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**BUILDING A FRAMEWORK FOR STRATEGY ORGANIZATION EVALUATION
BY USING FUZZY SET THEORY IN BSC**

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ABSTRACT

Undoubtedly, one of the principal tasks of monitoring and evaluating the performance of its organization. Strategies used to achieve the goals of the organization, there is always a need to review and assess the performance of the formulation and the implementation thereof in accordance with what is predicted to be one of the modern methods and expressing Performance Evaluation Score Card (BSC) in which the organization in terms of financial and non-financial aspects will be assessed. The use of fuzzy theory in the BSC can control the precise factors affecting organizational performance provides a clear picture of it. In addition to increasing the production phase control intelligent machines can play an important role in providing an organization's management control frameworks play smart. In this article we have tried to provide a new framework in which the phase error is very low compared to traditional frameworks, strategies and the performance of their organization's current assessment of the changes, quickly and accurately predicted.

Keywords: Strategy, performance measurement, balanced scorecard, fuzzy control, gradient descent, regression

INTRODUCTION

To explain the reasons for the failure of strategies, many studies have been done and it has been mentioned for many reasons. The main reason for this gap between the views of a strategic layer and operational layer in organizations. However, intellectual and scientific efforts to date, more attention has to

providemethodologies and tools to develop strategies to implement and evaluate it. Strategic management based on the formulation, implementation and evaluation of strategies based. Evaluating the performance of management tasks is to make it known to the concept of performance management. A

comprehensive definition of the performance and behavior of the two operating result or how to do it has been pointed out by Brumbrach is as follows. Performance results are means and means behaviors. Behaviors and practices arise from a single performer to act convert. Not only problem behaviors and to achieve results, but also to turn their resulting output. In other words, the physical effort and mental behaviors used to perform tasks that can be judged apart from the results output. When performance is the result of the definition of performance management, both inputs and outputs, the results should be considered. Measurement of process performance can be defined to quantify the efficiency and effectiveness of enforcement. A performance index can be used as a benchmark to quantify the efficiency and effectiveness of a defined activity, with this, a system of measuring the performance of a set of criteria used to quantify the efficiency and effectiveness of the activity. The nature is ambiguous, imprecise and uncertain rather than random, the fuzzier. Fuzzy set theory is possible to run this type of data and information that involves subjective judgments of the decision-making process is usually encountered in the real world. What this article is dealt with in one of the safest ways to measure performance that

can play an important role in the implementation of performance management as well as a reliable tool to measure performance and evaluate the organization's current strategy is used. In this article BSC in the review phase and the phase and gradient descent control principles is a framework for evaluating the performance offered. The new framework was compared with the non-fuzzy and improve results by MATLAB software is displayed.

The performance measurement system

Performance measurement activities for the following steps can be considered as the main activity.

1) Understanding the organization

At this stage, various activities of the Organization are examined. Because in a right of organization, strategies, objectives, programs and processes that are necessary for effective performance.

2) Development of Performance Assessment Framework Review of performance appraisal systems

investigating the specific application of the Investigating a variety of techniques to develop indicators. Investigating techniques of employee performance evaluation and incentive systems.

Assessment and comparison between the different methodologies and in the end choose the best framework.

3) Developing performance measurement indicators

At this stage, after the confirmation of the primary system, the indicators needed to measure performance will be provided. It should be noted that the characteristics of the funds, clients and stakeholders, processes and human resources will be.

In addition, the relationship between the variables studied and the birth of the index will be developed.

The traditional method of measuring performance and Disadvantages

The traditional method of measuring the financial performance and economic theories are based on views. Today, experts and managers have found that traditional systems alone can appropriate and complete picture of the inner workings of the organization to provide management control systems. The financial data for a certain amount and the real advantage of their own, but the important reasons against such a measure as follows: Financial data tend to be isolated and introverted policy that focuses more on economic self-reliance. Financial data less tangible factors such as product and service quality, consumer satisfaction and staff morale are included. Financial data are old parameters of what happened in the past show and predictor of future performance is poor. Compared with the benchmark

(benchmarking), an old method based on forecasts yesterday, in the sense of determining the performance of a business unit or organization compared to similar units in the organization or outside the organization. This broad perspective in performance measurement has created and can provide a measure of BEST PRACTICE. The purpose of performance measurement is a warning for future activities.

New measurement systems

Traditional performance measures and changes in the competitive environment and weak manufacturing, the need to redesign the system has created a performance measurement in organizations. In today's competitive environment, companies in product quality, delivery, reliability, after sales service and customer satisfaction are trying. None of these features can not be measured by traditional financial measures, while these characteristics are among the main objectives of the companies that operate globally. These financial measures are that the utility increase. More new measurement systems have been developed with the aim of implementation of the strategy. Implementation of the strategy, decision making with regard to link strategy and organizational structure, develop budgets, performance strategies,

incentive systems and monitoring efficiency and effectiveness of the strategy. In setting up this type of system, the superintendent of the set of criteria that offer the best performance of the strategy chosen. These criteria can be seen as critical success factors now and in the future.

If these factors improve, the company has implemented its strategy. What is important for enforcement agencies not only track the results of past practices in depicting financial criteria, but also non-financial criterion which lead to future performance.

Unfortunately, most organizations when evaluating performance, results of operations and strategies with traditional financial metrics compare.

Financial measures as mentioned show one of the aspects of organizational performance. To help assess the performance of non-financial indicators of the topics that were highly regarded during the 1990s.

Balanced Scorecard (BSC). The view in the 1990s, following changes in the development and monitoring of performance measurement systems developed by Professor Robert Kaplan (Robert Caplan) from Harvard University and David Norton (David Norton) strategy was developed to international shop. The

balance in the BSC or balance refers to the balance between financial goals this attitude on the one hand and non-financial objectives on the other hand, short-term goals and long term goals on one hand, on the other hand, internal goals and objectives on the one hand on the other is external. It is a comprehensive framework for strategic goals and mission to become a category of its performance criteria. BSC aims to give a comprehensive view of an organization's managers to the areas where the strategy forward, focus BSC framework includes a series of financial and non-financial criteria. Measures to assist the organization to implement the key elements in the strategic vision of the organization have been selected. In addition to the traditional criteria that the financial aspect, Kaplan and Norton (1992) have also introduced three measures of other non-financial aspects in the fall.

BSC, vision and strategy to make ends meet on their management focus. The scorecard devised by Kaplan and Norton, the organization of four funds, financial, customer, internal business processes and learning and growth seen that diagram shown in Figure 1. If necessary, you can view and equipment such as physical development perspectives, views and separate staff added Kaplan and Norton suggest that each

organization based on the BSC, which includes a series of criteria to be evaluated. It should be noted that BSC is a particular pattern generally not be used in an organization or industry. Market

opportunities, competitive strategies and different environments require different scorecards.

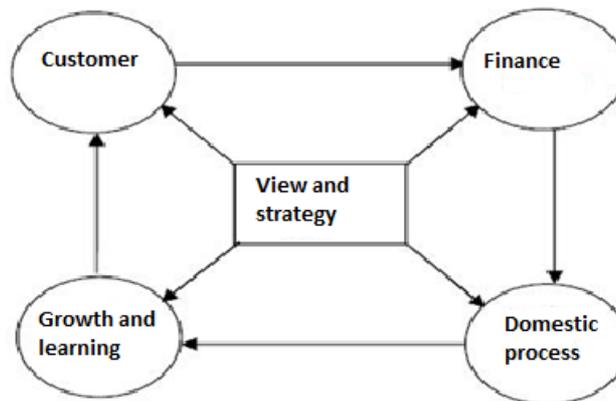


Fig. 1) BSC

A study in 1996 showed that 59% of Canadian managers and 33% of American executives are familiar with the term BSC. Research shows that a significant move BSC in practice, as it is a theoretical subject.

It is estimated that 60% of 1,000 wealthy United States of BSC concept or families to assess their performance. Of course, some companies are having financial and non-financial measures are claiming that the BSC.

Fuzzy set theory

Fuzzy set in 1965 by Professor Lotfi Asgarizadeh to resolve an ambiguous, imprecise and uncertain introduced. Generalization of the theory of fuzzy sets in the final set of the final set, for certain categories defined.

In other words, with a feature set is defined. If a given object, with the attributes member corresponding collection, and if not, is not a member of it. Now, imagine talking about those numbers is set to "Large". Here's a feature that is ill-defined and ambiguous "big" encountered large numbers of what are and what not large numbers are, it is different depending on different people.

Concepts and features that are used in real life concepts are imprecise and ambiguous. Mathematical theory of fuzzy sets can deal with the uncertainties of the grounds for reasoning, inference, control and provide decision-making under uncertainty. A fuzzy set A of the number of pairs that formed the first part, the second part of the show, the membership will bring it to the desired collection. When a reference is a

finite set, fuzzy set A on X can be expressed as follows.

$$A = \{(x, \mu_A(x); x \in X)\}$$

$$(A \cup B)(x) = \max[A(x), B(x)]$$

$$(A \cap B)(x) = \min[A(x), B(x)]$$

But these definitions are not only possible definitions. Other definition for union and intersection of two fuzzy sets, each

according to their characteristics, application areas have been special.

Linguistic terms and fuzzy numbers

Weight the importance of each criterion can be both directly and indirectly obtained by paired comparisons. Due to their ease of use to decision-makers is triangular fuzzy numbers, fuzzy number N is shown below.

By Triad (α, m, β) is shown.

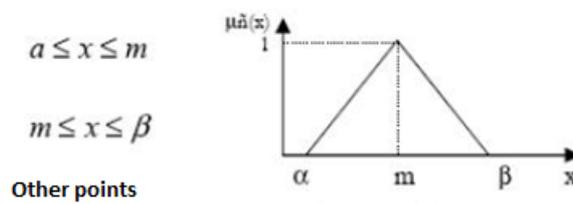


Figure 2) triangular fuzzy numbers

The purpose of a linguistic variable is a variable whose values are words or sentences of a natural or artificial language. For example, if the flow of a linguistic variable values rather than numbers, such as 100, 120 and 140 and the language (such as very high, high, medium, low and very low). A linguistic variable by a five-arranged $(X, T(x), U, G, M)$ is defined where X is the name of

the reference variable U and T (X) X linguistic term set of variable X that Rule G is produced by somehow. Finally, M is a semantic rule that each term T (X) means it is associated, the term of the membership function it specifies. Finally, the following table triangular fuzzy numbers linguistic terms and symbols relating to each of the example are shown.

Fuzzy numbers	Symbol	Verbal terms
(0,0,0.1)	U	Not important
(0.0,15,0.3)	LI	Less important
(0.1,0.3,0.5)	FLI	Somehow less important
(0.3,0.5,0.7)	N	Middle
(0.5,0.7,0.9)	FI	Somehow important
(0.7,0.9,1)	I	Important
(0.9,1,1)	VI	Very important

Fuzzy control

First in 1975 by Prof. Mamdani fuzzy controller was presented and the grounds for the use of fuzzy set theory in many

systems were controlled. The products that were fuzzy control theory of fuzzy sets and showed spectacular economic success and create further and faster progress in the

field of fuzzy control. Takagi and Sugeno in 1985, another framework offered fuzzy control. Up to now, several methods have been proposed for the development of the fuzzy controller fuzzy control of the main ideas of thought and human knowledge base and human beings to express their thoughts and knowledge of the linguistic variables used. A study of the controversial and fuzzy control membership and the membership functions of linguistic values them. After determining the values of the

control parameter in the form of linguistic variables, use variables and control values may obtain a knowledge base is formed. This knowledge base is expressed as a set of rules called the rules knowledge base - the foundation said. Using this database requires an inference engine to where the rules are not intended to state or in a state, the use of two or more rules may be a competitive method used to block diagram in Figure 3 is generally a fuzzy controller.

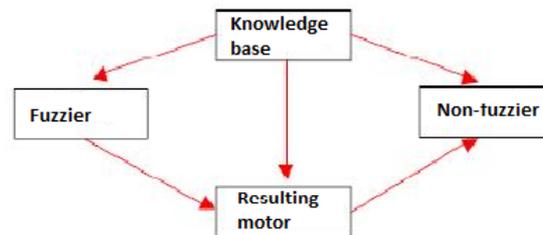


Figure 3. Fuzzy controller

A fuzzy decision FDMS system consists of four main sections:

Fuzzier: fuzzy task of reading the values of control variables and convert them to one of the values of linguistic variables.
Knowledge Base: defining a set of rules that the language used Azmtghyrhay. Provided that each linguistic variable number of values and the values of the membership function and rule on the arguments of the base has a direct effect. These rules form if - then they are.

Inference Engine: After gaining control rules and the knowledge base required to accept the input fuzzy engine results based on the rules of the knowledge base, create

suitable phase output. Non phase of output phase is converted to a certain quantity, methods of area (COA) first maximum (FOM) and the last maximum (LOM) is used in this field. As can be seen in Figure 3, fuzzy and non-fuzzy block is used to communicate with the process control. Also, when applied as a result of the inference engine by certain variables can influence the process, we need to by a non-fuzzy inference engine fuzzy outcome to a certain amount to be converted. Perhaps the biggest art Charchvbsazy fuzzy estimate non-linear functions of the input - output, something that regression framework are barely able to do it. Performance

Assessment Framework is designed using fuzzy logic and BSC. In this part of the framework for evaluating the performance of a system, which in the course of its life, based on expert opinion and fuzzy framework can be built. Various stages of construction Performance Assessment Framework are as follows:

Determination and extraction of all four operating sub BSC Determine effective measures for each of the four factors related to the system administrator is optional and multi-criteria decision-making methods such as AHP and TOPSIS been detailed in several articles. So in this article only refers to the expression using fuzzy TOPSIS resources can be important indicators offer the most impact on all four factors identified BSC. Production samples and evaluation by experts at data tables. To create an effective and accurate knowledge base of experts and specialists is required. Conditions in the indicators and their impact on performance is possible only through the eyes of experts because the results of the relevant legislation when efficient production is that laws are formulated with high accuracy.

3 Construction of the phase (phase-out, the rule base, inference, and non-phase-out): The membership function of a fuzzy set is a mapping of the set A [0,1] in such a way that:

$$A : X \rightarrow [0,1]$$

Generally any function that wrote off it can be used as a membership function of a fuzzy set. The study is one of the Gaussian functions have been used for this purpose. A Gaussian function is defined as follows:

$$gaussian(x; \sigma, a) = \exp\left(-\left(\frac{x - a}{\sigma}\right)^2\right)$$

It represents the center of symmetry in relation to a function and σ determines the opening function 4 function Register formula gaussian (x; 10.2) example shows. Fuzzy system is a logical rule-based system if - then using the concept of linguistic variable and fuzzy decision making process space of input variables on the output variables space. The most important part is a fuzzy rule base. The base set of rules if the rules - then the relationship between phase states. Among the two types of fuzzy systems most widely used, which are Mamdani type 11 and type 12 Sugeno processing system used in the framework of this research is Sugeno.

Sugeno system rules as follows:

If x_1 is A_1 & x_2 is A_2 & ... x_n is A_n then $y = f(x_1, \dots, x_n)$

Where A_1, A_2, \dots, A_n , fuzzy sets are A_s you can see if this law is the expression of the fuzzy, but the result of a real function of the amount of entries Normally this function is a linear relationship is $a_1x_1 + a_2x_2 + \dots + a_nx_n$.

As already stated, the most important part in defining rules of fuzzy if - then it is the right way. Various methods such as direct use of human knowledge, gradient descent method and neural - fuzzy used for this purpose.

If x_1 is A_1 & x_2 is A_2 & ... x_n is A_n then $y = f(x_1, \dots, x_n)$

Case study

Research conducted in 1393 showed that manufacturing in a company's competitive position in the market and also due to problems in management decisions require an efficient and accurate performance evaluation system. It can be assessed by various strategies, better strategies selected. Therefore, after the implementation of the BSC system with the administrative approach can be strategic objectives and indicators for each goal and set the company's strategic map. Funds and strategic objectives and indicators can be seen in Table 2. In this study, the effective index is determined using the first technique and was introduced for use in this context. In order to design and control the rules base of 10 separate values for each of the funds used. In addition to making the

rules of the indicators of experts in each of the funds were used. Scores recorded for each index value is between 0 and 10 where larger number represents the amount of supply is further stated objectives for each indicator. This rate is based on bipolar way that it can be used for both qualitative and quantitative indicators of the value. After the initialization phase by the experts of the 4 stage separation and runs Determining the number of groups and fuzzy membership function In Table 2, the number of entries in the index is 4, the number of groups in this phase to select the desired 3-phase. Obviously, the more accurate the results will increase the number of groups.

Figure 4. As mentioned also the membership function to determine the membership of each entry is a Gaussian function.

Figure 3. The average value of a data input function and the opening (σ) the variance is calculated using the formula:

$$\sigma^2 = \frac{\sum (x_i - a_i)^2}{n - 1}$$

The figures of fuzzy groups are as follows.

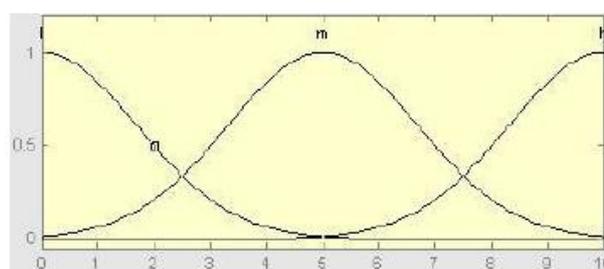


Figure 4

Table 2): Effective goals and indicators in a Manufacturing-Industrial

	Increase revenue	Financial
Added income from the previous year	reduction in costs	
Reduce the cost of each section	Increase customer satisfaction	Clients
Customer Satisfaction Index	Increase the number of customers	
Clients added over the previous year	Keeping customers	
The number of lost customer	Reduce complaints and improve quality	Domestic process
The number of customer complaints	Surge efficient	
The number of workers	Increase efficiency	
Stock Performance	Efficiency and utility staff	
Productivity Index	Increase staff training	Growth and learning
The number of added training per person	Use of technology	
The number and the type of technology	Improve employee satisfaction	

The total number of rules governing the control system P_n is the total number of rules governing the control system where N is the number of indicators for each dimension and P , the number of groups considered to be phased. Since the method used in the control systems is taken by Takagi-Sugeno. Therefore, we can consider the optimal number of laws in cases where the number of indexes or the number of groups is fuzzy memory of the registration of all existing

laws prevented. In this research funding is optimized with 2 indicators and given the number of groups considered the phase 3, 9 of the Law shall be regulated, but for all internal processes to better performance of a sample of 243 law that 10 of the existing rules will be used. After recording the rules of each relevant table for each of the funds of funds in the second half or the lower laws and adapted to more accurately calculate the equation clouds pages.

Table 3) Rules of domestic process

Row	X_1	X_2	X_3	X_4	Y
1	5.5	3	1.1	7	5
2	7.1	2.7	3.4	2	5.5
3	2.3	3.2	5	4.2	4.3
4	9.9	4.1	6.7	9.7	9.2
5	1.2	8	2.5	4.6	6.7
6	3	3.6	1	3	1.3
7	4.8	1.5	4.5	4	5.1
8	6.6	5	3.8	2	3.4
9	1	6	2.1	1.3	2.5
10	8	7.4	5.9	6.3	7.3

$$F_i(x) = a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + r_i$$

$$E_i = y_{red} - y_{model}$$

$$a_{(k+1)} = a_{(k)} - \xi E_i \left(\frac{\partial E_i}{\partial a_{(k)}} \right)$$

The purpose of y_{red} is the data available for the output table and y_{model} is the output of the training is obtained from each category, while ξ . Move is a step in the research results obtained using MATLAB software.

After the education system and the relationship between inputs and outputs in each row of finding the best ai turn to calculate the weight of the law and then get the final value is reached.

Calculating the weight of law

To calculate the weight of each membership obtained a law degree is sufficient for entry in the Venice multiply the output value of Equation 1:

$$W_i = \mu_{1i} \times \mu_{2i} \times \mu_{3i} \times \mu_{4i}$$

$$Q_i = W_i \times F_i(x)$$

Calculation of the final amount of output

Thus, the education system and result parameters and then output the final value estimated weight of the law to the output of

this framework can be used the following equation. It comes with a framework that can be used for a vector input x output of this framework to help estimate the following equation:

$$Y = \frac{\sum W_i F_i}{\sum W_i}$$

After the final calculation for each of the 4 way BSC final table that consists of 4 input 1 y and 2 y and 3 y and 4 y a final output that the performance of the company is formed using the above questions obtained final.

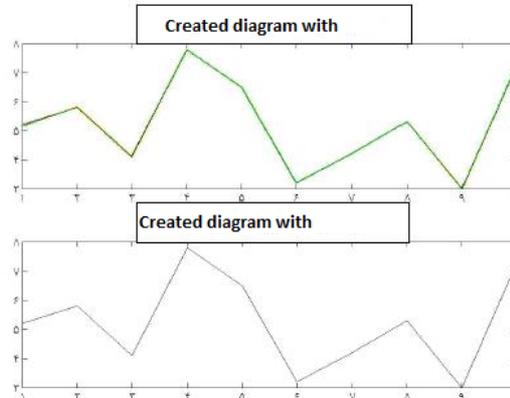


Figure 5: Comparing the output of framework with the real data and final performance of Company

CONCLUSION

Something we received in the fuzzy framework is so similar to the reality. The framework of linear regression that is a classic framework is used for designing the framework. It is shown in figure 6,

there is some differences in some points of regression that are the errors of estimation.

$$y = ax + b + \epsilon$$

Data of framework are designed by Matlab software based on the regression method:

The final performance is as follows.

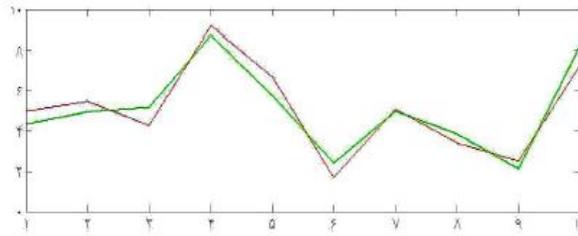


Figure 6: Comparing the output of classic regression with the real data in evaluating the performance

The error of fuzzy framework is less compared to the error of classic framework. As you can see in the diagrams, data and output diagram of

fuzzy framework are consistent. The error of classic and fuzzy frameworks are obtained by Matlab software and they are compared.

```
>> var(e)
ans =
0.4828
```

The error of classic model

```
>> var(e)
ans =
7.1424e-006
```

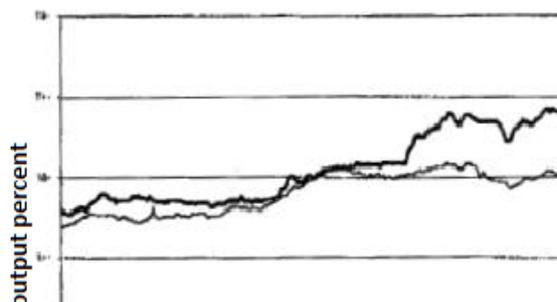
The error of fuzzy model

As you can see the error (e), the reduced amount of 70,000.

According to extensive research in the field of genetic algorithms, neural networks and predictive algorithms and frameworks have been proposed in recent years.

This approach is less error. The following are the results of some of this research and related charts are mentioned: In the Journal of Financial Research, School of

Management, University of Tehran in 2003 an article entitled "predict stock returns in the Tehran Stock Exchange: the artificial neural networks and multi-agent framework" wrote R. Rai and Al-Chavoshi doctor is published in which neural networks were used to predict. Forecast graph is shown on the next page. As you see, implementation of phase within less than two charts. In this context, the 0.092 is an error.



Comparing the output of the neural network with real data to predict stock returns. In 2006, the Journal of Commerce, an article called "Charchvbsazy forecast stock prices fuzzy neural network approach" to writing Doctor Adel Azar and Amir Afsar published. In this framework, fuzzy - neural presented to predict stock prices compared with the previous paper that was sent only using neural networks offer far fewer errors. This is the error of about 0.0009. In the research, it can be concluded that almost all the fuzzy algorithms and methods of forecasting capabilities have been better and more efficient and the results of it is closer to reality. What comes of this article represents the fact that today's organizations are able to compete in turbulent environment and to progress and even survival requires to determine your strengths and weaknesses in order to ensure the achievement of the basic objectives of the organization.

Considering one of the most important tools in modern management ideas to meet these needs evaluate performance. One of the challenges of indicators of performance evaluation framework and different frameworks are used for assessment, so that most experts believe that senior managers should be involved with a large number of indicators because the number of criteria, too, the effects and benefits will be lower in

the control objectives. Based on observations, the optimal number of strategic indicators for any organization, is probably number between 8 and 12 indicators in addition to simple indicators such as cash flow and investment, consider some qualitative indicators to assess is required.

Intelligent fuzzy control makes converter. It is noteworthy in this context squares method of reducing the error using gradient descent for training framework error far superior to linear regression multivariate dropped and it expresses the accuracy of this framework.

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