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Developing A Model to Determine the Optimum Production in Milk and Dairy Products Manufacturing Industry Emphasizing On Raw Materials Supply Chain (The Case of Mahabad Shevin Company)

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Abstract: The aim of the present study is to develop a model for determining the optimal capacity of production in milk and dairy industries companies indicating on raw materials supply chain in Shevin Company in an attempt to achieve the maximum profit sing linear planning techniques. The study is applied and descriptive in terms of the goal and quality of data collection, respectively. The reason of being applied is that the implications if the research result are employed to improve the product planning of production unit. The decision-making variables having to do with linear planning model involves types of buttermilk, yoghurt, and produced milk. To answer the linear planning pertinent to the problem of determining optimal combination of produced products of the considered unit, LINGO 14 software was utilized. It was found in the present study that the expenses having to with production line, penetration coefficient, available capital, raw materials of buttermilk, raw materials of milk, mil advertisements, buttermilk distribution, and produced wastes are higher than needed. Also, the optimum value of the target function is 249556.7.
Keywords: Optimum Capacity of Production, Optimum Combination, Supply Chain, Milk Industries Companies, Dairy Products, Linear Planning Model

Introduction

Production is the process throughout which the raw material are converted to the service by the organization. It is defined as using the resources for producing a good or service. A material can be changed in terms of form by a machine (tractor, sewing machine, computers, and etc.) or a process (statistical analysis or training) or through the facilities (faculties, restaurants or clinics0.

Activities in organizations lead to the production of goods or services. In production companies, the activities leading to physical production are visible. As an example, one can observe the part process of a tangible good such a refrigerator while in any organization which do not produce physical products, the product performance is less tangible. Activities such as check payment process, hospital caring, and etc., are among the service-based institutes. The economic and product firms have found themselves needy to the management and supervision on resources and elements having to do with outer sections of organization in addition to considering the organization and internal resources. The reason lies achieving the competitive advantage and aiming to obtain higher levels of share in the market. Activities such as planning for demand and supply, preparing the materials, planning and producing the product, maintaining goods, controlling for the capitals, distributing, delivering and providing service to customer have been transferred to the distributable supply chain.

Statement of the problem

Nowadays, the traditional management styles which followed less integrated procedure of their processes have lost their effectiveness. Considered as an appropriate approach, the supply chain enjoys the qualification of managing the materials sequence, goods information and finance. To put this philosophy in practice, traditional tools and techniques such as mathematical planning, simulation, metaheuristic methods, and etc. are helpful. There is a tight association between planning and managing the supply chains and chain success (Nagshine Fard, 2007). Managing the supply chain is regarded as a set of methods which are employed to integrate the suppliers, producers, stores, and markets so as to distribute the required products to the customers in proper amount and in determined time. Still, there is a traditional view of operation planning dealing with providing and offering the product and that the components of product distributing make decisions individually in light of their benefits which results in increasing the chain expenses, final product cost, lowering the potential of companies competition. Hence, the cooperation and integrity of supply chain is of great importance. This fact was viewed as a motivator for the researcher to develop a model to determine the optimum production in Milk and Dairy Products manufacturing industry emphasizing on raw materials supply chain in Mahabad Shevin Company so that the mangers and decision-makers make use of the findings of the present study.

Conceptual definitions

Production optimization: optimization followed the performance improvement in reaching the optimum points. This definition is categorized by two features: seeking for improvement to reach optimal point (Shafiei, 2011).

Optimum capacity: determining the capacity of company in producing the product based on the limitations, demand, supply and other conditions of production (Motahari, 2011).

Company production capacity: the production of output value regarding a system is called system's capacity. Nominal capacity is the extent to which we have defined it. Real capacity is the extent to which one gains from the system (Zahedi, 2011).

Process designing: it is defined as developing the process of converting the inputs to outputs. One should highlight in this stage that who production is enable. The processes are categorized by different types in terms of output, operation features, type of establishment, type of resources, and etc. (Jafari, 2009).

Supply chain; it is defined as the raw materials fluid, information, money and services from the suppliers and through the manufactures and suppliers to the final customer. Also, the supply chain involves the organizations and processes which deliver the products, information, and services to the final customer (Jafari, 2008).

Materials and methods

The aim of the present study is to determine the optimum production in Milk and Dairy Products manufacturing industry emphasizing on raw materials supply chain in Mahabad Shevin Company. The study is descriptive-survey in terms of goals and hypotheses.

The study has been conducted based on the data obtained from Mahabad Shevin Company. Based on the research topic, the notion of supply chain was discussed. To resolve the problem, linear planning was used and the developed model was resolved using LINGO 14 software.

Linear planning model of the corresponding enterprise

The overall formula of linear models is as follows:

$$(\max or \min)\ Z = c_1x_1 + c_2x_2 + \cdots + c_nx_n$$
$$a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n \leq or = or \geq b_1$$
$$a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n \leq or = or \geq b_2$$
$$\vdots$$
$$a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n \leq or = or \geq b_m$$
$$x_1, x_2, \dots, x_n \geq 0\ or\ \leq 0$$

One can summarize the linear planning problem as follows:

$$\min or \max) Z = \sum_{j=1}^{n} c_j x_j$$

$$\sum_{j=1}^{n} a_{ij} x_j \leq or = or \geq b_i \quad i = 1, \dots, m$$

$$x_i \geq 0 \; or \; \leq 0 \; or \; j = 1, \dots, n$$

The matrix form of the above equations is given as below:

$$(\min or \max) Z = Cx$$

$$Ax \leq or = or \geq b$$

$$x \geq 0 \; or \; \leq 0$$

To determine the linear panning model, decision-making variables, target function and model limitations are considered.

Decision-making variables

Decision-making variables of linear planning model include types of buttermilk, yoghurt and milk which are defined as follows:

Table 1

Product	Unit	Decision-making variable
Buttermilk (1.5 l gas-filled)	number	X1
Buttermilk (1.5 l gas free)	number	X2
Buttermilk (2.5 ; gas-filled)	number	X3
Buttermilk (4.5 l)	number	X4
Yogurt (1.5-700)	number	X5
Yogurt (1.5-2100)	number	X6
Yogurt (3-100)	number	X7
Yogurt (4-1400)	number	X8
Yogurt (4-2500)	number	X9
Yogurt (6-2100)	number	X10
Yogurt (6-2500)	number	X11
Yogurt (7-4500)	number	X12
Yogurt (8-5000)	number	X13
Milk (1.5-1000)	number	X14
Milk (5.1-900)	number	X15
Packed milk (1.5-1000)		X16

Results and discussion

Based on the findings, the value of target function is 249556.7. The results indicate that the company possessing human resource capacity, machines and other instruments can produce the goods to this extent without lowering the rate of interest. Also, the results highlight that the software reported an optimum response.

One can concluded that the buttermilk products (1.5 gas-filled and 1.5 l free-gas) are in optimal state in terms of the company product capacity and this company has made use of its maximum potential. Buttermilk products (2.5 l gas-filled and 4.5 l) should be produced in higher levels so that the maximum potential is employed. Yogurt products (1.5-700, 1.5 -2100, 3-100, 6-2100, 6-2500, 7-4500, 8-5000, 5-1400) make use of their maximum production potential.

The yogurt product (4-25000 faces lack of capability to make use of its maximum production potential. This value is less capable compared to other products and cannot achieve its optimal value. It should be noted in this regard that one can produced higher values of this product. In this regard, it is essential to capture the attention toward the market and advantageous aspect of the company.

Regarding the production of milk (1.5-1000 and 5.1-900) product that the resolving model shows the total potential of the product. The packed milk (1.5-1000) has not used the maximum potential of production.

Optimum values of target function

Table 2

Lowering Expenses	Variables	Expenses
0.000000	Buttermilk (1.5 l gas-filled)	18031.99
0.000000	Buttermilk (1.5 l gas free)	11528.59
0.9957142	Buttermilk (2.5 ; gas-filled)	0.000000
0.9269898	Buttermilk (4.5 l)	0.000000
0.000000	Yogurt (1.5-700)	31928.53
0.000000	Yogurt (1.5-2100)	284440.4
0.000000	Yogurt (3-100)	13161.68
0.000000	Yogurt (4-1400)	159939.6
4.492829	Yogurt (4-2500)	0.000000
0.000000	Yogurt (6-2100)	219628.2
0.000000	Yogurt (6-2500)	241070.5
0.000000	Yogurt (7-4500)	318576.8
0.000000	Yogurt (8-5000)	200952.9
0.000000	Milk (1.5-1000)	18589.25
0.000000	Milk (5.1-900)	13972.15
2.200000	Packed milk (1.5-1000)	0.000000

Calculated Doul values

Table 3

Limitation	Shadow Price	Shortage or Surplus	Rows	Price
Transferring Fluid Limitation		249556.7	1	1.000
Penetration Coefficient Limitation		180728.9	2	0.000
Available Capital Limitation		162042.0	3	0.000

Shevin Company faces the surplus of transferring fluid, penetration coefficient and capital in terms of producing its goods. This indicates that this company can produced more goods in this regard without the need for improving these components.

Table 4

Limitation	Shadow Price	Shortage or Surplus	Rows	Price
Demand Limitation		0.000000	4	0.7940767E-04
Raw Materials of Buttermilk Limitation		44634.40	5	0.000
Raw Materials of Yogurt Limitation		0.000	6	0.4239225
Raw Materials of Milk Limitation		156229.5	7	0.000

Shevin Company faces the product demand limitation in terms of the demand. This can be attributed to the advertisements, market and distribution. There is no analysis available in this regard.

The raw materials for buttermilk is sufficient and the company can produce more products. The company is suggested to produce more mil products so as to avoid the wasting and make use of all raw materials. Allocating raw materials of milk and producing mil for yogurt can improve the maximum potential of this product.

Table 5

Limitation	Shadow Price	Shortage or Surplus	Rows	Price
Buttermilk Advertisement Limitation		0.000	8	0.1150587
Yogurt Advertisement Limitation		713.7024	9	0.000
Milk Advertisement Limitation		201.3669	10	0.000

From the researchers' perspective, the price devoted for buttermilk advertisement is insufficient.

Table 6

Limitation	Shadow Price	Shortage or Surplus	Rows	Price
Buttermilk Distribution Limitation		65.2000	11	0.000
Yogurt Distribution Limitation		19889.66	12	0.000
Milk Distribution Limitation		0.000	13	10.44963
Production Waste Limitation		493.0880	11	0.000

Yogurt and buttermilk distribution limitations do not have any effect on the production, these products can be produced more so that the allocated capital is proper. Milk distribution is justified or this product. Production waste limitations shows hat the company wastes more materials which can be prevented by reasoning and improved by production profitability.

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