

In The Uncertainty Conditions Cost-Volume-Profit Anlysis Which is Used Fuzzy Logic:

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Abstract

To be successful in the global competitive environment, business are obliged to maintain their activities and plan their activities. Profit planning is the most important management tool, since the main target is to make profit.

The cost system, which is used, should provide information for the concerning people about the many aspects, such as inefficient parts, unprofitable products and determining the activities and products whose costs are high, but incomes are very low.

Activity-based costing is becoming as a tool supporting business management by supplying more detailed information as well as effort to determine more accurately the product costs. However, activity-based costing is criticized because it is found complex and application is difficult. In today's management where computers are used effectively can resolve the lack at this point by using computer-supported system.

In our study, in activity-based cost systems, a methodology was developed, based on turbid logic theory, so as to eliminate the uncertainty, remove the vagueness and make profit plan by using the estimated data.

Keywords: Cost-Volume Profit Analysis, Fuzzy Logic

1.INTRODUCTION

Uncertainty in the markets and global instability oblige firms to plan for future and to act quickly. Therefore, profit planning plays an important role in realizing their foremost aim “to make a profit”. Profit planning requires determining the factors affecting profit and coordination between them.

Cost-Volume-Profit analysis (CVP) aims to determine effects of factors which are required for profit planning on profit. Cost-volume-profit analysis is analysis that firms use in decision making process. Cost-volume-profit analysis brings flexibility and dynamism to firms in terms of profit planning. Right profit planning and right decisions depends on realistic costing.

Indirect expenditures increased its share in firms due to technologic developments. Traditional cost accounting methods remain incapable. While allocating production cost to goods, measures which are determined according to current output do not reflect product cost accurately.

With reference to the consideration “products consume activities and activities consume resources”, it is thought that costs will be more realistic by application of CVP on activity based costing. It is used not just in determining costs, but also in profit planning due to positive effects of activities on profit planning. Customer’s preferences determined by quality and quantity of activities require inclusion of activities based costing in this study.

Cost-Volume-Profit analysis (CVP) is used to make decision on a going-forward basis. However, it is hard to extrapolate that managers’ decisions should depend on more reliable information. It is possible to increase expected utility by incorporating atmosphere of uncertainty to CVP analyzes.

The way to make more reliable decisions by disambiguation is to provide managers with reliable information and flexibility reflecting atmosphere of uncertainty in planning. Only the firms which are capable to control uncertainty can manage to prevent potential fluctuations in their profits. Although there are some models using probabilistic and random variables, many of managers prefer not to use them considering these types of models as sophisticated and costly for small and middle sized corporations. Inexperienced managers in statistical and mathematical analysis also prefer not use these types of models. Therefore, managers need practical and simple methods to overcome difficulties in the atmosphere of uncertainty.

Probability models require standard distribution principles to provide flexibility in controlling dynamic work conditions. Simulation techniques also require using probabilistic data in related inputs. However, previous distributions do not always help in making decisions in atmosphere of uncertainty and remain incapable. Fuzzy logic is a model for small and medium sized corporations that can be used in analysing atmosphere of uncertainty. It helps managers to find answer to the questions of “if”. Without needing quantitative data, managers can find answers to their questions within a minute by this model. Managers can use fuzzy logic model in setting their plans to reach their first and foremost aim of “profit” (Yuan, 2007:1).

2.Fuzzy Logic Operations

Real world is complicated. The complication is derived from uncertainty and difficulty in making certain decisions. Uncertainty is being existed in almost every aspect of life such as social, economic and technical life due to immaturity of human being’s information capacity. Computers are unable to process such uncertainty and need numerical data. Due to the fact that limited capacity of human beings in comprehending such complicated and uncertain phenomenon, they guess by envisaging them. Unlike computers, Human beings are

able to guess basing on limited and uncertain information. As a general, these limited and uncertain information is called as “fuzzy” sources (Şen:2004:10-15).

Managers can make decisions providing that certain and full information is existed. However, it is almost impossible to extrapolate due to economic developments, some factors that are particular to investment, competition, technological developments, change in consumer’s perception, disagreement between employees and employers (Akgüç,1998:393). These factors oblige managers to make decision in the atmosphere of uncertainty.

One of mathematical models in estimating uncertainty flexibly is fuzzy logic. The most important opportunity of fuzzy clusters is, unlike classical clusters, to provide user transitivity between clusters (Şen,2004:21).

Application of fuzzy logic depends on complexity of the subject, unavailability of adequate information and a need to person’s views and value judgements. Fuzzy logic principles help to use such information sources (Baykal, 2004:166). The main phases in designing fuzzy logic controller are as follows; (Elmas, 2003:86):

- 1) To determine appropriateness of fuzzy logic method in the problem solving
- 2) To identify state, input and output variable sequences. Results of measurements by detectors produce input, control and output sequences.
- 3) To identify membership function for per input and output parameters. Number of the membership function depends on selection of designer and system conduct.
- 4) Main part of information includes linguistic rules, intuitive knowledge, and measurements of input and output parameters. So, fuzzing can be carried out and it is identified which rule is implemented.
- 5) A rule base is formed. Designer determines that how much rules are important.
- 6) Output for rule base and some sample input is examined and it is controlled that output is accurate and consistent with rule base.
- 7) Results are identified according to the rules.
- 8) During controlling phase, it is aimed to get adequately good solution rather than proper solution.
- 9) It is aimed to get the best controlling designer to control knowledge within acceptable accuracy interval.

3. Cost-Volume-Profit Analysis (CVP) by Activity Based Costing

Cost-Volume-Profit Analysis (CVP) is effective planning and decision making tool that aggregates important financial information for corporations such as costs, sale amounts and sale prices and deal with relations between them. Relationship based on self-interest between corporations and other groups and aim of having balanced and healthy relation with them oblige corporations to maximize their profits. One of the several methods to maximize their profits is profit planning. Profit planning is a method that considers many factors effecting

profit and aims to provide harmony between them. The factors which effects profit are; Sales prices, sales amount, sales mix, unit variables costs and fixed costs. Relations between these factors and variations of them affect output and profit. Profit planning requires decision making by managers on the issues such as new product, production volume, pricing and alternative production methods. Cost-Volume-Profit Analysis (CVP) helps managers in their decisions leading them observe effects of these relations on corporation activities.

Modern production style and aim of gaining competitive advantage require continuous improvement. The main aims of continuous improvement are prevent wastage, decrease total production time, increase quality and workers' productivity and reduce costs. Managers need to have adequate information about inventoriable costs. Since, right knowledge on costs reduces the number of the wrong decisions (Kurnaz, 2002:95).

Increasing usage of automation and computer aided production line in corporations have decreased the effects of employment costs on production overheads. At the same time, production overheads have become an important part of production costs due to increasing usage of automation. Today, dependence on machinery has increased while dependence on worker has decreased due to increasing product complexity (Doğan,1996:63).

Traditional cost accounting loses its importance and underperforms due to flexible, customer driven and knowledge based production models (Sullivan,1992:12). Traditional cost accounting was valid at the time that direct labour costs formed important part of total product cost.

New developments in production such as just in time production, increased usage of robots and flexible production systems have cut direct labour costs and increased the ratio of production overheads. Today, total costs are composed of direct labour costs (%10), material costs (%55, and production overheads (% 35). Production overheads can be resulted by differences in throughput, stock diversity and machine settings (Cooper,1988:45).

Due to the fact that traditional costs systems employ allocation, production overheads are becoming dependence on current output indirectly. However, production overheads does not depend on current output due to today's automation based production. Hence, production overheads include quality control, programming, product design and monitoring production process in today's automated based production. Then, many indirect costs do not appear to be proportionate to current output. So, traditional systems do not give adequate information on activity costs. (Glad and Becker,1996:125-126).

Activity based costing differ from other traditional systems that it firstly identifies consumption of sources by activities and then builds a relation between goods and costs of activities. So, Activity based costing provides accurate distribution of activity costs over inventoriable costs without depending on current output.

Expected advantages from activity based costing are as follows (Romano,1990:73);

- Activity based costing provides accurate distribution of indirect costs (production overheads) which are not dependent on production volume and accurate calculation of inventoriable costs.
- Activity based costing provides accurate calculation of profits by accurate information on costs.
- Activity based costing helps corporations to take right decisions.
- Activity based costing leads corporations to concentrate on value-added activities.
- Activity based costing facilitates to take right decisions on pricing and discontinue of production.
- Unlike traditional performance measurements, activity based costing helps to develop new performance measurement.
- Activity based costing provides effective cost management by analysing activities in corporation and providing accurate information on costs.
- Activity based costing helps to reduce costs by providing indirect costs separately.
- Activity based costing provides corporations with flexibility to adopt themselves to new production environments

Unlike traditional systems, activity based costing can produce such information. Activity based costing help managers to analyse general factory costs in detail and to observe costs from different points of views. The method also helps managers to determine the departments where waste of sources and unproductivity are existed by showing production and non-production processes in detail. However, activity based costing does not prevent wastage and cut production costs separately. The method just calls managers' attention to costs and main reasons in profiting. (Taniş,1999:149).

3.1.The Usage of Activity Based Costing Information:

i) In Analysis of Return on Production

New production systems and competition environment have decreased profit margin and have required calculating inventoriable costs and its effect on total profit in detail. (Haftacı, 2005:184). Traditional cost information does not provide accurate information for profit analyses as a result of cost transmission in calculation of product costs and exclusion of some expenditure which are considered period cost though they are directly related with goods. However, product profitability analyse is a tool to canalize efforts to most profitable areas.

Activity based costing enables corporations to carry out product profitability analyses accurately providing right financial information. Activity based costing prepares the grounds for accurate analysing of product lines considering processes of purchasing, quality tests and stocking which are particular to product line. Activity based costing also enables corporations to carry out profit simulations at different levels of price and sale projecting profit rate per unit and sale amounts (Pazarçeviren,2006:53).

ii) In Analyses of Customer Profitability

Profit and expenditure per customer should be determined for customer profitability analysis. While it is possible to determine profit for per customer easily, it is hard to determine expenditure per customer. It is required to monitor costs for per customer in terms of sale, marketing and distribution. Yet, it can be said that these types of expenses increase more than sales revenue in recent years and so these types of expenses are not stable and they are related to operating volume (Öker,2003:71-72).

Issuing information on costs on the basis of customers helps corporations to take decisions on customers easily. Some of these decisions are as follows (Karsak, 2001:24):

- a) To keep touch with customer with high profit sharing and improve business volume with them
- b) To reprice some goods which require special costing on the basis of customer
- c) To apply reductions to customers with high profit sharing
- d) To assign constantly losing customers to rival firms
- e) To try to get prospect customers with high profit

iii) In Product Design and Development

One of most effective tools for corporations to cut costs is product design. Activity based costing enables corporations to determine easily the effects of some alternatives on costs identifying cost drivers. The information through activity based costing is used to understand indirect costs and cost drivers by designers and to do better cost estimates. Activity based costing is used basically for two missions (Öker,2003:76).

To get accurate cost information in contrast with traditional cost methods,

To provide data base for technical staff in decision making

4. Case Study: CVP Analysis of Changes in Costs in Different Goods by Fuzzy Logic on the Basis of Consignment and Product

An Example of Root Canal Therapy by CVP

In the firm that more than one product or service are provided, components include sale revenues, variable costs, information costs and constant costs.

Root Canal Therapy by CVP Mamdani Fuzzy Logic Model:

Sales Revenue TL	Low	92.55	92 – 140
	Moderate	141.11	120 – 160
	High	214.66	150 – 215
Variable Cost	Low	45	45 – 70
	Moderate	75	60 – 90

TL	High	136	85 – 136
Design or Information Cost	Low	7.13	7 - 12
	Moderate	14.27	11 -17
TL	High	19.03	16 - 19
Constant Cost	Low	14.27	14 – 21
	Moderate	23.79	20 – 26
	High	28.55	25 -29

Profit	VeryLow		0-24
	Low		23-45
	Moderate		44-63
	High		60-105
	Very High		100-150

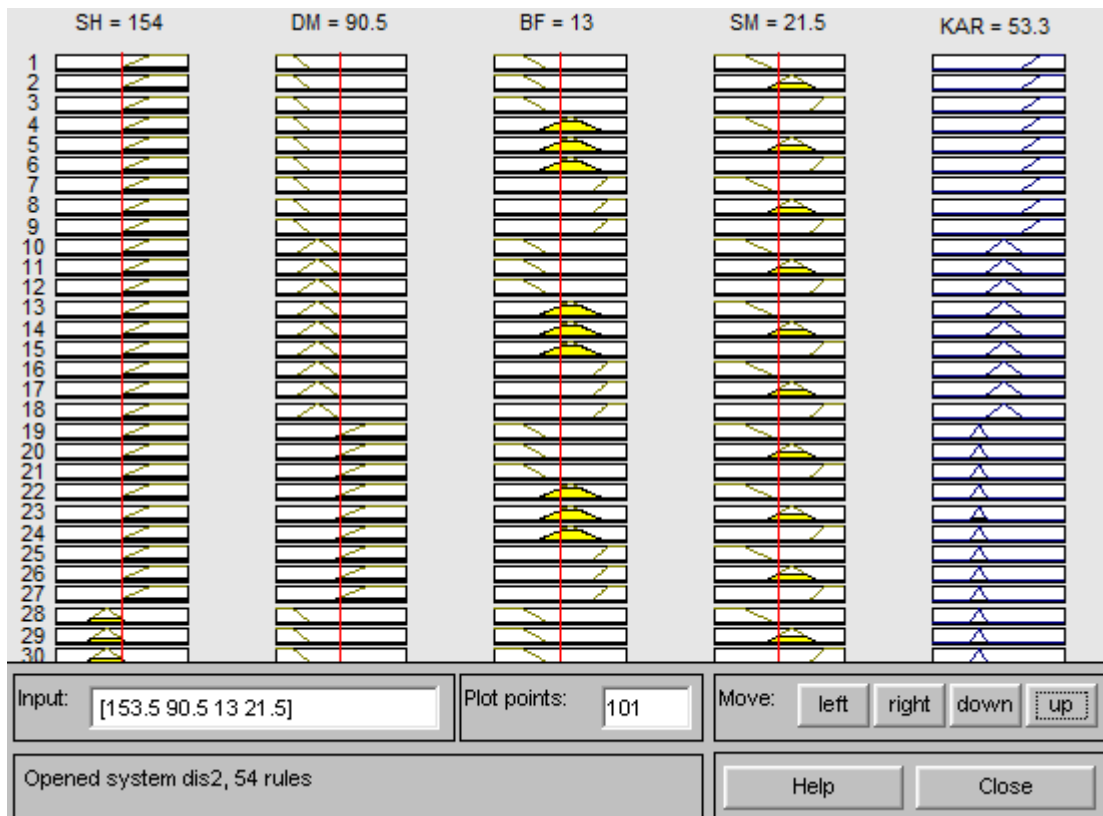
4.1. Saving from Fuzziness and Finalization

Rules in the fuzzy logic are formed as if than rules;

SF HIGH, DM LOW, BF LOW, SM LOW THAN PROFIT VERY HIGH.

In the CVP analysis of lot and goods level costs, the above rules are acquired through manager's experience and profit result is calculated through manager's profit parameters.

Profit Result:



Entering fuzzy information by fuzzify unit on the basis of the rules, it is aimed to reach a conclusion by max-min method. Output variable is as above.

Profit amount is calculated by the formula as follows;

$$\text{Turnover providing desired profit} = \frac{\text{Constant Cost} + \text{Profit}}{\text{Content Rate}}$$

4.2. The result of root canal therapy by CVP through Mamdani fuzzy logic model: 53,30 TL

Profit amount is calculated by the formula as follows;

$$154 = \frac{21,50 + \text{Profit}}{0,41}$$

$$63,14 = 21,50 + \text{Profit}$$

$$\text{Profit} = 63,14 - 21,50$$

$$\text{Profit} = 41,64 \text{ TL}$$

The result by the formula is close to the result by fuzzy logic. The managers argue that the result by fuzzy logic is more realistic.

5.CONCLUSION

Activity based costing is needed to remove skew costing of traditional costing as a result of product cost transfer between products. According to activity based costing, costs in firms are results of activities. Goods consume aforesaid activities. So, it is required to understand operating costs, interrelation between goods and factors which have effects on activities. Activity based costing agree that some costs change according to production units while some costs are not related with production units. However, while activity based costing agrees that non-unit-level costs are stable according to the change in production volume; in the same time it agrees most non-unit-level costs are more variable according to other cost drivers. According to activity based costing, the difference in terms of constant costs will become apparent when a comparison is conducted between formulas in CVP analysis and formulas in traditional CVP analysis. Constant costs emerges as variable costs in activity based costing as a result of cost drives such as making ready for job, engineering hours and R&D (Erden,2004: 88-92).

CVP analysis produces more meaningful and strategically important information thanks to new perspective of activity based costing. Combination of activity based costing and CVP analysis enables firms to look ahead, to make better plans and to take more correct decisions in terms of monitoring costs and strategic sense (Erden:92).

Combination of CVP analysis, fuzzy logic and activity based costing result in as follows;

It is understood that activity based costing and CVP analysis can be calculated by forming fuzzy logic which bases on managers' experience and knowledge.

Inserting of uncertainty in CVP analysis is important for getting expected utility. It enables firms to take more realistic decisions carrying out simulations in the period of uncertainty.

Activity based costing analysis by fuzzy logic is more profitable in the period of uncertainty and high production costs (indirect) which has a capacity to affect decisions.

Activity based costing analysis by fuzzy logic enables firms to maintain costs effectively in the period of uncertainty.

Subjective decisions and past experiences are inserted to decision making process by fuzzy logic. So, formal decision making process becomes more effective, fast and realistic.

Activity based costing analysis by fuzzy logic has a potential of usage as a decision making tool in some areas such as customer profitability in addition to product costing.

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