the future when envisioning the proposed systems that they believe are necessary to achieve the desired results."

1.2. Define the linear programming model

Linear programming is one of the methods used in the science of operations research, and it is a mathematical method that enables to reach the best or optimal possible solutions to a set of problems that meet certain mathematical conditions. We find that the word "programming" refers to the systematic mathematical method on which to reach The optimal solution to the problem in application among all available and possible solutions. While we find the word “linear” indicating the conditions that must be met in the problem being applied in order to be solved by linear programming. This word is used to describe the relationship between two or more variables and it is a direct relationship and changes in the same proportion (Sheikh, 2003,p161).

1.3. Stages of applying linear programming in production planning

1.3.1. Collecting information and data and analyzing it: At this stage, the decision maker using linear programming, whether at the level of production planning or in any other field, should be careful in collecting data and information, so he should be able to collect as much data, statistics and information related to the means as possible. And the necessary financial and human capabilities, as well as information related to the market and the conditions of demand, and that the data and statistics are accurate, recent and expressive of the actual reality, so that they can be relied upon to achieve the goals of the model adequately and effectively, otherwise the dependence of the model on missing or outdated data and information Or false, to fall into fictitious results that are not practically applicable (Ali, 1986,p26).

1.3.2. Determining the nature of the problem: After collecting and analyzing the information, the decision-maker determines the general framework of the problem he faces, and here we are faced with two main points, the first of which is whether the problem under study is the problem of access to the maximum revenue or access to the lowest costs, and secondly what are the revenues And expenses related to the studied problem, and this remains insufficient as well, as the decision-maker must keep in touch with information through visits, field studies and personal interviews with the stakeholders of the solution to get to know their views closely, to reach a good analysis of the problem, and study the relative importance of each factor of These factors are different for the goal to be achieved (Ali, 1986,p27)

1.3.3. Building the appropriate model: At this stage the model is built or designed, where the decision-maker depicts the reality in a simple way, through a set of relationships, equations or mathematical inequations, where he determines the goal function (writing its equations, and the set of related constraints) after determining Variables that will actually affect the model, i.e. on the goal function or constraints, this is with determining the decision variables whose unknown values represent solutions to the problem, and after preparing the model must make sure that it matches the problem, then to be evaluated and analyzed to identify the effects of different factors of the problem and to reach the appropriate solution to it (Ali, 1986,p27).

1.3.4. Evaluating the model: In this stage, the problem model is analyzed, by improving the solution at each stage and searching for the ideal solution. Sensitivity analysis provides an effective analysis of the model and enables study and identification of relevant factors,

That would affect the solution, and thus this stage is mainly concerned with studying and analyzing the problem model, identifying the effect of the various factors surrounding it and finally reaching the ideal solution for the model (Ali, 1986,p28).

1.3.5. Verification of the solution: At this stage, the decision-maker or the planner sees the possibility of applying the results actually reached, otherwise he must reformulate the model again and reconsider the data and datum, as well as the method of formulating the constraints, the goal function, and placing the right sides of the constraints, which represent the quantities of various kinds of resources available.

1.3.6. Decision-making and tracking its implementation: After tracking these stages, the final decision is taken, but before that the decision-maker must take into account other variables, which may prevent the application of these results, then these variables may be social or legal, for example, and others, and if this is confirmed It is very necessary to track implementation of the decision stages and monitor its accomplishments, given that new factors and circumstances may interfere that require the solution of the problem to be compatible with these conditions (Burhan, 1983,p13).

III- Results and discussion :

1. Decision and target function variables

1.1. Decision variables:

To determine the variables of the decision, we relied on the quality of the produced material and the weight of the bag from each material produced. This is due to the difference in the cost price per unit produced and also the difference in the selling price. The following decision variables can be explained:

1.2. Target function

Through this linear program, we aim at maximizing the profits of the organization for a period (March 2019), and this is done by specifying the optimal units for all products produced or sold, and assuming that the unit profit margin for the product is constant during the period in question, then the target function is only the algebraic sum of Multiplying the produced and sold quantity of the product by the unitary profit margin of the product, and accordingly the mathematical formulation can be given in the following form for the goal function in the case of maximization, so it is only the algebraic sum of the product of the product and sold quantity of the product in the profit margin of the product, and accordingly the mathematical formulation can be given as:

$$MAXZ = \sum C_J X_J = C_1 X_1 + C_2 X_2 + ...C_{14} X_{14}$$

Where: Xj is the number of units produced and sold by producer j.
And Cj represents the profit margin of the product j based on the difference between the two variables, the first of which is the selling price of the product and the second is the cost price of the unit produced.

The cost price includes the production costs plus the transportation and storage costs for the finished products, which are represented in direct costs (materials and consumables, services, user expenses, depreciation) and indirect (costs consumed, supplies, services, user expenses, depreciation, general expenses, administrative expenses).
Thus, we will find that the target function will be written as follows:

$$MAXZ = \sum C_J X_J = 265.20X1 + 240.502 + 211.25X3 + 221X4 + 162.50X6 + 143X7 + 130X8 + 123.50X10 + 130X11 + 130X12 + 130X13 + 130X14$$

2.the limitations of the model

The Souf flour business is active in a rapidly changing external environment. In recent years, several competing production institutions have emerged, which has led to an increase in its production level and reduced costs in order to increase its revenues and maintain its market share.

2.1. Extraction restrictions:

When treating 100kg of the raw material (hard wheat or soft wheat) to produce a specific product, the extraction quantities for this product are of the type either premium semolina, normal semolina or flour, so the treatment will be according to the following ratios shown in the table below:
Since 100kg of Soufi wheat will give at least 68% of the excellent semolina, semolina residues and bran should not exceed the percentages given in the above table, and in the same way you treat the normal semolina and the flour, where 100kg of hard wheat should not be less than the extraction of 72% of normal semolina, and not more than 5% and 23% of semoulina residues and bran, while 100kg of soft wheat will give at least 80% of the flour and that the percentage of bran does not exceed 20%, and the amount of raw materials used during March 2019 are of the two types of hard and tender wheat estimated about 19800 kg for hard wheat, while 51700 kg are for soft wheat, so we will find That the restrictions for raw materials are written as follows:

Registration of raw material for hard wheat:

X1+X2+X3+X4+X11+X12+X13+X14 <= 19.800

Registration of the raw material for soft wheat:

X6+X7+X8+X10 <= 51.700

As for the extraction restrictions, they differ according to the type of products (linked to the extraction rates) and therefore the set of restrictions are formulated as follows:
Raw material processing (hard wheat) to produce premium semolina:

Registration of the excellent semolina course:

X1+X2 >=0.68(X1+X2+X11+X13)
0.32X1+0.32X2-0.68X11-0.68X13 >= 0

Registration of semolina residues:

X11 <= 0.68.0.10(X1+X2)
X11 - 0.068X1-0.068X2 <= 0

Registration of bran:

X13 <= 0.68.0.23(X1+X2)
X13 - 0.1564X1-0.1564X2 <= 0

Raw material processing (hard wheat) to produce normal semolina:

Registering the normal semolina:

$$X3+X4 >=0.72(X3+X4+X12+X14)$$
$$0.32X1+0.32X2-0.68X12-0.68X14 >= 0$$

Registration of semolina residues:

$$X12 <= 0.72.0.05(X3+X4)$$
$$X12 - 0.036X3-0.036X4 <= 0$$

Registration of bran:

$$X14 <= 0.72.0.22(X3+X4)$$
$$X14 - 0.1584X3-0.1584X4 <= 0$$

Processing the raw material (soft wheat) to produce the flour:

Registration of material:

$$X6+X7+X8=0.80(X6+X7+X8+X10)$$
$$0.20\ X6+0.20X7+0.20X8-0.80X10 >=0$$

Registration of bran:

$$X10 <=0.80\ .\ 0.20(X6+X7+X8)$$
$$X10 - 0.160X6 – 0.160X7 - 0160X8 <= 0$$

2.2. production restrictions:

These restrictions indicate the total production of semolina and ferment material, and this depends on the maximum production capacity of the unit and the number of working hours available per month, (i.e. 24 working hours per day on 24 working days during the month) and the production capacity is 400 Kg / hour in relation to the semolina, which is equivalent Daily production capacity is 96000 kg / day, while the production capacity of the flour material is 10000 Kg / hour, which is equivalent to 240000 Kg / day. Therefore, the maximum energy restrictions for production are as follows:

Registration of semolina material:

$$X1+X2+X3+X4+X11+X12+X13+X14 < = 40 \times 24 \times 24$$
$$X1+X2+X3+X4+X11+X12+X13+X14 < = 23.040$$

Recording the material of the flour:

$$X6+X7+X8+X10 < = 100 \times 24 \times 24$$
$$X6+X7+X8+X10 < = 57.600$$

2.3. the restrictions of the productive stage:

The production process passes through four different stages, each of these stages has a special function that distinguishes it from the rest of the stages, where the transformative process begins from the washing stage and then followed by the cleaning stage and is followed by the grinding stage and finally the filling stage.

2.3.1. The washing stage: This stage is completed in the workshop and contains special equipment for each raw material. You can work with a capacity of 5000 kg per hour for hard wheat, while you can work with a capacity of 9000 kg per hour for soft wheat.

The restrictions for this stage are formulated as follows:

Restrictions on fittings for hard wheat:

$$X1+X2+X3+X4+X11+X12+X13+X14 < = 50 \times 24 \times 24$$
$$X1+X2+X3+X4+X11+X12+X13+X14 < = 28.800$$

Restrictions on supplies for soft wheat:

$$X6+X7+X8+X10 < = 90 \times 24 \times 24$$
$$X6+X7+X8+X10 < = 51.840$$

2.3.2. Cleaning stage: This workshop contains equipment for the treatment of hard wheat, and another for soft wheat, each of which operates with a conversion capacity of 5000 kg / hour and 9000 kg / hour respectively, and stage restrictions can be formulated as follows:

Restrictions on hard wheat processing equipment:

$$X1+X2+X3+X4+X11+X12+X13+X14 <= 50 \times 24 \times 24$$
$$X1+X2+X3+X4+X11+X12+X13+X14 <= 28.800$$

Restrictions on equipment for soft wheat processing:

$$X6+X7+X8+X10 <= 90 \times 24 \times 24$$
$$X6+X7+X8+X10 <= 51.840$$

2.3.3. Grinding stage: This is the main stage in the production process, as its equipment is divided into two parts. The first treats hard wheat with a capacity of 4000 kg per hour, which is equivalent to 96000 Kg per day, and the second it grinds soft wheat with a production capacity of 10000per hour and the equivalent of 240000 per day, and restrictions have been formulated At maximum production capacity.

We note that the previous three phases, operating at a capacity of 4,5,5 tons / hour with respect to the treatment of hard wheat respectively, and consequently the bottlenecks of the production process appear in the milling stage before other stages, so it is possible to limit the restrictions of this stage instead of considering all the restrictions of the three sprinkles.

While the production capacity is 9,10 tons / hour for soft wheat processing, respectively, and thus the bottlenecks of the production process appear in the washing and cleaning stage before other stages, so it is possible to limit the restrictions of this stage instead of considering all the restrictions of the three sprinkles.

Wheat Processing In Progress:

$$X1+X2+X3+X4+X11+X12+X13+X14 <= 23.040$$

In the process of processing soft wheat:

$$X6+X7+X8+X10 <= 51.840$$

2.3.4. The packing stage: The production unit mobilizes the main products of semolina and flour materials in bags with different weights by two machines for each type. You can fill 2 bags per minute (120 bags / hour) and it is intended for semolina only. As for the second type machine, it is designated for the flour material and the third type is for a substance The sanders work at the same capacity as the first machine, and two machines are intended for semolina weighing only 10 kg.

It remains to point out that the by-products (bran material) are not packaged, as they are delivered to the customer directly from special stores after the end of the grinding stage.

The set of restrictions for the filling workshop gives the following relationship:

The first machine for semolina 25 kg:

$$4X1+4X3 <= 69120$$

The second machine for the flour:

$$10X6 <= 69120$$
$$+4X7+2X8 <= 138240$$

The third machine for the semolina residues :

$$8X11+8X12 <= 69120$$

Fourth machine for semolina 10 kg:

$$20X2+20X4 <= 69120$$

2.4. Orders Restrictions:

Estimated orders for the foundation are 5850kg and 2250 kg of premium semolina weighing 25 kg and 10 kg respectively, while 320000 kg of normal semolina weighing 25 kg and 41360 Kg of flour, including 240, 460,1000 respectively 10 kg, 25 kg, 50 kg, while 369000 kg Of the semolina residues extracted from the normal and excellent semolina, 70000 Kg of bran were extracted from the normal and excellent semolina and 10340 bran was extracted from the flour.

Registration of premium semolina by weight of 25 kg:

$$X1 >= 5850$$

Registration of premium semolina by weight of 10 kg:

X2 > = 2250

Registration of normal semolina by weight of 25 kg:

X3 > = 3200

Recording the material of the flour:

X6+X7+X8 > = 41360

Recording the flour material by weight of 10 kg:

X6 > = 240

Registration of flour material by weight of 25 kg:

X7 > = 260

Registration of flour material by weight of 50 kg:

X8 > = 1.000

Restricting the material of the semolina residues:

X11+X12 > = 3690

Registration of the bran extracted from semolina:

X13+X14 > = 700

Record the bran extracted from the flour:

X10 > = 10340

3. showing the effectiveness of the proposed program

To ensure the validity of the proposed linear programming model, and its effectiveness in improving production planning in small and medium enterprises, by finding an optimal production plan from the products available with the organization, in this case we take the profitability criterion as a basis for comparison between the linear programming scheme and the enterprise plan, as well as the rates of achievement The underlined program and the optimal use of the available resources, through the following elements:

Through the above table, it is clear to us how effective the planned program is by using quantitative methods, which are represented in the linear programming method, for the optimization it provides to the company in achieving the best profit through the produced quantities, by comparing the achieved profit using the program and the estimated value of **11705957 DZD** with the actual profit of the organization estimated at **9384310 DZD** That is, a difference of **232,167 DZD**.

IV- Conclusion:

1. Results :

It became clear through the results of this research the importance and role of the planning process in general in avoiding many problems with the production process, as we were able to answer the study hypotheses as follows:

- The first hypothesis is that the planning process is one of the most important processes that coincide with the path of the productive institution, and this is proven through the theoretical study of the institution. The planning process is the essence of the administrative practice of the institution in order to avoid daily problems.

2. **theoretically**, a medium-term strategy is adopted on the basis of cost and taking into account the conditions of application and market demands, and this is by providing a set of data before the beginning of planning such as total demand, level of production, size of stock, number of workers and this using one of the mathematical methods such as linear programming and in practical terms, SOUF foundation for flour adopts a constant strategy, which is the stability of the workforce and the lack of attention to stock, and the expected demand for the planning periods takes into consideration and thus shows the critical importance of the organization's production planning represented in the second hypothesis.

3. **As for** the third and fourth hypothesis, and with the use of quantitative methods such as linear programming method, which increase in directing external expertise to contribute to the production planning process, the high value of outputs and the low costs of inputs when good exploitation of resources result in an increase in production capacity and thus obtaining new financial resources, for example In many cases, the production process stops due to a lack of raw materials stock, which leads to delays in the delivery of orders and consequently the establishment incurs losses due to insufficient supply, and this is achieved when a good mix of production factors can be seen. Its impact on decisions taken through the use of mathematical and scientific methods that follow a systematic path necessarily production planning is appropriate compared to planning in traditional methods.

4. Finally, the fifth hypothesis, which is that the productive institution in general and the Souf Foundation specifically will try to adopt modern methods such as quantitative methods to achieve the set goals and reach good production planning, i.e. the optimal solution and from it to the greatest possible profit, and the results of solving the linear program have proven that maximizing production is not It represents an economic goal in itself, but rather the goal is to maximize production in light of the restrictions imposed.

The productive institution generally seeks to achieve the goals set for it through good planning for production at all levels and all this by using modern planning methods such as quantitative methods, including the method of linear programming, but these methods we find are not applied to the fullest way, because the institution under study does not use them as it should because of a defect in Its principles, but only on the basis of experience, is possible for the lack of conviction of administrators and workers.

There is no doubt that the effectiveness of the proposed linear model depends on providing several factors, such as providing the correct data and embodying it on economic reality. The importance of the model becomes clearer when applied.

Thanks to the proposed linear model of the Souf unit for flour for a specific period of time, we were able to determine the optimal production mix in order to maximize total profit margin in light of the restrictions imposed on various resources.

The linear program formulated using the information program (Lindo) was implemented, where we obtained the optimal solution, then undertaking a study and analysis of the optimum product range and the resources allocated to it.

Depending on the application of the linear programming method of Souf Company, it will become clear to us that it is a successful company in the near term, because its performance is high and one of its characteristics is that it achieves increasing profits from year to year, which allows it to expand financially.

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Appendix:

Table (1) : Explain the decision variables

Products	Variables
Produced amount of premium semolina by weight of 25 kg	X1
Produced amount of premium semolina by weight of 10 kg	X2
The produced amount of normal semolina by weight of 25 kg	X3
The produced amount of normal semolina by weight of 10 kg	X4
The produced amount of semolina residues produced by weight of 25 kg	X5
The produced amount of flour by weight of 10 kg	X6
The produced amount of flour by weight 25 kg	X7
The produced amount of flour by weight of 50 kg	X8
The amount of bran produced from semolina weighing 25 kg	X9
The amount of bran produced from the flour weighing 25 kg	X10
The amount of bran produced from excellent semolina	X11
The amount of bran produced from normal semolina	X12
The amount of semolina residues produced from the excellent semolina	X13
The amount of semolina residues produced from the normal semolina	X14

Source: Prepared by the researcher, based on documents provided by the Marketing Department

Table (2) : Table of profit margins for products

Profit margin	Selling prices	Cost price	Products	Variables
265.20	4,080.00	3,814.80	premium semolina weighing 25 kg	X1
240.50	3,700.00	3,459.50	premium semolina weighing 10 kg	X2
211.25	3,250.00	3,038.75	normal semolina by weight of 25 kg	X3
221.00	3,400.00	3,179.00	normal semolina by weight of 10 kg	X4
130.00	2,000.00	1,870.00	semolina residues produced by weight of 25 kg	X5
162.50	2,500.00	2,337.50	flour weighing 10 kg	X6
143.00	2,200.00	2,057.00	flour weighing 25 kg	X7
130.00	2,000.00	1,870.00	flour weighing 50 kg	X8
130.00	2,000.00	1,870.00	bran produced from semolina weighing 25 kg	X9
123.50	1,900.00	1,776.50	bran produced from the flour weighing 25 kg	X10
130.00	2,000.00	1,870.00	bran produced from excellent semolina	X11
130.00	2,000.00	1,870.00	bran produced from normal semolina	X12
130.00	2,000.00	1,870.00	Semolina residues produced from excellent semolina	X13
130.00	2,000.00	1,870.00	Semolina residues produced from the normal semolina	X14

Source: From Marketing Authority documents

Table (3): Tables of extraction rates

100kg of raw material (hard wheat) to produce premium semolina		
bran	Semolina residues	Excellent semolina
%22	%10	% 68
One pound of raw material (hard wheat) to produce normal semolina		
bran	Semolina residues	normal semolina
%23	%5	% 72
100kg of raw material (soft wheat) to produce the flour		
bran	The flour	
% 20	% 80	

Source: documents from the Production Department

Table (4): Explains the effectiveness of the proposed program

Unitary profit	Profit margin	Actual production	Unitary profit	Profit margin	Proposed production	VAR
1127100	265.2	4250	2569788	265.2	9690	X1
156325	240.5	650	541125	240.5	2250	X2
654875	211.25	3100	676000	211.25	3200	X3

0	221	0	0	221	0	X4
74750	162.5	460	1123200	162.5	6912	X6
5332470	143	37290	4783064	143	33448	X7
130000	130	1000	130000	130	1000	X8
1276990	123.5	10340	1276990	123.5	10340	X10
260000	130	2000	425627.4	130	3274	X11
254800	130	1960	89172.65	130	685.9	X12
32500	130	250	22100	130	170	X13
84500	130	650	68889.6	130	529.9	X14
9384310	Total actual profit		11705957	Total Planned profit		

Source: Prepared by the researcher

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