

Synergizing Sustainability: A Holistic Approach to Enhancing CSR Effectiveness through Operations Research Methodologies

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ABSTRACT

This paper explores the utilization of operations research methodologies for enhancing the effectiveness of corporate social responsibility (CSR) initiatives within multinational corporations. Specifically, it examines the CSR endeavors of Siemens Ltd to identify optimization opportunities. Siemens is a multinational conglomerate renowned for its commitment to sustainability and social responsibility. We focus on two key areas: Resource Allocation: We employ linear programming and network optimization models to allocate resources efficiently across various CSR initiatives, maximizing their impact based on predetermined objectives and constraints. Supply Chain Sustainability: We leverage data analytics and simulation techniques to assess the environmental and social footprints within Siemens' supply chains, identifying opportunities for greening the procurement process and improving working conditions for suppliers' employees. Through this comprehensive analysis, the research aims to: Demonstrate the value of operation research techniques in enhancing CSR effectiveness. Provide specific recommendations for Siemens to optimize its CSR resource allocation, supply chain practices, and impact measurement. It offers a replicable framework for other companies to integrate operation research into their CSR strategies. The findings of this research hold significant implications for both Siemens and the broader corporate landscape, potentially leading to more impactful and data driven CSR initiatives that contribute meaningfully to sustainable development and social good.

Key words: CSR activities, Resource allocation, maximization, Sustainable development, Operations Research, Simplex Method, Networking.

1. INTRODUCTION

The Objective of this study aims to optimize Siemens's CSR initiatives to maximize their outcome using Simplex Method.

Siemens: A Global Leader committed to Corporate Social Responsibility

Siemens, a multinational technology and engineering conglomerate with a 173-year history, over 10000 crore on average annual turnover is renowned not only for its innovative solutions but also for its dedication to Corporate Social Responsibility (CSR). They view themselves as a "responsible corporate citizen" with a mission to improve lives and create lasting value for society.

Siemens' commitment to Corporate Citizenship is demonstrated by its "Corporate Citizenship" policy, which has three main areas of concentration.

1. Education and Science: By supporting equitable access to high-quality education from elementary school through university, Siemens promotes science and technical education. In addition to supporting research and

innovation, they put into practice role models for vocational training programs and foster curiosity and project-based learning.

2. **Social Development:** The basic needs of society are covered in this section. Siemens priorities facilitating access to essential resources such as energy, water, and healthcare. The company also participates in disaster relief operations and supports Community-Based development projects.

3. **Environment:** Siemens uses technology innovation to achieve sustainability. They offer resource-efficient solutions for industries like transportation, energy, and building technologies with the goal of lowering their own environmental footprint and assisting clients in doing the same.

Siemens' CSR efforts have garnered recognition through numerous awards and rankings, solidifying their reputation as a responsible leader. However, the company continues to strive for improvement, constantly seeking ways to leverage their expertise and resources to make a tangible difference in the world.

2. REVIEW OF LITERATURE

2.1 CSR

Corporate Social Responsibility is referred to as CSR. It speaks to a business's dedication to conducting operations in a way that is sustainable in terms of the economy, society, and environment. CSR, to put it briefly, is the practice of companies being accountable for their social effect in addition to their financial performance. Initiatives and programs pertaining to moral business conduct, environmental sustainability, social welfare, and community development can fall under this category. In order to positively impact the larger social and environmental context in which they operate, companies that engage in corporate social responsibility (CSR) may take part in initiatives including philanthropy, ethical labor practices, environmental protection, and community participation.

The aim of CSR is to make sure that companies are not just profitable, but also ethical and responsible members of society. Ideally, companies should be giving back to the communities they exist within so that everyone can benefit from their success.

2.2 Evolution of CSR

The evolution of Corporate Social Responsibility (CSR) has gone through several phases over the years:

§ **Philanthropic Era (Late 1800s - Early 1900s):** The early roots of CSR can be traced back to philanthropy, where some industrialists and business leaders engaged in charitable activities to address social issues. However, these efforts were often individual and sporadic.

§ **Post-World War II Era (1940s - 1960s):** The aftermath of World War II saw an increased awareness of social issues and the role of corporations in society. This period marked the beginning of a more systematic approach to CSR, with businesses starting to consider their impact on society and implementing social responsibility initiatives.

§ **Social Awareness Era (1970s - 1980s):** The 1970s brought a surge in social activism and environmental awareness. Influential events like the publication of Rachel Carson's "Silent Spring" and environmental disasters spurred a heightened focus on corporate responsibility. Governments started implementing regulations, and businesses began to adopt more structured CSR practices.

§ **Corporate Citizenship Era (1990s - Early 2000s):** During this period, CSR became more ingrained in business strategies. Companies began to view themselves as "citizens" in the larger societal context, emphasizing responsible business practices. Stakeholder engagement became a key component of CSR, recognizing the interests of various stakeholders, including employees, customers, communities, and shareholders.

§ **Sustainability Era (2000s - Present):** The 21st century has seen a shift towards sustainability as a central theme in CSR. Companies focus on integrating economic, social, and environmental considerations into their core business models. Sustainability reporting and certifications, such as the Global Reporting Initiative (GRI) and B Corp certification, gained prominence. Stakeholder engagement and transparency continued to be critical elements in CSR practices.

§ **Globalization and Connectivity (Present):** With the increasing interconnectedness of the global economy, companies face scrutiny not only from local stakeholders but also from a global audience. The rise of social media and increased awareness among consumers has made companies more accountable for their actions, encouraging a more holistic and inclusive approach to CSR.

§ **Throughout its evolution, CSR has transformed from a charitable and philanthropic endeavor to an integral aspect of business strategy, acknowledging the interconnectedness of business operations with societal and environmental factors.**

2.3 Fundamentals of CSR

The fundamentals of Corporate Social Responsibility (CSR) encompass a range of principles and practices that guide businesses in operating ethically, sustainably, and responsibly. Here are the key fundamentals of CSR in brief.

Ethical Business Practices:

- § Conducting business with integrity, honesty, and fairness.
- § Upholding high ethical standards in all interactions and transactions.

Environmental Sustainability:

- § Minimizing the environmental impact of operations.
- § Implementing eco-friendly practices and initiatives.
- § Committing to sustainable resource management and reducing carbon footprint.

Social Responsibility:

- § Ensuring fair labor practices and treating employees with respect.
- § Promoting diversity, equality, and inclusion within the workplace.
- § Contributing to community development and addressing social issues.

Transparency and Accountability:

- § Communicating transparently about business practices, goals, and performance.
- § Being accountable for the social and environmental impact of operations.
- § Engaging stakeholders in decision-making processes.

Stakeholder Engagement:

- § Identifying and understanding the interests of various stakeholders, including employees, customers, communities, and shareholders.
- § Actively involving stakeholders in decision-making and seeking their input.
- § Philanthropy and Community Involvement:
- § Supporting charitable initiatives and community projects.
- § Investing in the well-being and development of the communities in which the business operates.

Legal Compliance:

- § Adhering to all applicable laws and regulations.
- § Proactively managing legal and regulatory risks.
- § Sustainable Supply Chain Management.
- § Ensuring that suppliers and partners adhere to similar CSR principles.
- § Promoting responsible sourcing and supply chain practices.

Employee Well-being:

- § Providing a safe and healthy work environment.
- § Offering fair wages, benefits, and opportunities for professional development.
- § Long-term Value Creation:
- § Focusing on sustainable and responsible business practices for long-term success.
- § Balancing financial performance with social and environmental considerations.

By integrating these fundamentals into their operations, businesses can contribute positively to society, foster a positive corporate reputation, and build long-term sustainable value for all stakeholders.

3. SCOPE

3.1 CSR in MNC's like Siemens

Siemens Ltd. has a comprehensive Corporate Social Responsibility (CSR) program that focuses on areas such as education, social, environmental sustainability, and community development. Their initiatives include skill development programs, environmental conservation efforts, and support for underprivileged communities. Siemens actively engages in partnerships with local NGOs, government agencies, and communities to maximize the impact of their CSR activities. Through these endeavors, Siemens demonstrates its commitment to social welfare and sustainable development, contributing positively to society while aligning with its business values and objectives.

3.2 Optimization of profit

Siemens Ltd. optimizes profit through various strategic measures, including efficient resource allocation, cost reduction initiatives, market expansion, innovation in products and services, and leveraging economies of scale. They focus on enhancing productivity, streamlining operations, and adopting advanced technologies to improve efficiency and competitiveness. Additionally, Siemens emphasizes risk management and diversification of revenue streams to mitigate market uncertainties. Through prudent financial management and continuous performance evaluation, Siemens aims to maximize profitability while maintaining a strong commitment to corporate governance and ethical business practices, ensuring sustainable growth and value creation for stakeholders.

3.3 Supply Chain Sustainability

By incorporating ethical, environmental, and social factors into every step of its procurement procedures, Siemens Ltd. places a strong emphasis on supply chain sustainability. Their first priority is responsible sourcing, whereby they make sure suppliers follow ethical standards, fair labor practices, and environmental legislation. Siemens regularly monitors supplier performance and compliance through audits and evaluations, which promotes accountability and transparency throughout the supply chain. They work with suppliers to

carry out programs that benefit neighborhood communities, encourage resource efficiency, and lessen carbon footprint. By making these efforts, Siemens hopes to build a sustainable supply chain that improves operational resilience while also benefiting the environment and stakeholders in the long run.

4. PROBLEM STATEMENT

A vital component of sustainable development is becoming more widely acknowledged: the incorporation of Corporate Social Responsibility (CSR) into business operations. There remains a gap in leveraging advanced analytical techniques, particularly Operations Research (OR), to comprehensively analyze and optimize CSR activities. This research aims to address this gap by focusing on Siemens, a global leader in CSR, and utilizing OR techniques to evaluate the effectiveness, efficiency, and impact of their CSR initiatives. Siemens is enhancing its CSR effectiveness and sustainability by developing models to optimize resource allocation, measure social and environmental impacts, and enhance decision-making processes using OR methodologies.

5. OBJECTIVES

The objective of this research is to apply OR techniques to systematically analyze and optimize CSR activities at Siemens. Develop mathematical models to optimize resource allocation and decision-making processes within Siemens' CSR initiatives.

- Evaluate the effectiveness and efficiency of CSR programs through rigorous quantitative analysis.
- Assess the social and environmental impact of CSR activities using data-driven approaches.
- Provide actionable insights to Siemens for enhancing the effectiveness and sustainability of their CSR initiatives.
- Contribute to the body of knowledge by demonstrating the applicability of OR techniques in analyzing CSR activities, thereby fostering sustainable business practices.

6. RESEARCH METHODOLOGY:

This research paper has been based on secondary research analysis by referring various research papers written previously along with data available on Siemens annual report.

Illustration: Given below are four major CSR activities of Siemens India ltd. of the last three years with total cost (in Million) and average cost allotted to these activities. The manager wants to optimize the cost allocation to these activities to get maximum social impact.

i) The table given below shows the amount spent on various CSR activities.

CSR Activities	Year		
	2021	2022	2023
Project Asha (x1)	56.2	62.9	42.3
Siemens Scholarship Program (x2)	52.2	91.4	103.2
Dual VET at Govt. ITI (x3)	4.6	15.7	29.8
STEM in schools(x4)	9	12.9	16.8
Total Cost	122	182.9	192.1
2% Allocated for CSR	272.00	271.8	283.33
Actual Spent on CSR	274.50	278.4	283.60

The manager can make use of L.P.P to find out how much cost should be allotted to the activities to optimize cost and enhance social impact.

In the above table, we considered as Decision Variables some of CSR activities like Project Asha, Scholarship, Dual vet and STEM in order to minimize the cost of expenditure on CSR activities.

Objective function $Min Z = 20x_1 + 30x_2 + 6x_3 + 5x_4$

Where as,

Project Asha x_1 = additional water storage in million liters

Scholarship x_2 = No. of students benefited

Dual vet x_3 = No. of ITI's benefitted

Stem x_4 = No. of students benefited

Constraints are conditions or limitations that must be satisfied in order to achieve a feasible solution. Each constraint represents a requirement or limitation that the decision variables (x_1, x_2, x_3, x_4) must adhere to

$$56.2x_1 + 52.2x_2 + 4.6x_3 + 9x_4 \geq 122$$

This constraint ensures that the total benefit derived from all the projects (additional water storage, scholarships, ITI benefits, STEM education) is greater than or equal to 122 for the year 2021

$$62.9x_1 + 91.4x_2 + 15.7x_3 + 12.9x_4 \geq 182.9$$

This constraint ensures that the total benefit derived from all the projects is greater than or equal to 182.9 for the year 2022

$$42.3x_1 + 103.2x_2 + 29.8x_3 + 16.8x_4 \geq 192.1$$

This constraint ensures that the total benefit derived from all the projects is greater than or equal to 192 for the year 2023

ii) The table given below shows social impact of various CSR activities.

CSR Activities	Year	
	2022	2023
Project Asha	292	293.14
Siemens Scholarship Program	142	628
Dual VET at Govt. ITI	24000	50000
STEM in schools	23000	19800
Social Impact	50000	75000

In the above presented scenario, we've identified specific Corporate Social Responsibility (CSR) endeavors, including Project Asha, Scholarship, Dual vet, and STEM, as our decision variables. Our goal is to optimize their social impact, drawing from responses collected following the implementation of diverse CSR initiatives. This approach aims to elevate the overall effectiveness and influence of our CSR endeavors.

Objective Function: $Max Z = 45x_1 + 45x_2 + 45x_3 + 45x_4$

Where as,

Project Asha x_1 = additional water storage in million liters

Scholarship x_2 = No. of students benefited

Dual vet x_3 = No. of ITI's benefitted

Stem x_4 = No. of students benefited

Constraints are conditions or limitations that must be satisfied in order to achieve a feasible solution. Each constraint represents a requirement or limitation that the decision variables (x_1, x_2, x_3, x_4) must adhere to.

$$292x_1 + 142x_2 + 24000x_3 + 23000x_4 \leq 50000$$

This constraint ensures that the total impact derived from all the projects (additional water storage, scholarships, ITI benefits, STEM education) is less than or equal to 50k for the year 2022.

$$293.14x_1 + 628x_2 + 50000x_3 + 19800x_4 \leq 75000$$

This constraint ensures that the total impact derived from all the projects is less than or equal to 75000. For the year 2023.

8. Data Interpretation & Findings:

For Table 1 the details LPP model will be,

$$Min Z = 20x_1 + 30x_2 + 6x_3 + 5x_4$$

Subject to,

$$56.2x_1 + 52.2x_2 + 4.6x_3 + 9x_4 \geq 122$$

$$62.9x_1 + 91.4x_2 + 15.7x_3 + 12.9x_4 \geq 182.9$$

$$42.3 x_1 + 103.2x_2 + 29.8x_3 + 16.8 x_4 \geq 192.1$$

Using Excel LP solver software or algorithms we will solve the formulated linear Programming problem. We get the following Optimal Solution:

$$MinZ = 20x_1 + 30x_2 + 6x_3 + 5x_4 = 60.728$$

$$x_1 = 1.25 \text{ Million}$$

$$x_2 = 0.83 \text{ Million}$$

$$x_3 = 1.78 \text{ Million} \ \& \ x_4 = 0$$

From table 1 the findings :

These constraints reflect the importance of ensuring that the benefits derived from various projects meet certain minimum thresholds, ensuring effective utilization of resources and maximizing overall impact.

- They provide guidelines for decision-makers to allocate resources (such as funding, scholarships, educational programs) across different projects in a manner that maximizes the total benefit derived.
- By setting minimum requirements for the benefits derived from each project, these constraints help in prioritizing projects and allocating resources effectively to achieve desired outcomes.
- Violating these constraints could indicate that the combined benefits from the projects are insufficient to meet the specified targets, suggesting a need for reevaluation of resource allocation or project implementation strategies.

For Table 2 the detailed LPP model will be,

Objective Function: $\text{Max } Z = 45x_1 + 45x_2 + 45x_3 + 45x_4$

Subject to, $292x_1 + 142x_2 + 24000x_3 + 23000x_4 \leq 50000$

$293.14x_1 + 628x_2 + 50000x_3 + 19800x_4 \leq 75000$

Using Excel LP solver software or algorithms we will solve the formulated linear programming problem. We get the following Optimal Solution:

$\text{Max } Z = 45x_1 + 45x_2 + 45x_3 + 45x_4 = 8886.65$

$x_1 = 146.38$ Million

$x_2 = 51.09$ Million

$x_3 = 0$ & $x_4 = 0$

From table 2 Findings:

- The optimal solution provides insights into resource allocation, indicating the optimal quantities of resources x_1 and x_2 that should be allocated to maximize the objective function.
- The decision to allocate zero units for x_3 and x_4 implies that these resources may not be essential for maximizing the overall benefit, or their contribution may be insignificant compared to x_1 and x_2 .
- Further analysis may be required to understand why certain resources are not needed for maximizing the benefit and whether reallocating resources could lead to better outcomes.
- Overall, the optimal solution guides decision-makers in allocating resources effectively to maximize benefits within the given constraints.

9. Conclusion

In this case study, we used the Simplex algorithm to provide a creative solution that effectively optimized a company named Siemens CSR initiatives. Creating a mathematical model of a linear programming problem from a real-world scenario is the more difficult aspect. Following the formulation of the LPP, the Simplex Algorithm's usual procedural stages were followed, and the optimized resulting variables were effectively produced.

10. Suggestions:

The Company can opt for the famous 5 R's and 1 I aim to measure the overall success of a CSR campaign, by looking at the:

- **Revenue** - Specifically looking at customer retention, new customers, and cost savings.
- **Reputation** - Customer perception of the brand, awareness of the brand.
- **Recruitment** - Attraction of talent to the organization.
- **Retention** - How are the employee levels of satisfaction and involvement within the company?
- **Relationships** - Consider the business partnerships and whether they are thriving.
- **Impact** - Are your KPIs reflective of a job well done?

Ensuring that the company is monitoring its inputs, outputs, and results is a task, and maintaining track of all these factors is a lot of work. It will provide the company with a far better understanding of how well its CSR campaign is performing, though, if it will put in the time and effort to monitor these various areas.

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