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# Assessing Corporate Social Responsibility Performance using Grey Relation Coefficient Method: A Comparative Study

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**Abstract.** Corporate Social Responsibility (CSR), or as we commonly refer to it, is expected to dominate business reporting. Every company is required to have CSR policies and report on their related activities annually. This enables us to describe both socially responsible practices and socially irresponsible activities, which can be recognized. Today, CSR is considered an advanced universal concept that has evolved and grown methodologically. It is a globally known language and perspective that has become increasingly significant. In this decade, partners are expected to prioritize more than just making money and complying with the law; they must also demonstrate concern for business development. CSR has become an integral part of modern-day business. **Social Impact:** CSR studies enable us to comprehend how businesses affect society and what they have to offer. They examine how businesses promote sustainable practices, address social and environmental challenges, and enhance local communities. **Research sheds light on the positive impact that corporations can have on society through the analysis of CSR programs and their outcomes.** **Stakeholder Involvement:** CSR research emphasizes the importance of participation, including that of employees, clients, suppliers, communities, and investors. It investigates how businesses interact with and respond to their stakeholders to promote cooperation, communication, and trust. By developing deeper relationships and understanding successful stakeholder engagement tactics, businesses can enhance their social license to operate. **Sustainability:** CSR research plays a crucial role in the development of sustainable business operations. It explores how companies incorporate resource efficiency, environmental considerations, and climate change mitigation measures into their day-to-day practices. **Research helps generate best practices and facilitates the transition to a more sustainable economy by identifying effective sustainability initiatives.** **Gray correlation analysis is a tool originally proposed by Deng to address MCTM (Multiple Criteria and Targeted Measure) problems. It has been successfully used to resolve various MCTM problems. GRA (Gray Relational Analysis) stands for the analysis pattern that examines the serial and data type relationship or geometric pattern between measurable impacts in a communication evaluation model. The following factors were analyzed in the study: Community relations, Diversity aspects, Employee relations, Ecological environment, Product aspects, Ownership by family, Ownership by founder, Ownership by mutual funds, Ownership by banks and insurance firms, Ownership by employees (ESOP), Family CEO (dummy), Founder CEO (dummy), Debt/equity, Return on assets. From the results, it is seen that the Founder CEO (dummy) has obtained the first rank, whereas the ownership by banks and insurance firms has the lowest rank.**

**Keywords:** Social Responsibility, Ecological environment, Community relations, Ownership.

## 1. INTRODUCTION

Over the past several decades, corporate social responsibility (CSR) has become a complex and multifaceted concept that is often sidelined. However, feedback is increasingly central to much of today's corporate decision-making. Corporate social responsibility is equally important in these debates, although it was previously limited to a small group of academics. Throughout this book, let's refer to it as CSR. Every company has CSR-related policies and its annual report describes its activities. It is important to recognize both socially responsible practices and socially irresponsible activity within a company. Thus, there are several different definitions of CSR that we

can explore. What is the broad definition of corporate social responsibility? It should encompass the relationship between universal companies, governments of countries, and individual citizens, both domestically and internationally. It is about the relationships a company has with the local community it operates in, as well as the relationship between the company and its shareholders. These influential ideas emphasize individual interests rather than collective interests. A central principle of CSR is the accountability to all stakeholders of society, which is a social contract between the company and civil society. It can be described as a form of citizenship, but it extends beyond the current members of the community to include future members. It is important to remember that social responsibility is about society's future and the responsibility owed to its members. In terms of international trade and investment-related policies, CSR focuses on advancing recommendations for sustainable development. This includes economic policy, climate change and energy, measurement and assessment, and sustainable natural resource management. Companies report on their international efforts through the internet. The modern creation of CSR is the product of the post-World War era. It emerged in the 1960s due to changes in social sentiment, especially in civil rights, women's rights, consumer rights, and environmental movements. Since then, CSR has been on the rise and has gained significant stature. Today, CSR is a universal concept that is recognized and has changed perspectives worldwide. There is an increasing emphasis on stakeholders because of this, and it is expected that modern businesses will focus on more than just making money. It is essential for businesses to adhere to laws and regulations and care about development. However, along with economic growth, there are negative consequences and general issues that arise incrementally. The cost involved in addressing these problems is high, but it is crucial to tackle them rather than solely focusing on philanthropy. Corporate conduct, including issues of ethics and corruption, has gained public attention and calls for action. Overall, CSR has expanded its scope and benefits to markets and society, but it also comes with challenges and costs. "A few in the financial sector. Governments expect this to be fixed. Optimal behavioral and welfare practices in business restore character and attract more invested resources. Related to this, the provision of common good or laws and the requirements of regulation beyond negative externalities reduce conclusions on Corporate Social Responsibility (CSR). Theoretical and empirical research efforts in economics (and to some extent empirical work) are reviewed and translated into a coherent construct. They are then combined in new ways to establish a consistent account of CSR research. Management and political science, sociology, law, and economics are related to female research. They are structured and uniquely placed to contribute to integrated analysis. The "general nature" of social or environmental performance is given when the economy is privately managed. The basic mechanism for understanding the corporate, public delivery of goods departs from here. Behavioral economics and sports principles, shareholders, stakeholders, strategy, contact information economics, and contracts theory are analyzed to integrate information asymmetry. The effects of CSR on communication can be calculated and analyzed using economical quantitative and experimental economics, resulting in a connected market structure. Theory and empirical CSR reality. Early GRA models are generally similar and closely related to the measure. They are GRA models proposed by Prof. Zhulong (1985). Deng's GRA model measures trend similarity between corresponding points and depends on the distance. The ability-based GRA system installs and selects the best employee based on their score. After discussing the findings, the employee is selected. The techniques or procedures used to obtain data are called data collection methods. Analyze and determine which employee characteristics are associated with each objective. Selection criteria include communication skills, character traits, self-motivation, interpersonal skills, the ability to market oneself and ideas, decision-making skills, technical knowledge base skills, professional development aspirations, and management skills. They should be work-related factors. The MCM method creates a GRA based on the use of linguistic factors and describes the capabilities of individuals available to accomplish a common set of organizational goals. Establish a competency-based GRA system and select the best employee based on their score. After discussing the findings, the employee is selected. A step-by-step integration process is first presented to clearly show the recommended personnel evaluation and selection framework: develop a hierarchy of evaluation and selection to match the right candidates with the right positions. The thesis of this study is that the theory of GRA sets is well-suited for human evaluation and decision-making tasks. The ability to define the defining judgments of our reasoning system without resorting to an artificial procedure is made possible by GRA logic. The goal of this study is to use the idea of GRA sets to show how GRA logic can be used to reveal the inherent uncertainty in people's actions and thought processes related to the personnel evaluation and selection process. This study suggests a method of using multi-factor competency-based metrics in a hierarchical framework to eliminate subjectivity in skilled employee evaluation and selection. The recommended GRA technique assesses employee performance from a strategic or tactical standpoint by integrating critical competencies with employee performance data."

## 2. MATERIALS & METHODS

**Alternative:** Community relations, Diversity aspects, Employee relations, Ecological environment, Product aspects.

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**Evaluation parameter:** Ownership by family, Ownership by founder, Ownership by mutual funds, ownership by banks and insurance firms, Ownership by employees (ESOP), Family CEO (dummy), Founder CEO (dummy), Debt/equity, Return on assets.

**Community relations:** community relations are a business practice involving the development of mutually beneficial community partnerships within the areas in which a business operates. This form of customer relations helps build strong relationships and goodwill through time, money, or product donations.

**Diversity aspects:** diversity means ethnic and ethnic, socioeconomic, geographic and academic/professional background the differences in different concepts, backgrounds (degrees and social experience), religious beliefs, political beliefs, sexuality orientations, tradition and people with life experience.

**Employee relations:** industrial relations or employment relations are studying the employment relationship it is a multidisciplinary field of study; that is, employers and employees, labor/unions, employers and govt between the complex interactions.

**Ecological environment:** an "ecosystem" (ecosystem system) is a specific all in the area and living beings (humans including) and organisms contact air, water and inanimate such as mineral soil a biology with components is social. For ecosystems always clear there will be no boundaries.

**Product aspects:** various features of a product contain – price, name, features, attributes, quality, design and more. Before display, food, the same firm as the chair an understanding product as object was, but now it's just physical things not having, on the contrary includes service, ideas, etc.

**Grey Relational Analysis (GRA):** Gray correlation analysis (GRA), this type of problem to solve data envelopment analysis facility analyzed. Layout and dispatch rules both cases of selection problem are gra's to illustrate the application, gra procedure were analyzed using gra's core process is first of all compare the performance of alternatives sequential translation. This step ash is called associated formation. Then, compare all gray between rows and reference row the correlation coefficient is calculated. Finally, this gray is related in terms of coefficients, reference sequence and for each comparison sequence the gray in between relative quality is calculated [13]. The surface roughness and bur of the work piece drilling process parameters for height gray related analysis to improve application introduced. An orthogonal sequence to the experimental design was used. Many performances characteristics surface gray for hardness and burr height ash obtained from corresponding analysis machining parameters optimized by relevant standards are determined. By the author of this work for better knowledge, gray is related drilling down using analysis optimization and in the process effect of cutting parameters on several performance characteristics there is no published work to evaluate [14]. Deng (1989) is a gray relational proposed the analysis. Gray relational analysis is gray relational approximate rows using grade a method of measuring quantity. Some other researchers of process parameters optimization has also been studied. Die-sinking EDM machining parameters related to gray to shape analysis. In polycarbonate composites of yield stress and elongation injection molding for mechanical properties to obtain optimum parameters of the process gray relational analysis. The simulation used the taguchi method and presented an ash-related analysis. Taguchi method and gray related analysis with several performance characteristics improve turn functions. Particle with multiple performance properties wire of reinforced material is electric to optimize the extrusion process gray relational analysis. Taguchi method and gray relational analysis final grinding dry for high purity graphite in process improve machining parameters [15]. Gray correlation analysis, a weighted average in practice depends on several criteria. Several criteria have been proposed decision making for ordering goods. Gray correlation analysis (GRA) is commonly used in asia. It's an impact assessment model, which is relational two in terms of quality similarity between rows or measures the degree of difference. A global comparison to a local comparison is done by measuring the distance between two data sets between two points. Gra has the merit of point set topology therefore, it is subjective to the parameters in the model avoids side effects of the system. Using the ordered pair concept available products and eol the two result domains of the strategy are linked this article is going to provide the method. To apply this domain-combination method the gra model is obviously appropriate [16] Istanbul stock exchange (ISE) some funds in the financial sector index order shares of companies do gray correlation analysis (GRA) is used. Gra has become a benchmark of global comparability contains and to instead, it does not change any hierarchical structure. To retain eligibility, all criteria are also the means of decision are equally distributed. The original decision model was multilevel if in a multilevel hierarchical structure, multiple a level from levels weighting for performance characteristics a change must be made [17] Gray correlation analysis (GRA) based on the use of optimization of wastewater treatment alternatives gray is related to selection analysis. Bad, incomplete and to deal with uncertain information it has been proven to be effective. The main directions gray relational analysis (GRA) is in current applications one of gray system. Gray relationship grades multiple performance by optimizing complexity between characteristics gra can be used to effectively resolve correlations [18]. Gray relational analysis is used with many performance characteristics to solve the turning functions. As a performance index gray relative quality using the taguchi method optimum cutting parameters by can be determined. Ash taguchi by relational analysis multiple performance characteristics by method an overview of optimization first is given. Then, cut select and turn parameters evaluation of machine performance in operations is discussed. Gray communication of taguchi method by analysis basically turn functions the upgrade

is described in detail [19]. In gray correlation analysis, electrode wear, material removal rate and surface roughness test results are initially zero, in the normalized range, it is gray, also known as correlation formation. For determining optimum machining parameters gray relational analysis, it is reported step by step. Many considering performance characteristics optimum machining parameters are obtained [20]. The following conclusions on the benefits of using the Gra method are based on original data, a gray area in multi-attribute decision making (MADM) problems is correlation analysis (GRA) method. The calculations are simple and easy to understand. In a business context helps in making management decisions this is one of the best methods [21] multi-functional properties surface removal rate and maximum surface area all 203 particles with hardness for machining reinforced material optimized wire electrical discharge machining (WEDM) gray to determine the parameters correlation analysis. Gray relational analysis method material removal rate using the tool abrasion, surface roughness and specific shear stress of multi-functional properties including basically cutting speed, feed rate, turning parameters such as depth of cut and machining time [22].

### 3. RESULT AND DISCUSSION

TABLE 1. Corporate social responsibility

	Community relations	Diversity aspects	Employee relations	Ecological environment	Product aspects
Ownership by family	23.24	54.36	58.73	39.53	15.42
Ownership by founder	29.12	45.13	57.13	42.97	58.43
Ownership by mutual funds	43.12	35.76	49.32	22.58	36.12
ownership by banks and insurance firms	34.75	65.45	73.13	28.28	32.14
Ownership by employees (ESOP)	28.13	71.43	51.47	36.41	43.12
Family CEO (dummy)	23.14	45.36	76.14	25.12	48.15
Founder CEO (dummy)	25.16	73.64	27.42	17.42	27.43
Debt/equity	27.12	51.43	39.40	12.46	33.33
Return on assets	31.08	43.31	35.42	24.08	29.43

Table 1 shows the Corporate social responsibility for alternative Community relations, Diversity aspects, Employee relations, Ecological environment, Product aspects. Evaluation Parameter Ownership by family, Ownership by founder, Ownership by mutual funds, ownership by banks and insurance firms, Ownership by employees (ESOP), Family CEO (dummy), Founder CEO (dummy), Debt/equity, Return on assets

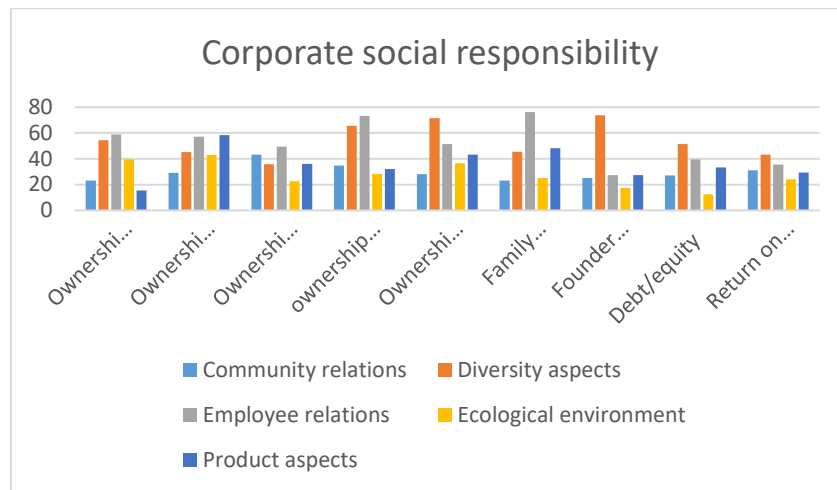


TABLE 1. Corporate social responsibility

Figure 1 Shows the Community relations it is seen that Ownership by mutual funds is showing the highest value for Family CEO (dummy) is showing the lowest value. the Diversity aspects it is seen that Founder CEO (dummy) is showing the highest value for Ownership by mutual funds is showing the lowest value. the Employee relations it is seen that ownership by banks and insurance firms is showing the highest value Founder CEO (dummy) for is showing the lowest value. the Ecological environment it is seen that Ownership by family is showing the highest value for Debt/equity is showing the lowest value. the Product aspects it is seen that Ownership by founder is showing the highest value for Ownership by family is showing the lowest value.

**TABLE 2.** Normalized Data

Normalized Data				
Community relations	Diversity aspects	Employee relations	Ecological environment	Product aspects
23.24	54.36	58.73	39.53	15.42
29.12	45.13	57.13	42.97	58.43
43.12	35.76	49.32	22.58	36.12
34.75	65.45	73.13	28.28	32.14
28.13	71.43	51.47	36.41	43.12
23.14	45.36	76.14	25.12	48.15
25.16	73.64	27.42	17.42	27.43
27.12	51.43	39.40	12.46	33.33
31.08	43.31	35.42	24.08	29.43

Table 2 shows the Normalized data for Community relations, Diversity aspects, Employee relations, Ecological environment, Product aspects

**TABLE 3.** deviation sequence

	Community relations	Diversity aspects	Employee relations	Ecological environment	Product aspects
<b>Ownership by family</b>	0.9950	0.5090	0.3573	0.1127	1.0000
<b>Ownership by founder</b>	0.7007	0.7526	0.3902	0.0000	0.0000
<b>Ownership by mutual funds</b>	0.0000	1.0000	0.5505	0.6683	0.5187
<b>ownership by banks and insurance firms</b>	0.4189	0.2162	0.0618	0.4815	0.6113
<b>Ownership by employees (ESOP)</b>	0.7503	0.0583	0.5064	0.2150	0.3560
<b>Family CEO (dummy)</b>	1.0000	0.7466	0.0000	0.5851	0.2390
<b>Founder CEO (dummy)</b>	0.8989	0.0000	1.0000	0.8374	0.7208
<b>Debt/equity</b>	0.8008	0.5863	0.7541	1.0000	0.5836
<b>Return on assets</b>	0.6026	0.8007	0.8358	0.6191	0.6743

Table 3 provides a succession of deviations for several criteria connected to various ownership structures and corporate performance measures. Let's quickly describe the table. In the first column of the table, various ownership arrangements are listed, including family, founder, employee stock ownership plans (ESOP), mutual funds, banks, and insurance companies. The following columns indicate the various characteristics or components being analyzed, including the ecological environment, employee relations, community relations, diversity aspects, and product aspects. Each cell in the table denotes the value of the deviation between the respective ownership structure and the analyzed component. The range of the deviation values is 0 to 1, with 0 denoting no correlation or influence and 1 denoting a high correlation or influence. Using the first row as an illustration, family ownership has a high deviation value of 0.9950 for community relations and 1.0000 for product attributes, demonstrating a significant link between family ownership and these categories. In the second row, ownership by founder has a low or no link with ecological environment and product features (deviation value of 0.0000), but a significantly high deviation value of 0.7526 for diversity aspects. Similar to this, the values of various ownership structures' deviations from each component are assessed.

**TABLE 4.** Grey Relation Coefficient

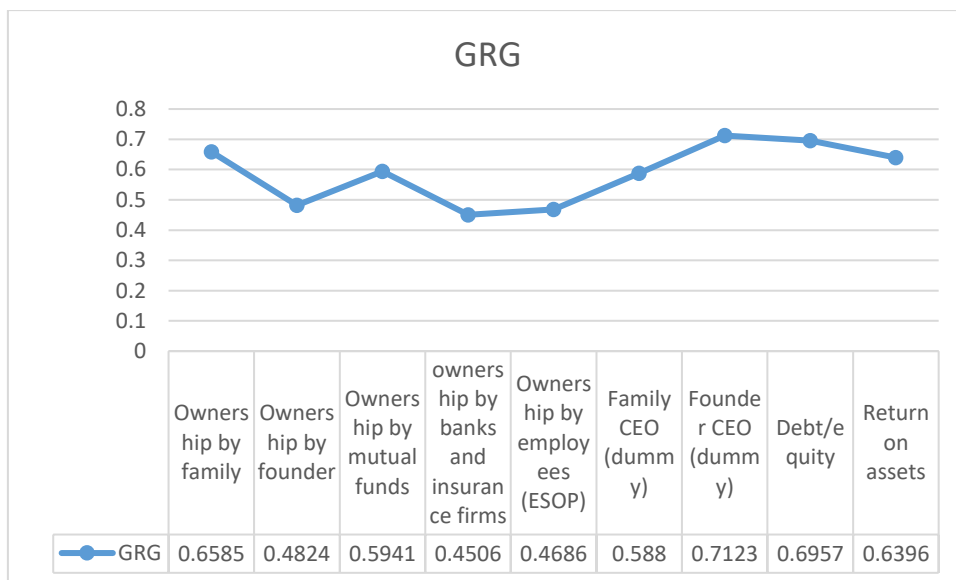
	Community relations	Diversity aspects	Employee relations	Ecological environment	Product aspects
<b>Ownership by family</b>	0.9775	0.9891	0.9920	0.9812	0.9775
<b>Ownership by founder</b>	0.9841	0.9833	0.9933	0.9774	0.9841
<b>Ownership by mutual funds</b>	1.0000	0.9774	1.0000	1.0000	1.0000
<b>ownership by banks and insurance firms</b>	0.9904	0.9961	0.9799	0.9936	0.9904
<b>Ownership by employees (ESOP)</b>	0.9830	1.0000	0.9982	0.9846	0.9830
<b>Family CEO (dummy)</b>	0.9774	0.9834	0.9774	0.9971	0.9774
<b>Founder CEO (dummy)</b>	0.9797	1.0014	1.0192	1.0059	0.9797
<b>Debt/equity</b>	0.9818	0.9872	1.0086	1.0116	0.9818
<b>Return on assets</b>	0.9863	0.9821	1.0121	0.9983	0.9863
<b>Ownership by family</b>	0.9775	0.9891	0.9920	0.9812	0.9775

The Grey Relation Coefficients for various ownership arrangements and factors under consideration are shown in Table 4. Analyzing the table now in the first column of the table, the same ownership arrangements as in the preceding table are listed: ownership by family, founder, mutual funds, banks, and insurance companies; employees (ESOP); family CEO; founder CEO; debt/equity; and return on assets. For each category being assessed—community relations, diversity aspects, employee relations, ecological environment, and product features—the following columns indicate the Grey Relation Coefficients. For instance: High Grey Relation Coefficients for family ownership in the first row, ranging from 0.9775 to 0.9920, show a substantial relationship between family ownership and the analysed components. Similar to other ownership models, each factor has a unique Grey Relation Coefficient.

**TABLE 5. GRG Values**

	<b>GRG</b>
Ownership by family	0.6585
Ownership by founder	0.4824
Ownership by mutual funds	0.5941
ownership by banks and insurance firms	0.4506
Ownership by employees (ESOP)	0.4686
Family CEO (dummy)	0.5880
Founder CEO (dummy)	0.7123
Debt/equity	0.6957
Return on assets	0.6396

The GRG (Grey Relational Grade) scores for the various ownership structures and evaluating elements are shown in Table 5. Now let's look at the table: Ownership by family, founder, mutual funds, banks, and insurance companies, employees (ESOP), family CEO, founder CEO, debt/equity, and return on assets are included under the ownership structures in the first column. The appropriate GRG values for each ownership structure and factor are shown in the second column. For instance: Family ownership has a GRG value of 0.6585, which represents its Grey Relational Grade in connection to the elements that were analysed. Similar to this, every ownership arrangement has a unique GRG value.



**FIGURE 2. GRA**

Figure 2. shows the graphical representation in Ownership by family 0.6585, Ownership by founder 0.4824, Ownership by mutual funds 0.5941, ownership by banks and insurance firms 0.4506, Ownership by employees (ESOP) 0.4686, Family CEO (dummy) 0.5880, Founder CEO (dummy) 0.7123, Debt/equity 0.6957, Return on assets 0.6396.

**TABLE 6.** Rank

	Rank
Ownership by family	3
Ownership by founder	7
Ownership by mutual funds	5
Ownership by banks and insurance firms	9
Ownership by employees (ESOP)	8
Family CEO (dummy)	6
Founder CEO (dummy)	1
Debt/equity	2
Return on assets	4

Table 6 shows the in Rank the final result of this paper the Ownership by family is in third rank, the Ownership by founder is in Seventh rank, the Ownership by mutual funds is in fifth rank, the Ownership by banks and insurance firms is in ninth rank, the Ownership by employees (ESOP) is in Hight rank, the Family CEO (dummy) is sixth in rank, the Founder CEO (dummy) is in first rank, the Debt/equity is in second rank, the Return on assets is in fourth rank,

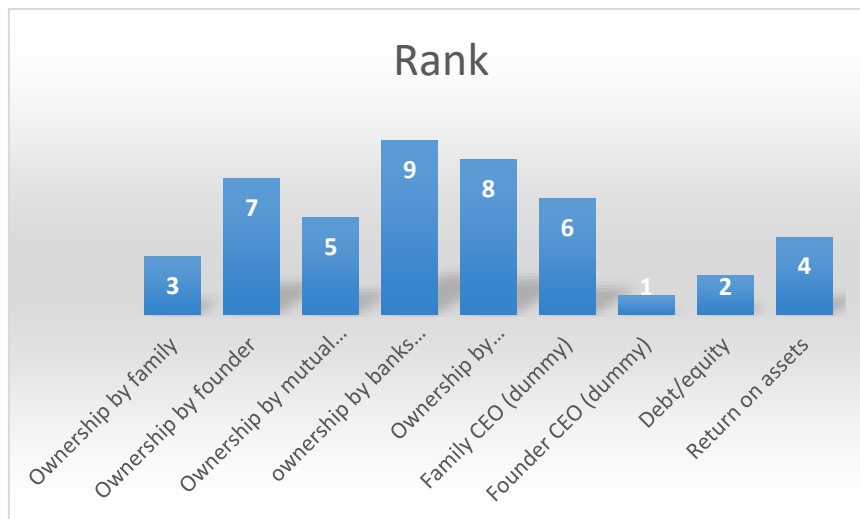
**FIGURE 3.** Rank

Figure 3. shows the graphical representation in Rank the final result of this paper the Ownership by family is in 3<sup>rd</sup> rank, the Ownership by founder is in 7<sup>th</sup> rank, the Ownership by mutual funds is in 5<sup>th</sup> rank, the Ownership by banks and insurance firms is in 9<sup>th</sup> rank, the Ownership by employees (ESOP) is in 8<sup>th</sup> rank, the Family CEO (dummy) is 6<sup>th</sup> in rank, the Founder CEO (dummy) is in 1<sup>st</sup> rank, the Debt/equity is in 2<sup>nd</sup> rank, the Return on assets is in 4<sup>th</sup> rank.

#### 4. CONCLUSION

Each company has its own CSR policy that describes its activities and prepares annual reports on products. It allows us to recognize both socially responsible practices and socially irresponsible activities, which are essential for accountability to all stakeholders in society. Social responsibility is a central principle of accountability and a social contract between the company and society. It extends beyond the current members of the community and is important to civil society, as well as future and prospective members. CSR encompasses various areas such as economic policy, climate change and energy, measurement and assessment, standardization, and natural resource management. It is important to note that CSR is not limited to a specific timeframe but extends to the present and future. We, as an international company, also report on our CSR efforts. Corporate social responsibility (CSR) emerged in the post-war period as a modern concept. It gained momentum in the 1960s driven by societal changes, including civil rights, women's rights, consumer movements, and environmental awareness. Since then, CSR has evolved into an advanced and universal concept. It is a language known and practiced worldwide, emphasizing the importance of stakeholders. Modern businesses are expected to prioritize more than just making money and complying with the law; they are expected to care for business development and ensure CSR implementation. In the field of personnel evaluation and selection, the Multiple Criteria Decision Making (MCDM) method,

specifically the Gray Relational Analysis (GRA), can be used. GRA incorporates linguistic factors and aligns organizational goals with individual skills to select the best employees based on their scores. By developing a hierarchy of evaluation and selection, companies can match the right candidates to the right positions. The study suggests that GRA is well-suited for human evaluation and decision-making tasks, allowing us to define judgments without resorting to artificial procedures. The findings of this paper, the Ownership by family is positioned as the third-ranked factor. The Ownership by founder holds the seventh rank, while Ownership by mutual funds is ranked fifth. Ownership by banks and insurance firms is placed in the ninth position, followed by Ownership by employees (ESOP) in the eighth rank. The presence of a Family CEO (dummy) is ranked sixth, whereas a Founder CEO (dummy) secures the top position. Debt/equity is ranked second, and return on assets holds the fourth rank.

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