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Research paper



Heuristics modelling for dynamic corporate performance assessment

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Abstract

A major goal of corporate performance is to maximize the shareholder's value. Corporate performance is evaluated with the help of EVA (Economic Value Added).EVA concept is employed to ascertain if the organization contributed positively to shareholder's wealth over a period of time. Efficient corporate performance management needs to capture the dynamic nature of the relevant factors occurring from multiple sources and when more number of Strategic Business Units(SBU) are involved , the complexity of the problem increases in the process. In this paper, an innovative heuristic methodology is proposed to generate necessary analytics to assess emerging corporate performance levels subject to the risk environment the company is operating in and to take appropriate mitigation measures to overcome inferior corporate performance.

Keywords: *Economic Value Added; Performance Modelling; Performance Assessment; Heuristic Methodology; Particle Swarm Optimization (PSO).*

1. Introduction

It is of paramount importance for an organization to know the ways in which finance is managed within a business organization and to know how to evaluate the different sources of finance, make a comparison of the ways in which these are used. The organization should be adept at how to apply financial information to make appropriate decisions. For this purpose, techniques on how to analyze and evaluate financial performance of a business play a vital role.

The primary measure of any organization's performance is to maximize the shareholder's wealth. Shareholder's value means the value delivered to the shareholders through higher earnings, share prices and dividends. In other words shareholder's value is the aggregate of all strategic decisions that impacts the firm's ability to increase the amount of free cash flows over a period of time. EVA has been used as an internal management performance measure for the measurement of shareholders value creation and refers to the profit earned by firm less cost of capital.

Shareholder's value as a new standard for business performance decides the competitiveness in today's marketplace [1]. "Economic Value Add", is focused as measure of financial performance.in the era of global competition and highlights that EVA adoption improves the financial performance of a company [2] [5].The concept of EVA as a practical oriented empirical analysis is found useful by organizations [3] [6]. EVA is an economic metric for corporate performance with respect to shareholders interest towards increased economic profit. [4]. Particle Swarm Optimization (PSO) methodology is found appropriate for implementing the proposed approach. [7 - 9].

2. Method and methodology

An organization may comprise of many Strategic Business Units. We assume a company is operating 5 business units namely SBU1, SBU2, SBU3, SBU4 and SBU5.

For each SBU for each period (preferably quarterly), EVA is computed as follows:

EVA = Net Operating profits after Tax – (Weighted Average Cost of Capital x capital Invested)

A database consisting of EVA data values is created for each period and for each SBU.

An appropriate optimization methodology is designed accordingly as illustrated in Figure 1 to generate predictive analytics for emerging EVA pattern.

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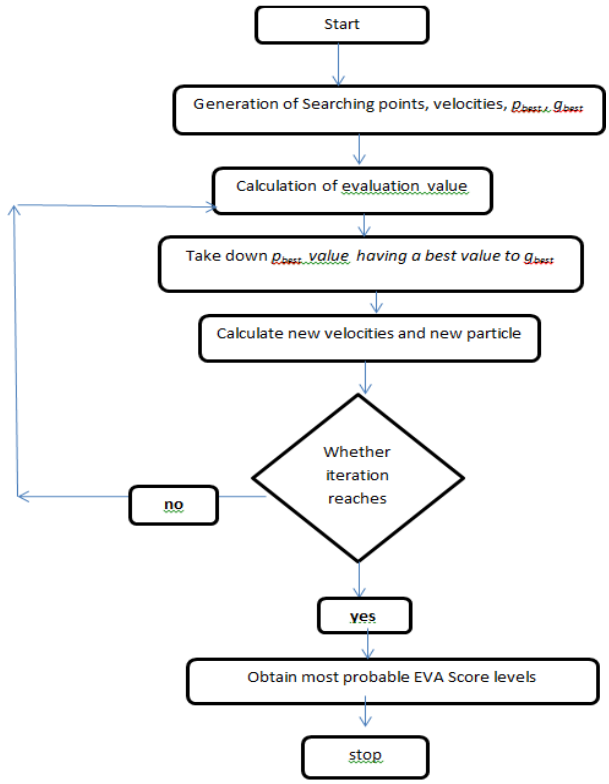


Fig. 1: PSO Methodology.

The PSO methodology is outlined below.
The individuals of the population, searching points, velocities, and are randomly initialized but within the lower and upper bounds of the EVA values which needs to be specified in the algorithm.
An evaluation function that is to be optimized evaluates the fitness values of all the particles. For every individual particle, a comparison is made between its evaluation value and its p_{best}. The g_{best} indicates the best evaluation value among the p_{best}.
The evaluation function to evaluate the fitness values of all the particles is determined by the following function

$$f(i) = -\log\left(1 - \frac{n_{occ}(i)}{n_{tot}}\right) \quad i = 1,2,3,\cdots,n \;;$$

This formulated function is used to capture the most probable earned value performance levels from the data base as well as the convergence criteria for stopping the algorithm.
$n_{occ}(i)$ is the number of occurrences of particle in the data set
n_{tot} is the total number of records in the data set.
n is the total number of iterations;
For every individual particle, a comparison is made between its evaluation value and its p_{best} . The g_{best} indicates the best evaluation value among the p_{best} . This serves as an index that points to the best individual particle generated so far.
The adjustment of the velocity of each particle is performed to diversify the search space as well as to intensify the search towards better feasible solutions as follows:

$$v_{new}(a,b) = w * v_{cnt}(a) + c_1 * r_1 * [p_{best}(a,b) - I_{cnt}(a,b)]$$
$$+ c_2 * r_2 * [g_{best}(b) - I_{cnt}(a,b)]$$

Where,
$a = 1,2,\cdots\cdots,N_p$ (Number of particles)
$b = 1,2,\cdots\cdots,d$ (Dimension of the particle)
This is done to diversify the search space as well as to intensify the search towards better feasible solutions
In the equation, $v_{cnt}(a)$ represents current velocity of the particle, $v_{new}(a,b)$ represents new velocity of a particular parameter of a particle, r_1 and r_2 are arbitrary numbers in the interval [0,1] , c_1 and c_2 are acceleration constants (often chosen as 2.0), w is the inertia weight that is determined using

$$w = w_{max} - \frac{w_{max} - w_{min}}{iter_{max}} \times iter$$

Where,
w_{max} and w_{min} are the maximum and minimum inertia weight factors respectively that are chosen randomly in the interval [0,1]. Also v_{min} and v_{max} are the minimum and maximum limit for velocities respectively
$iter_{max}$ is the maximum number of iterations
$iter$ is the current number of iteration
Also the parameters are confined to the lower bound and upper bound limits.
This process continues until the algorithm converges when there is no more improvement in the search space is possible.

3. Implementation results

The analysis based on PSO methodology has been implemented in the platform MATLAB. The sample data having the information about past EVA values is given in the Table 1 A.

Table 1: A) Sample Database of Past EVA Values in $

Period	SBU1	SBU2	SBU3	SBU4	SBU 5
1	20000	-1000	2750	-2950	15000
2	18000	-1400	6800	-2400	12000
3	17000	-2670	2750	1500	14000
4	16000	1500	4800	2800	12000
5	17000	-1400	2750	-2950	9800
6	19800	-2000	2950	-3800	12000
7	20000	-1000	4560	-2950	13000
8	17000	2850	2750	-2400	12000
9	14000	-1400	2750	1500	14000
10	16000	1500	4800	-2950	13000

The random individuals are generated as given in Table 1b.

Table 1: B) Initial Random Individuals

SBU1	SBU2	SBU3	SBU4	SBU 5
18000	-14000	6800	-2400	12000
17000	-26700	2750	1500	14000

Table 1c represents random velocities as shown below:

Table 1: C) Initial Random Velocities

SBU1	SBU2	SBU3	SBU4	SBU 5
0.1098	0.1098	0.1098	0.1098	0.1098
0.0276	0.0276	0.0276	0.0276	0.0276

Simulation result showing Fitness function improvement is shown in Table 2:

Table 2: Simulation Iteration

Number of iterations	Evaluation function value
50	0.384
80	0. 522
150	0.647
200	0.8547
240	1. 1522
280	1. 1522

When the convergence criterion is met and final output is given in Table 3.

Table 3: Final Output

SBU1	SBU2	SBU3	SBU4	SBU 5
17000	-14000	2750	-2950	12000

The final individual thus obtained represents the most emerging pattern for the EVA levels. Now, we find the Total EVA (TEVA) by adding all the EVA values.
If TEVA >0, then the company increased the company's total worth adding to shareholders wealth;
If TEVA <0, then there is a decline in the company's value over the period and not adding to shareholders wealth.
The positive number tells us that company has more than covered its cost of capital. A negative number indicates that the company did not make enough profit to cover the cost of doing business. Then we look at the particular SBUs not performing well & take necessary remedial measured in the forthcoming period to mitigate the negative EVA levels.

4. Conclusion

Positive EVA shows the overall profitability of the firm and is an important component leading to significant enhancement of shareholders value. We have proposed an innovative and efficient approach based on PSO algorithm to generate essential predictive analytics on EVA for the forthcoming period. For negative EVA, as a remedial measure, the company needs to focus on increasing EVA by increasing the Net operating profits after tax and decreasing the cost of capital as much as possible for better corporate performance.

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