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The Study of the Relationship between the Performance of Fuzzy Goal Programming Method and Production Factor Promotion

Kamaledin Rahmani, Naser Feghhi Farahmand, Houshang Taghizadeh, Arash Hajikarimi

Department of Industrial Management, College of Management, Economy and Accounting, Tabriz Branch, Islamic Azad University, Tabriz, Iran

Abstract

In order to determine a systematic method for increasing productivity, different methods have been implemented. However, these methods were mostly used for measuring the current situation and implementing a suitable instrument for the purpose of presenting an efficient solution in order to promote the productivity seems essential. For this purpose, operational research method is one of the most efficient and useful tools which tries to make the best advantage of them and use them systematically by implementing optimal resources.

Using an goal planning tool through determining the essential goals for promoting productivity is a modern method which has attracted the attention of productivity areas and is able to study the interaction between the essential elements with productivity promotion approach. The purpose of this research is to study the relation between performing Fuzzy Goal Programming Method and productivity promotion of production factors such as the promotion of materials, capital productivity, and human resources. The deign used for this method is applied, analytic and descriptive. Twenty four hundreds experts from five major detergents companies existing in detergents industrial clusters were considered as the population of the present study. The results indicated that there is a positive strong relation between the three factors including promotion of materials, capital productivity, and human resources by implementing goal planning model.

Keywords: Material productivity, capital productivity, human resource productivity, fuzzy goal programming method

Introduction

During the last two decades, the need to promote productivity in organizations has been of great importance. Productivity management, using science and knowledge in administration, and improving product quality tries to establish a system for measuring, evaluating, planning, and improving productivity in the organization through the use of management systems, and attempts to solve complex issues of organizations by the necessary information. Thus, standards are often set and organization performance is compared with these standards. (Latour, 2006)

The main research problem is stated as follows:

Studying the amount of relationship between each factor of the productivity with capital, human resource and material productivity.

It can be said that development of all organization factors can result from development and enhancement of productivity and interaction of resources with each other.

Regarding to Peter Drucker's study, the biggest challenge in developing countries in front of the managers is the knowledge-based productivity improvement. (Prokopenko, 2006)

By careful investigation of the research, it can be understood that human's economic efforts, were always impelled toward getting maximum results from minimum effort and resources. These desires may be called, the desire to attain more "productivity", that is the fundamental issue of the research. Discussing about productivity is one of the issues that today, all over the world is followed with great intensity. It seems that this word is being used as a slogan, and its importance is being understood more and more every day, however, there is no structured model in its improvement. (Scholes, 2006)

Corresponding author: Arash Hajikarimi, Department of Industrial Management, College of Management, Economy and Accounting, Tabriz Branch, Islamic Azad University, Tabriz, Iran. E-mail: arashhajikarimi@yahoo.com

Given the above, the main issue of research is the lack of a structured model in order to improve the productivity in industrial companies and inappropriate use of available resources that exist in the three areas: 1) Material productivity, 2) Human resource productivity and 3) Capital productivity. (Fakhradini,2002)

In this research, we seek to develop goal programming model with fuzzy approach to increase productivity in three abovementioned areas through it. According to the variables defined, mathematical programming problem as standard in finding optimal solutions, is a hierarchical structure decision that is even contradictory with desired goals .(Latour, 2006) In this regard, development variables of each of the production factors have been considered as input factors, process factors, output factors, business structure, competitor factors and government policy. (Naebi,1994)

In the study problem, to obtain maximum productivity, the plan must ensure that all resources are used effectively. Thus, production planning must be related to minimizing the time between operations and minimizing time spent on operations. In many other fields of production, the balance should appear. (Hip, 2006)

Methodology

This research is a cross-sectional descriptive analytical research and is quantitative, that according to the case study in the detergent industry, is of survey type.

According to the definition of the dependent variables, the main objective of developing and improving the productivity model of the production factors of organization, is in three desired goals. (Nursha, 2006).

- First goal: Material productivity
- Second goal: Human resource productivity
- Third goal: Capital productivity

First the dependent variables are considered as the basic goals of the model, and then based on all possible restrictions, limitations will be fuzzy in the goal model. (Alizadeh, 2001)

Other confounding variables, such as product price and marginal parameters are also considered to take into account their impact on the model. (Fakhradini, 2002)

Developing model

By pretest conducted with a 50 initial samples to determine the weight of goals through questionnaire, and for weigh impact of each factor which is conducted in accordance with SPSS® analysis, have been identified through reliability and use of questionnaire. After pre-testing the questionnaire, using 240 items, by calculating values of Cronbach's alpha and achieving value 0.812, which is more than 0.65, the validity of the questionnaire is confirmed.

First step: Distributing a questionnaire to collect data from experts, to consider the weight of each productivity factor in each of the three goals. Based on target sample, the number of people in the case study will be identified and then the questionnaire will be distributed. Comments rankings will be done according to the assumption of independence of factors from analytic hierarchical process. (Caballero, 2006)

Second step: Considering the objective function, the considered objective function is three factors of material productivity, human resource productivity and capital productivity.

Population

Given the strategic nature of the detergent industry in current conditions and low productivity due to high capital requirements and large volume of material in the manufacturing process, in improving the productivity of this industry should be considered.

Target population will be extracted to determine the weight of each productivity index from five major detergents companies existing in detergents industrial clusters that was mentioned in the scope of the investigation.

The working population is about 3000 people in various levels of senior executives, middle managers, executives, experts and employees, that distributed cluster sampling will be done based on the type of sample to complete questionnaires.

The population of this research is staff of detergent industry from five factories. (Bolden, 2006)

Considering that the selected population is in the industrial cluster of detergents and is considered in the study of manufacturing companies in detergent industry, the studies in question will be carried out according to the tools presented. To rank the goals also the following sampling will be used.

$$n = \frac{Nt^2pq}{t^2pq + (N-1)d^2} \qquad (3\text{-}11)$$

$$n = \frac{650*(1.96)^2*0.5*0.5}{1.96^2*0.5*0.5+(650-1)*(0.05)^2} = 240$$

Sampling method is the cluster method that based on selecting various layers of managers in three clusters of senior managers, middle managers and executives have been considered. Weight considered in each cluster is identical, and samples of each cluster of five companies were created.

Data analysis

In this study, library studies are used to design the model and different models that are designed in creating productivity index are utilized. Also for case analysis in the detergent industry and determining the impact of each factor, the questionnaire is used. (Lin,2009)

In this study, a questionnaire is used for collecting data in question, in order to formulate the weight of each question and ultimately weights of gain objective functions and the rate of powder and liquid production, are used in fuzzy goal planning.

Data collection tool to the design the model is library studies. Also, in order to determine the productivity weight of each of the areas, questionnaires have been used. In the case study, the detergent industry has been selected and for sampling Tolypers company has been considered. (Liao, 2009)

Data analysis is as follows:

Measuring productivity by defined scales, without applying target model in the area of material productivity, human resource productivity, and capital productivity

In order to analyze and interpret data of the study, principles of inferential statistics have been used and according to the hypothesis testing for each question, and estimating the distribution of t, rejection or acceptance of each hypothesis is investigated. By using SPSS software, all questions in 18 variables have been studied and with respect to the mean and standard deviation of each question have been rejected or accepted and determined correlation of each question in hypotheses. (Romero,2006)

Based on sample selection, 240 questionnaires are designed and distributed among 240 experts in the organization and information is collected. The validity and reliability of the data was identified by SPSS software.

Other information about the values, resources and time of production has been acquired through field studies in Tolypers Company. (Chandrashkar, 2006)

The population in this study consists of executives, and experts of five detergents corporate that the sample size is achieved 240. Thus, the required sample size for this study is 240, which in order to achieve 100% return rate for the questionnaires, questionnaires were distributed a little more than necessary. After data collection, data collected were entered into SPSS software, whose descriptive statistics are as follows:

When data are collected in the ranking manner, or are converted to rank, the Spearman correlation coefficient or Spearman's ρ method can be used. The correlation and relationship between two variables is important and in this way one of these two variables can be controlled or predicted. To measure this kind of correlation, various coefficients are used, one of which is the Spearman correlation coefficient, which is one of nonparametric methods. (Marc, 2005)

The null hypothesis in this test assumes that there is no correlation. Rank correlation coefficient is indicated by r_s. Calculating the rank correlation coefficient for paired data (x_i, y_i) for $i = 1,2,...,k$ is as follows: First, we rank all xs based on their values and also do the same for ys, then we calculate the difference between the scores of each pair that is shown by d_i. Next, we calculate the square of ds, ultimately using this formula, we calculate rank correlation coefficient. (Glasl, 2006)

$$r_s = 1 - \frac{6\sum_{i=1}^{k} d_i^2}{n(n^2 - 1)}$$

To test the null hypothesis, that claims the variables x and y are not correlated and these are paired randomly, there is no need for a particular hypothesis about population sample. For large amounts of sample (10 <n) rs distribution can be approximated by the normal distribution, in which case the test statistic is calculated using the following formula: (Beck, 2006)

$$Z = r_s \sqrt{n-1}$$

First hypothesis

H1: There is a direct relationship between establishing the model of productivity factors in goal planning and increase in material productivity.

H0: There is not a direct relationship between establishing the model of productivity factors in goal planning and increase in material productivity.

Table 1. Studying the relationship between establishing goal planning and material productivity

Number of data	Significance level	Spearman Correlation Coefficient	Variable features
240	0.000	0.79	Productivity factors in goal planning-material productivity

As can be observed there is a positive and direct correlation between establishing the goal planning model and materials productivity.

Second hypothesis

H1: There is a direct relationship between establishing the model of productivity factors in goal planning and increase in capital productivity.

H0: There is not a direct relationship between establishing the model of productivity factors in goal planning and increase in capital productivity.

As can be observed, there is a positive and direct correlation between establishing the goal planning model and capital productivity.

Table 2. Studying the relationship between establishing goal planning and capital productivity

Number of data	Significance level	Spearman Correlation Coefficient	Variable features
240	0.000	0.713	Productivity factors in goal planning-capital productivity

Third hypothesis

H1: There is a direct relationship between establishing the model of productivity factors in goal planning and increase in human resource productivity.

H0: There is not a direct relationship between establishing the model of productivity factors in goal planning and increase in human resource productivity.

As can be observed there is a positive and direct correlation between establishing the goal planning model and human resource productivity.

Table 3. Studying the relationship between establishing goal planning and human resource productivity

Number of data	Significance level	Spearman Correlation Coefficient	Variable features
288	0.000	0.819	Productivity factors in goal planning-human resource productivity.

Table 4. The results of the hypotheses

Result	Test statistic	Significance level of test	Spearman Correlation Coefficient	Hypothesis
Rejection H_0	000/0	05/0	79/0	First
Rejection H_0	000/0	05/0	713/0	Second
Rejection H_0	000/0	05/0	819/0	Third

Conclusion and Recommendation

Considering selection of statistics and placement of all variables in the reception area and selecting rank as Likert spectrum, based on the correlation between variables, as very high, high, medium, low and very low, the following results are extracted:

Analysis of productivity factors with establishing goal planning *:*

1. Relationship of establishing goal planning and material productivity is very high.
2. Relationship of establishing goal planning and human resource productivity is very high.
3. Relationship of establishing goal planning and capital productivity is very high.

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