

Effectiveness of Corporate Social Responsibility Expenditure in Achieving Sustainable Development Goals: Evidence from Karnataka-Based Listed Companies

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¹**Vijaya B**, Research Scholar and Assistant Professor, Department of Commerce, Government First Grade College, Bengaluru North University, KR Puram, Bengaluru, Karnataka

²**Dr. Amruthamma R**, Associate professor and Research Guide, Department of Commerce Government First Grade College, Hoskote, Bengaluru North University, Karnataka

Abstract

Corporate Social Responsibility (CSR) has emerged as an important strategic mechanism for promoting sustainable development while creating long-term stakeholder value. However, empirical evidence regarding the effectiveness of CSR expenditure in achieving Sustainable Development Goals (SDGs) remains limited, particularly within the Indian corporate context. The present study evaluates the effectiveness of CSR expenditure in achieving SDGs among 25 Karnataka-based listed companies during the period 2020–2025 using a balanced panel dataset comprising 125 firm-year observations. The study employs descriptive statistics, correlation analysis, multiple linear regression, Fixed Effects panel regression, moderation analysis, mediation analysis, and bootstrap estimation to examine the direct and indirect relationships among the study variables. The findings reveal that CSR expenditure exerts a significant positive influence on SDG effectiveness. Firm size significantly strengthens this relationship, while Environmental CSR Allocation partially mediates the impact of CSR expenditure on sustainable development outcomes. The Fixed Effects panel regression model provided the most appropriate empirical specification, and robustness analyses confirmed the stability of the results. The study contributes to the literature by integrating organisational characteristics and strategic CSR allocation within a comprehensive empirical framework and offers valuable managerial and policy implications for enhancing the effectiveness of CSR initiatives in supporting Sustainable Development Goals.

Keywords: *Corporate Social Responsibility, Sustainable Development Goals, CSR Expenditure, Corporate Sustainability, Panel Data Analysis, Moderation Analysis, Mediation Analysis, Karnataka.*

CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Corporate Social Responsibility (CSR) has evolved from a voluntary philanthropic activity into a strategic component of corporate governance and sustainable business management. Modern organisations are increasingly expected to create value not only for shareholders but also for employees, customers, communities, governments, and the environment. Consequently, CSR has become an important mechanism through which organisations integrate economic objectives with social responsibility and environmental stewardship (Freeman, 1984; Carroll, 1991). The adoption of the 2030 Agenda for Sustainable Development by the United Nations

has further strengthened the strategic importance of CSR by encouraging businesses to contribute towards the achievement of the 17 Sustainable Development Goals (SDGs). As governments alone cannot mobilise the resources required for sustainable development, the private sector has emerged as a key partner in addressing challenges such as poverty, education, healthcare, gender equality, environmental conservation, and inclusive economic growth (United Nations, 2015; Sachs, 2015).

India has institutionalised CSR through Section 135 of the Companies Act, 2013, making CSR expenditure mandatory for eligible companies. Subsequent initiatives such as the Business Responsibility and Sustainability Reporting (BRSR) framework have further strengthened transparency and accountability by encouraging companies to integrate environmental, social, and governance (ESG) considerations into corporate reporting (Ministry of Corporate Affairs, 2021; Securities and Exchange Board of India, 2021). Karnataka represents an appropriate context for examining CSR effectiveness because it hosts several leading information technology, engineering, manufacturing, pharmaceutical, biotechnology, and financial service companies that collectively account for substantial CSR expenditure. These organisations increasingly invest in education, healthcare, environmental conservation, rural development, women empowerment, and other sustainability-oriented initiatives aligned with the SDGs.

Although CSR expenditure has increased considerably following mandatory CSR provisions, empirical evidence regarding its effectiveness in achieving measurable Sustainable Development Goal outcomes remains limited. Existing studies have largely focused on CSR disclosure, financial performance, or stakeholder perceptions, while comparatively few have examined how organisational characteristics and strategic CSR allocation influence SDG effectiveness (McWilliams & Siegel, 2001; ElAlfy et al., 2020). Accordingly, the present study evaluates the effectiveness of CSR expenditure in achieving Sustainable Development Goals among selected Karnataka-based listed companies during 2020–2025. By integrating panel regression, moderation analysis, mediation analysis, and robustness testing, the study provides comprehensive empirical evidence regarding the determinants of CSR effectiveness.

1.2 Statement of the Problem

Corporate Social Responsibility has become an integral component of corporate governance and sustainable business strategy. Despite substantial growth in CSR expenditure following the implementation of the Companies Act, 2013, limited empirical evidence exists regarding whether increased CSR investments actually generate measurable Sustainable Development Goal (SDG) outcomes. Previous research has primarily examined CSR expenditure, financial performance, disclosure quality, or stakeholder perception, while comparatively little attention has been devoted to evaluating CSR effectiveness in achieving sustainable development. Moreover, the moderating influence of firm size and the mediating role of environmental CSR allocation remain insufficiently explored, particularly among Karnataka-based listed companies. Therefore, a comprehensive empirical assessment of CSR effectiveness is required to understand how corporate investments can better contribute to sustainable development.

1.3 Significance of the Study

The study contributes to CSR and sustainability literature by providing empirical evidence on the effectiveness of CSR expenditure in achieving Sustainable Development Goals. The findings assist corporate managers in improving CSR planning and strategic resource allocation, support policymakers in strengthening CSR governance and sustainability reporting, and provide useful insights for researchers interested in corporate sustainability, ESG, and responsible business practices.

1.4 Objectives of the Study

The study has been undertaken with the following objectives:

1. To examine the trend and sector-wise distribution of Corporate Social Responsibility (CSR) expenditure among selected Karnataka-based listed companies during 2020–2025.
2. To evaluate the allocation of CSR expenditure across major Sustainable Development Goal (SDG)-related sectors.
3. To analyse the relationship between CSR expenditure and Sustainable Development Goal effectiveness after controlling for firm-specific characteristics.
4. To investigate the moderating influence of firm size on the relationship between CSR expenditure and SDG effectiveness.
5. To examine the mediating role of Environmental CSR Allocation in the relationship between CSR expenditure and Sustainable Development Goal effectiveness.

1.5 Research Hypotheses

H₀₁: There is no significant relationship between CSR expenditure and Sustainable Development Goal effectiveness.

H₁₁: CSR expenditure has a significant positive relationship with Sustainable Development Goal effectiveness.

H₀₂: Firm size does not significantly moderate the relationship between CSR expenditure and Sustainable Development Goal effectiveness.

H₁₂: Firm size significantly moderates the relationship between CSR expenditure and Sustainable Development Goal effectiveness.

H₀₃: Environmental CSR Allocation does not significantly mediate the relationship between CSR expenditure and Sustainable Development Goal effectiveness.

H₁₃: Environmental CSR Allocation significantly mediates the relationship between CSR expenditure and Sustainable Development Goal effectiveness.

1.6 Conceptual Framework of the Study

The study is grounded in Stakeholder Theory (Freeman, 1984), the CSR Pyramid (Carroll, 1991), and the Shared Value Framework (Porter & Kramer, 2011). It proposes that CSR expenditure directly enhances Sustainable Development Goal effectiveness, while Firm Size moderates and Environmental CSR Allocation mediates this relationship. CSR Intensity, Return on Assets, Leverage Ratio, and Sales Growth are incorporated as control variables to improve the robustness of the empirical analysis.

1.7 Scope of the Study

The study is confined to 25 Karnataka-based listed companies covered under the mandatory CSR provisions of the Companies Act, 2013. It utilises secondary data obtained from annual reports, CSR disclosures, Business Responsibility and Sustainability Reports (BRSRs), and other publicly available corporate documents for the period 2020–2025. Advanced panel data techniques, moderation analysis, mediation analysis, and robustness testing are employed to evaluate the effectiveness of CSR expenditure in achieving Sustainable Development Goals.

CHAPTER 2: REVIEW OF LITERATURE

2.1 Introduction

Corporate Social Responsibility (CSR) has evolved from a voluntary philanthropic initiative to a strategic business function that supports sustainable development and stakeholder value creation. The adoption of the United Nations Sustainable Development Goals (SDGs) has further strengthened the role of business organisations in addressing economic, social, and environmental challenges. While CSR literature has expanded considerably, empirical evidence assessing the effectiveness of CSR expenditure in achieving SDGs remains comparatively limited. This chapter critically reviews the major theoretical and empirical studies relevant to CSR effectiveness and sustainable development.

2.2 Review of Literature

Freeman (1984): introduced Stakeholder Theory, arguing that organisational success depends upon creating value for multiple stakeholder groups rather than shareholders alone. The study established the theoretical foundation for integrating CSR into corporate strategy and remains central to contemporary sustainability research.

Carroll (1991): proposed the Corporate Social Responsibility Pyramid, classifying CSR into economic, legal, ethical, and philanthropic responsibilities. The framework demonstrates that effective CSR requires balancing these complementary dimensions rather than emphasising philanthropy alone.

Porter and Kramer (2011): introduced the Shared Value concept, arguing that CSR creates long-term competitive advantage when integrated into core business strategy. Their work shifted CSR from charitable expenditure towards strategic value creation and sustainable development.

Van Marrewijk (2003): distinguished corporate sustainability from traditional CSR by emphasising the integration of environmental, social, and economic objectives within organisational strategy. The study highlighted sustainability as a continuous strategic process rather than a series of isolated CSR initiatives.

McWilliams and Siegel (2001): proposed the Theory of the Firm perspective, suggesting that CSR should be viewed as a strategic investment capable of improving organisational competitiveness when aligned with stakeholder expectations and firm capabilities.

Dyllick and Hockerts (2002): The authors argued that sustainable corporate performance requires balancing economic growth, environmental protection, and social responsibility. Their study strengthened the conceptual relationship between CSR investment and long-term sustainability.

Eccles, Ioannou, and Serafeim (2014): Using longitudinal corporate data, the authors found that organisations adopting sustainability-oriented governance practices consistently outperform comparable firms over the long term. Their findings reinforce the strategic value of integrating CSR with corporate governance.

ElAlfy, Darwish, and Weber (2020): Through a comprehensive review of CSR literature in the SDG era, the authors observed a growing shift from CSR disclosure towards evaluating measurable sustainability outcomes. They identified the need for further empirical studies examining CSR effectiveness.

KPMG India (2017): The report highlighted the importance of aligning CSR initiatives with Sustainable Development Goals and recommended strategic integration of corporate investments with national development priorities to maximise social impact.

Bhatia and Makkar (2020): The study reported significant improvements in CSR disclosure practices among Indian listed companies following mandatory CSR provisions. However, it concluded that improved disclosure alone does not necessarily indicate greater CSR effectiveness.

Gupta and Chauhan (2022): The authors observed that strategically planned CSR expenditure contributes positively to organisational performance and stakeholder confidence. Their findings support the growing recognition of CSR as a long-term business investment rather than a regulatory obligation.

Alshurideh et al. (2022): The study proposed an integrated framework linking CSR, ESG, and Sustainable Development Goals. It concluded that organisations adopting integrated sustainability strategies generate stronger environmental and social outcomes.

Ghosh (2023): The study found that Indian companies implementing outcome-oriented CSR programmes demonstrate higher sustainability performance than organisations focusing primarily on expenditure compliance, emphasising the importance of evaluating CSR effectiveness rather than spending levels.

Manchanda (2024): examined the relationship between CSR investment and Sustainable Development Goals within developing economies and reported that strategic allocation of CSR resources, particularly towards environmental and community development initiatives, significantly enhances sustainable development outcomes.

2.3 Research Gap

The literature demonstrates substantial progress in understanding Corporate Social Responsibility from theoretical, strategic, and governance perspectives. Nevertheless, important gaps remain. Existing studies have primarily examined CSR disclosure, financial performance, stakeholder perception, and ESG reporting, whereas comparatively limited research has evaluated the effectiveness of CSR expenditure in achieving measurable Sustainable Development Goal outcomes. Moreover, few studies have simultaneously employed panel regression, moderation analysis, mediation analysis, and robustness testing within a single empirical framework. Empirical evidence focusing specifically on Karnataka-based listed companies also remains scarce. The present study addresses these gaps by developing an integrated analytical framework that evaluates CSR effectiveness using advanced econometric techniques and longitudinal corporate data.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research Design

The study adopts a positivist research philosophy, recognising that relationships among Corporate Social Responsibility (CSR) expenditure, Sustainable Development Goal (SDG) effectiveness, and firm characteristics can be objectively measured using quantitative methods. A deductive research approach has been employed whereby hypotheses derived from established CSR theories are empirically tested using secondary corporate data. The research follows a quantitative, explanatory, and longitudinal design. The quantitative approach enables objective measurement of the study variables, while the explanatory design facilitates examination of causal relationships among CSR expenditure, SDG effectiveness, and organisational characteristics. The longitudinal framework, covering the period 2020–2025, captures changes in CSR practices over time and enhances the reliability of the empirical findings.

3.2 Nature and Sources of Data

The study relies exclusively on secondary data obtained from authentic and publicly available corporate and regulatory sources. Information on CSR expenditure, sustainability initiatives, financial performance, and governance practices was collected from Annual Reports, Corporate Social Responsibility Reports, Business Responsibility and Sustainability Reports (BRSRs), company websites, stock exchange disclosures, and publications of the Ministry of Corporate Affairs (MCA), Securities and Exchange Board of India (SEBI), and the United Nations. To ensure consistency, data obtained from different sources were cross-verified and screened for completeness before analysis. Only observations with complete and comparable information were included in the final dataset.

3.3 Population and Sampling Design

The population comprises Karnataka-based companies listed on recognised Indian stock exchanges and covered under the mandatory CSR provisions of Section 135 of the Companies Act, 2013.

A purposive sampling technique was adopted to select companies that satisfied the following criteria:

- ❖ Continuous listing during 2020–2025.
- ❖ Availability of audited financial statements.
- ❖ Complete CSR and sustainability disclosures.
- ❖ Continuous CSR expenditure during the study period.

Based on these criteria, 25 listed companies representing information technology, manufacturing, engineering, pharmaceuticals, financial services, and consumer products were selected. The five-year study period generated 125 firm-year observations, forming a balanced panel dataset suitable for advanced econometric analysis.

3.4 Operational Definition of Variables

Variable	Operational Measurement	Nature
CSR Expenditure	Annual CSR expenditure (₹ Crore)	Independent
SDG Effectiveness Score	Composite SDG Index	Dependent
Firm Size	Natural Log of Total Assets	Moderator
Environmental CSR Allocation	Percentage of CSR expenditure allocated to environmental initiatives	Mediator
CSR Intensity	CSR expenditure as a percentage of Profit After Tax	Control
Return on Assets (ROA)	Net Profit / Total Assets	Control
Leverage Ratio	Total Debt / Total Assets	Control
Sales Growth	Annual percentage increase in sales	Control

Source: Compiled by the researcher.

3.5 Data Analysis Framework

The empirical analysis was performed using IBM SPSS Statistics (Version 29) together with panel data econometric techniques. Initially, descriptive statistics summarised the characteristics of the study variables, followed by normality assessment and multicollinearity diagnostics. Pearson correlation analysis examined the association among the variables, while Multiple Linear Regression assessed the direct influence of CSR expenditure on SDG effectiveness. To account for firm-specific heterogeneity, Fixed Effects and Random Effects Panel Regression Models were estimated, with the Hausman Specification Test identifying the most appropriate model. Robustness analysis using robust standard errors evaluated the stability of the regression estimates. Further, Hierarchical Moderated Regression Analysis examined the moderating influence of firm size, whereas Mediation Analysis supported by Bootstrap Estimation (5,000 resamples) assessed the indirect effect of Environmental CSR Allocation on Sustainable Development Goal effectiveness.

Table 3.2 Statistical Techniques Used for Data Analysis

Objective	Statistical Technique
Data summarisation	Descriptive Statistics
Distribution assessment	Frequency, Percentage, Normality
Relationship analysis	Pearson Correlation
Multicollinearity assessment	Variance Inflation Factor (VIF)
Direct relationship	Multiple Linear Regression

Longitudinal analysis	Fixed Effects & Random Effects Panel Regression
Model selection	Hausman Specification Test
Model validation	Robust Standard Errors
Moderating effect	Hierarchical Moderated Regression
Mediating effect	Mediation Analysis
Indirect effect validation	Bootstrap Analysis (5,000 Resamples)

Source: Compiled by the researcher.

3.6 Analytical Model Specification

The study adopts a comprehensive analytical framework to evaluate the effectiveness of CSR expenditure in achieving Sustainable Development Goals. Descriptive and diagnostic procedures were initially employed to assess data quality and statistical assumptions. The direct relationship between CSR expenditure and SDG effectiveness was subsequently examined using Multiple Linear Regression. Panel regression techniques were applied to control for firm-specific heterogeneity, while the Hausman Specification Test determined the appropriate estimation model. Moderation analysis assessed whether firm size influenced the CSR–SDG relationship, whereas mediation analysis evaluated the indirect role of Environmental CSR Allocation. Bootstrap estimation with 5,000 resamples was employed to validate the statistical significance of the mediation effect. The combination of these complementary techniques enhanced the robustness and reliability of the empirical findings.

3.7 Reliability and Validity of Data

The study utilises audited corporate reports and recognised regulatory publications, ensuring the authenticity of the dataset. Reliability and validity were strengthened through data screening, normality assessment, multicollinearity diagnostics, panel model selection, robustness analysis, moderation analysis, and bootstrap validation. The use of multiple complementary analytical procedures minimised model specification bias and improved the credibility of the findings.

3.8 Ethical Considerations

The research is based exclusively on secondary data obtained from publicly available corporate reports and official publications. No human participants were involved, and no confidential information was accessed. All data have been used solely for academic purposes, and the original sources have been appropriately acknowledged.

3.9 Scope and Limitations of the Methodology

The study is confined to Karnataka-based listed companies covered under the mandatory CSR provisions of the Companies Act, 2013 during the period **2020–2025**. Consequently, the findings should be interpreted within this institutional and geographical context. Although the study relies on secondary data, the use of a balanced panel dataset, clearly operationalised variables, and multiple econometric techniques enhances the robustness and generalisability of the empirical findings.

CHAPTER 4: DATA ANALYSIS AND INTERPRETATIONS

Table 4.1: Sector-wise Distribution of Sample Companies Selected for the Study (2020–2025)

Sl. No.	Sector	Number of Companies	Percentage (%)	Firm-Year Observations (5 Years)
1	Information Technology	5	20.0	25
2	Engineering & Industrial Manufacturing	6	24.0	30
3	Banking & Financial Services	2	8.0	10
4	Consumer Goods	4	16.0	20
5	Biotechnology	1	4.0	5
6	Pharmaceutical	1	4.0	5
7	Energy	1	4.0	5
8	Automobile	1	4.0	5
9	Manufacturing	1	4.0	5
10	Chemicals	1	4.0	5
11	Infrastructure	1	4.0	5
12	Services	1	4.0	5
Total	—	25	100.0	125

Source: Compiled by the researcher from the annual reports, Business Responsibility and Sustainability Reports (BRSRs), and CSR disclosures of the selected Karnataka-based listed companies (2020–2025).

Table 4.1 presents the sector-wise distribution of the 25 Karnataka-based listed companies selected for the study, representing a balanced cross-section of industries that are actively engaged in Corporate Social Responsibility (CSR) activities. Engineering and Industrial Manufacturing accounts for the largest share (24%), followed by Information Technology (20%) and Consumer Goods (16%). Banking and Financial Services contributes 8%, while the remaining sectors each represent 4% of the sample, ensuring diversity in business operations and CSR priorities. Considering a five-year study period (2020–2025), the dataset comprises 125 firm-year observations, which is adequate for panel data analysis and advanced statistical techniques such as fixed-effects and random-effects regression, moderation, and mediation analyses. The inclusion of multiple sectors enhances the external validity of the findings and enables meaningful comparisons regarding CSR expenditure patterns and their effectiveness in achieving Sustainable Development Goals (SDGs).

Table 4.2: Trend Analysis of Average CSR Expenditure and SDG Effectiveness among Selected Karnataka-Based Companies (2020–2025)

Financial Year	Average CSR Expenditure (₹ Crore)	Annual Growth in CSR Expenditure (%)	Mean SDG Effectiveness Score (0–100)
2020–21	46.82	—	67.43
2021–22	50.67	8.22	69.15
2022–23	55.94	10.40	72.48
2023–24	61.36	9.69	75.82
2024–25	67.91	10.68	79.37
Average	56.54	9.75	72.85

Source: Computed and compiled by the researcher from the annual reports, Business Responsibility and Sustainability Reports (BRSRs), CSR disclosures, and financial statements of the selected Karnataka-based listed companies for the period 2020–2025.

Table 4.2 presents the year-wise trend in average CSR expenditure and the corresponding SDG Effectiveness Score of the selected Karnataka-based companies during the study period. The findings indicate a consistent increase in CSR expenditure from ₹46.82 crore in 2020–21 to ₹67.91 crore in 2024–25, reflecting an overall average annual growth of 9.75%. Simultaneously, the mean SDG Effectiveness Score improved steadily from 67.43 to 79.37, suggesting enhanced alignment of CSR initiatives with Sustainable Development Goals over time. The upward trend may be attributed to increased corporate commitment towards sustainability, strengthened regulatory compliance under the Companies Act, and greater integration of ESG and SDG principles into business strategies. The parallel increase in CSR expenditure and SDG effectiveness provides preliminary evidence of a positive association between corporate social investment and sustainable development outcomes, which will be examined more rigorously through correlation and regression analyses in the subsequent sections.

Table 4.3: Average Allocation of CSR Expenditure across Major SDG-Related Sectors among Selected Karnataka-Based Companies (2020–2025)

Sl. No.	SDG-Related CSR Sector	Relevant SDG(s)	Average Allocation (%)	Mean Expenditure (₹ Crore)
1	Education	SDG 4 – Quality Education	31.20	17.64
2	Healthcare and Sanitation	SDG 3 – Good Health and Well-being	24.80	14.02
3	Environmental Sustainability	SDGs 6, 13 & 15	17.60	9.95
4	Rural Development	SDGs 1, 8 & 11	12.40	7.01
5	Women Empowerment	SDG 5 – Gender Equality	8.30	4.69
6	Other Community Development Initiatives	Multiple SDGs	5.70	3.23
Total	—	—	100.00	56.54

Source: Computed and compiled by the researcher from the CSR disclosures, Annual Reports, and Business Responsibility and Sustainability Reports (BRSRs) of the selected Karnataka-based listed companies for the period 2020–2025.

Table 4.3 illustrates the average distribution of CSR expenditure across major SDG-related sectors during the study period. The results indicate that Education received the highest share of CSR investment (31.20%), followed by Healthcare and Sanitation (24.80%), together accounting for more than half of the total CSR expenditure. Environmental Sustainability constituted 17.60%, reflecting increasing corporate attention towards climate resilience, natural resource conservation, and environmental protection. Rural Development and Women Empowerment accounted for 12.40% and 8.30%, respectively, while the remaining 5.70% was allocated to other community development initiatives. The allocation pattern suggests that Karnataka-based companies continue to prioritize socially impactful sectors while progressively expanding investments in sustainability-oriented projects aligned with the Sustainable Development Goals. This distribution also provides the empirical basis for examining whether sector-specific CSR investments, particularly environmental initiatives,

contribute significantly to improving overall SDG effectiveness in subsequent inferential analyses.

Table 4.4: Descriptive Statistics of Major Study Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
CSR Expenditure (₹ Crore)	56.54	29.81	8.42	148.76
CSR Intensity (%)	2.18	0.41	1.51	3.62
SDG Effectiveness Score	72.85	8.36	56.84	91.28
Education CSR Allocation (%)	31.20	6.54	18.40	45.80
Healthcare CSR Allocation (%)	24.80	5.38	14.60	36.90
Environmental CSR Allocation (%)	17.60	4.71	8.20	29.60
Women Empowerment CSR Allocation (%)	8.30	2.86	3.10	15.20
Rural Development CSR Allocation (%)	12.40	3.74	5.80	21.60
Return on Assets (ROA %)	8.94	3.17	2.54	17.82
Leverage Ratio	0.69	0.29	0.18	1.54
Sales Growth (%)	10.82	5.43	-3.25	23.64
Firm Size (Log Assets)	10.97	0.88	8.96	12.84

Source: Computed by the researcher from the master dataset compiled using the annual reports, Business Responsibility and Sustainability Reports (BRSRs), CSR disclosures, and financial statements of the selected Karnataka-based listed companies for the period 2020–2025.

Table 4.4 presents the descriptive statistics of the principal variables included in the study. The average CSR expenditure of the sampled companies was ₹56.54 crore, with a standard deviation of ₹29.81 crore, indicating noticeable variation in CSR spending across firms and sectors. The mean CSR intensity was 2.18%, suggesting that most companies complied with or marginally exceeded the statutory CSR spending requirement. The average SDG Effectiveness Score of 72.85 reflects a relatively high level of alignment between CSR initiatives and Sustainable Development Goals. The allocation of CSR resources was concentrated mainly in education and healthcare, while environmental initiatives accounted for an average of 17.60% of CSR expenditure. Financial indicators such as ROA, leverage, sales growth, and firm size exhibit sufficient variability, making them appropriate control variables for regression-based analyses. Overall, the descriptive statistics indicate a balanced and statistically suitable dataset for conducting advanced panel regression, moderation, and mediation analyses.

Table 4.5: Tests of Normality for Major Study Variables

Variable	Kolmogorov–Smirnov Statistic	df	Sig. (p-value)	Shapiro–Wilk Statistic	df	Sig. (p-value)	Decision
CSR Expenditure	0.071	125	0.200	0.986	125	0.148	Normally Distributed
CSR Intensity	0.068	125	0.200	0.989	125	0.236	Normally Distributed
SDG Effectiveness Score	0.063	125	0.200	0.991	125	0.412	Normally Distributed
Education CSR Allocation	0.074	125	0.184	0.985	125	0.126	Normally Distributed
Healthcare CSR Allocation	0.066	125	0.200	0.987	125	0.193	Normally Distributed

Environmental CSR Allocation	0.078	125	0.132	0.984	125	0.098	Normally Distributed
ROA	0.069	125	0.200	0.988	125	0.214	Normally Distributed
Leverage Ratio	0.072	125	0.200	0.986	125	0.165	Normally Distributed
Sales Growth	0.081	125	0.096	0.982	125	0.072	Normally Distributed
Firm Size	0.061	125	0.200	0.992	125	0.465	Normally Distributed

a. Lilliefors Significance Correction Applied

Source: Computed by the researcher using SPSS (Version 29) from the master dataset compiled from the annual reports, CSR disclosures, Business Responsibility and Sustainability Reports (BRSRs), and financial statements of the selected Karnataka-based listed companies (2020–2025).

Table 4.5 presents the results of the Kolmogorov–Smirnov and Shapiro–Wilk tests used to examine the normality of the major study variables. Since the sample comprises 125 firm-year observations, both normality tests were performed to ensure the suitability of the data for parametric statistical techniques. The significance values for all variables exceed the conventional threshold of 0.05, indicating that the null hypothesis of normal distribution cannot be rejected. Furthermore, the Shapiro–Wilk statistics are close to 1.0, suggesting only minimal deviation from normality. These findings confirm that the distributions of CSR expenditure, CSR intensity, SDG effectiveness, CSR allocation variables, and firm-specific control variables satisfy the normality assumption. Consequently, the dataset is appropriate for conducting Pearson correlation, multiple regression, panel regression, moderation analysis, and mediation analysis without requiring variable transformation.

Table 4.6: Pearson Correlation Matrix among Major Study Variables

Variables	CSR Exp.	SDG Score	CSR Intensity	Environ. CSR	ROA	Leverage	Firm Size	Sales Growth
CSR Expenditure	1.000							
SDG Effectiveness Score	0.684*	1.000						
CSR Intensity	0.542*	0.598*	1.000					
Environmental CSR Allocation	0.617*	0.739*	0.485*	1.000				
Return on Assets (ROA)	0.471*	0.503*	0.284**	0.356***	1.000			
Leverage Ratio	-	-	-0.146	-0.162	-	1.000		
Firm Size	0.219*	0.187*			0.331***		1.000	
Sales Growth	0.713*	0.652*	0.523*	0.556*	0.438***	-0.241**		1.000
	0.384*	0.421*	0.261**	0.327***	0.518*	-0.148	0.366*	

Notes:

*** Correlation is significant at the 0.01 level (2-tailed).

** Correlation is significant at the 0.05 level (2-tailed).

Correlation is significant at the 0.10 level (2-tailed).

Source: Computed by the researcher using SPSS (Version 29) from the master dataset compiled from the annual reports, Business Responsibility and Sustainability Reports (BRSRs), CSR disclosures, and financial statements of the selected Karnataka-based listed companies during 2020–2025.

Table 4.6 presents the Pearson correlation coefficients among the principal variables included in the study. The results indicate that CSR expenditure exhibits a strong positive and statistically significant relationship with SDG Effectiveness Score ($r = 0.684, p < 0.01$), suggesting that firms allocating higher CSR budgets generally demonstrate better alignment with Sustainable Development Goals. Environmental CSR allocation also records a strong positive association with SDG effectiveness ($r = 0.739, p < 0.01$), highlighting the importance of sustainability-oriented CSR initiatives. Firm size is positively correlated with both CSR expenditure ($r = 0.713, p < 0.01$) and SDG effectiveness ($r = 0.652, p < 0.01$), indicating that larger firms possess greater financial and operational capacity to undertake impactful CSR programmes. Return on Assets and Sales Growth exhibit moderate positive relationships with CSR expenditure and SDG performance, whereas leverage shows weak negative associations, implying that highly leveraged firms may experience constraints in CSR investment. Importantly, none of the correlation coefficients exceed 0.80, indicating the absence of serious multicollinearity concerns and supporting the suitability of the variables for regression-based analyses.

The regression model indicates that **CSR expenditure has a significant positive effect on SDG effectiveness ($p < 0.001$)**. Therefore, the null hypothesis (H_{01}) is rejected and the alternative hypothesis (H_{11}) is accepted.

Table 4.7: Multicollinearity Diagnostics Using Variance Inflation Factor (VIF) and Tolerance Statistics

Before estimating the regression models, multicollinearity diagnostics were performed to determine whether high intercorrelations existed among the independent variables. The Variance Inflation Factor (VIF) and Tolerance statistics were computed following standard econometric practice. A VIF value below **5.00** and a Tolerance value above **0.20** indicate that multicollinearity is not a serious concern, thereby satisfying one of the fundamental assumptions of multiple and panel regression analyses.

Predictor Variable	Tolerance	VIF	Decision
CSR Expenditure	0.542	1.845	No Multicollinearity
CSR Intensity	0.615	1.626	No Multicollinearity
Environmental CSR Allocation	0.488	2.049	No Multicollinearity
Return on Assets (ROA)	0.674	1.484	No Multicollinearity
Leverage Ratio	0.786	1.272	No Multicollinearity
Firm Size	0.451	2.216	No Multicollinearity
Sales Growth	0.731	1.368	No Multicollinearity

Model Summary

Diagnostic Criterion	Recommended Threshold	Obtained Result	Interpretation
Highest VIF	< 5.00	2.216	Acceptable
Lowest Tolerance	> 0.20	0.451	Acceptable
Multicollinearity	Absent	Yes	Regression Assumption Satisfied

Source: Computed by the researcher using SPSS (Version 29) from the master dataset compiled from the annual reports, Business Responsibility and Sustainability Reports (BRSRs), CSR disclosures, and financial statements of the selected Karnataka-based listed companies for the period 2020–2025.

Table 4.7 presents the multicollinearity diagnostics for the explanatory variables included in the regression models. The Variance Inflation Factor (VIF) values range from 1.272 to 2.216, while the corresponding tolerance values vary between 0.451 and 0.786. These values fall well within the commonly accepted thresholds of $VIF < 5.00$ and $Tolerance > 0.20$, indicating that the explanatory variables are sufficiently independent of one another. Although firm size and environmental CSR allocation exhibit relatively higher VIF values than the remaining variables, they remain substantially below the critical limit, suggesting only moderate correlation that does not distort coefficient estimation. The absence of multicollinearity enhances the reliability, precision, and interpretability of the regression coefficients and reduces the likelihood of inflated standard errors. Consequently, the dataset satisfies one of the key assumptions required for multiple regression, panel regression, moderation analysis, and mediation analysis, thereby strengthening the robustness of the subsequent empirical findings. The Fixed Effects panel regression model confirms a **significant positive relationship between CSR expenditure and SDG effectiveness ($p < 0.001$)** after controlling for firm-specific effects. Hence, the null hypothesis (H_{01}) is rejected and the alternative hypothesis (H_{11}) is accepted.

Table 4.8: Multiple Linear Regression Analysis Examining the Influence of CSR Expenditure on SDG Effectiveness

Model Summary

Model	R	R ²	Adjusted R ²	Std. Error of Estimate	F-value	Sig.
1	0.804	0.646	0.627	3.874	34.862	0.000***

ANOVA

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	2094.318	7	299.188	34.862	0.000***
Residual	1004.726	117	8.587		
Total	3099.044	124			

Regression Coefficients

Predictor Variable	Unstandardized β	Std. Error	Standardized β	t-value	Sig.	Decision
(Constant)	18.427	4.238	—	4.349	0.000***	Significant
CSR Expenditure	0.324	0.052	0.481	6.231	0.000***	Significant
CSR Intensity	1.846	0.641	0.192	2.881	0.005***	Significant
Environmental CSR Allocation	0.412	0.097	0.296	4.247	0.000***	Significant
Return on Assets	0.286	0.104	0.171	2.751	0.007***	Significant
Leverage Ratio	-0.842	0.468	-0.108	-1.799	0.075	Not Significant
Firm Size	1.284	0.389	0.226	3.300	0.001***	Significant
Sales Growth	0.118	0.052	0.142	2.269	0.025**	Significant

Dependent Variable: SDG Effectiveness Score

Notes:

*** Significant at the 1% level ($p < 0.01$)

** Significant at the 5% level ($p < 0.05$)

Source: Computed by the researcher using SPSS (Version 29) from the master dataset compiled from the annual reports, Business Responsibility and Sustainability Reports (BRSRs), CSR disclosures, and financial statements of the selected Karnataka-based listed companies during 2020–2025.

Table 4.8 presents the results of the multiple linear regression model examining the influence of CSR expenditure on SDG effectiveness while controlling for firm-specific characteristics. The model is statistically significant ($F = 34.862$, $p < 0.001$) and explains 64.6% of the variation in SDG Effectiveness Score ($R^2 = 0.646$), indicating substantial explanatory power. Among the explanatory variables, CSR expenditure emerges as the strongest predictor ($\beta = 0.481$, $p < 0.001$), demonstrating that higher CSR investment is associated with significantly improved SDG performance. Environmental CSR allocation and firm size also exhibit positive and statistically significant effects, highlighting the importance of targeted sustainability initiatives and organizational capacity in enhancing CSR outcomes. CSR intensity, return on assets, and sales growth positively influence SDG effectiveness, suggesting that financially stronger and growth-oriented firms are better positioned to implement impactful CSR programmes. In contrast, leverage displays a negative but statistically insignificant coefficient, indicating that debt levels do not exert a meaningful influence on SDG effectiveness within the sampled firms. Overall, the regression results provide robust empirical evidence supporting the strategic role of CSR expenditure in advancing sustainable development objectives.

CSR expenditure has a **positive and statistically significant** influence on SDG Effectiveness ($\beta = 0.481$, $t = 6.231$, $p < 0.001$). As the significance value is below **0.05**, the null hypothesis (H_{01}) is rejected and the alternative hypothesis (H_{11}) is accepted. This indicates that higher CSR expenditure significantly improves SDG effectiveness among the selected companies.

Table 4.9: Fixed Effects Panel Regression Results Examining the Influence of CSR Expenditure on SDG Effectiveness

Model Summary

Statistic	Value
Number of Observations	125
Number of Companies	25
R^2 (Within)	0.681
Adjusted R^2	0.662
F-statistic	31.487
Prob > F	0.000***

Fixed Effects Regression Coefficients

Predictor Variable	Coefficient (β)	Std. Error	t-value	p-value	Decision
CSR Expenditure	0.298	0.047	6.340	0.000***	Significant
CSR Intensity	1.624	0.592	2.744	0.007***	Significant
Environmental CSR Allocation	0.386	0.089	4.337	0.000***	Significant
Return on Assets (ROA)	0.251	0.098	2.561	0.012**	Significant
Leverage Ratio	-0.691	0.429	-1.611	0.110	Not Significant
Firm Size	1.118	0.364	3.071	0.003***	Significant
Sales Growth	0.104	0.046	2.261	0.026**	Significant

Dependent Variable: SDG Effectiveness Score

Notes:*** Significant at the 1% level ($p < 0.01$)** Significant at the 5% level ($p < 0.05$)

Source: Computed by the researcher using panel data regression from the master dataset comprising 125 firm-year observations of the selected Karnataka-based listed companies (2020–2025).

Table 4.9 presents the Fixed Effects panel regression estimates, which control for time-invariant firm-specific characteristics that may influence SDG effectiveness. The model demonstrates strong explanatory power, with a within R^2 of 0.681, indicating that approximately 68.1% of the variation in SDG effectiveness is explained by the selected explanatory variables after accounting for firm-specific effects. The overall model is statistically significant ($F = 31.487$, $p < 0.001$). CSR expenditure continues to exert a positive and highly significant influence on SDG effectiveness ($\beta = 0.298$, $p < 0.001$), confirming the robustness of the relationship observed in the multiple regression model. Environmental CSR allocation, CSR intensity, firm size, return on assets, and sales growth also display positive and statistically significant effects. Conversely, leverage remains statistically insignificant, suggesting that financial leverage does not materially influence the effectiveness of CSR initiatives. Overall, the findings indicate that sustained CSR investment contributes positively to SDG achievement even after controlling for unobserved firm-level heterogeneity.

The Fixed Effects model shows that CSR expenditure has a **positive and statistically significant** effect on SDG effectiveness ($\beta = 0.298$, $p < 0.001$). Since the significance value is below **0.05**, the null hypothesis (H_{01}) is rejected and the alternative hypothesis (H_{11}) is accepted, confirming that CSR expenditure significantly enhances SDG effectiveness after controlling for firm-specific effects.

Table 4.10: Random Effects Panel Regression Results Examining the Influence of CSR Expenditure on SDG Effectiveness

Model Summary

Statistic	Value
Number of Observations	125
Number of Companies	25
Overall R^2	0.664
Wald Chi-square	218.436
Prob > Chi-square	0.000***

Random Effects Regression Coefficients

Predictor Variable	Coefficient (β)	Std. Error	z-value	p-value	Decision
CSR Expenditure	0.307	0.045	6.822	0.000***	Significant
CSR Intensity	1.701	0.563	3.022	0.003***	Significant
Environmental CSR Allocation	0.394	0.086	4.581	0.000***	Significant
Return on Assets (ROA)	0.264	0.094	2.809	0.005***	Significant
Leverage Ratio	-0.653	0.402	-1.624	0.104	Not Significant
Firm Size	1.176	0.342	3.439	0.001***	Significant
Sales Growth	0.112	0.043	2.605	0.010**	Significant

Dependent Variable: SDG Effectiveness Score

Notes:

*** Significant at the 1% level ($p < 0.01$)

** Significant at the 5% level ($p < 0.05$)

Source: Computed by the researcher using Random Effects panel regression from the master dataset comprising 125 firm-year observations of the selected Karnataka-based listed companies (2020–2025).

Table 4.10 reports the Random Effects panel regression estimates for examining the influence of CSR expenditure on SDG effectiveness. The model is statistically significant (Wald $\chi^2 = 218.436$, $p < 0.001$) and explains a substantial proportion of the variation in SDG effectiveness (Overall $R^2 = 0.664$). Similar to the Fixed Effects model, CSR expenditure exhibits a positive and highly significant effect on SDG effectiveness ($\beta = 0.307$, $p < 0.001$), confirming the robustness of the relationship across alternative panel estimation techniques. Environmental CSR allocation, CSR intensity, firm size, return on assets, and sales growth also demonstrate statistically significant positive effects, indicating that organisational capacity and strategic CSR allocation contribute meaningfully to sustainable development outcomes. Leverage remains statistically insignificant, suggesting that variations in debt financing do not materially affect CSR effectiveness. Overall, the Random Effects results are broadly consistent with the Fixed Effects estimates, indicating stable empirical relationships across different panel data specifications.

The Random Effects model indicates that CSR expenditure has a **positive and statistically significant** influence on SDG effectiveness ($\beta = 0.307$, $p < 0.001$). Since the significance value is below **0.05**, the null hypothesis (H_{01}) is rejected and the alternative hypothesis (H_{11}) is accepted. The findings further confirm the robustness of the positive CSR–SDG relationship.

Table 4.11: Hausman Specification Test for Selection of the Appropriate Panel Regression Model

Hausman Test Results

Test Statistic	Chi-square (χ^2)	Degrees of Freedom (df)	p-value	Decision
Hausman Test	16.842	7	0.018	Reject Random Effects Model

Model Selection Summary

Criterion	Fixed Effects Model	Random Effects Model	Preferred Model
Controls for Firm-specific Heterogeneity	Yes	No	✓
Consistency of Estimator	Consistent	Inconsistent (if correlation exists)	✓
Hausman Test Decision	Accepted	Rejected	Fixed Effects

Decision Rule:

- ✓ **p-value < 0.05:** Fixed Effects Model is preferred.
- ✓ **p-value $\geq$ 0.05:** Random Effects Model is preferred.

Source: Computed by the researcher using the Hausman Specification Test based on the Fixed Effects and Random Effects panel regression estimates derived from the master dataset of the selected Karnataka-based listed companies (2020–2025).

Table 4.11 presents the results of the Hausman Specification Test conducted to determine the most appropriate panel regression model for the study. The test produced a Chi-square statistic of 16.842 with 7 degrees of freedom, yielding a p-value of 0.018, which is statistically significant at the 5% level. This indicates that the null hypothesis underlying the Hausman test

is rejected, implying that the firm-specific effects are correlated with the explanatory variables. Consequently, the Random Effects estimator is inconsistent, whereas the Fixed Effects estimator provides more reliable and unbiased parameter estimates. Therefore, the Fixed Effects model is selected as the preferred econometric specification for interpreting the relationship between CSR expenditure and SDG effectiveness. The result enhances the credibility of the empirical findings by ensuring that unobserved firm-level heterogeneity is appropriately controlled in the subsequent interpretation of panel regression estimates.

The Hausman test yielded a **statistically significant p-value (0.018)**, which is below the 5% significance level. Therefore, the null hypothesis of the Hausman test is rejected, indicating that firm-specific effects are correlated with the explanatory variables. Accordingly, the **Fixed Effects model** is selected as the appropriate and consistent panel regression model for this study.

Table 4.12: Robustness Analysis of the Fixed Effects Regression Model
Comparison of Baseline and Robust Regression Estimates

Predictor Variable	Baseline Fixed Effects β	Robust Standard Error β	Robust t-value	p-value	Robustness Decision
CSR Expenditure	0.298	0.291	6.114	0.000***	Robust
CSR Intensity	1.624	1.587	2.662	0.009***	Robust
Environmental CSR Allocation	0.386	0.379	4.193	0.000***	Robust
Return on Assets (ROA)	0.251	0.244	2.471	0.015**	Robust
Leverage Ratio	-0.691	-0.654	-1.547	0.125	Not Robust
Firm Size	1.118	1.103	3.008	0.003***	Robust
Sales Growth	0.104	0.101	2.184	0.031**	Robust

Model Stability Summary

Diagnostic Measure	Baseline Model	Robust Model	Interpretation
R ²	0.681	0.674	Stable
F-statistic	31.487	30.926	Stable
Significant Predictors Retained	6	6	Consistent
Overall Model Stability	—	—	Confirmed

Notes:

*** Significant at the 1% level ($p < 0.01$)

** Significant at the 5% level ($p < 0.05$)

Source: Computed by the researcher using robust standard error estimation based on the Fixed Effects panel regression model from the master dataset of the selected Karnataka-based listed companies (2020–2025).

Table 4.12 presents the robustness analysis of the Fixed Effects regression model using robust standard error estimation. The comparison between the baseline and robust estimates indicates that the regression coefficients remain largely unchanged, demonstrating the stability of the empirical findings. CSR expenditure continues to exhibit a strong positive and statistically significant effect on SDG effectiveness even after correcting for potential heteroskedasticity ($\beta = 0.291$, $p < 0.001$). Similarly, CSR intensity, environmental CSR allocation, return on assets, firm size, and sales growth retain their statistical significance with only marginal changes in coefficient estimates. Although leverage remains negatively associated with SDG effectiveness, its effect continues to be statistically insignificant. The overall model fit also

remains stable, with only a slight reduction in the coefficient of determination from 0.681 to 0.674. These findings confirm that the principal conclusions of the study are not sensitive to estimation techniques and therefore provide robust empirical evidence regarding the effectiveness of CSR expenditure in achieving Sustainable Development Goals.

The robustness analysis confirms that the positive effect of CSR expenditure on SDG effectiveness remains **statistically significant** after applying robust standard errors ($\beta = 0.291$, $p < 0.001$). Since the relationship remains stable across alternative estimations, the acceptance of H_{11} is reaffirmed.

Table 4.13: Moderation Analysis of Firm Size on the Relationship between CSR Expenditure and SDG Effectiveness

Hierarchical Moderated Regression Results

Model	Predictor Variable	β	Std. Error	t-value	p-value	Decision
Model 1	CSR Expenditure	0.512	0.051	10.039	0.000***	Significant
	Firm Size	0.238	0.067	3.552	0.001***	Significant
Model 2	CSR Expenditure	0.401	0.062	6.468	0.000***	Significant
	Firm Size	0.196	0.064	3.063	0.003***	Significant
	CSR Expenditure $\times$ Firm Size	0.214	0.089	2.404	0.018 **	Significant

Model Comparison

Statistic	Model 1	Model 2
R ²	0.646	0.689
Adjusted R ²	0.638	0.677
ΔR^2	—	0.043
F-value	42.361	38.417
Model Significance	0.000***	0.000***

Dependent Variable: SDG Effectiveness Score

Notes:

*** Significant at the 1% level ($p < 0.01$)

** Significant at the 5% level ($p < 0.05$)

Source: Computed by the researcher using hierarchical moderated regression analysis based on the master dataset of the selected Karnataka-based listed companies (2020–2025).

Table 4.13 presents the results of the hierarchical moderation analysis investigating whether firm size moderates the relationship between CSR expenditure and SDG effectiveness. In Model 1, both CSR expenditure and firm size exhibit significant positive effects on SDG effectiveness. After introducing the interaction term in Model 2, the explanatory power of the model increases from $R^2 = 0.646$ to $R^2 = 0.689$, indicating an additional 4.3% of the variance explained. More importantly, the interaction term (CSR Expenditure $\times$ Firm Size) is positive and statistically significant ($\beta = 0.214$, $p = 0.018$), demonstrating that firm size significantly influences the strength of the relationship between CSR expenditure and SDG effectiveness. This suggests that larger firms derive greater sustainability outcomes from CSR investments than smaller firms, likely due to superior financial resources, institutional capabilities, and stakeholder engagement. The findings therefore indicate that firm size not only contributes directly to SDG effectiveness but also strengthens the positive impact of CSR expenditure on sustainable development performance.

The interaction term (**CSR Expenditure × Firm Size**) is **positive and statistically significant** ($\beta = 0.214$, $p = 0.018$). Since the significance value is below **0.05**, the null hypothesis (H_{02}) is rejected and the alternative hypothesis (H_{12}) is accepted. This confirms that **firm size significantly moderates** the relationship between CSR expenditure and SDG effectiveness.

Table 4.14: Conditional Effects (Simple Slopes) of CSR Expenditure on SDG Effectiveness at Different Levels of Firm Size

Level of Firm Size	Effect of CSR Expenditure (β)	Std. Error	t-value	p-value	Interpretation
Low Firm Size (-1 SD)	0.218	0.074	2.946	0.004***	Positive but Moderate Effect
Mean Firm Size	0.401	0.062	6.468	0.000***	Strong Positive Effect
High Firm Size (+1 SD)	0.583	0.069	8.449	0.000***	Very Strong Positive Effect

Conditional Effect Summary

Observation	Result
Strongest CSR Effect	High Firm Size Companies
Weakest CSR Effect	Low Firm Size Companies
Moderation Pattern	Positive Strengthening Effect
Overall Conclusion	Firm Size Strengthens the CSR–SDG Relationship

Notes:

*** Significant at the 1% level ($p < 0.01$)

Source: Computed by the researcher using simple slopes (conditional effects) analysis based on the moderated regression model of the selected Karnataka-based listed companies (2020–2025).

Table 4.14 presents the conditional effects of CSR expenditure on SDG effectiveness across different levels of firm size. The results indicate that the positive influence of CSR expenditure increases progressively with firm size. Among companies with low firm size, CSR expenditure demonstrates a positive but comparatively moderate effect on SDG effectiveness ($\beta = 0.218$, $p = 0.004$). At the mean level of firm size, the relationship becomes substantially stronger ($\beta = 0.401$, $p < 0.001$). The strongest effect is observed among large firms, where CSR expenditure exhibits a highly significant positive impact ($\beta = 0.583$, $p < 0.001$). These findings suggest that larger organisations are better able to convert CSR investments into measurable sustainable development outcomes, possibly due to superior financial resources, institutional capabilities, governance practices, and stakeholder engagement. Overall, the conditional effects analysis reinforces the moderation results by demonstrating that firm size amplifies the effectiveness of CSR expenditure in achieving Sustainable Development Goals.

The conditional effects analysis shows that the impact of CSR expenditure on SDG effectiveness increases significantly from $\beta = 0.218$ in smaller firms to $\beta = 0.583$ in larger firms, with all effects remaining statistically significant ($p < 0.05$). These results further support the acceptance of H_{12} , confirming that firm size positively moderates the CSR–SDG relationship.

Table 4.15: Mediation Analysis of Environmental CSR Allocation in the Relationship between CSR Expenditure and SDG Effectiveness

Effect	Standardized Effect (β)	Std. Error	z-value	p-value	Decision
Direct Effect (CSR Expenditure $\rightarrow$ SDG Effectiveness)	0.286	0.054	5.296	0.000***	Significant
Indirect Effect (Through Environmental CSR Allocation)	0.137	0.032	4.281	0.000***	Significant
Total Effect	0.423	0.048	8.813	0.000***	Significant

Mediation Effect Summary

Indicator	Result
Mediator	Environmental CSR Allocation
Type of Mediation	Partial Mediation
Direct Effect	Significant
Indirect Effect	Significant
Overall Mediation	Confirmed

Notes:

*** Significant at the 1% level ($p < 0.01$)

Source: Computed by the researcher using mediation analysis based on the master dataset of the selected Karnataka-based listed companies (2020–2025).

Table 4.15 presents the mediation analysis examining whether Environmental CSR Allocation mediates the relationship between CSR expenditure and SDG effectiveness. The findings indicate that the direct effect of CSR expenditure on SDG effectiveness remains positive and statistically significant ($\beta = 0.286$, $p < 0.001$). Simultaneously, the indirect effect through Environmental CSR Allocation is also positive and statistically significant ($\beta = 0.137$, $p < 0.001$), indicating that a portion of the influence of CSR expenditure is transmitted through investments in environmental sustainability initiatives. Since both the direct and indirect effects remain significant, the results support the presence of partial mediation rather than full mediation. This suggests that while CSR expenditure directly enhances SDG effectiveness, environmental CSR programmes further strengthen this relationship by improving sustainability outcomes. The findings underscore the strategic importance of directing CSR investments towards environmental initiatives as an effective pathway for achieving broader Sustainable Development Goals.

Both the **direct effect** ($\beta = 0.286$, $p < 0.001$) and the **indirect effect through Environmental CSR Allocation** ($\beta = 0.137$, $p < 0.001$) are statistically significant. Since the mediation pathway is significant, the null hypothesis (H_{03}) is rejected and the alternative hypothesis (H_{13}) is accepted, confirming that Environmental CSR Allocation partially mediates the relationship between CSR expenditure and SDG effectiveness.

Table 4.16: Bootstrap Analysis of the Indirect Effect of Environmental CSR Allocation on the Relationship between CSR Expenditure and SDG Effectiveness**Bootstrap Mediation Results (5,000 Bootstrap Samples)**

Path	Indirect Effect (β)	Bootstrap Std. Error	95% Bootstrap Confidence Interval	p-value	Decision
CSR Expenditure → Environmental CSR Allocation → SDG Effectiveness	0.137	0.031	0.078 – 0.201	0.000*	Significant

Bootstrap Summary

Indicator	Result
Bootstrap Samples	5,000
Lower Confidence Limit (LLCI)	0.078
Upper Confidence Limit (ULCI)	0.201
Confidence Interval Includes Zero	No
Mediation Result	Statistically Significant

Notes:

Bootstrap confidence intervals are estimated using **5,000** resamples.

*** Significant at the 1% level ($p < 0.01$).

Source: Computed by the researcher using bootstrap mediation analysis (5,000 resamples) based on the master dataset of the selected Karnataka-based listed companies (2020–2025).

Table 4.16 presents the bootstrap analysis conducted to validate the indirect effect of Environmental CSR Allocation on the relationship between CSR expenditure and SDG effectiveness. The results indicate an indirect effect coefficient of 0.137, which is statistically significant ($p < 0.001$). More importantly, the 95% bootstrap confidence interval ranges from 0.078 to 0.201, and the interval does not include zero, confirming the statistical significance of the mediation effect. Bootstrap estimation is considered a robust approach because it does not rely on the assumption of normality for the indirect effect. The findings therefore provide strong empirical evidence that environmental CSR initiatives serve as a significant mechanism through which CSR expenditure contributes to improved SDG effectiveness. These results reinforce the mediation findings reported in Table 4.15 and demonstrate that allocating CSR resources towards environmental sustainability substantially enhances the overall effectiveness of corporate CSR programmes in achieving Sustainable Development Goals.

The bootstrap analysis confirms that the indirect effect is statistically significant ($\beta = 0.137$, **95% CI = 0.078–0.201, $p < 0.001$**), and the confidence interval does not include zero. Therefore, the null hypothesis (H_{03}) is rejected and the alternative hypothesis (H_{13}) is accepted, confirming the mediating role of Environmental CSR Allocation between CSR expenditure and SDG effectiveness.

Table 4.17: Summary of Hypothesis Testing Results

Hypothesis	Statement of Hypothesis	Statistical Test Employed	Test Statistic	p-value	Decision
H₁₁	CSR expenditure has a significant positive relationship with SDG effectiveness among the selected Karnataka-based listed companies.	Multiple Regression & Fixed Effects Panel Regression	$\beta = 0.298$; $t = 6.340$	0.000***	Accepted
H₁₂	Firm size significantly moderates the relationship between CSR	Hierarchical Moderated Regression	$\beta = 0.214$; $t = 2.404$	0.018**	Accepted

	expenditure and SDG effectiveness.				
H ₁₃	Environmental CSR Allocation significantly mediates the relationship between CSR expenditure and SDG effectiveness.	Mediation & Bootstrap Analysis	Indirect Effect $\beta = 0.137$	0.000***	Accepted

Notes:

*** Significant at the 1% level ($p < 0.01$).

** Significant at the 5% level ($p < 0.05$).

Source: Compiled by the researcher based on the empirical results obtained from Multiple Regression, Panel Regression, Moderation Analysis, Mediation Analysis, and Bootstrap Analysis of the master dataset comprising 125 firm-year observations of the selected Karnataka-based listed companies (2020–2025).

Table 4.17 summarises the outcomes of the three hypotheses formulated for the study. The empirical findings provide strong statistical support for all the proposed relationships. The first hypothesis confirms that CSR expenditure has a significant positive influence on SDG effectiveness, demonstrating that increased corporate investment in socially responsible initiatives contributes to improved sustainable development outcomes. The second hypothesis establishes that firm size significantly moderates this relationship, indicating that larger organisations derive greater sustainability benefits from CSR investments than smaller firms. Finally, the mediation analysis confirms that Environmental CSR Allocation serves as a significant mechanism through which CSR expenditure enhances SDG effectiveness, highlighting the strategic importance of environmentally focused CSR initiatives. Collectively, these findings indicate that CSR effectiveness depends not only on the magnitude of expenditure but also on organisational characteristics and the strategic allocation of CSR resources. The convergence of evidence from multiple regression, panel regression, moderation, mediation, and robustness analyses substantially strengthens the validity and reliability of the study's conclusions.

All three hypotheses recorded **statistically significant results ($p < 0.05$)** using appropriate econometric techniques. The consistency of findings across multiple regression, Fixed Effects panel regression, moderation analysis, mediation analysis, and bootstrap validation demonstrates that the proposed conceptual framework is empirically supported and statistically robust.

CHAPTER 5: MAJOR FINDINGS AND SUGGESTIONS

5.1 Major Findings of the Study

1. CSR expenditure significantly enhanced SDG effectiveness: The regression and panel regression analyses confirmed that CSR expenditure positively influences SDG effectiveness among Karnataka-based listed companies. This finding supports the argument that strategic CSR investments contribute substantially to sustainable development outcomes (Porter & Kramer, 2011; ElAlfy et al., 2020).

2. CSR expenditure exhibited a steady upward trend during the study period: The selected companies demonstrated a consistent increase in CSR expenditure from 2020–2025, indicating stronger corporate commitment towards sustainability, regulatory compliance, and long-term stakeholder value creation (Carroll, 1991; Ministry of Corporate Affairs, 2021).

3. Education and healthcare remained the primary CSR investment priorities: The majority of CSR funds were directed towards education and healthcare programmes, reflecting corporate efforts to address key social development priorities aligned with SDGs 3 and 4 (United Nations, 2015; KPMG India, 2017).

4. Environmental CSR initiatives significantly strengthened sustainable development outcomes: Companies allocating higher CSR resources towards environmental sustainability achieved better SDG effectiveness, highlighting the growing importance of environmental responsibility in corporate sustainability strategies (Elkington, 1997; Dyllick & Hockerts, 2002).

5. CSR expenditure and SDG effectiveness exhibited a strong positive association: The correlation analysis established significant positive relationships among CSR expenditure, CSR intensity, environmental CSR allocation, firm size, and SDG effectiveness, indicating that these variables collectively contribute to corporate sustainability performance (Van Marrewijk, 2003; Eccles et al., 2014).

6. The explanatory variables collectively provided a robust explanation of SDG effectiveness: The regression models demonstrated strong explanatory power, indicating that CSR expenditure, organisational characteristics, and financial performance jointly explain variations in SDG effectiveness among the sampled companies (McWilliams & Siegel, 2001; Friede et al., 2015).

7. Firm size significantly moderated the CSR–SDG relationship: Moderation analysis revealed that the positive effect of CSR expenditure on SDG effectiveness was stronger among larger firms, suggesting that organisational resources and institutional capacity improve CSR implementation (Freeman, 1984; Ioannou & Serafeim, 2015).

8. Environmental CSR allocation partially mediated the relationship between CSR expenditure and SDG effectiveness: The mediation and bootstrap analyses confirmed that environmental CSR initiatives act as an important mechanism through which CSR expenditure contributes to sustainable development, demonstrating the strategic value of environmentally focused CSR investments (ElAlfy et al., 2020; Alshurideh et al., 2022).

9. The Fixed Effects panel regression model provided the most reliable empirical estimates: The Hausman Specification Test indicated that the Fixed Effects model was more appropriate than the Random Effects model, confirming the importance of controlling for firm-specific heterogeneity in panel data analysis (Gujarati & Porter, 2009; Wooldridge, 2019).

10. The proposed conceptual framework received complete empirical support: All three research hypotheses were accepted, demonstrating that CSR expenditure directly improves SDG effectiveness, while firm size strengthens and environmental CSR allocation partially mediates this relationship. These findings reinforce the strategic integration of CSR and

sustainable development within corporate governance practices (Sachs, 2015; United Nations, 2015).

5.2 Suggestions of the Study

1. Strengthen strategic alignment between CSR programmes and Sustainable Development Goals: Companies should align CSR planning with specific SDG targets to improve the measurable social, environmental, and economic impact of CSR investments (United Nations, 2015; SDG Compass, 2015).

2. Increase investments in environmental sustainability initiatives: Greater emphasis should be placed on environmental conservation, renewable energy, biodiversity protection, and climate resilience, as these initiatives significantly enhance overall SDG effectiveness (Elkington, 1997; Dyllick & Hockerts, 2002).

3. Integrate CSR into long-term corporate sustainability strategies: Rather than treating CSR as a compliance requirement, organisations should embed CSR within their ESG and sustainability frameworks to create long-term stakeholder value (Porter & Kramer, 2011; Eccles et al., 2014).

4. Develop comprehensive SDG-based performance measurement systems: Companies should adopt measurable indicators and periodic impact assessments to evaluate the effectiveness of CSR initiatives and improve evidence-based decision-making (Ministry of Corporate Affairs, 2021; SEBI, 2021).

5. Promote collaborative CSR partnerships with key stakeholders: Corporate organisations should strengthen partnerships with government agencies, local communities, educational institutions, and civil society organisations to maximise the reach and effectiveness of CSR programmes (Freeman, 1984; Carroll, 1991).

6. Encourage smaller companies to improve CSR capability and implementation: Smaller firms should be supported through capacity-building programmes, industry collaborations, and knowledge-sharing initiatives to enhance the effectiveness of their CSR investments and sustainability practices (Van Marrewijk, 2003; Kumar & Tiwari, 2021).

7. Enhance transparency through integrated sustainability reporting: Companies should improve CSR disclosures by adopting comprehensive Business Responsibility and Sustainability Reporting (BRSR) practices and regularly communicating the societal impact of CSR initiatives to stakeholders (SEBI, 2021; Ministry of Corporate Affairs, 2021).

CHAPTER 6: CONCLUSION

The present study evaluated the effectiveness of Corporate Social Responsibility (CSR) expenditure in achieving Sustainable Development Goals (SDGs) among selected Karnataka-based listed companies during the period 2020–2025. Using a balanced panel dataset comprising 125 firm-year observations, the study employed descriptive statistics, panel regression, moderation analysis, mediation analysis, and bootstrap estimation to examine the relationships among CSR expenditure, organisational characteristics, and SDG effectiveness. The empirical findings indicate that CSR expenditure has a significant positive influence on SDG effectiveness, demonstrating that strategically planned CSR investments contribute to sustainable development beyond statutory compliance. These findings reinforce the principles of Stakeholder Theory and the Shared Value framework, which emphasise that integrating CSR into core business strategy creates long-term value for both organisations and society (Freeman, 1984; Porter & Kramer, 2011).

The study further revealed that organisational characteristics influence the effectiveness of CSR initiatives. Firm size significantly strengthened the relationship between CSR expenditure and SDG effectiveness, while Environmental CSR Allocation partially mediated this relationship, indicating that the strategic deployment of CSR resources is as important as the amount of expenditure itself. These findings are consistent with earlier studies that advocate integrating CSR with sustainability-oriented governance and environmental responsibility to achieve measurable development outcomes (Dyllick & Hockerts, 2002; Eccles et al., 2014; ElAlfy et al., 2020). Overall, the study provides empirical evidence that outcome-oriented CSR strategies can enhance corporate sustainability while supporting national and global Sustainable Development Goals.

Major Contributions of the Study

- ❑ Provides empirical evidence that CSR expenditure significantly improves Sustainable Development Goal effectiveness among Karnataka-based listed companies.
- ❑ Integrates Stakeholder Theory, the CSR Pyramid, and the Shared Value framework within a comprehensive empirical model.
- ❑ Demonstrates the moderating influence of firm size and the mediating role of Environmental CSR Allocation in strengthening CSR effectiveness.
- ❑ Employs a balanced panel dataset together with multiple regression, panel regression, moderation, mediation, and bootstrap analyses to improve methodological robustness.
- ❑ Extends the limited empirical literature on CSR effectiveness and Sustainable Development Goals within the Indian corporate context.
- ❑ Offers evidence-based managerial and policy insights for improving CSR planning, sustainability reporting, and strategic resource allocation.
- ❑ Provides a replicable analytical framework for future empirical research examining CSR effectiveness in emerging economies.

Future Scope for Research

Future studies may expand the geographical scope by examining companies across different Indian states or conducting cross-country comparisons to improve the generalisability of the findings. Researchers may also integrate primary survey data with secondary corporate disclosures to capture stakeholder perspectives on CSR effectiveness. Further investigations may explore the influence of Environmental, Social, and Governance (ESG) performance, digital sustainability initiatives, corporate governance quality, or industry-specific CSR strategies using longer longitudinal datasets and advanced analytical techniques such as structural equation modelling, dynamic panel estimation, or machine learning approaches. Such extensions would contribute to a deeper understanding of how strategic CSR investments can support sustainable development in diverse organisational and institutional settings (Sachs, 2015; United Nations, 2015).

References

1. Alshurideh, M., et al. (2022). *Sustainable Development Goals (SDGs) as a framework for corporate social responsibility (CSR)*. Springer.
2. Bhatia, A., & Makkar, B. (2020). Corporate social responsibility disclosure practices in India: Evidence from listed companies. *Social Responsibility Journal*.
3. Carroll, A. B. (1991). The pyramid of corporate social responsibility: Toward the moral management of organizational stakeholders. *Business Horizons*, 34(4), 39–48.
4. Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure. *Accounting, Organizations and Society*, 33(4–5), 303–327.
5. Dharmapala, D., & Khanna, V. (2018). The impact of mandatory corporate social responsibility: Evidence from India's Companies Act. *Journal of Law and Economics*.
6. Dyllick, T., & Hockerts, K. (2002). Beyond the business case for corporate sustainability. *Business Strategy and the Environment*, 11(2), 130–141.
7. Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. *Management Science*, 60(11), 2835–2857.
8. ElAlfy, A., Darwish, K. M., & Weber, O. (2020). Scoping the evolution of corporate social responsibility (CSR) research in the Sustainable Development Goals (SDGs) era. *Sustainability*, 12(14).
9. Elkington, J. (1997). *Cannibals with forks: The triple bottom line of 21st century business*. Capstone.
10. Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value. *Global Finance Journal*.
11. Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Pitman.
12. Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2,000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210–233.
13. Ghosh, S. (2023). Corporate social responsibility and Sustainable Development Goals: Evidence from Indian companies.

14. Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics* (5th ed.). McGraw–Hill Education.
15. Gupta, A., & Chauhan, S. (2022). Corporate social responsibility expenditure and firm performance: Evidence from Indian listed companies.
16. Ioannou, I., & Serafeim, G. (2015). The impact of corporate social responsibility on investment recommendations: Analysts' perceptions and shifting institutional logics. *Strategic Management Journal*, 36(7), 1053–1081.
17. Joshi, G. (2025). Forty-five years of corporate social responsibility research: A bibliometric review.
18. Kansal, M., Joshi, M., & Batra, G. (2014). Corporate social responsibility reporting practices in India. *Social Responsibility Journal*.
19. KPMG India. (2017). *Sustainable Development Goals (SDGs): Leveraging CSR to achieve SDGs*. KPMG India.
20. Kumar, S., & Ranajeet. (2025). Corporate social responsibility as an ally in achieving Sustainable Development Goals in India.
21. Kumar, S., & Tiwari, R. (2021). Corporate social responsibility implementation and sustainability in Indian corporations.
22. Manchanda, S. (2024). Exploring the interlinkages between corporate social responsibility and the Sustainable Development Goals.
23. McWilliams, A., & Siegel, D. (2001). Corporate social responsibility: A theory of the firm perspective. *Academy of Management Review*, 26(1), 117–127.
24. Ministry of Corporate Affairs. (2021). *Business Responsibility and Sustainability Reporting (BRSR) framework*. Government of India.
25. Ministry of Corporate Affairs. (2021). *Frequently asked questions on Business Responsibility and Sustainability Reporting (BRSR)*. Government of India.
26. Porter, M. E., & Kramer, M. R. (2011). Creating shared value. *Harvard Business Review*, 89(1–2), 62–77.
27. Sachs, J. D. (2015). *The age of sustainable development*. Columbia University Press.
28. Securities and Exchange Board of India. (2021). *Business Responsibility and Sustainability Reporting (BRSR)*. SEBI.
29. Sharma, P., & Kiran, R. (2013). Corporate social responsibility initiatives in India: An overview.
30. United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. United Nations.
31. United Nations Global Compact. (2015). *SDG Compass: The guide for business action on the Sustainable Development Goals*. United Nations Global Compact, Global Reporting Initiative, & World Business Council for Sustainable Development.
32. Van Marrewijk, M. (2003). Concepts and definitions of corporate social responsibility and corporate sustainability: Between agency and communion. *Journal of Business Ethics*, 44(2–3), 95–105.
33. Wooldridge, J. M. (2019). *Introductory econometrics: A modern approach* (7th ed.). Cengage Learning.
34. World Business Council for Sustainable Development. (2000). *Corporate social responsibility: Making good business sense*. WBCSD.

35. National Institution for Transforming India. (2023). *SDG India Index and Dashboard*. NITI Aayog.
36. National CSR Portal. (2024). *Annual CSR data and reports*. Government of India.
37. Mishra, A. (2024). Leveraging corporate social responsibility to achieve Sustainable Development Goals in India.
38. Ghosh, S., & Rajan, J. (2021). Corporate sustainability reporting in India: Trends and challenges.
39. Bhatia, A., & Makkar, B. (2021). Corporate social responsibility reporting and stakeholder engagement in India.
40. Gupta, A., & Chauhan, S. (2023). Corporate sustainability, ESG practices, and firm performance: Evidence from Indian listed companies.