

IMPLEMENTATION OF DECISION SUPPORT SYSTEM FOR RICE PRODUCTION

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Abstract

Decision support system (DSS) is gaining an increased popularity in various domains. DSS ensures access to considerably larger markets, better recognition of the company and a constant presence in the marketplace. Economic production lot size model is developed for a production-inventory system where the demand rate increases with time; the production rate is finite and adjustable in each cycle over an infinite planning horizon. In manufacturing sectors, it is important to make plans for producing products with costs effective and on the other hand, to meet the customer demands. This system proposes the work done on the development of a decision support system for rice production factory by using an economic production lot size model and marginal costing method. This system also proposes a procedure to find approximately the minimum total cost over a finite time horizon. Moreover, this system gives decision whether to purchase product or not according to the results of the marginal costing method. This method is used to calculate the profit or loss of stocks. To produce monthly report, break-even analysis is also used. This system is proposed as management decision support system for rice production factory.

Keyword: Economic Production Lot Size Model, Marginal Costing and Break-even Analysis

1. INTRODUCTION

Nowadays, Business can be thought of as a social process involving the assembly and utilization of productive resource to produce products and services capable of satisfying society's needs and wants. Every business have loss products and gain products. Decision support system is a computer system that analyzes

business data and presents it so that user can make business decision more easily. Decision support system is to support business people decision making responsibilities and that decision making is often a difficult task. The purpose is to support the business people in the decision making process by supplying needed information.

When an item is setup to produce, a large lot size is produced to cover demand over a number of future periods and hence defer the next time when the item will be setup and produced. But it will cost highly the setup and inventory costs. Small lot size will cost highly the holding costs and inventory costs. Therefore, an organization will need to make a decision for maintaining the right balance between high and low inventory to minimize cost. The lot-sizing problem is to determine the relative frequency of setups so as to minimize total variables cost for inventory over a specified time period.

Marginal costing distinguishes between fixed and variable costs. The marginal cost of a stock is its variable cost. The accounting system in which variable costs are change to cost units and fixed cost of the written-off in full against the aggregate contribution. This decision support system calculates profit and loss by using marginal costing method and also produces the monthly report by using break-even analysis. This system intends to help rice production factory's management in control and decision making to reduce costly inventory overheads, to list which customers are paid with their target date and to make better decisions with Decision Support System using Economic Production Quantity Model (EPQ) and Marginal Costing Method.

2. RELATED WORK

Mukesh Kumar [5] presents the EPLS (Economic Production Lot Size) model which accounts for a production system producing perfect and imperfect quality items. Also, a single period multi-item volume flexible production model is for deteriorating items with stochastic demand and stochastic imperfect production. Deterioration is taken as constant. Linear holding cost is considered. Shortages are permitted in inventory with partial backlogging. Profit maximization techniques are also used. The problem parameter effects upon the optimal solutions are examined numerically.

C. Fredrik [1] proposed an optimal airport-pricing model, both with and without a constraint on the revenues that includes all relevant external marginal costs. Given the results of the model he discussed the implications on the profit of airports, and find that given that the proceeds of the environmental charges are seen as revenue for the airport, a marginal cost-pricing scheme would result in financial deficits for the airports, this despite the reasonable assumption of increasing returns to scale in airport capacity.

3. BACKGROUND THEORY

The goal of this system is to implement management decision support system by using economic production lot size model, marginal costing method and break-even analysis.

3.1. Decision Support System

A decision support system (DSS) is a computer-based information system that supports business or organizational decision-making activities. DSSs serve the management, operations, and planning levels of an organization and help to make decisions, which may be rapidly changing and not easily specified in advance. Decision support systems can be either fully computerized, human or a combination of both [2].

DSSs include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge, or business models to identify and solve problems and make decisions [8].

3.2. Economic Production Lot Size Model

Economic production lot size model is also known as economic production quantity (EPQ) model. EPQ model determines the quantity a company or retailer should order to minimize the total inventory costs by balancing the inventory holding cost and average fixed ordering cost. EPQ is a single product lot scheduling method. A multiproduct extension to these models is called Product Cycling Problem. EPQ only applies where the demand for a product is constant over the year and that each new order is delivered/ produced incrementally when the inventory reaches zero.

Economic production lot size model's variables costs are annual holding cost and annual set-up costs. Annual holding cost is the carrying cost that results from maintaining the inventory. Annual set-up cost is the cost that incurred from getting a machine ready to produce the desired good. The inventory is reached maximum when every production cycle is finished and it is changed with time. Large setup times to be large batch size and increase in inventory cost and potential loss for products becoming obsolete.

The EPQ model determine how much to product at one production cycle. In many cases, inventory arrives gradually. The EPQ model assumes inventory is being produced at a rate of p units per day. There is a setup cost each production begins. The annual setup cost is calculated with the following formula [3].

$$C_o \equiv (D/Q)C_o$$

And the annual holding costs is

$$C_h \equiv [1/2Q^*(1-d/p)]*C_h$$

As in the EOQ model, at the optimal quantity Q^* we should have

$$(D/Q)C_o = [1/2Q^*(1-d/p)]*C_h$$

Rearranging to solve for Q^* ,

$$Q^* = \sqrt{(2DC_o / [C_h(1-d/p)])}$$

where,

Q^* = Optimal production quantity (or EPQ), C_o = Setup cost, C_h = Holding cost, D = Annual demand, P = Annual production rate, d = Daily demand rate and p = Daily production rate.

3.3. Marginal Costing Method

Marginal costing is used to provide a basis for the interpretation of cost data to measure the profitability of different products, processes and cost centers in the

course of decision making. It can, therefore, be used in conjunction with the different methods of costing such as job costing, process costing, etc., or even with other techniques such as standard costing or budgetary control.

In marginal costing, cost ascertainment is made on the basis of the nature of cost. Marginal costing is the amount of any given volume of output by which aggregate costs are changed if the volume of output is increased or decreased by one unit. A decrease in the volume of output will be accompanied by a less than proportionate fall in the aggregate cost. An increase in output may give rise to a more than proportionate increase in aggregate cost [6].

Marginal Cost = Variable Cost = Direct Labour + Direct Material + Direct Expenses + Variable Overheads

3.3.1. Total Cost

Total cost comprises of total variable costs and total fixed costs. Fixed cost is a cost does not change when production or sales levels do change. Variable costs are costs directly related to production units. The variable cost times the number of units sold will equal the total variable cost. It determines the overall cost incurred to produce a certain quantity of output. Contribution is the difference between sales and marginal or variable costs. It contributes toward fixed cost and profit [6].

Total Cost = Total Variable Cost + Total Fixed Cost

Contribution = Selling price – Variable cost.

3.4. Break-Even Analysis

One of the most common tools used in evaluating the economic feasibility of a new enterprise or product is the break-even analysis. The break-even point is the point at which revenue is exactly equal to costs. At this point, no profit is made and no losses are incurred.

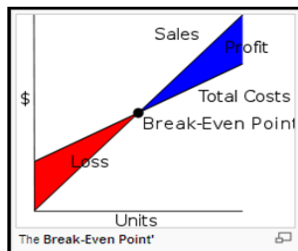


Figure 1. Break-Even Point

Methods of break-even point are as follows [7]:

Breakeven Point in units = Fixed Cost/ Contribution per unit

Sales revenue at breakeven point = Breakeven Point * Selling Price

Break-even analysis is based on two types of costs: fixed costs and variable costs. One important aspect of break-even analysis is that it is normally not this simple. In many instances, the selling price, fixed costs or variable costs will not remain constant resulting in a change in the break-even. And these changes will change the break-even. So, a break-even cannot be calculated only once. It should be calculated on a regular basis to reflect changes in costs and prices, and to maintain profitability or make adjustments in the product line [4].

4. PROPOSED SYSTEM ARCHITECTURE

This system is implemented as management decision support system to minimize various costs and to maximize profit for Rice Production Factory. Proposed system architecture is shown in Figure 2.

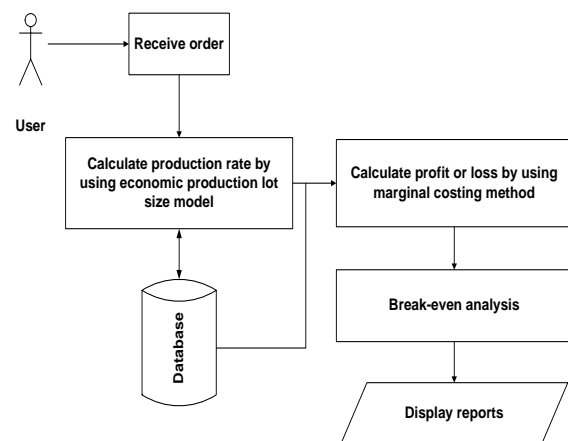


Figure 2. Proposed System Architecture

This system consists of four parts. In the first part, this system receives rice order from the customer. And then, in the second part, this system calculates the optimal lot size about rice production by using Economic Production Lot Size Model. Moreover, this system calculates profit or loss about this factory by using Marginal Costing Method in the third part. In the final part, this system also uses Break-even analysis to produce reports.

4.1. System Flow Diagram

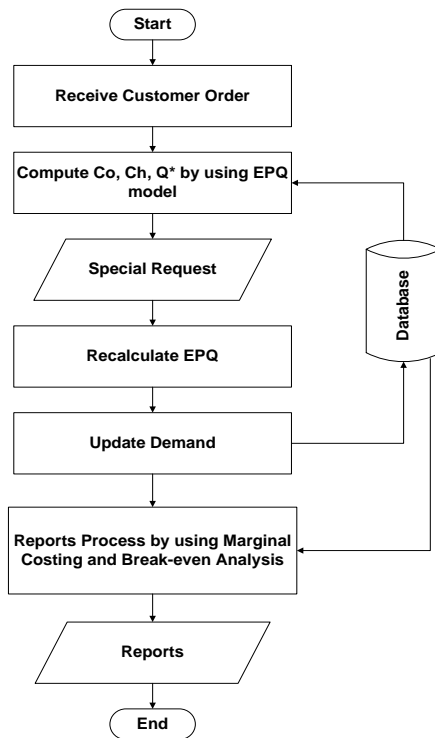


Figure 3. System Flow Diagram

System flow diagram is shown in Figure 3. In this system, there are two types of user as owner (administrator) and customer. For owner, he/ she can define budget, variable costs and fixed costs. At first of the system, the system user receives orders from the customers. And then, this system computes annual setup cost and holding cost. After computing, this system calculates the optimal lot size for rice production within Rice Production Factory by using annual production rate, annual demand rate, annual holding cost and annual setup cost. If the customer updates the annual demand, this system calculates the optimal lot size with the change demand again.

Finally, the system user calculates the profit or loss about rice production by using marginal costing method. Moreover, in this system, break-even analysis is also used for monthly reports.

4.2. Experimental Result

In this system, Rice Production Factory has been using production runs (has 365 business days per year) of 4,500 bags, 10 times per year to meet the demand of

45,000 bags annually. And so their annual production rate is 146,000 bags and their annual demand is 45,000 bags. The cost of one item for holding in factory is 4% of the manufacturing cost of 15,000 kyats per bag, and the machine setup cost for one cycle is 500,000 kyats.

4.2.1. Calculating Optimal Lot Size for Rice Production

In the calculation of optimal lot size for rice production, we obtain P (Annual production rate) = 146,000, D (Annual demand) = 45,000, C_h (Holding cost) = 600 and C_o (Setup Cost) = 500,000. Economic Production Lot Size model's variables costs are annual holding costs and annual setup costs. And so, TC, the total variable cost is,

$$TC = \text{Holding Costs} + \text{Setup Costs}$$

$$= [1/2 Q (1-d/p)] C_h + (D/Q) C_o$$

$$= 207.53427Q + 22,500,000,000/Q$$

Thus, Q is used to calculate the total annual variable cost. The optimal production lot size Q^* is

$$Q^* = \text{Sqrt}(2DC_o/[C_h (1-d/p)]) = 10,412 \text{ bags}$$

In the calculation of the amount of Rice Production Factory, the total cost of current schedule is 54,167 and the total cost of optimal lot size schedule is 28,868.

$$\text{Optimal TC} = 207.53427 (10,412) + 22,500,000,000/10,412$$

$$= 4,321,815 \text{ ks}$$

$$\text{Current TC} = 207.53427 (4,500) + 22,500,000,000/4,500$$

$$= 5,933,904 \text{ ks}$$

$$\text{Difference} = 5,933,904 - 4,321,815 = 1,612,089 \text{ ks}$$

Therefore, the production factory saves 1,612,089 and so the EPQ to be minimize the total inventory cost.

4.2.2. Calculating Profit or Loss by using Marginal Costing Method

Marginal cost is the variable cost. The sum of the labour, other expense and costs of goods sold are regarded as variable cost. The differences between sales and fixed cost are regarded as contribution. The differences between contribution and fixed cost are regarded as net profit.

$$\begin{aligned} \text{Total Variable Cost} &= \text{Variable cost of Goods sold} + \\ &\text{Variable selling expenses} + \text{Variable admin expense} + \\ &\text{Other variable expenses} \end{aligned}$$

$$= 791,419,750 + 5,563,520 + 6,126,480 + 200,000$$

$$= 803,309,750 \text{ ks}$$

$$\text{Contribution} = \text{Sales} - \text{Total Variable Cost}$$

$$= 846,625,000 - 803,309,750$$
$$= 43,315,250 \text{ ks}$$

$$\text{Total Fixed Cost} = \text{Fixed selling expenses} + \text{Fixed admin expenses} + \text{Other fixed expenses}$$
$$= 5,000,000 + 4,000,000 + 120,000$$
$$= 9,120,000 \text{ ks}$$

$$\text{Net Profit} = \text{Contribution} - \text{Total Fixed Cost}$$
$$= 43,315,250 - 9,120,000$$
$$= 34,195,250 \text{ ks}$$

According to the calculation of marginal costing method, Rice Production Factory get profit 34,195,250 kyats.

4.2.3. Producing Reports by using Break-even Analysis

By using Break-even analysis, the system can improve the sales amount to get the profit. At the Break-even point, the profit is equal to the loss.

$$\text{Breakeven Point in units} = \frac{\text{Total Fixed Cost}}{\text{Contribution per unit}}$$
$$= \frac{9,120,000}{1000}$$
$$= 9,120 \text{ units}$$

$$\text{Sales revenue at breakeven point} = \text{Breakeven Point} * \text{Selling Price}$$
$$= 9120 * 15,000$$
$$= 136,800,000 \text{ ks}$$

5. CONCLUSION

This system is implemented for Rice Production Factory as a management decision support system by using economic production lot size model and marginal costing method. Every business management expected to get many profit. This system also used break-even analysis because some of the factory is getting risk which to adjust the loss of product as possible to cover the fixed cost. This system was tested with different demand and inventory costs such as setup cost, holding cost and inventory variable costs. It is also possible that the system's performance will improve an organization's needs to get the production processes, to become better performance, higher efficient, more effectiveness, and better retrieval. It can be flexible for any Production System.

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