A Decision Support Tools Using Multi-Criteria Decision-Making Approach for Financial Performance Analysis in a Competitive Global Economy

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Abstract

Stakeholders may gauge a company's financial well-being, profitability, and efficiency via a financial performance review. An outline of the main points of evaluating financial performance is given in this abstract. Revenue growth, profitability, liquidity, cash flow, return on investment, debt management, asset efficiency, market value, return on equity, and comparative analysis against industry peers are all the evaluation's financial criteria and metrics. The market value, debt levels, liquidity, profitability, cash flow management, revenue-generating capabilities, and the firm's financial condition may be better understood by looking at these metrics. We proposed a methodology to evaluate the financial performance in the competitive global economy. We gather the criteria to be analyzed. So, we used the concept of multi-criteria decision-making (MCDM) to deal with various and conflicting criteria. We compute the weights of the criteria by the mean value. Then, we used the criteria weights as input into the MCDM method. We used the VIKOR method to rank the various companies in this study. We collected ten criteria and 20 companies to be organized. We conducted the sensitivity analysis in two parts and changed the weights of criteria under ten different cases. In the second case, we change the parameter in the VIKOR method with a value between 0.1 and 1. The results of the two cases show the results are stable and the proposed model performs well.

Keywords: Market Analysis; Global Economy; Decision Support; MCDM; VIKOR Method; Financial Performance.

1. Introduction

Stakeholders may gauge a company's financial well-being, profitability, and efficiency via financial performance review. This review aids stakeholders in making educated choices about investments, strategy, and resource allocation by assessing various financial criteria and measures that contribute to the company's overall financial success[1], [2].

Assessing the income statement, balance sheet, and cash flow statement, among others, is essential to evaluating financial performance since it provides a holistic view of the company's financial situation. It digs more deeply than just looking at the figures to determine what's driving the company's financial results[3], [4].

The main objective of the financial performance review is to examine a company's resource utilization, profit generation, debt management, and value creation for shareholders. All parties involved may use this information to evaluate the firm's health, development prospects, and capacity to produce long-term profits[5], [6].

DOI: https://doi.org/10.54216/AJBOR.000105

Financial performance evaluation uses several criteria and metrics, such as growth in revenue, profitability ratios, liquidity ratios, cash flow analysis, debt management indicators, asset efficiency metrics, return on equity, market value ratios, and comparisons with industry peers.

The capacity to generate income, profitability, liquidity, debt levels, assets, and market value can be better understood by looking at these metrics. This analysis helps gauge the company's strengths and weaknesses, see possible dangers, and make better decisions to boost its bottom line[7], [8].

Benchmarking, or comparing the company's performance to its peers or rivals in the industry, may also be laid out by a financial performance review. Through this study, stakeholders can get insight into the company's market position, pinpoint improvement opportunities, and establish attainable financial performance targets.

An essential step in gauging a business's soundness, profitability, and efficiency is conducting a financial performance review. Stakeholders may influence the company's long-term financial performance by making educated choices, identifying areas for development, and analyzing different financial criteria and data. Stakeholders may optimize their financial strategy for sustainable development and confidently navigate the evolving business environment using the insights gathered from this review[9], [10].

Decision support tools (DST) aim to facilitate better decision-making by guiding users through well-defined decision-making processes and providing realistic probabilities of potential outcomes. Dynamic software solutions like these may provide an ideal decision-making route by adapting their suggestions to the user's inputs[11], [12].
To help with the challenges of dealing with complicated information and accommodating multiple perspectives, the first multi-criteria decision-making (MCDM) approach came out in the 1960s[13], [14]. These features have prompted planners to use MCDM with other planning instruments[15], [16].
The steps involved in making a multi-criteria decision are as follows:

1. Deciding what you want to achieve.
2. Deciding how you want to assess success.
3. Listing potential solutions.
4. Giving each criterion a weight.
5. Using a suitable mathematical procedure to rank the solutions.

Independently identifying and evaluating the most suitable planning solutions is made possible by MCDM, which enables the requirement for impartial integration of current planning goals.
The main contributions of this study are:
We analyze the financial performance in a competitive global economy between various companies.
We used a decision support tool such as the VIKOR method to rank the companies and evaluate their financial performance.
We used the MCDM concept to combine various criteria and rank them.
We collect ten criteria and 20 companies to compute the criteria weights and rank the alternatives.

2. Decision Support Tool

In this section, we introduce the VIKOR method as a MCDM in a decision support tool. We introduce the steps and then apply them to financial performance.

As a practical approach to use in MCDM, the compromise ranking method (VIKOR) was presented. It depends on the notion of the positive-and negative-ideal solution, which is utilized to compare several projects that are competing with the MCDM model. An ideal solution with a positive sign indicates the best possible outcome, whereas an ideal solution with a negative sign indicates the worst possible outcome. When faced with an issue with competing priorities, VIKOR may help decision-makers find a middle ground by ranking and selecting potential solutions from a pool of options[17]–[20]. Research has shown that VIKOR is an effective method for assessing alternatives according to all criteria. The VIKOR method, which ranks compromises, follows these steps:

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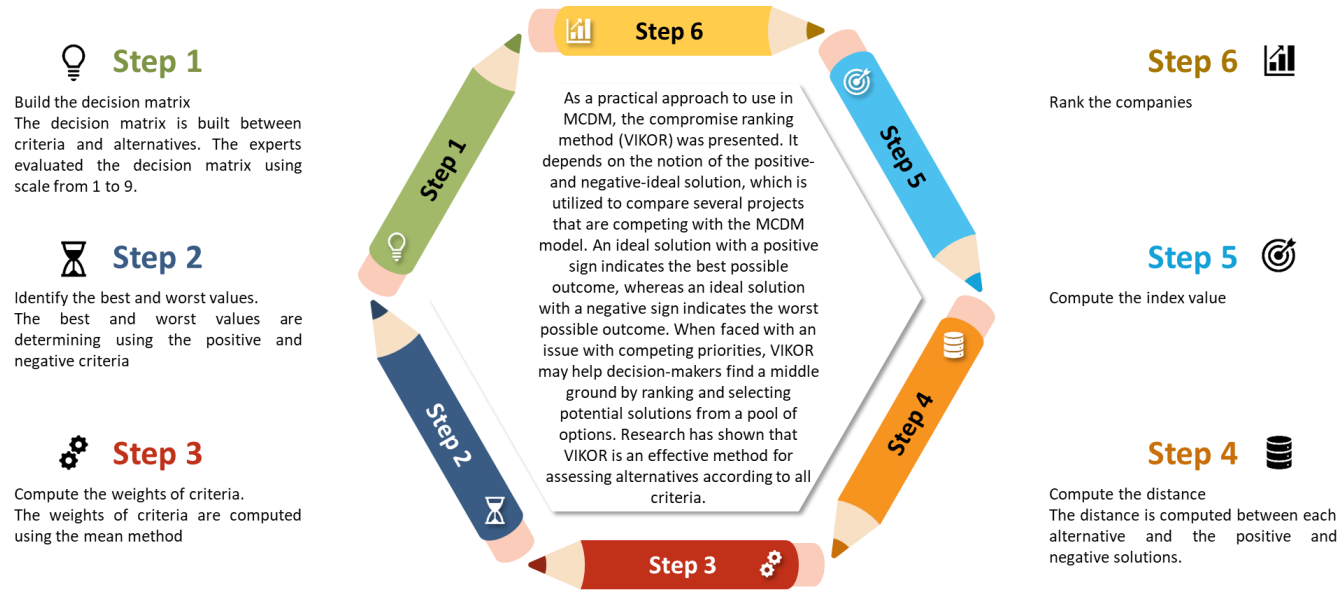

Figure 1: The steps of the VIKOR method.

Step 1. Build the decision matrix

The decision matrix is built between criteria and alternatives. The experts evaluated the decision matrix using a scale from 1 to 9.

Step 2. Identify the best and worst values.

The best and worst values are determined using the positive and negative criteria:

$$n_i^* = \max_i n_{ij} \quad (1)$$

$$n_i^- = \min_i n_{ij} \quad (2)$$

Where $i = 1,2,..m; and\ j = 1,2,...n$. The n_{ij} refers to the value in the decision matrix.

Step 3. Compute the weights of the criteria.

The weights of the criteria are computed using the mean method.

Step 4. Compute the distance

The distance is computed between each alternative and the positive and negative solutions.

$$S_i = \sum_{j=1}^{n} \left(\frac{n_i^* - n_{ij}}{n_i^* - n_i^-}\right) \quad (3)$$

$$Q_i = \max_i \left\{\frac{w_j(n_i^* - n_{ij})}{n_i^* - n_i^-}\right\} \quad (4)$$

Step 5. Compute the index value

$$V_i = \varphi\left[\frac{S_i - S^*}{S^- - S^*}\right] + (1-\varphi)\left[\frac{Q_i - Q^*}{Q^- - Q^*}\right] \quad (5)$$

$$S^* = \min_i S_i \quad (6)$$

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$$S^- = \max_i S_i \quad (7)$$

$$Q^* = \min_i Q_i \quad (8)$$

$$Q^- = \max_i Q_i \quad (9)$$

Step 6. Rank the companies

3. Results

This section introduces the results of applying the MCDM method to analyze the financial performance of companies in a competitive global economy. We collected the ten criteria in this study and ranked the 20 companies in the global economy. The details of the ten criteria are:

- FPC1. Market Value: Ratios of market value, such as market-to-book and price-to-earnings (P/E), should be examined. These measures show how investors see the company's financial health and potential for development.
- FPC2. Liquidity: Look at the current and quick ratios to see how liquid the firm is. If these ratios are high, the firm has enough cash to pay its short-term bills and keep running.
- FPC3. Return Investment: Examine the profitability of the capital investments made by the firm to determine the return on investment. Return on investment (ROI) measures a company's efficiency in turning its resources into profit.
- FPC4. Revenue Growth: Analyze the firm's long-term, steady revenue development potential. Position in the market, demand from customers, and the efficacy of the company's marketing and sales efforts are all shown by this metric.
- FPC5. Profitability: Determine the business's profitability by looking at key performance indicators, including gross profit, operational profit, and net profit margins. You may learn a lot about a business's profitability from these measurements.
- FPC6. Debt Management: examine the debt-to-equity and interest coverage ratios, among other measures, to assess the management of the company's debt. These measures show how well the firm controls its debt, pays its interest bills, and avoids risky financial situations.
- FPC7. Cash Flow: Analyze the cash flow statement of the business, taking into consideration its operations, investments, and financing. The capacity to create and handle cash, pay bills on time, and engage in development possibilities may all be better understood with the help of a cash flow analysis.
- FPC8. Return on Equity: You can tell how well a firm is doing with its equity investments by looking at its return on equity. Return on equity (ROE) gauges a company's profitability about the capital shareholders invest.
- FPC9. Comparative Analysis: Evaluate the business by comparing its financial results to similar companies in the same industry. In addition to providing a more holistic view of the company's performance, this study aids in identifying its strengths and weaknesses.
- FPC10. Asset Efficiency: Find out how well the business uses its assets by looking at ratios like asset turnover and inventory turnover. These measures show how efficient the business is at turning its assets into revenue and keeping track of its stock.

Step 1. We built the decision matrix between the criteria and alternatives through the opinions of experts and decision-makers. We used a scale from 1 to 9 in the decision matrix.

Step 2. Eqs. (1 and 2) are used to identify the best and worst values based on the cost and positive criteria.

Step 3. We computed the weights of the criteria by the mean value. We let experts evaluate the criteria, then we use the mean method to obtain the weights of the criteria as shown in Figure 2. The results show that criterion 4 has the highest weight and criterion 9 has the lowest weight.

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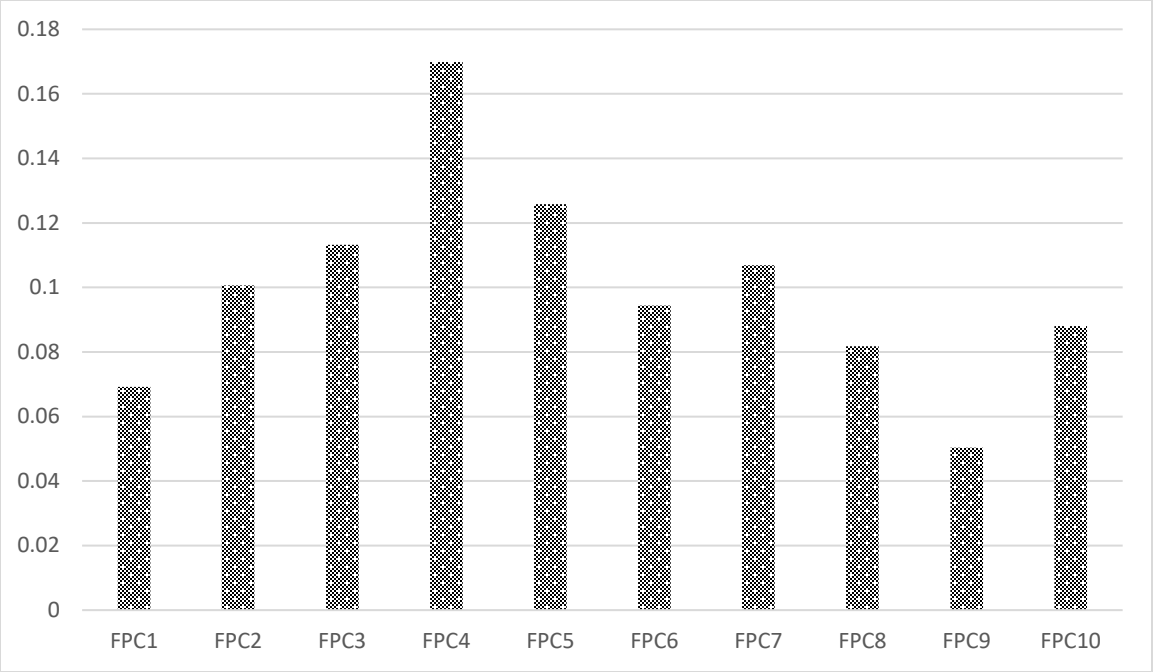

Figure 2: The weights of criteria in financial performance analysis.

Step 4. Eqs. (3 and 4) are used to compute the distance between each alternative and the positive and negative solutions as shown in Table 1.

Table 1: The distance between alternatives and positive and negative values.

	FPC_1	FPC_2	FPC_3	FPC_4	FPC_5	FPC_6	FPC_7	FPC_8	FPC_9	FPC_{10}
FPA_1	0.098533	0.032844	0.042229	0	0.016422	0.014076	0	0.098533	0.049267	0.075467
FPA_2	0.056305	0.016422	0.042229	0	0	0.056305	0.061583	0.049267	0.098533	0.1132
FPA_3	0.070381	0.032844	0.042229	0	0.049267	0.098533	0.061583	0.024633	0.098533	0.0566
FPA_4	0.014076	0.065689	0.042229	0.049267	0	0	0.024633	0.061583	0.0739	0.075467
FPA_5	0.056305	0.016422	0.098533	0.049267	0.098533	0.042229	0.061583	0.049267	0	0
FPA_6	0.014076	0.082111	0.056305	0.098533	0.065689	0.084457	0.049267	0.03695	0.024633	0.0566
FPA_7	0	0.032844	0.014076	0.049267	0.082111	0.042229	0.03695	0	0.098533	0.1132
FPA_8	0.042229	0.098533	0	0.065689	0.098533	0.084457	0.0739	0.012317	0.024633	0.075467
FPA_9	0.056305	0.049267	0.042229	0.082111	0.049267	0.056305	0.086217	0.049267	0	0.018867
FPA_{10}	0.084457	0	0.056305	0.032844	0.032844	0.098533	0.098533	0.086217	0.098533	0
FPA_{11}	0.098533	-0.03284	0.11261	0.016422	-0.01642	0.042229	0.061583	0.03695	0.024633	0.075467

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FPA12	0.11261	-0.01642	0.028152	0	0.016422	0	0.049267	0.0739	-0.04927	0.132067
FPA13	0.070381	0.032844	0.042229	0.049267	0	0.014076	0.03695	0.086217	-0.0739	0.075467
FPA14	0.056305	0.01642	0.098533	0.049267	-0.01642	0	0	0.061583	-0.04927	0.132067
FPA15	0.098533	0.01642	0.056305	0.065689	0.032844	0.042229	0	0.049267	-0.02463	0.075467
FPA16	0.042229	-0.03284	0	0.082111	0.049267	0.098533	0.012317	0.03695	0.049267	0
FPA17	0	0	0.014076	0.098533	0.032844	0.056305	0.049267	0	0.024633	0.0566
FPA18	0.014076	-0.01642	0.042229	0.098533	0.032844	0.056305	0.061583	0.012317	0.098533	0.037733
FPA19	0.028152	-0.03284	0.014076	0.082111	0.049267	0.084457	0.086217	0.098533	0.0739	0.150933
FPA20	0.014076	0.01642	0.056305	0.049267	0.065689	0.056305	0.03695	0.0739	0.123167	0.094333

Step 5. Then we compute the index value by using Eqs. (5-9) as shown in Figure 3. The results show that alternative 1 is the best and alternative 6 is the worst.

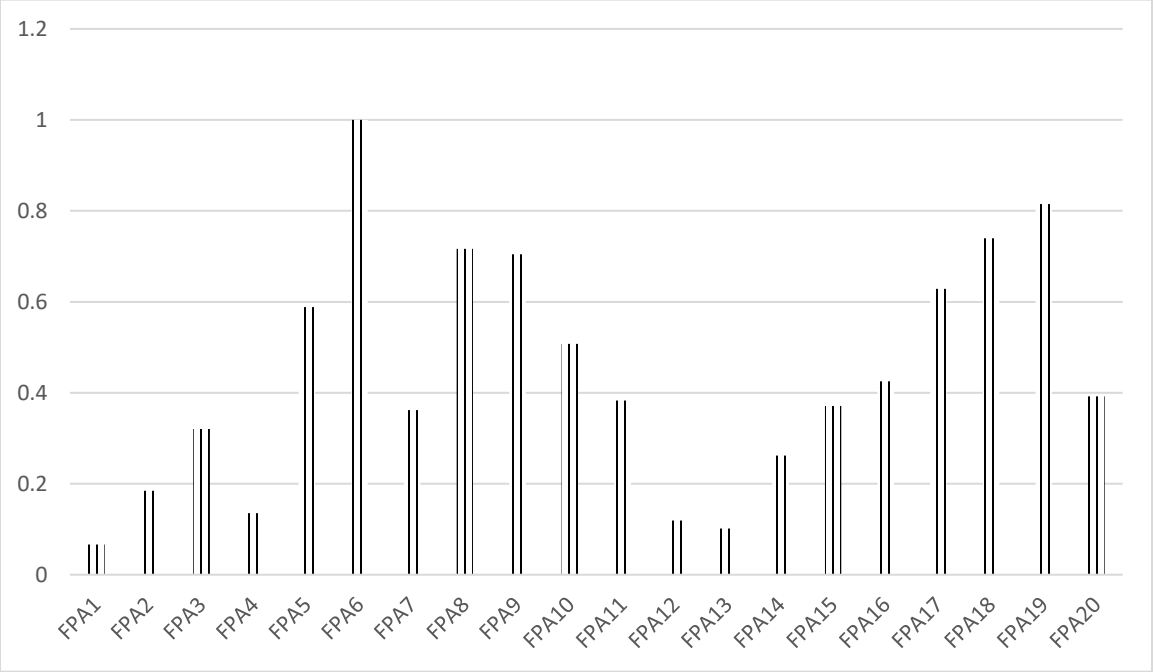

Figure 3: The index values of each alternative.

We applied the sensitivity analysis to show the stability of the results. We split the sensitivity analysis into two parts. In the first part, we change of φ parameters and then rank the alternatives. We change the value of φ between 0.1 and 1. Figure 4 shows the rank of alternatives under different values of φ. We observed the results are stable under different cases.

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In the second, we change the weights of criteria under different cases. We put one criterion 0.1132 weight and the other criteria are the same value as shown in Figure 5. Then we rank the alternatives according to different cases in weights of criteria as shown in Figure 6. We show the results are stable in the analysis.

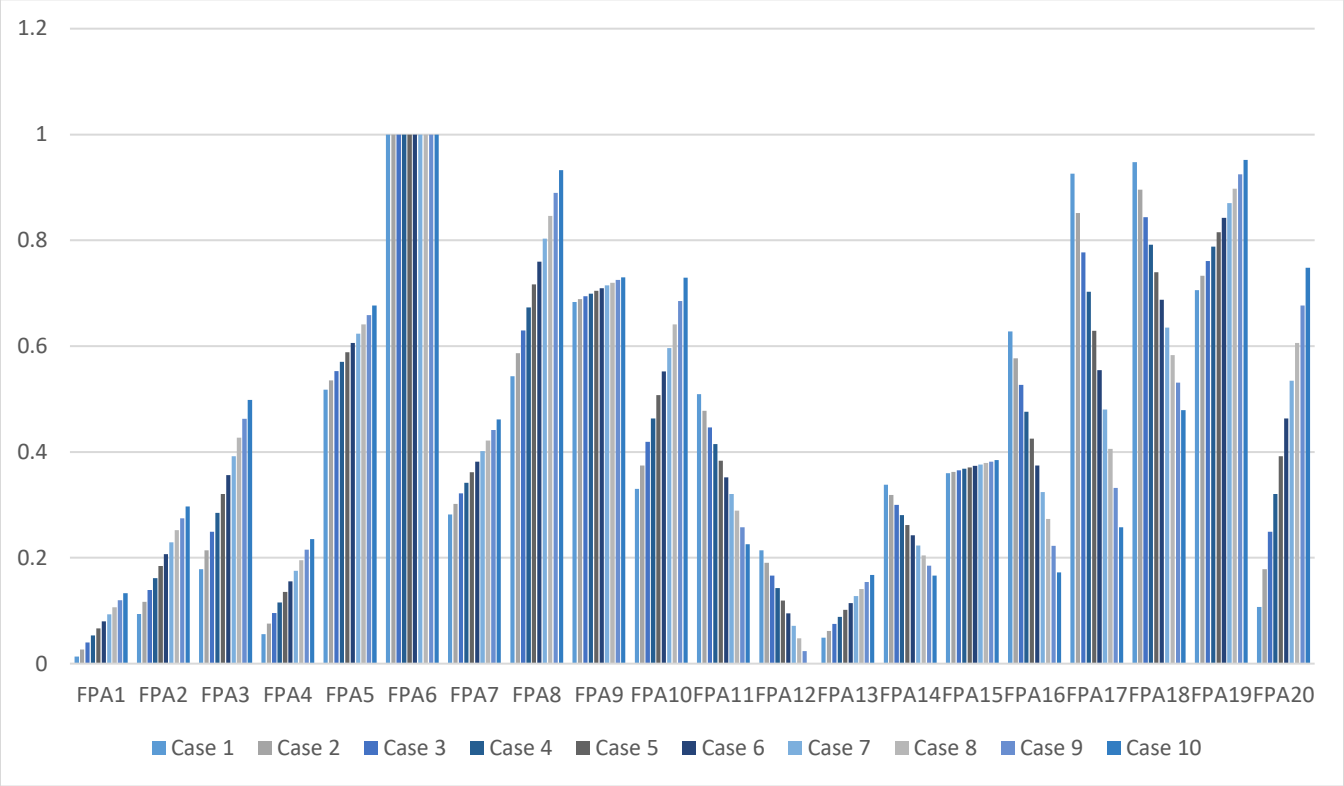

Figure 4: The rank of alternatives under different values of φ.

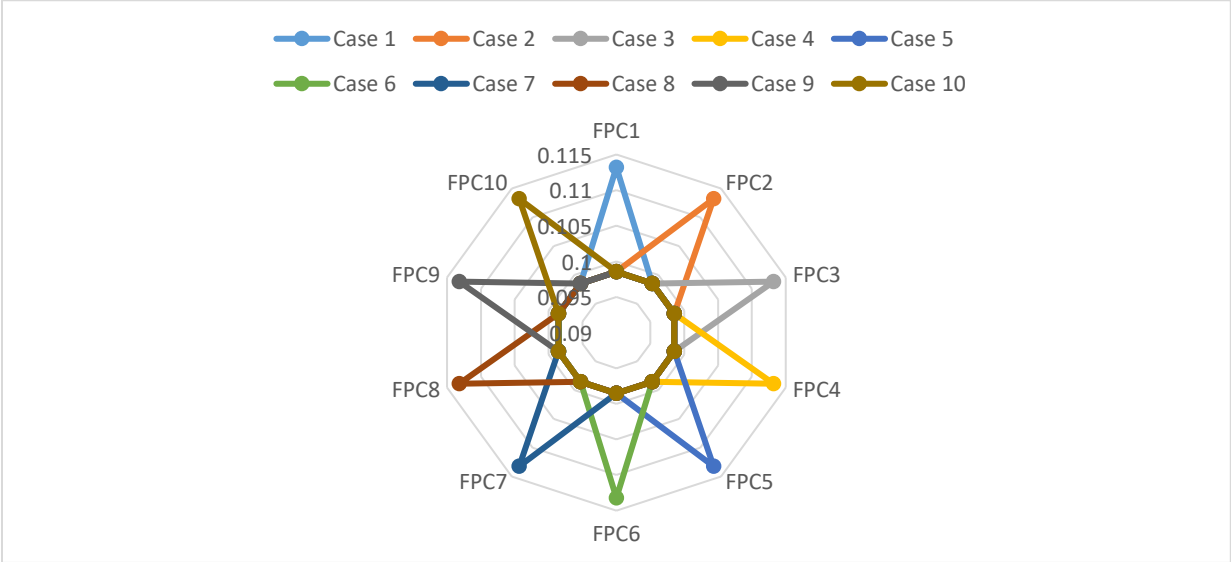

Figure 5: The different cases in weights of criteria.

DOI: https://doi.org/10.54216/AJBOR.000105

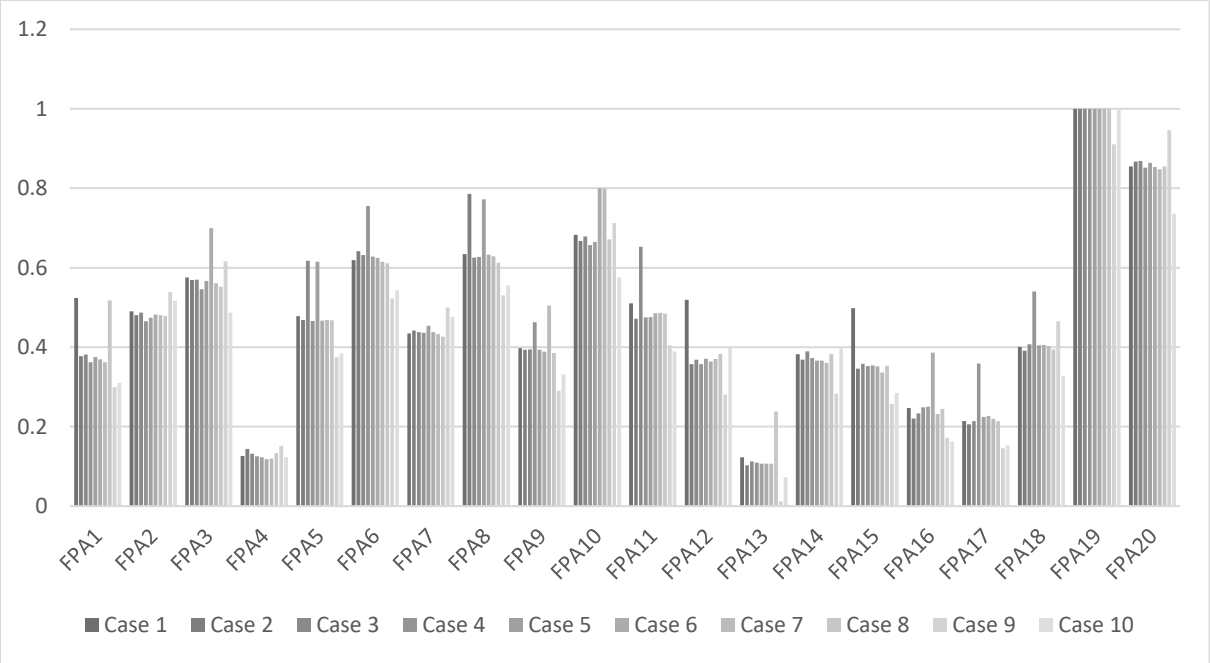

Figure 6: The rank of alternatives under different cases in weights of criteria.

4. Conclusions

Evaluating a company's financial performance is essential for understanding its overall economic well-being and performance. By looking at its financial criteria and metrics, stakeholders may learn a lot about a company's revenue production, profitability, liquidity, debt levels, asset efficiency, ROI, and market value.

Investors, planners, and allottees of resources may all benefit from this assessment's findings. It aids in determining the company's strengths and weaknesses by providing a thorough picture of its financial situation. Insights like these may help stakeholders optimize financial performance, reduce risks, and fuel long-term development.

To put things in perspective and find places to improve, benchmarking and comparing financial performance with industry peers or rivals is also possible. The relative status of the firm in the market may be better understood, and attainable financial performance targets can be more easily created with the help of this study.

Evaluation of financial performance also increases openness and responsibility among employees. Management choices may be better aligned with financial goals, resources can be allocated more effectively, and key performance indicators and financial targets can be more easily monitored with its guidance. Organizations may stay financially stable and competitive by routinely evaluating their performance to see patterns, foresee problems, and take proactive measures to resolve them.

Stakeholders can make better financial choices when they have access to objective data and analysis via financial performance review. As such, it is essential for value generation, risk management, and strategic planning. Companies may react to changing market circumstances, optimize their financial plans, and encourage long-term success in today's dynamic business climate by harnessing the insights acquired from this examination.

In this paper, we evaluated the financial performance based on criteria. We used the ten criteria in this study. We used the concept of a decision support tool to analyze the criteria. We used the MCDM method to analyze the criteria and rank the companies. We compute the weights of criteria by the mean method. Then, we applied the VIKOR method to rank the companies. We used the sensitivity analysis to show the stability of the results.

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