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Measuring Corporate Social Responsibility in India: A Composite Indicator Model

Francis Kuriakose
June 2021

Abstract

This paper proposes a composite indicator model called CSR index to measure corporate social responsibility practices of Indian companies. The proposed CSR index comprises three dimensions of CSR implementation, stakeholder management and sustainability, which are measured using 39 indicators. Data is collected from annual reports and business responsibility reports for top 100 companies ranked according to market capitalisation in March 2019. The final ranking using the CSR index highlights how Indian companies perform in their CSR practices beyond the legally mandated expenditure recommended by the Companies Act 2013. Robustness analysis shows that the ranking is robust with respect to input factors, data selection and data transformation. Regression modelling of select dimension scores of CSR index with exogenous variables of firm performance such as internal complaint resolution, turnover and profit shows positive correlation. The CSR index helps managers and policy makers to channelize a given company's efforts at CSR into targeted programmes through resource allocation and monitoring, whilst comparing its relative performance within and across dimensions and industries.

Keywords: Corporate social responsibility, Sustainability, Corporate governance, Business ethics, Corporate citizenship

Introduction

The nature and scope of corporate social responsibility (CSR) activities have mostly remained voluntary under national jurisdictions, with the exception of regulatory guidelines for disclosure norms. In July 2001, the European Union (EU) introduced a Green Paper integrating social and environmental concerns as well as stakeholder interactions of business operations, under the purview of CSR (Delbard, 2008). In the United Kingdom, regulatory norms regarding CSR disclosure have evolved from a number of sources including the EU norms, industry association guidelines, and legislation, culminating in the appointment of a Minister for CSR in 2000 (Idowu & Towler, 2004). In 2015, 81 per cent of S&P 500 companies in the United States reported their sustainability activities despite disclosure being voluntary (D'Aquila, 2018). Since the beginning of the twenty-first century, the global trend has been an increased public policy concern with CSR practices concomitant with sustainable development goals and evolving norms of business ethics.

In 2013, India became the first country in the world to legally mandate CSR activities and disclosure practices for companies of specific eligibility criteria, when the Companies Act (TCA) was legislated. Section 135 of TCA requires every company with net worth of INR 500 crores (5000 million) or more, or turnover of INR 1000 crores (10000 million) or more, or net profit of INR 5 crores (50 million) or more during any year, to set aside 2 per cent of the average net profit of the immediately preceding three financial years for CSR activities (The Companies Act [TCA], 2013). TCA also delineates the setting up of CSR committee with at least three directors out of which one is independent, to recommend expenditure and monitor activities. Additionally, CSR programmes have to be reported in the prescribed format in annual reports and Schedule VII of TCA suggests nine areas of CSR activities (TCA, 2013). TCA (2013) was enforced from 1 April 2014.

Subsequently, the Companies (Amendment) Act 2017 and the high-level committee (HLC) reports on CSR clarified the ambit of specific provisions of TCA (The Companies [Amendment] Act 2017; Ministry of Corporate Affairs [MCA] 2015, 2019). Concurrent with TCA, the Ministry of Corporate Affairs had also brought out national voluntary guidelines (NVG) that laid down nine principles of social, environmental, and economic responsibilities of businesses (MCA, 2011). In 2019, the top 1000 listed firms based on market capitalisation in Bombay Stock Exchange and National Stock Exchange were mandated to file their ESG initiatives following NVG principles in their business responsibility reports (MCA, 2011).

TCA and NVG remain the two principal mechanisms through which socially and environmentally sustainable practices of Indian companies are regulated. There are no measurement indices to understand CSR practices of Indian companies. This paper aims to fill this gap by proposing a composite indicator model called CSR index.

The paper is organised as follows. The second section surveys the conceptual definitions and existing measurement approaches of CSR. The model specification and methodology of building the CSR index is provided in the third section. The fourth section analyses the final rankings along industrial sector and dimensions of the model. The results of the robustness analysis of the model are given in the fifth section. The sixth section describes the results of regression modelling with exogenous variables. Policy and managerial implications of the CSR index is given in the seventh section. The eighth section concludes the arguments and suggests areas of further research.

Review of Concept and Measurement

CSR has evolved in definition and scope through four distinct schools of thought (Melé, 2008). The first of these definitions, rooted in sociology, is the idea of 'corporate social performance' that argues that a company's performance has to align with the expectations of the society in which it is embedded (Davis, 1975). The second school, rooted in economics, argues that enlightened self-interest and shareholder value creation are the foundational principles of 'strategic corporate social responsibility' (Friedman, 1970). The third school, founded in ethics, advises corporations to balance multiple claims of various stakeholders by using 'stakeholder value theory' (Freeman, 1984). Finally, the school of 'corporate citizenship', based in political science, argues that corporations can be providers of social rights, enablers of economic rights, and channels for claiming political rights (Matten & Crane, 2005).

The definitional variety of CSR has resulted in various measurement approaches at the firm level. Cost-benefit approach computes the monetary value of CSR using the discounted cash flow logic (Weber, 2008). The balanced scorecard approach has been used with multicriteria analysis to select variables in eight categories of CSR performance, and linearly aggregating and scoring them on a five-degree scale (Aravossis et al., 2006).

Another well-known approach of CSR measurement is the rating of aggregates. The Kinder, Lyderberg, Domini Research & Analytics (KLD) criteria measures corporate social performance through seven strength and concern variables and the aggregate the rating of their scores (Chatterji, Levine, & Toffel, 2007). The Thomson Reuters corporate responsibility ratings use three pillars of environment, social and corporate governance aspects with 226 indicators to rate companies across 52 industries through raw scores, ratings and percentile ranks (Reuters, 2013).

The CSR-index approach has been used for rating firms across four dimensions of management, social, economic, and environmental factors in China CSR Development Index (Chen et al., 2015). In this approach, weights are assigned through analytical hierarchical process, linearly aggregated, and industry-adjusted final scores classified into five best-in-class performance categories. Gjølberg (2009) uses an index-approach to measure CSR practices of firms across 20 countries and aggregate company-level data to national scores to classify them as leading, intermediate, and laggard groups.

The diversity of measurement approaches indicates that any measurement tool of CSR should ideally be a function of the nature of its conceptual definition and scope, and the national policy agenda. Among the approaches, the composite indicator model differs from other techniques of measurement in its explicit acknowledgement of the multidimensionality of CSR and the attempt to measure it through a single index indicative of relative performance. Both these features fit well with the Indian policy context.

Composite Indicator Model

Dataset, Dimensions and Indicators

A composite indicator is formed when individual indicators are compiled into a single index on the basis of an underlying model (Joint Research Centre, European Commission, 2008). This model used corporate citizenship framework to select 39 indicators along three non-overlapping and equal dimensions with 13 indicators each. The dimensions were selected based on the theoretical definition and Indian national policy agenda. The indicators were selected based on their relevance to the index, analytical soundness, and data availability.

The first dimension ‘CSR implementation’ deals with the constitution of a CSR committee, presence of an independent director, budget outlays, modality of implementation, and provisions for monitoring and evaluation. The second dimension ‘stakeholder management’ involves policies for fair participation, association, grievance redress and communication with employees, customers, suppliers and local vendors. The third dimension ‘sustainability’ includes advocacy, sustainable waste management, adoption of renewable energy, product standards and disclosure, and adoption of clean development measures to mitigate climate change. Table 1 illustrates the dimensions and indicators.

Table 1. Dimensions and Indicators

No	Indicator	Indicator Type
Dimension 1: CSR Implementation		
1	Disclosure of CSR report	Binary
2	Presence of implementation strategy	Binary
3	Presence of implementation schedule	Binary
4	Presence of independent director in CSR committee	Binary
5	Monitoring mechanism for CSR	Binary
6	Evaluation mechanism for CSR	Binary
7	Expenditure of mandatory profit percent for CSR	Categorical
8	Overhead expense limit	Binary
9	Reason for not spending mandatory amount	Binary
10	Local area preference in CSR activities	Binary
11	Local employment generation through CSR generation	Binary
12	Local social impact of CSR activities	Binary
13	Local capacity building through CSR activities	Binary

Dimension 2: Stakeholder Management		
14	Stakeholder identification	Binary
15	Projects for stakeholder empowerment	Binary
16	Presence of employee association	Binary
17	Proportion of employees given safety training	Numerical
18	Presence of local vendor partners	Categorical
19	Consumer complaint redress mechanism	Categorical
20	Resolution of consumer complaint within 90 days	Categorical
21	Consumer survey	Categorical
22	Stakeholder consultation in business responsibility reporting (BRR) policy	Binary
23	Communication of BRR policy to stakeholders	Binary
24	Implementation agency for BRR	Binary
25	Grievance redress for stakeholders	Binary
26	Monitoring and evaluation for BRR practices	Binary
Dimension 3: Sustainability		
27	Program for climate change mitigation	Binary
28	Programs under clean development mechanism	Binary
29	Programs for energy efficiency	Binary
30	Follows emission norms mandated by pollution control boards	Categorical
31	Advocacy programs for social and environmental issues	Binary
32	Product information through label	Categorical
33	Product label follows industry standards	Categorical
34	Presence of sustainable sourcing	Categorical

35	Presence of renewable energy in operations	Categorical
36	Presence of sustainable waste management practices	Binary
37	Recycling at plant/office level	Categorical
38	Recycling advocacy at consumer level	Categorical
39	Recycling advocacy at general public level	Binary

Source: The author.

Data was collected for the top 100 firms according to market capitalisation on 31 March 2019 from their publicly disclosed annual reports, and business responsibility reports for the year 2018-19.

Exploratory Data Analysis

Using FactoMineR package in R software (3.6.3), factorial analysis of mixed data (FAMD) was performed to understand the underlying structure of data. Only complete observations were used. A total of 20 firms (top five firms in each quartile) and 16 indicators were selected as sample.

A summary of FAMD results is presented in table 2. FAMD groups indicators into 'statistical' dimensions (SD) that explain the proportion of variance. From the summary of eigen values in table 2, the first dimension explains 11.33 percent of the total covariance whereas the first four dimensions account together for 37 per cent of the total covariance of the indicators selected.

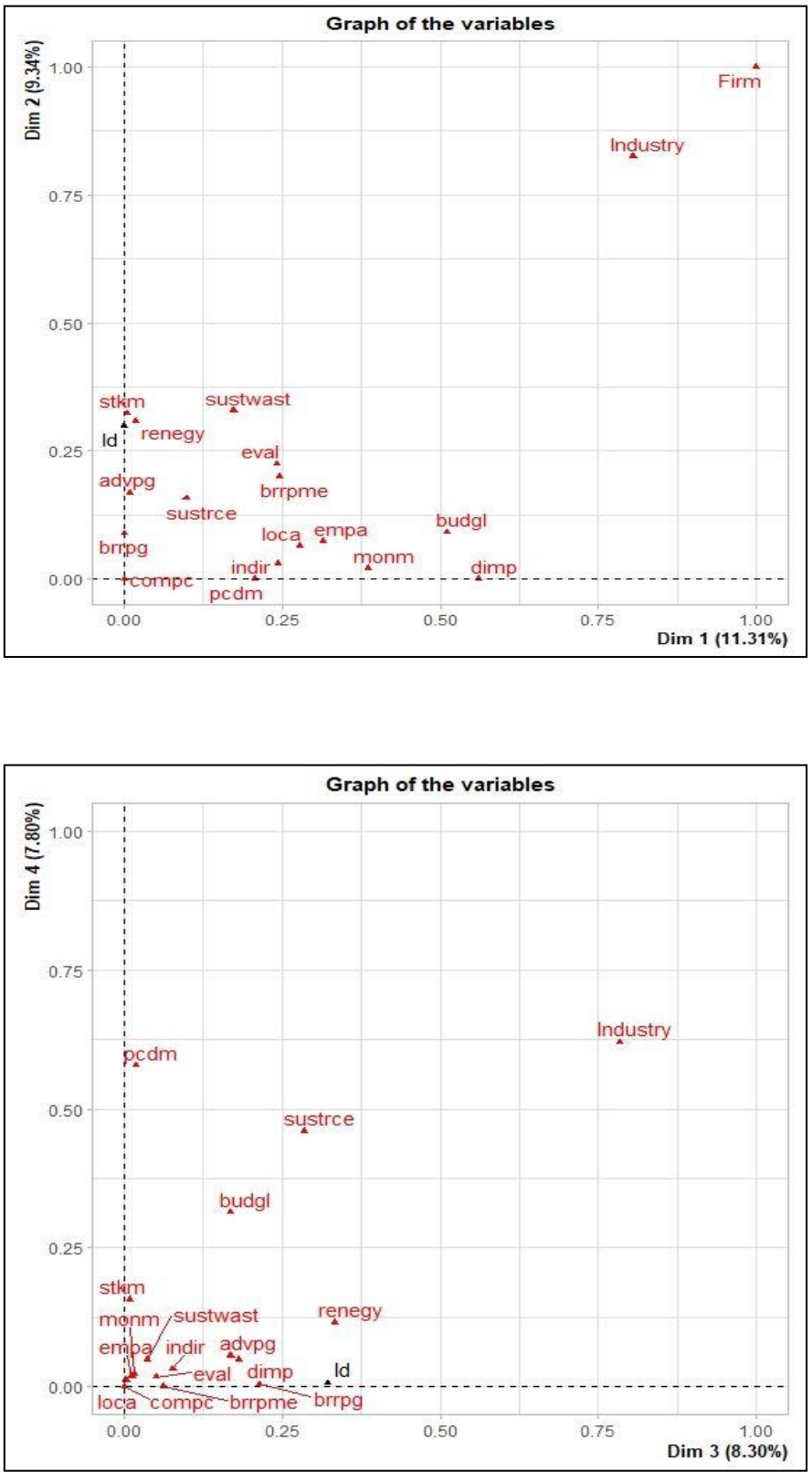
Table 2. Summary of Eigen Values from FAMD

Dimensions	Eigen Values	Variance (%)	Cumulative Variance (%)
Dim.1	5.1	11.3	11
Dim.2	4.2	9.3	21
Dim.3	3.7	8.3	29
Dim.4	3.5	7.8	37
Dim.5	3.4	7.5	44

Source: The author.

The graph of categorical variable in figure 1 depicts the squared correlation ratio between dimension and indicator. Closer an indicator is to a dimension, the greater correlation between the two. Indicators aligning with each statistical dimension roughly corresponds with conceptual dimensions of CSR implementation (SD 2,3), stakeholder management (SD 1), and sustainability (SD 4).

Figure 1. Relationship between Statistical Dimensions and Indicators

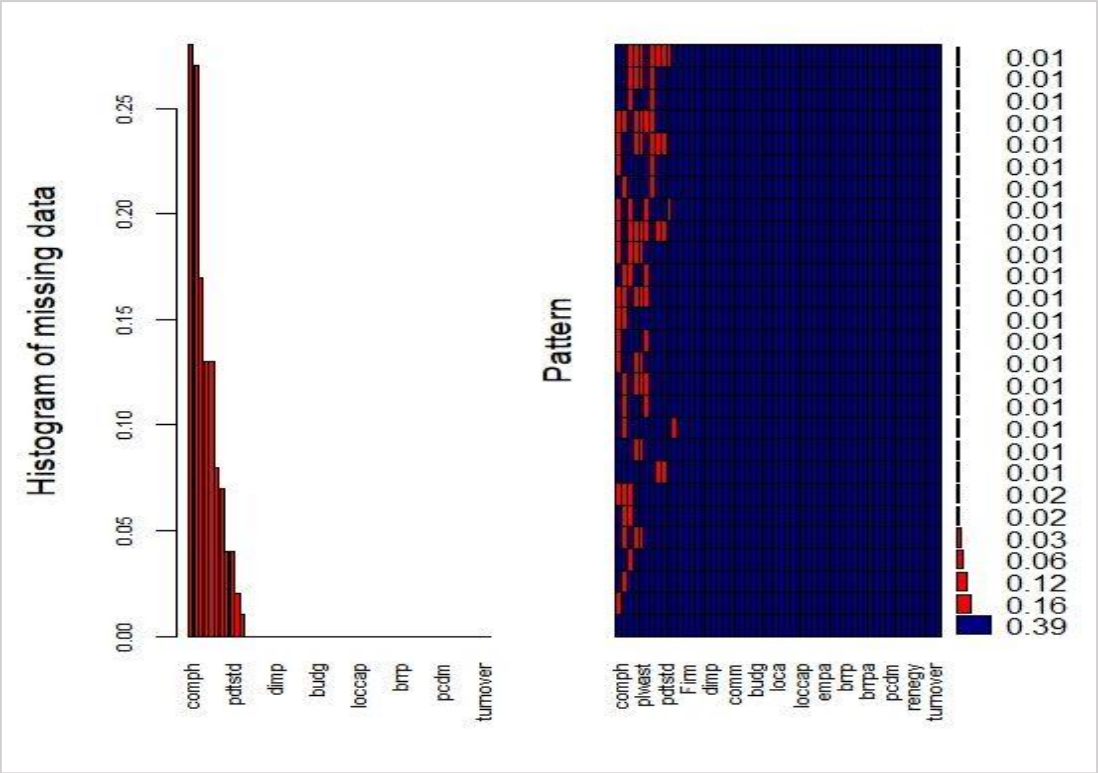


Source: The author.

Standardisation, Weighting and Aggregation

The numerical indicators were standardised using z-scores. Indicators with negative polarity were recoded to ensure positive polarity before weights were added. Out of the 53 observations collected per company, missing data pattern as shown in figure 2 indicated that there were 38 complete observations. Multiple imputation method was used to fill in the missing values using MICE package in R software (3.6.3). Further computation and regression modelling were done on imputed datasets and the results pooled together.

Figure 2. Missing Data Pattern



Source: The author.

In a composite indicator, weights indicate the importance of individual indicators in the final measurement (Joint Research Centre, European Commission, 2008). This study uses a statistical-based approach to determine weights and apportions equal weights to indicators at the dimension level, and to the dimensions at the composite indicator level. Aggregation method is a measure of trade-offs that determines compensability (Gan et al., 2017). At the

dimension level, linear aggregation is used since low score of an indicator can be off-set by high score in another. At the composite indicator level, the dimensions represent distinct facets of CSR that are not completely compensable. Therefore, geometric aggregation that allows partial compensability is used.

The final CSR composite indicator model specification is given by equations 1 and 2.

$$\mathrm{CSR} = \sqrt[n]{\prod_{i=1}^{n} D_i} \quad (1)$$

$$D_i = \sum_{i=1}^{n} I_i \, w_i \quad (2)$$

where w_i is the weight assigned to the i^{th} indicator I_i, and D_i is the i^{th} dimension.

Ranking and Implications

The CSR index-based ranking of 100 firms is given in table 3. For a company, the rank indicates its relative position among others in CSR performance. The final score of the first ranked company (0.89) is 73 per cent higher than that of the last ranked company (0.24), indicating substantial difference in performance of companies along the indicators. From table 3 it is observed that the top 10 companies are from a range of industries, whereas 60 per cent of the bottom-ranked 10 companies are from the financial industry. A possible explanation could be that stakeholder management and sustainability have different impact on industries based on natural resources as opposed to those based on consumer services.

Table 3. CSR Index Rank of 100 Companies

Company	Final Score	Rank
Ambuja Cements Ltd	0.8935206	1
Gail (India) Ltd	0.889312	2
Ultratech Cement Limited	0.8696027	3
Mahindra & Mahindra Ltd	0.8590459	4
Tata Steel Limited	0.8585904	5
L&T Infotech Limited	0.8318377	6
Oil And Natural Gas Corp.	0.8311668	7
Piramal Enterprises Ltd	0.8255273	8
Power Grid Corp. Ltd.	0.817813	9
UPL Limited	0.8117907	10
JSW Steel Limited	0.8114352	11
Infosys Limited	0.8026179	12
Hindustan Petroleum Corp	0.8022172	13
Titan Company Limited	0.8003778	14
Eicher Motors Ltd	0.7917348	15
Marico Limited	0.7885928	16
Berger Paints (I) Ltd	0.7859271	17
Asian Paints Limited	0.7857694	18
United Spirits Limited	0.7836765	19
Wipro Ltd	0.7797753	20

HDFC Amc Limited	0.7794128	21
Shree Cement Limited	0.7791478	22
Interglobe Aviation Ltd	0.7723809	23
Hindustan Zinc Limited	0.7686619	24
Tech Mahindra Limited	0.7670421	25
Britannia Industries Ltd	0.763933	26
Cipla Ltd	0.763933	26
Vedanta Limited	0.7634185	28
HDFC Ltd	0.7631527	29
Larsen & Toubro Ltd.	0.7631527	29
State Bank Of India	0.7612105	31
Acc Limited	0.756262	32
NTPC Ltd	0.7488244	33
Torrent Pharmaceuticals L	0.7366512	34
Siemens Ltd	0.7366018	35
Reliance Industries Ltd	0.7334899	36
Tata Motors Limited	0.732596	37
Dabur India Ltd	0.7258869	38
Grasim Industries Ltd	0.7251845	39
Bharat Petroleum Corp Ltd	0.7211381	40
Hero Motocorp Limited	0.7148924	41
HDFC Life Ins Co Ltd	0.7139074	42
Adani Port & Sez Ltd	0.713775	43
United Breweries Ltd	0.7091725	44

Maruti Suzuki India Ltd.	0.7079493	45
Axis Bank Limited	0.7059433	46
Tata Consultancy Serv Lt	0.7058616	47
Glaxosmithkline Consumer	0.7045645	48
Yes Bank Limited	0.7025444	49
Bosch Limited	0.701139	50
HindalCo Industries Ltd	0.6997119	51
Bharti Infratel Ltd.	0.6975472	52
NMDC Ltd.	0.6941698	53
Indian Oil Corp Ltd	0.6898912	54
L&T Finance Holdings Ltd	0.6836558	55
REC Limited	0.6821574	56
Sun Pharmaceutical Ind Ltd	0.6796656	57
Biocon Limited.	0.6745645	58
Punjab National Bank	0.6744803	59
Hindustan Unilever Ltd.	0.668858	60
HCL Technologies Ltd	0.6657299	61
Godrej Consumer Products	0.662303	62
Pidilite Industries Ltd	0.6602432	63
Colgate Palmolive Ltd.	0.6602432	63
Lupin Limited	0.6599932	65
Kotak Mahindra Bank Ltd	0.6564171	66
Avenue Supermarts Limited	0.6558216	67
P&G Hygiene & Health Care	0.6528886	68

Oracle Fin Serv Soft Ltd.	0.6521844	69
Power Fin Corp Ltd.	0.6473824	70
Aurobindo Pharma Ltd	0.6466513	71
Cadila Healthcare Limited	0.6398296	72
Indiabulls Hsg Fin Ltd	0.6341544	73
Container Corp Of Ind Ltd	0.6294464	74
DLF Limited	0.6240184	75
Divi's Laboratories Ltd	0.6235399	76
Havells India Limited	0.6154507	77
Bank of Baroda	0.6147564	78
Dr. Reddy's Laboratories	0.6102611	79
ICICI Lombard Gic Limited	0.6084865	80
Bajaj Auto Limited	0.6063884	81
IDBI Bank Limited	0.587926	82
General Ins Corp of India	0.5762752	83
ICICI Pru Life Ins Co Ltd	0.5691113	84
Vodafone Idea Limited	0.5665236	85
Motherson Sumi Systems Lt	0.5564392	86
SBI Life Insurance Co Ltd	0.5552189	87
ITC Ltd	0.5508862	88
IndusInd Bank Limited	0.5455886	89
Bandhan Bank Limited	0.5387463	90
The New India Assu Co Ltd	0.5226282	91
Coal India Ltd	0.5133563	92

Petronet Lng Limited	0.5108792	93
HDFC Bank Ltd	0.4716087	94
ICICI Bank Ltd.	0.4707057	95
Bajaj Holdings & Invs Ltd	0.4618025	96
Bharti Airtel Limited	0.4575439	97
Bajaj Finserv Ltd.	0.4563611	98
Zee Entertainment Ent Ltd	0.4083175	99
Bajaj Finance Limited	0.2483629	100

Source: The author.

Additionally, reporting of CSR practices varies across industries despite the mandatory format issued by the state. Appendix 1 gives an industry-wise ranking of the top 100 companies based on their CSR final scores. Industries in the natural resource sensitive sector tend to give detailed information on sustainability and stakeholder engagement because of sustainability auditing and judicial norms governing the sector, where as those in the consumer sector tend to file brief CSR reports. Beyond disclosure, whether the performance of these two industrial sectors vary significantly should be examined using a larger sample of companies over a time period. Appendix 2 compares market capitalisation ranking with CSR index ranking.

Robustness Analysis

Robustness analysis is performed through uncertainty and sensitivity tests. Uncertainty analysis brings out how uncertainty in the input factors propagates through the structure of the composite indicator and affects its final value, whereas sensitivity analysis examines how much each individual source of uncertainty contributes to the output variance (Saisana, Saltelli & Tarantola, 2005). Uncertainty analysis has three components- input factors, output factors and a model that describes the relationship between input and output factors. Each step in the

building of composite indicator can potentially be transformed as input factors and uncertainty of outputs analysed. The result of uncertainty analysis is given as summary statistics of output factors. Confidence interval bound specifies the range in which the mean lies and its width gives the precision of the estimate.

The robustness of two measures, final composite indicator score and final ranking, was assessed through uncertainty and sensitivity analyses with the software SIMLAB (2.2.1). To perform uncertainty analysis, two input factors X_1 (data selection) and X_2 (data transformation) were selected. 100 samples of input factors were generated through random sampling. The composite indicator model was evaluated repeatedly using Monte Carlo approach. The output factors of interest were final CSR values C_1 and final rank R_1. These output factors were compared with original values of final CSR scores C_0 and final rank R_0.

A non-parametric test based on Tchebyecheff's theorem was applied to estimate the confidence bound on the mean because the frequency distributions of both sets of outputs R_1 and R_0 as well as C_1 and C_0 were found to be non-normal. Tchebyecheff's theorem assumes null and alternate hypotheses based on the mean value μ as given in equation 3.

$$\text{Ho: } \mu_1 = \mu_0; \text{ H}_1\text{: : } \mu_1 \neq \mu_0 \qquad (3)$$

For the output factors R_1 and R_0, the mean lies within a confidence interval of 95 as shown in table 4. This implies that the final rank is robust with respect to both the input factors taken. No further analysis is done on the output factors R_1 and R_0.

Table 4. Results of Uncertainty Analysis (Ranking)

Summary Statistics	R_0	R_1
Mean	50.470000	50.480000
Variance	833.889100	833.629600
Standard deviation	28.877138	28.872644
Skewness	0.001655	0.001010
Kurtosis	-1.183632	-1.182482
Tchebycheff test	12.914249	12.912239
T test	4.806600	4.805852

Source: The author.

Note: The results of Tchebycheff test and T test are at 95 % confidence bounds.

However, the output factors C_1 and C_0 show significant difference in estimates of mean which lie outside the confidence interval bounds as shown in table 5.

Table 5. Results of Uncertainty Analysis (Final Scores)

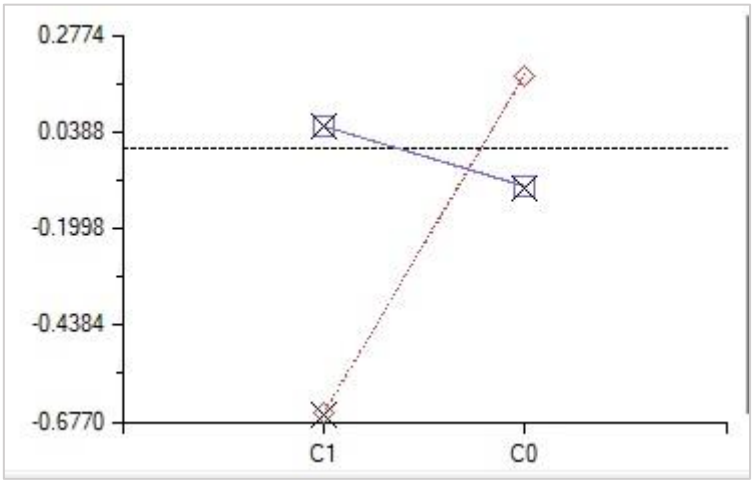
Summary Statistics	C_0	C_1
Mean	0.684013	1.045632
Variance	0.012916	0.173011
Standard deviation	0.113647	0.415946
Skewness	-0.840776	0.435299
Kurtosis	1.199845	-1.324913
Tchebycheff test	0.050825	0.186017
T test	0.018917	0.069234

Source: The author.

Note: The results of Tchebycheff test and T test are at 95 % confidence bounds.

Sensitivity analysis is further performed using Pearson Product Moment Correlation Coefficient (PEAR) test. Sensitivity index is calculated for both input factors X_1 and X_2 for output factors C_1 and C_0. The result given in figure 3 shows that the sensitivity index for input factor X_2 on C_0 is significant. C_1 and C_0 refer to the composite indicator score of robustness analysis and original score respectively. The square symbol refers to input factors X_1 (data selection) and the rhombus signifies X_2 (data transformation). This implies that data transformation contributes to the output variance of the estimates of final CSR score given by C_0.

Figure 3. Sensitivity Analysis



Source: The author.

Regression Modelling with Exogenous Variables

In order to test how the components of CSR index are related to other variables of firm performance, a model was proposed as given in equation 4.

$$P = \beta_0 + D_{i+} \varepsilon \quad (4)$$

where P is the variable of firm performance, β_0 is the slope, D_i the aggregated score of the i^{th} CSR dimension and ε, the error term. Three exogenous variables - proportion of internal complaints resolved (comph), annual turnover (turnover), and profit after tax (profit) - were selected as the portfolio of firm performance. OLS regression was run with exogenous variables as outcome variables and dimension scores as predictor variables in R software (3.6.3).

For each outcome variable, different sets of predictor variables D_1 (CSR implementation), D_2 (stakeholder management), and D_3 (sustainability) were used. The regression results and significant p values are given in table 6. For outcome variables 'comph' and 'turnover', the dimension D_1 (CSR implementation) is significant whereas for 'profit', the dimension with significant p value is D_3 (sustainability).

Table 6. Results of Regression Modelling

Outcome variable: comph					
Term	estimate	std.error	Statistic	Df	p.value
(Intercept)	1.0475165	0.9306167	1.125615	85.22568	0.263488
D1	-2.0102473	0.9247503	-2.17383	82.73566	0.032576
D2	-0.4656505	0.9915603	-0.46961	30.30482	0.641993
D3	1.4320383	0.9815564	1.458947	39.35977	0.152515
Outcome variable: turnover					
(Intercept)	0.7159621	0.7039964	1.016997	94.05118	0.311764
D1	-2.0369232	0.7379884	-2.7601	94.05118	0.006947
D2	0.4105729	0.6297637	0.651948	94.05118	0.516025
D3	0.8957701	0.6786411	1.319947	94.05118	0.190057

Outcome variable: profit					
(Intercept)	-0.8179415	0.7164909	-1.14159	94.05118	0.256521
D1	0.6233722	0.7510862	0.829961	94.05118	0.408663
D2	-0.7061475	0.6409408	-1.10174	94.05118	0.273388
D3	1.3637809	0.6906856	1.974532	94.05118	0.051254

Source: The author.

Note: The regression results are of pooled estimates. Significant p-values are highlighted.

The significance of a variable in relation to the predictive power of a model is assessed through multivariate Wald test and combined D2-statistic. Significant p value of multivariate Wald test implies that removing the variable from the model reduces its predictive power. Table 7 shows that the dimension D_1 (CSR implementation) is significant in explaining the model for the outcome variable 'comph'. For the next two outcome variables, a combined significance test was computed using the D2-statistic as given in table 7. The p-values for predictor variable D_1 (CSR implementation) is significant for 'turnover' where as that of D_3 (sustainability) is significant for 'profit'.

Table 7. Results of Multivariate Wald Test and Combined D-statistic Test

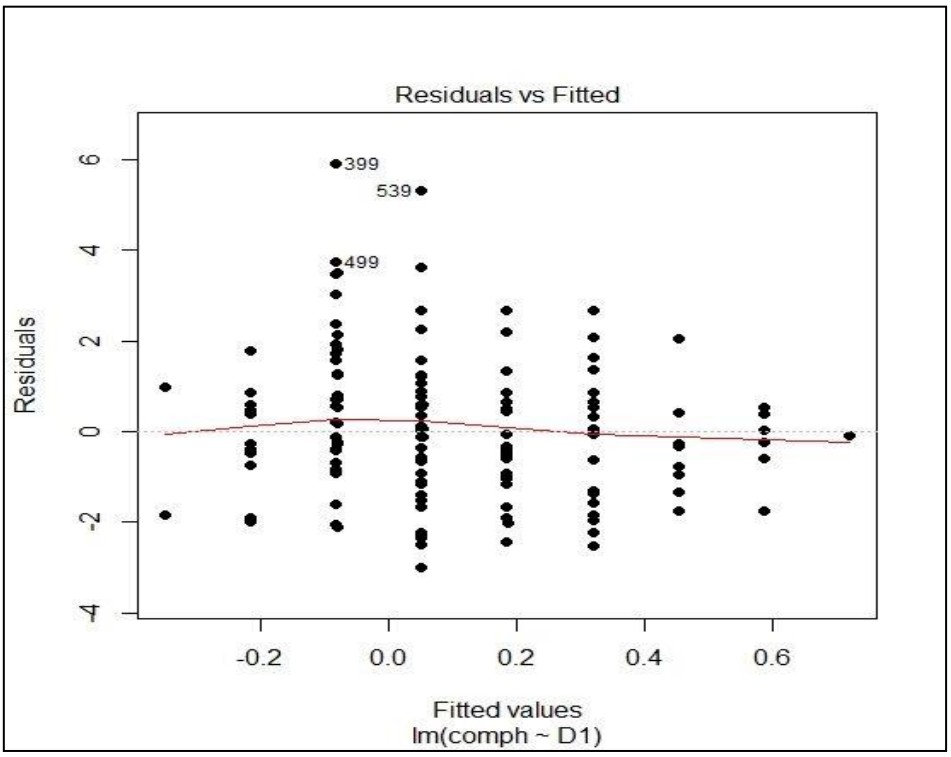
Variables	Test Method	Statistic	df1	df2	df.com	p.value	Riv
comph v D1	1	4.725524	1	4	90	0.095401	0.036748
turnover v D1	2	7.618163	1	Inf	NA	0.005778	0
profit v D3	2	3.898777	1	Inf	NA	0.048321	0

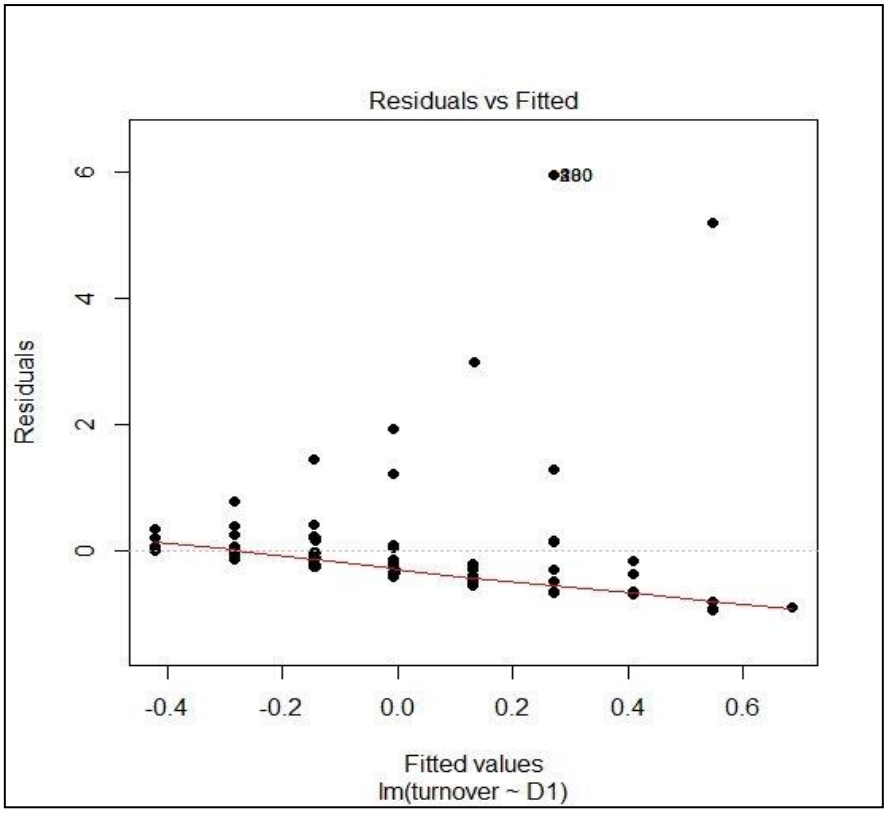
Source: The author.

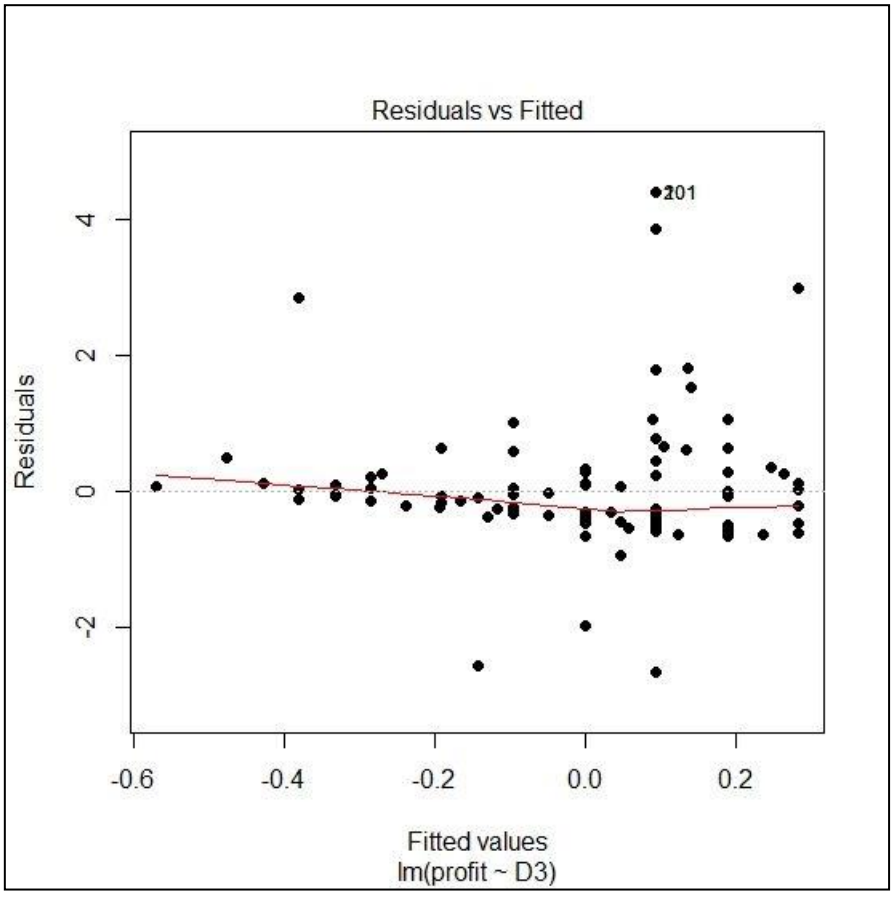
Note: Test method 1 refers to multivariate Wald test and 2 refers to combined D-statistic test. Significant p-values are highlighted.

The residual and fitted line plots are estimated for the revised models as per the goodness of fit results given by Wald and D2-statistic tests. As the residual plots in figure 4 indicate, the residuals are not randomly distributed around the line suggesting that the relationship between predictor and outcome variables is not perfectly linear. The residuals roughly form a horizontal band around the line indicating that the variances of error terms are approximately equal. However, some residuals also stand out from the basic random pattern signifying the presence of outliers.

Figure 4. Residual vs Fitted Plots of Regression Models







Source: The author.

Policy and Managerial Impact

The CSR index proposed in this paper is the first of its kind for India. In line with the legal mandate, the proposed CSR index can be used to compare the performance of firms in CSR spending and the social impact of their CSR programmes within and across industries and dimensions through their annual ranking.

The CSR index takes a comprehensive view of CSR by including three distinct and overlapping dimensions. Such an approach aligns corporate India's CSR efforts with the broader sustainability development agenda of the United Nations. This approach also makes comparability of India's CSR efforts with those of other firms in other contexts possible.

The proposed model of CSR index is open. It is possible to add or remove indicators or dimensions without compromising the integrity of the model. This openness is a characteristic that would make this model flexible for adoption in other national or industrial contexts.

The CSR index conceptually clarifies what goes within the black box called 'corporate social responsibility'. Managers could channelise a company's efforts at CSR into targeted programmes through internal resource allocation and monitoring. The CSR index also signals how adequate such efforts are by making comparison within and across dimensions and industries possible. These dimensions and industry cues provide data for managers to understand the specific challenges that a company or an industrial sector faces to meet its CSR targets.

Finally, the regression modelling of CSR index with exogenous variables brings out the correlation between profitability and sustainability for firms. The dimensions of CSR index are

directly correlated with firm performance such as grievance redress, turnover and profit. Performing well in CSR dimensions improves firm performance in other aspects of investor interest as well.

Conclusion

The CSR index proposed in this paper measures CSR through the three dimensions of CSR implementation, stakeholder management and sustainability, with 13 indicators in each dimension. The top 100 companies based on their market capitalisation in March 2019 are ranked according to their final scores. Further, the companies are analysed based on their dimension scores and industry type to understand disaggregated effects of the CSR index on industrial sector and disclosure practices. Robustness analysis reveals that the ranking of the CSR based on this composite indicator model is robust with respect to two input factors, data selection and data transformation whereas the final composite indicator value is sensitive to the input factor data transformation. Regression modelling shows that that aggregated dimension scores are correlated with other exogenous variables of firm performance.

There are promising avenues for further research using the proposed CSR index. The ranking of firms based on CSR index can be extended to all listed firms based on market capitalisation to whom the CSR eligibility conditions apply. Such an annual survey of firms can be used for monitoring CSR spending in India. A longitudinal comparison of CSR over the years can yield trends of sustained CSR expenditure across firms, dimensions, and industries. Such a comparison would make targeted prescription of CSR spending efforts specific to firms in industrial sectors.

Further robustness analysis of the CSR index using other input factors such as weighting, aggregation, and inclusion/exclusion of indicators can bring out the uncertainty effects of input factors on the ranking and final scores. In addition to the results of regression modelling of dimension scores given in this paper, an expanded set of exogenous variables of firm performance could be a useful exercise in developing a sustainability-based investor portfolio for Indian companies.

References

Aravossis, K. G., Panayiotou, N., & Tsousi, K. (2006). A proposed methodological framework for the evaluation of corporate social responsibility. In K. Aravossis, C.A. Brebbia, E. Kakaras, & A.C. Kungolos (Eds.) *Environmental economics and investment assessment* (pp. 87-96). Southampton: WIT Press.

Chatterji, A. K., Levine, D. I., & Toffel, M. W. (2007). *Do corporate social responsibility ratings predict corporate social performance? (*HBS Working Paper Number:07-051). Boston, Massachusetts: Harvard Business School.

Chen J., Huang Q., Peng H., & Zhong H. (2015). Research Report on Corporate Social Responsibility of China. Current Chinese Economic Report Series. Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-662-45363-6_1

D'Aquila, J.M. (2018). The current state of sustainability reporting: A work in progress. *The CPA Journal*, 88(7), 44-50.

Davis, K. (1975). Five propositions for social responsibility. *Business Horizons*, 18(3), 19-24. https://doi.org/10.1016/0007-6813(75)90048-8

Delbard, O. (2008). CSR legislation in France and the European regulatory paradox: An analysis of EU CSR policy and sustainability reporting practice. *Corporate Governance*, 8 (4), 397-405. https://doi.org/10.1108/14720700810899149

Freeman, R.E. (1984). *Strategic management: A stakeholder approach*. Boston: Massachusetts: Pitman.

Friedman, M. (1970, September 13). *The social responsibility of business is to increase its profits*. The New York Times Magazine. http://umich.edu/~thecore/doc/Friedman.pdf

Gan, X., Fernandez, I. C., Guo, J., Wilson, M., Zhao, Y., Zhou, B., & Wu, J. (2017). When to use what: Methods for weighting and aggregating sustainability indicators. *Ecological Indicators*, 81, 491-502. https://doi.org/10.1016/j.ecolind.2017.05.068

Gjølberg, M. (2009). Measuring the immeasurable?: Constructing an index of CSR practices and CSR performance in 20 countries. *Scandinavian journal of management*, 25(1), 10-22. https://doi.org/10.1016/j.scaman.2008.10.003

Idowu, S.O., & Towler, B.A. (2004). A comparative study of the contents of corporate social responsibility reports of UK companies. *Management of Environmental Quality*, 15(4), 420-437. https://doi.org/10.1108/14777830410540153

Joint Research Centre, European Commission. (2008). *Handbook on constructing composite indicators: Methodology and user guide*. OECD.

Matten, D., & Crane, A. (2005). Corporate citizenship: Toward an extended theoretical conceptualization. *Academy of Management Review*, 30(1), 166-179. https://doi.org/10.5465/amr.2005.15281448

Melé, D. (2008). Corporate Social Responsibility Theories. In A. Crane, D. Matten, A. McWilliams, J. Moon, & D.S. Siegel (Eds.), *The Oxford Handbook of Corporate Social Responsibility* (pp.47-82). Oxford: Oxford University Press: https://doi.org/10.1093/oxfordhb/9780199211593.003.0003

Ministry of Corporate Affairs (2011). *National voluntary guidelines on social, environmental & economic responsibilities of business*. Government of India. https://www.mca.gov.in/Ministry/latestnews/National_Voluntary_Guidelines_2011_12jul2011.pdf

Ministry of Corporate Affairs (2015). *Report of the high-level committee to suggest measures for improved monitoring of the implementation of corporate social responsibility policies*. Government of India. http://www.companiesact.in/mailer/HLC_report_05102015.pdf

Ministry of Corporate Affairs (2019). *Report of the high-level committee on corporate social responsibility.* Government of India. https://www.mca.gov.in/Ministry/pdf/CSRHLC_13092019.pdf

Reuters, T. (2013). *Thomson Reuters corporate responsibility ratings* (TRCRR). Thomson Reuters Corporation: New York, NY, USA.

Saisana, M., Saltelli, A., & Tarantola, S. (2005). Uncertainty and sensitivity analysis techniques as tools for the quality assessment of composite indicators. *Journal of the Royal Statistical Society: Series A (Statistics in Society*), 168(2), 307-323. https://doi.org/10.1111/j.1467-985X.2005.00350.x

The Companies Act (2013), Chapter 9 § 135. https://www.mca.gov.in/Ministry/pdf/CompaniesAct2013.pdf

The Companies (Amendment) Act (2017). http://www.nfcg.in/UserFiles/THE-COMPANIES-AMENDMENT-ACT-2017.pdf

Weber, M. (2008). The business case for corporate social responsibility: A company-level measurement approach for CSR. *European Management Journal*, 26(4), 247-261. https://doi.org/10.1016/j.emj.2008.01.006

Appendix 1. Industry-wise ranking by final CSR scores

Firm	Industry	Final	Rank
M&M	Auto, Machinery, Paint	0.8590459	1
EICHER	Auto, Machinery, Paint	0.7917348	2
BERGER	Auto, Machinery, Paint	0.7859271	3
ASIANPNT	Auto, Machinery, Paint	0.7857694	4
TATAMOTORS	Auto, Machinery, Paint	0.732596	5
HERO	Auto, Machinery, Paint	0.7148924	6
MARUTI	Auto, Machinery, Paint	0.7079493	7
BOSCH	Auto, Machinery, Paint	0.701139	8
BAJAJAUTO	Auto, Machinery, Paint	0.6063884	9
MOTHERSON	Auto, Machinery, Paint	0.5564392	10
BAJAJHLDNG	Auto, Machinery, Paint	0.4618025	11
AMBUJACEM	Cement, Steel, Infra	0.8935206	1
ULTRATECH	Cement, Steel, Infra	0.8696027	2
TATASTEEL	Cement, Steel, Infra	0.8585904	3
JSW	Cement, Steel, Infra	0.8114352	4
SHREE	Cement, Steel, Infra	0.7791478	5
LT	Cement, Steel, Infra	0.7631527	6
ACC	Cement, Steel, Infra	0.756262	7
ADANIPORT	Cement, Steel, Infra	0.713775	8
PIDILITE	Cement, Steel, Infra	0.6602432	9
CONCOR	Cement, Steel, Infra	0.6294464	10
DLF	Cement, Steel, Infra	0.6240184	11
BHARTIINFRATEL	Communication	0.6975472	1

VODAFONE	Communication	0.5665236	2
BHARTIATL	Communication	0.4575439	3
ZEE	Communication	0.4083175	4
GAIL	Energy & NR	0.889312	1
ONGC	Energy & NR	0.8311668	2
POWERGRID	Energy & NR	0.817813	3
HINDPETRO	Energy & NR	0.8022172	4
HINDZINC	Energy & NR	0.7686619	5
VEDANTA	Energy & NR	0.7634185	6
NTPC	Energy & NR	0.7488244	7
RIL	Energy & NR	0.7334899	8
BPCL	Energy & NR	0.7211381	9
HINDALCO	Energy & NR	0.6997119	10
NMDC	Energy & NR	0.6941698	11
IOC	Energy & NR	0.6898912	12
REC	Energy & NR	0.6821574	13
PFC	Energy & NR	0.6473824	14
COALINDIA	Energy & NR	0.5133563	15
PETRONET	Energy & NR	0.5108792	16
HDFCAMC	Financials	0.7794128	1
HDFC	Financials	0.7631527	2
SBIBNK	Financials	0.7612105	3
HDFCLI	Financials	0.7139074	4
AXIS	Financials	0.7059433	5
YESBANK	Financials	0.7025444	6

L&TFIN	Financials	0.6836558	7
PNB	Financials	0.6744803	8
KOTAK	Financials	0.6564171	9
OFSS	Financials	0.6521844	10
INDIABULLS	Financials	0.6341544	11
BOB	Financials	0.6147564	12
ICICILG	Financials	0.6084865	13
IDBI	Financials	0.587926	14
GICRE	Financials	0.5762752	15
ICICIPRU	Financials	0.5691113	16
SBILI	Financials	0.5552189	17
INDUSIND	Financials	0.5455886	18
BANDHAN	Financials	0.5387463	19
NIACL	Financials	0.5226282	20
HDFCBNK	Financials	0.4716087	21
ICICIBNK	Financials	0.4707057	22
BAJAJFINS	Financials	0.4563611	23
BAJAJFIN	Financials	0.2483629	24
TITAN	FMCEG	0.8003778	1
MARICO	FMCEG	0.7885928	2
MCDOWELL	FMCEG	0.7836765	3
BRITTANIA	FMCEG	0.763933	4
DABUR	FMCEG	0.7258869	5
UBL	FMCEG	0.7091725	6
GSK	FMCEG	0.7045645	7

HUL	FMCEG	0.668858	8
GODREJCP	FMCEG	0.662303	9
COLPAL	FMCEG	0.6602432	10
DMART	FMCEG	0.6558216	11
PGHH	FMCEG	0.6528886	12
HAVELLS	FMCEG	0.6154507	13
ITC	FMCEG	0.5508862	14
L&TINFO	IT	0.8318377	1
INFY	IT	0.8026179	2
WIPRO	IT	0.7797753	3
TECHMAHI	IT	0.7670421	4
TCS	IT	0.7058616	5
HCLTECH	IT	0.6657299	6
PEL	Pharma	0.8255273	1
CIPLA	Pharma	0.763933	2
TORRENT	Pharma	0.7366512	3
SUNPHARMA	Pharma	0.6796656	4
LUPIN	Pharma	0.6599932	5
AUROPHARMA	Pharma	0.6466513	6
CADILAHC	Pharma	0.6398296	7
DIVIS	Pharma	0.6235399	8
DRREDDY	Pharma	0.6102611	9
SIEMENS	Textiles	0.7366018	1
GRASIM	Textiles	0.7251845	2

Source: The author.
Note: Companies that belong to industries with no more than one member have been avoided in this ranking scheme.

Appendix 2. Comparison of Ranking by Market Capitalisation and CSR Index

Marcap Rank	Firm Full Name	Industry	CSR Index Rank
1	RELIANCE INDUSTRIES LTD	Energy & NR	36
2	TATA CONSULTANCY SERV LT	IT	47
3	HDFC BANK LTD	Financials	94
4	HINDUSTAN UNILEVER LTD.	FMCEG	60
5	ITC LTD	FMCEG	88
6	HDFC LTD	Financials	29
7	INFOSYS LIMITED	IT	12
8	STATE BANK OF INDIA	Financials	31
9	ICICI BANK LTD.	Financials	95
10	KOTAK MAHINDRA BANK LTD	Financials	66
11	MARUTI SUZUKI INDIA LTD.	Auto, Machinery, Paint	45
12	OIL AND NATURAL GAS CORP.	Energy & NR	7
13	AXIS BANK LIMITED	Financials	46
14	LARSEN & TOUBRO LTD.	Cement, Steel, Infra	29
15	BAJAJ FINANCE LIMITED	Financials	100
16	WIPRO LTD	IT	20
17	INDIAN OIL CORP LTD	Energy & NR	54
18	HCL TECHNOLOGIES LTD	IT	61
19	COAL INDIA LTD	Energy & NR	92

20	ASIAN PAINTS LIMITED	Auto, Machinery, Paint	18
21	NTPC LTD	Energy & NR	33
22	BHARTI AIRTEL LIMITED	Communication	97
23	HINDUSTAN ZINC LIMITED	Energy & NR	24
24	SUN PHARMACEUTICAL IND L	Pharma	57
25	BAJAJ FINSERV LTD.	Financials	98
26	ULTRATECH CEMENT LIMITED	Cement, Steel, Infra	3
27	INDUSIND BANK LIMITED	Financials	89
28	POWER GRID CORP. LTD.	Energy & NR	9
29	TITAN COMPANY LIMITED	FMCEG	14
30	AVENUE SUPERMARTS LIMITED	FMCEG	67
31	BHARAT PETROLEUM CORP LT	Energy & NR	40
32	BAJAJ AUTO LIMITED	Auto, Machinery, Paint	81
33	MAHINDRA & MAHINDRA LTD	Auto, Machinery, Paint	4
34	GAIL (INDIA) LTD	Energy & NR	2
35	ADANI PORT & SEZ LTD	Cement, Steel, Infra	43
36	HDFC LIFE INS CO LTD	Financials	42
37	TECH MAHINDRA LIMITED	IT	25
38	BRITANNIA INDUSTRIES LTD	FMCEG	26
39	DABUR INDIA LTD	FMCEG	38
40	JSW STEEL LIMITED	Cement, Steel, Infra	11

41	GODREJ CONSUMER PRODUCTS	FMCEG	62
42	VEDANTA LIMITED	Energy & NR	28
43	SHREE CEMENT LIMITED	Cement, Steel, Infra	22
44	YES BANK LIMITED	Financials	49
45	PIDILITE INDUSTRIES LTD	Cement, Steel, Infra	63
46	BANDHAN BANK LIMITED	Financials	90
47	TATA STEEL LIMITED	Cement, Steel, Infra	5
48	SBI LIFE INSURANCE CO LTD	Financials	87
49	BHARTI INFRATEL LTD.	Communication	52
50	GRASIM INDUSTRIES LTD	Textiles	39
51	EICHER MOTORS LTD	Auto, Machinery, Paint	15
52	INTERGLOBE AVIATION LTD	Aviation	23
53	BOSCH LIMITED	Auto, Machinery, Paint	50
54	VODAFONE IDEA LIMITED	Communication	85
55	HERO MOTOCORP LIMITED	Auto, Machinery, Paint	41
56	PIRAMAL ENTERPRISES LTD	Pharma	8
57	TATA MOTORS LIMITED	Auto, Machinery, Paint	37
58	ICICI PRU LIFE INS CO LTD	Financials	84
59	UPL LIMITED	Agribusiness	10
60	HAVELLS INDIA LIMITED	FMCEG	77
61	MOTHERSON SUMI SYSTEMS LT	Auto, Machinery, Paint	86
62	ICICI LOMBARD GIC LIMITED	Financials	80

63	AMBUJA CEMENTS LTD	Cement, Steel, Infra	1
64	DR. REDDY'S LABORATORIES	Pharma	79
65	HINDALCO INDUSTRIES LTD	Energy & NR	51
66	AUROBINDO PHARMA LTD	Pharma	71
67	DIVI'S LABORATORIES LTD	Pharma	76
68	MARICO LIMITED	FMCEG	16
69	HINDUSTAN PETROLEUM CORP	Energy & NR	13
70	ZEE ENTERTAINMENT ENT LTD	Communication	99
71	CIPLA LTD	Pharma	26
72	GENERAL INS CORP OF INDIA	Financials	83
73	UNITED SPIRITS LIMITED	FMCEG	19
74	SIEMENS LTD	Textiles	35
75	BAJAJ HOLDINGS & INVS LTD	Auto, Machinery, Paint	96
76	PETRONET LNG LIMITED	Energy & NR	93
77	UNITED BREWERIES LTD	FMCEG	44
78	INDIABULLS HSG FIN LTD	Financials	73
79	BIOCON LIMITED.	Biotech/Pharma	58
80	PUNJAB NATIONAL BANK	Financials	59
81	DLF LIMITED	Cement, Steel, Infra	75
82	IDBI BANK LIMITED	Financials	82
83	CADILA HEALTHCARE LIMITED	Pharma	72

84	P&G HYGIENE & HEALTH CARE	FMCEG	68
85	COLGATE PALMOLIVE LTD.	FMCEG	63
86	BANK OF BARODA	Financials	78
87	LUPIN LIMITED	Pharma	65
88	TORRENT PHARMACEUTICALS L	Pharma	34
89	HDFC AMC LIMITED	Financials	21
90	POWER FIN CORP LTD.	Energy & NR	70
91	CONTAINER CORP OF IND LTD	Cement, Steel, Infra	74
92	NMDC LTD.	Energy & NR	53
93	BERGER PAINTS (I) LTD	Auto, Machinery, Paint	17
94	ACC LIMITED	Cement, Steel, Infra	32
95	THE NEW INDIA ASSU CO LTD	Financials	91
96	L&T FINANCE HOLDINGS LTD	Financials	55
97	GLAXOSMITHKLINE CONSUMER	FMCEG	48
98	REC LIMITED	Energy & NR	56
99	L&T INFOTECH LIMITED	IT	6
100	ORACLE FIN SERV SOFT LTD.	Financials	69

Source: The author.

Note: Market capitalisation ranking of top 100 Indian companies is as on 31 March 2019.