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# Pricing in Supply Chain Based on Activity-Based Costing and Earned Value

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**Abstract:** Globalization of the markets and competition between enterprises as well as increasing the customers' Expectations for achieving high quality products and better services has led enterprises to try for their Survival, and increase their efficiency in the supply chain. Since a reasonable competitive appraisal with other enterprises is one of the important goals of any organization, applying some methods to allocate costs based on the activity can be a good way in order to reduce costs and be competitive appraisal in the market. The recognition of the present costs, collecting of the costs in the related centers, and applying multiple factors are 3 main components to allocate costs based on activity. The present research has been done in AMOL Kalleh Meat Products Company. The activities which are evaluated in the current research include human resources, production, maintenance, transportation. Regarding the received data from Kalleh Meat Company, the applying of the costs allocation based on activities cause to reduce them and is affordable for the enterprises with high over headed costs. Then according costs, customers willing to pay and earned value to get pricing. The prices obtained in this way are less than company's prices, because we considered attention to customers willing to pay.

**Keywords:** Supply chain; Activity based costing; Pricing; Earned value

## 1 INTRODUCTION

For many years, members of supply chains have been separated by organization and philosophy. Interactions between them have often been adversarial, with each trying to gain at the other's expense. Today, this long-established pattern is rapidly giving way to system integration due to increasing external competitive threat. The advocates argue that all of the subsystems of a supply chain are connected. The outputs from one system are the inputs of the other systems. Thus, integration of the complete scope of the supply chain from the supplier through the manufacturer to the retailer needs to be considered so that fully transparent information is shared freely among members, and collective strategies can be designed to optimize the system's joint objectives. While the importance of achieving integration in the supply chain is generally well recognized, for real-world applications designing a sophisticated integrated system is an arduous task. Few firms are so

powerful that they can manage the entire supply chain so as to drive individual members to a superimposed integrated objective.[2]

A fundamental change in the global competitive landscape is driving prices to levels that in real terms are as low as they have ever been. A number of causal factors have contributed to this new market environment. First, there are new global competitors who have entered the marketplace supported by low-cost manufacturing bases. The dramatic rise of China as a major producer of quality consumer products is evidence of this. Secondly, the removal of barriers to trade and the de-regulation of many markets has accelerated this trend enabling new players to rapidly gain ground. One result of this has been overcapacity in many industries [5]. Over-capacity implies an excess of supply against demand and hence leads to further downward pressure on price. A further cause of price deflation, it has been suggested [7], is the

Internet which makes price comparison so much easier. The Internet has also enabled auctions and exchanges to be established at industry wide levels that have also tended to drive down prices.

Changes in competition (globalization, standardization in production and so on) have recently led to many businesses cutting production in order to focus on key competencies. Thus, an even larger portion of value added is subcontracted resulting in significant expansion in the supply chain in many industrial markets. While this trend has brought benefits in that businesses have been able to concentrate on their strengths and focus their main assets in specific areas, this strategic orientation also has increased the need to collaborate and integrate activities between the different companies in the supply chain. Therefore, most companies today try to establish relationships with their partners in the supply chain rather than concentrating on purchasing [8].

This development is further supported by today's business relationships offering one of the most effective remaining opportunities for significant cost reduction and value improvement [2]. However, Frazier, Spekman Robert, and O'Neal Charles [4] observes that these opportunities mainly depend on the closeness of the relationship.

In this sense, suppliers in particular have cultivated business relationships for years by investing in their customers with a view to safeguarding subsequent business dealings from outsuppliers [6]. However, there comes a point where making business relationships closer is only possible when both the supplier and the customer are prepared to invest in this special type of collaboration, as relationships in which the reason for staying in are solely determined by investments made on the part of the supplier are unstable by their very nature. As soon as competitors offer comprehensive benefits in alternative business transactions, there is an economic reason for customers to switch suppliers [1]. This means that further investments will only become financially viable from the supplier's point of view if the customer is also prepared to put himself into a position of some dependence on the supplier. Both transaction partners then may devolve their economic welfare, at least in part, to the conduct of the other partner. Companies must be aware that Supply Chain Pricing will only provide a clear competitive advantage for the period of time when the competitors not yet have adapted to the new perspective. Taking the situation into consideration where a market or branch has completely switched into SCP, the use of our concept will no longer dispose of our stated over all advantage. In this situation, it can surely

amount to nothing more than the prevention of competitive disadvantage[9].

## **2 MODELLING THE PROBLEM**

### **2.1 Activity Base Costing**

Activity based costing method is that activities spent products, resources spent activities, costs spent resources .This study pay to identified the cost of activities that in a three-layer supply chain included provider, manufacturer , customer.

### **2.2 Costs of manufacturing, Cost of raw material production**

First to prepared fresh material are used from valid slaughterhouses and have international certificates. Due to the need and importance of allocation especial salons for preparing, meats sent based on the final product, bone taking, segmentation, and time required to use for KALLEH AMOL Company.

### **2.3 Cost of human resources**

Skilled manpower and the knowledge are assets of an organization and as a key competitive advantage and the scarce resource in today's knowledge-based economy. Therefore, the business strategy of today's organizations essentially focused on human resources.

Cost of manpower= (Variable cost of manpower per person × number of hours) +Fixed costs

### **2.4 Cost of production**

Production costs include costs are that created of during the production.

Cost of production = (Variable cost of production × each unit of output) +Fixed costs

### **2.5 Cost of maintaining Products**

Maintenance costs comprise the major part of production costs. According to type of industry will take about 15 to 60 percent of the cost of production.

Cost of maintaining Products = (Variable cost of maintenance × each unit of output) + Fixed costs

### **2.6 Cost of Transportation**

Activities will be created between the manufacturer and the customer, including the transportation.

Cost of Transportation = (Variable Cost of Transportation × each unit of output) (+Fixed costs

### **2.7 The earned value**

The percentage deviation of the cost difference between the real cost of work performed and the earned value represents the amount of deviation costs.

$CV = EV - AC$ ;  $CV\% = CV / EV$

CPI = EV / AC Cost performance Index.

**2.8 Pricing**

The scope of pricing and revenue optimization (PRO) is to set and update the prices for each combination of product, customer segment and channel. The goal in PRO is to provide the appropriate price for any products, any customer segments and any channels. Due to market condition changes over times, the PRO is responsible to update the prices .The basic element of a PRO is the price-response function or the price-response curve showing by d (P). The following specifications are considered for price-response curve:

- non-negativity
- continuous
- differentiable

The price-response curve is pursuing the demand changes considering the variations in price for a product. The demand function is linear and increasing the price cause reduction in demand until for the maximum demand the price get to zero. This type of demand function are called demand curve for monopoly market in economy.

In real world, the producer determines the price and customers decide to buy or not. The price-response function identifies the number of potential customers transforming to active ones while the producer descend the price or how many active customers are missed if the producer grows the prices. Thus, customers’ behavior configures the price-response function. Let us investigate the concept of willingness to pay (WTP). Any potential customer has a maximum WTP which is called reservation price interchangeably. Therefore, a customer would buy a product only if its price is lower than his maximum WTP. We can compute

the WTP of different customers for a given price interval [p1, p2] as follows,  $WTP = \int_{p1}^{p2} W(x) dx$ .

Also W(x) is the WTP function. As stated, the maximum demand (D) is obtained to be D=d (p), i.e., the maximum demand is when the price is zero. Here, we can obtain the price-response function using WTP,  $d(x)=D \cdot \int w(x)d(x)$

In our proposed model, assuming WTP is a uniform probability distribution function, the demand function is considered to be linear using the proposed integral. As a result, the following linear demand function is obtained  $d(p) = D - m \cdot P$ . D=d (0) is the maximum demand, m is the gradient of the demand curve and P is the price.

Also effort for Making the maximum profit, Price determined are multiplying the number, We reduce the cost of doing so would the benefit obtain price that must have The earned value, with The earned values and activity based costing in the supply chain.

**2.9 Numerical results**

Here, we perform the methodology using the collected data from the factory based on the cost functions in the supply chain, willingness to pay of customers and pricing.

**2.10 Calculate the costs of supply chain based on activity based costing**

Total production cost, manpower cost, transportation cost and maintenance cost in the supply chain Based on activity based costing for each product are as follows:

$$F(C) = F(CI) + F(CH) + F(CP) + F(CM) + F(CTr)$$

Also, the total costs for the products obtained from the equations are reported in Table 1.

Table 1. The overall costs for the products

Product Type	Product1	Product2	Product3	Product4	Product5
Total costs for each product	311514192	1062452191	127437624	170231492	5240518294

**2.11 Customer demands**

Each of the five products made by manufacturer, have specific demands behalf of customers.

Demands for Manufacturer products of the Customers in the table are as follows:

Table 2. Customers’ demands

Customer demand for different products	Product1	Product2	Product3	Product4	Product5
Customer1	792	159	324	50	6047
Customer2	396	600	162	162	3168
Customer3	198	150	81	108	2520

First, we must to get amount of costs the products that these customers want to get. As a result, the total cost of production divided by the number and

multiplied the production rate for the three customers.

Table 3. The obtained costs per products

Products	Product1	Product2	Product3	Product4	Product5
Total cost of products per customer demand	109029968	71506667	44603169	25172864	923136122

Now we can to get breakeven point price for the products using the following formula:

$$(Price*number)-costs=0,$$

Table 4. Breakeven point price

	Product1	Product2	Product3	Product4	Product5
Breakeven point price	78666	78665	78666	78667	78665

Breakeven point prices are the lower boundary for the customers' willingness to pay integral; the upper limit of integral is a multiplied certain

amount of expected profit. Products with their corresponding aggregated costs and the expected profit are shown in Table 5.

Table 5. Aggregated costs with the expected profit

	Product1	Product2	Product3	Product4	Product5
Customer1	4984215	1000622	2152280	314660	38055077
Customer2	87318	87318	87318	87318	87318
Customer3	2024842	1533971	828345	1104460	88891

Customers' willingness to pay for various products is given in Table 6.

Table 6. Customers' willingness to pay

	Product1	Product2	Product3	Product4	Product5
Customer1	1259	1049	3147	2517	1574
Customer2	1731	1236	1442	2884	1442
Customer3	1461	1137	1704	2044	1705

**2.12 Pricing**

After obtaining the price of each product in the breakeven point and an ideal profit, and the computed willingness to pay for different

customers, now we get to the pricing using the following formula (see Table 7):

$$Price= (head to head price+ willingness to pay)*number$$

Table 7. Pricing

Pricing	Product1	Product2	Product3	Product4	Product5
Customer1	63300600	12674526	26507412	4059200	485205233
Customer2	31837212	47940600	12977496	13211262	253778976
Customer3	15865146	11970300	6509970	8716788	202532400

**2.13 The earned value**

$$CV = EV - AC; CV\% = CV / EV$$

In order to obtain the earned value the following relations are used:

Table 8. Earned value computations for the proposed method prices

Earned value	Product1	Product2	Product3	Product4	Product5
Customer1	997762,1.5%	166758,1.3%	396086,1.4	125940,3.1%	9516769.1.9%
Customer2	685793,2.1%	741480,1.5%	233734,1.8%	467501,3.5%	4567623,1.7%
Customer3	289437,1.8%	170520,1.4%	138089,2.1%	220947,2.5%	4296096,2.1%

Table 9. The earned values for the company prices

	Product1	Product2	Product3	Product4	Product5
earned values of the company's prices	53825032,33	31664833,30	14364831,24	12747136,33	473328878,33

We stated that the company itself set prices, thus we can compute the earned values for these prices as shown in Table 9. The results show that the obtained result from our proposed pricing procedure is much more reliable regarding earned value analysis.

**3 CONCLUSIONS**

This paper proposed an integrated methodology in a supply chain to consider the costs in pricing. The costs were obtained via activity based costing due to different activities performed in the supply chain. The customer willingness to pay was a merit effective on the total price of a product. Breakeven point (via activity based costing), favorite expected profit for company and willingness to pay for customer were three significant elements in forming the optimal price. The numerical study in Kaleh meat company verified the implementation of the methodology. Earned value was an analytical method to compare the current prices and prices obtained by the proposed approach confirming the proposed approach's efficiency.

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