

## Multi-Criteria decision analysis for optimizing proper selection medium for CSR in automobile industry

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### Abstract

Industrial sector is comprised of various set of financial and non-financial target. Corporate Social Responsibility (CSR) is a concept that underlies a multi-pillar strategy where many quantitative and qualitative objectives of multiple stakeholders lever a company's success. CSR refers to the totality of a corporation's financial, social, and environmental performance in conducting its business. Making sure CSR initiatives tie back to company's mission and align with their brand identity. It can be tempting to support a wide variety of non-profits, but it is more powerful to pick a few core focus areas in which to make a significant impact. Within the field of operations research, MCDA has evolved over the last three decades as one major discipline, it provides financial decision makers (DMs) and analysts a wide range of methodologies, which are well suited to the complexity of selecting optimum area for CSR in automobile Industry. The aim of this study is to provide an in-depth presentation of the contributions of MCDA in the field of finance, focusing on the methods used and their real-world applications to form a framework for selecting most suitable and profitable CSR initiatives through a survey of companies in automobile Industry.

**Keywords:** corporate social responsibility, multi-criteria decision aid, finance, multi-objective optimization

### 1. Introduction

Many believe that the sole responsibility of a business is to make a profit. The maximization of financial efficiency is considered to be the primary goal of an enterprise within the theory of corporate finance. In this case, financial goals constitute a common denominator for the evaluation of a firm's outcomes; by this, the integrity and purposefulness of a firm's management are safeguarded. Financial-goal orientation determines the related decision-making. However, as to how the financial goal is expressed and organized is of no importance from the perspective of a firm's financial and non-financial outcomes. Consequently, the financial and non-financial goals of enterprises are deliberated with respect to how goal-setting affects management practices.

Corporate Social Responsibility (CSR) is a concept that suggests that it is the responsibility of the corporations operating within society to contribute towards economic, social and environmental development that creates positive impact on society at large. Although there is no fixed definition, however the concept revolves around that fact the corporations needs to focus beyond earning just profits. The term became popular in the 1960s and now is formidable part of business operations<sup>[1]</sup>. A CSR strategy begins with a long-term vision and commitment from the top of the executive food chain. Optimizing proper Selection medium for CSR in Automobile Industry can be considered a multi criteria decision making problem as there are many factors (criterion) which are to be considered for selecting the best area of CSR. Analytical Hierarchy Process is a multi-criteria decision making tool which can be used to find an optimum solution for selecting most beneficial area in terms of financial as well non-financial growth of industry AHP is a structured technique for organising and analysing complex decisions rather than focusing on the correct decision, the AHP helps decision makes find most optimum solution for achieving

their target. It provides a comprehensive and rational framework for structuring and decision problem, for representing and quantifying its elements for relating those elements with overall goals and for evaluating alternative solutions.

### 2. Statement Problem

In any company the main objective is allocating its resources both financial and non-financial in cost effect, time efficient and productive manner. Although allocating companies funds in Corporate Social Responsibility (CSR) activities is beneficial to company but when it comes to deciding which areas of CSR to invest in, it becomes a problematic situation. If they make most appropriate choice of selection CSR area company can exhibit following benefits improved financial performance, Lower operating costs, Enhanced brand image and reputation, Increased sales and customer loyalty, bigger productivity and quality, additional ability to draw in and retain workers, Reduced regulative oversight, Access to capital, manpower diversity, Product safety and small liability. The idea of company social responsibility is currently firmly stock-still on the world business agenda. However so as to maneuver from theory to concrete action, several obstacles got to be overcome<sup>[2]</sup>. This method must consider the various characteristics benefits and risks before implementing solutions for selecting optimum area for CSR in automobile Industry. The aim of this study is to provide an in-depth presentation of the contributions of MCDA in the field of finance, focusing on the methods used and their real-world applications to form a framework for selecting most suitable and profitable CSR initiatives through a survey of companies in automobile Industry. The branch of MCDA that is considered for providing solution is Analytic Hierarchy Process (AHP). It is very powerful and powerful tool because the scores, and therefore the final ranking, are obtained on the basis of the pairwise relative evaluations of both the criteria

and the options provided by the user.

### 3. Literature Review

For the process of selecting the best alternatives for determining the key areas for CSR activities is very crucial step. Realizing the fact many researchers have done a lot of work in this area. Constantin Zopounidis <sup>[3]</sup> explained how the complexity of financial decisions has rapidly increased over the decade, thus highlighting the importance of developing and implementing sophisticated and efficient quantitative analysis techniques for supporting and aiding financial decision making. Multi-criteria decision aid (MCDA), an advanced field of operations research, provides financial decision makers (DMs) and analysts a wide range of methodologies, which are well suited to the complexity of financial decision problems.

Further a descriptive study done by Anna Doś <sup>[4]</sup> explained about how despite the fact that some studies focused on both CSR and finance, little is still known about how MCDMs can be used to integrate financial management and CSR. The research also concluded how maximization of financial efficiency constitutes a common denominator for the evaluation of a firm's outcomes, the integrity and purposefulness of the firm's management are safeguarded. The key benefits company exhibits while involving itself with CSR activities are summed up as follows:

1. **Improves Brand Image:** Companies that demonstrate their commitment to various causes are perceived as more philanthropic than companies whose corporate social responsibility endeavours are non-existent.
2. **Brand Awareness by Media Coverage:** Media visibility is important as it sheds a positive light on your organization and shows that company is transparent.
3. **Boosts Employee Engagement:** Employees like working for a company that has a good public image and is constantly in the media for positive reasons.
4. **Networking and Maintaining Relationships:** Interaction with client outside the scope of the project to overcome the problem of relationship discontinuity, regular communication with the clients.
5. **Generating Sales leads:** connecting with various employees of target companies as potential clients.
6. **To increase Web Traffic:** with availability of company's profile on various social platforms it becomes easy to redirect to company's website thereby increasing web traffic.

CSR activities are focused on six broad themes with the goal of improving the overall socio- economic status in its areas of operation

1. Promoting healthcare, sanitation and making safe drinking water available
2. Employment enhancement through training and vocational skill development
3. Income enhancement through farm based and other livelihood opportunities
4. Promoting education & sports
5. Environmental sustainability
6. Infrastructure development

From literature review one can conclude that there exist lots of beneficial factors that can be linked with CSR activities and finance but one must eliminate most obvious choices and should pay proper attention while selecting the characteristic benefits through CSR and areas where they can be implemented. The next portion describes the methodology of

AHP approach.

### 4. Research Methodology

#### 4.1 Multi-Criteria Decision Aid (MCDA)

Multi-criteria decision aid (MCDA) or multiple-criteria decision analysis (MCDA), an advanced field of operations research that explicitly evaluates multiple conflicting criteria in decision making. Research into operations provides many interesting insights into multiple-criteria decision-making (MCDM) and multi-attribute decision tools, which then enhance decision rationality under circumstances where a number of heterogenic objectives must be achieved. The most-popular multi-criteria decision tools include AHP, PROMETHEE, ELECTRE, TOPSIS, and their families <sup>[5]</sup>.

The Analytic Hierarchy Process (AHP), introduced by Thomas Saaty (1980), is an effective tool for dealing with complex decision making, and may aid the decision maker to set priorities and make the best decision. By reducing complex decisions to a series of pairwise comparisons, and then synthesizing the results, the AHP helps to capture both subjective and objective aspects of a decision. In addition, the AHP incorporates a useful technique for checking the consistency of the decision maker's evaluations, thus reducing the bias in the decision making process <sup>[6]</sup>.

Steps involved in AHP are as follows:

1. Identify the problem.
2. Identify the criteria that influences the behavior of the problem-brainstorming and judgement of expert are used to identify the criteria.
3. Structure the hierarchy of criteria and alternatives
4. Remove ambiguity by carefully defining every element in the hierarchy
5. Prioritize the primary criteria with respect to their impact on the overall objective. This is done by first comparing every element to each other, two at a time. This is called pairwise comparison. After the scores are given multiply the scores and raise it to power of 'n' where 'n' is the number of criteria (and alternatives). Add these scores and divide each score with the sum obtained. This way we obtain the normal priority vector.
6. Similarly, prioritize the sub-criteria with respect to respective alternatives.
7. To obtain the overall rankings, multiply the matrix obtained by prioritizing the alternatives and transpose of the priority vector of characteristics.
8. For checking the consistency of the results, first calculate the Principal Eigenvalue ( $\lambda_{max}$ ) of the priority vector. For consistency index use the formula:

$$C.I = \frac{\lambda_{max} - n}{n - 1}$$

For consistency ratio, use the formula:

$$C.R = \frac{C.I}{R.I}$$

A consistency ratio of 0.1 or less is considered acceptable. For our case with n = 6 in both the characteristics matrix and sub-criteria matrix. Therefore R.I for n = 6 is 1.24.

### 5. Numerical illustration

During this study, through different research papers and by expert opinion we have identified some of the key benefits achieved by company by involving themselves with CSR

activities. Some of those factors are:

$N_1$ - Improves Brand Image,  $N_2$ - Brand Awareness by Media Coverage,  $N_3$ - Boosts Employee Engagement,  $N_4$ - Networking and Maintaining Relationships,  $N_5$ - Generating Sales leads,  $N_6$ - To increase Web Traffic. Some key areas where CSR activities are focused in automobile industry. These areas are represented as:  $M_1$ - Promoting healthcare, sanitation and making safe drinking water available,  $M_2$ - Income enhancement through farm based and other livelihood opportunities,  $M_3$ - Promoting education & sports,  $M_4$ - Employment enhancement through training and vocational skill development,  $M_5$ - Environmental sustainability and  $M_6$ - Infrastructure development. First step is collection of data from all experts and analyse it and summarize it. Then AHP methodology is followed for generating optimum solution.

**Table 1:** Pairwise comparison of required characteristic benefits of CSR

	N1	N2	N3	N4	N5	N6
N1	1	0.25	0.5	0.5	0.25	0.25
N2	4	1	2	2	1	1
N3	2	0.5	1	1	0.5	0.5
N4	2	0.5	1	1	0.5	0.5
N5	4	1	2	2	1	1
N6	4	1	2	2	1	1

$\lambda_{max} = 6, C.I = 0, C.R = 0$

**Table 2:** Pairwise comparison of various areas of CSR based on N1

	M1	M2	M3	M4	M5	M6
M1	1	2	0.25	6	6	6
M2	0.25	1	0.17	4	4	4
M3	4	6	1	8	8	8
M4	0.17	0.25	0.125	1	1	1
M5	0.17	0.25	0.125	1	1	1
M6	0.17	0.25	0.125	1	1	1

$\lambda_{max} = 6.1474, C.I = 0.02948, C.R = 0.023774$

**Table 3:** Pairwise comparison of various areas of CSR based on N2

	M1	M2	M3	M4	M5	M6
M1	1	3	1	0.25	4	4
M2	0.33	1	0.25	0.17	2	2
M3	1	4	1	0.25	5	5
M4	5	3	4	1	6	6
M5	0.25	0.5	0.5	0.17	1	2
M6	0.25	0.5	0.20	0.17	0.5	1

$\lambda_{max} = 6.2724, C.I = 0.05448, C.R = 0.043935$

**Table 4:** Pairwise comparison of various areas of CSR based on N3

	M1	M2	M3	M4	M5	M6
M1	1	2	0.25	4	4	3
M2	0.5	1	0.17	1	0.5	0.5
M3	4	6	1	6	4	4
M4	0.25	1	0.17	1	0.5	0.5
M5	0.33	2	0.25	2	1	1
M6	0.33	2	0.25	2	1	1

$\lambda_{max} = 6.2005, C.I = 0.0401, C.R = 0.032339$

**Table 5:** Pairwise comparison of various areas of CSR based on N4

	M1	M2	M3	M4	M5	M6
M1	1	1	1	2	2	0.20
M2	1	1	1	2	2	0.20
M3	1	1	1	2	2	0.33
M4	0.5	0.5	0.5	1	1	0.25
M5	0.5	0.5	0.5	1	1	0.25
M6	5	5	3	4	4	1

$\lambda_{max} = 6.1193, C.I = 0.02386, C.R = 0.019242$

**Table 6:** Pairwise comparison of various areas of CSR based on N5

	M1	M2	M3	M4	M5	M6
M1	1	1	1	0.5	2	4
M2	1	1	1	0.5	2	4
M3	1	1	1	0.5	2	4
M4	2	2	2	1	6	8
M5	0.5	0.5	0.5	0.17	1	2
M6	0.25	0.25	0.25	0.125	0.5	1

$\lambda_{max} = 6.0184, C.I = 0.00368, C.R = 0.002968$

**Table 7:** Pairwise comparison of various areas of CSR based on N6

	M1	M2	M3	M4	M5	M6
M1	1	1	1	1	2	4
M2	1	1	1	1	2	4
M3	1	1	1	1	2	4
M4	1	1	1	1	2	4
M5	0.5	0.5	0.5	0.5	1	2
M6	0.25	0.25	0.25	0.25	0.5	1

$\lambda_{max} = 6, C.I = 0, C.R = 0$

**Table 7:** Pairwise comparison of various areas of CSR based on N6

	M1	M2	M3	M4	M5	M6
M1	1	1	1	1	2	4
M2	1	1	1	1	2	4
M3	1	1	1	1	2	4
M4	1	1	1	1	2	4
M5	0.5	0.5	0.5	0.5	1	2
M6	0.25	0.25	0.25	0.25	0.5	1

$\lambda_{max} = 6, C.I = 0, C.R = 0$

### 6. Results and Analysis

From Table 8. It is evident that Employment enhancement through training and vocational skill development should get most priority considering the various characteristic benefits for which company receives while involving with CSR activities. Following Employment enhancement through training and vocational skill development is Promoting education & sports, Promoting healthcare, sanitation and making safe drinking water available and Income enhancement through farm based and other livelihood opportunities. These areas are based on automobile industry expert’s point of view.

**Table 8:** Priority vector of characteristic benefits of CSR and priority matrix of key areas of CSR

	<b>N1 0.0588</b>	<b>N2 0.2352</b>	<b>N3 0.1176</b>	<b>N4 0.1176</b>	<b>N5 0.2352</b>	<b>N6 0.2353</b>	<b>Priority Weight</b>
M1	0.231842908	0.18354273	0.204651845	0.130937654	0.170731382	0.210526316	0.18601
M2	0.125107874	0.07493101	0.06312699	0.130937654	0.170731382	0.210526316	0.13790
M3	0.510352278	0.20742622	0.459427859	0.142573676	0.170731382	0.210526316	0.23935
M4	0.044232313	0.43612998	0.059077899	0.076270728	0.36533516	0.210526316	<b>0.25664</b>
M5	0.044232313	0.05461896	0.105264849	0.076270728	0.079787493	0.105263158	0.08035
M6	0.044232313	0.0433511	0.105264849	0.44300956	0.042682845	0.052631579	0.00973

However, this strategic and expert opinion analysis cannot be generalised for all the industries and is limited to content and expert advice of automobile industry only. Also the criteria chosen also was dependent upon the very few experts when compared to whole automobile sector thus the results can be improved with the help of more number of experts and by giving more time to the problem faced by automobile company's during CSR activities.

### 7. Conclusion

The study of this paper focuses on providing financial decision makers (DMs) and analysts a wide range of methodologies, which are well suited to the complexity of selecting optimum area for CSR in automobile Industry. To find the proper solution of the cited problem Analytical hierarchy approach was used which is tool of MCDA. Out of the chosen areas where a company can invest in CSR activities importance rating order comes as: Employment enhancement through training and vocational skill development (M4) > Promoting education & sports (M3) > Promoting healthcare, sanitation and making safe drinking water available (M1) > Income enhancement through farm based and other livelihood opportunities (M2) > Environmental sustainability (M5) > Infrastructure development (M6). Hence the automobile company will be most benefited if they invest in Employment enhancement through training and vocational skill development.

These studies however have certain limitation. First of all the study was made in context of automobile industry sector and criteria for deciding the optimum area for CSR activity is based on few expert opinion which can vary from business to business. They may also differ within different automobile company.

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### Availability of data and materials

The study is based on secondary data which have been collected from the annual audited reports of sampled automobile industries. All data generated and analyzed during the study are included in this article. All sample industries that were analyzed for this study maintain company websites and provide information regarding products and services via downloadable PDF format documents of their annual reports.

### Authors' contributions

First author conducted the literature review, data collection, tabulation, and empirical studies. Second author assisted to check and interpret the whole paper several times including referencing. Both authors read and approved the final manuscript.

### Competing interests

The authors declare that they have no competing interest.

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