Contemplating Preference Ratings of Corporate Social Responsibility Practices for Supply Chain Performance System Implementation

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Abstract—The objective of this research work is to identify and analyze the significant corporate social responsibility (CSR) practices with an aim to improve the supply chain performance of automobile industry located at National Capital Region (NCR) of India. To achieve the objective, 6 CSR practices have been considered and analyzed using expert's preference rating (EPR) approach. The considered CSR practices are namely, Top management and employee awareness about CSR (P_1), Employee involvement in social and environmental problems (P_2), Protection of human rights (P_3), Waste reduction, energy saving and water conservation (P_4), Proper visibility of CSR guidelines (P_5) and Broad perception towards CSR initiatives (P_6). The outcomes of this research may help mangers in decision making processes and framing polices for SCP implementation under CSR context.

Keywords—Supply chain performance, corporate social responsibility, CSR practices, expert's preference rating approach.

I. INTRODUCTION

IN the present surrounding, CSR can be seen as a very exclusive theme among the manufacturing organizations. To accomplish a better stability and reputation, in the competitive market place, organizations are focusing on implementation of CSR policies along with their supply chain functions.

CSR emphasizes more attention of firm's responsibilities towards the social and environmental practices, instead of only on legal and economic concerns. CSR is seen as an inclusive set of policies, practices, and programs that are integrated into business operations, supply chains, and decision-making processes throughout the company. According to [1], CSR is a multi-dimensional structure and has four important dimensions: Economic, legal, ethical and discretionary. Reference [2] defined CSR as the set of activities related to social, environmental etc. those may be beyond the interest of the firm but may be required by law. Reference [3] defined CSR as: "a driver for an organization in order to improve the reputation, long term success, health and safety regulations, public awareness, and managing risk, brand recognition, cost reduction and customer loyalty". Reference [4] stated that CSR works as a key enabler to enlarge the view of responsibilities of business to integrate the environment, local

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communities, employment practices, and ethics in business practices, human rights, the marketplace as well as the workplace. Reference [5] described that CSR practice should be structured in a way of having responsibility about the impact on employees, customers, communities and operational environment. CSR not only affects the company and its shareholder but it also has beneficial impact on society [6]. [7] stated that CSR has a positive relationship with social performance.

The aim of present research work is to identify and analyze the important CSR practices in order to improve the supply chain performance of an organization under CSR considerations. For the analysis purpose, an EPR approach has been used.

II. IDENTIFICATION OF CSR PRACTICES

To meet the aim, six CSR practices have been identified on the basis of literature review and discussion with the field experts taken from of automobile sector located at NCR of India. A summary of identified CSR practices with corresponding reference support is given in Table I.

TABLE I
IDENTIFIED CSR PRACTICES

SNo.	CSR practices	References
1.	Top management and employee awareness about CSR	[11]-[13]
2.	Employee involvement in social and environmental problems	[14]-[17]
3.	Protection of human rights	[15], [17]-[20]
4.	Waste reduction, energy saving and water conservation	[12], [18], [21]-[24]
5.	Proper visibility of CSR guidelines	[25]-[30]
6.	Broad perception towards CSR initiatives	[26], [31]-[35]

III. PREFERENCE RATING APPROACH WITH NUMERICAL ILLUSTRATION

This research work provides a mutual interaction among the significant CSR practices by using a rating approach, called EPR approach developed by [8]. This approach determines the relative importance rating of the CSR practices in a precise way without consideration of any data scale. To model the human's incomplete or uncertain opinions, a graph theory-based representation technique has been used to structure the preference graph's (PG's) in order to visualize the mutual relationships of considered practices at initial level [9], [10]. However, various multi-criteria decision making approaches

exists in the literature, such as AHP, ANP, fuzzy AHP, fuzzy ANP, DEMATEL, and fuzzy DEMATEL. While all have a need of particular data scale in order to capture the opinions of field experts. In comparison, the EPR approach does not have a need of any type of scale. In EPR approach structured the PG's and analyzes them to determine the relative importance ratings of the considered practices.

The PG representations of expert preferences about the CSR practices are given in Fig. 1. During this research, four experts are selected and six CSR practices are identified based on the literature and expert opinions. These four experts are denoted as EP_1, EP_2, EP_3 and EP_4 and six practices as P_1, P_2, P_3, P_4, P_5, and P_6 respectively (P_1 for "Top management and employee awareness about CSR", P_2 for "Employee involvement in social and environmental problems", P_3 for "Protection of human rights", P_4 for "Waste reduction, energy saving and water conservation", P_5 for "Proper visibility of CSR guidelines", P_6 for "Lack of consensus on implementing CSR is Broad perception towards CSR initiatives sues"). PG's represented by four experts can be denoted as PG_1, PG_2, PG_3 and PG_4, and are shown as in Fig. 1.

Preference graph (PG_1) over M practices (here, M = 6) may be made by expert 1. For a set of n experts, EP_n represent a PG. Then, let PG_n be an adjacency matrix for the PG and let M be a positive integer. Then, the entry pg_{ij} (i, j=1, 2,···, m, ····, M) of PG_n^M gives the number of M stage dominances of i over j. That is, the dominance matrix D^n is:

$$D^n = PG_n^1 + PG_n^2 + \dots PG_n^m \dots + PG_n^M \tag{1}$$

The sum of the entries (d_m^n) in row m of the dominance matrix means the total number of ways that m is dominant one, two, …, M stages [36]. In this research, (M-1) stage dominances are considered for the PG. Here, six CSR practices have been considered; it means five dominance stages will exist. The adjacency matrix of PG_1 is given as:

$$PG_1^1 = \begin{bmatrix} 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix} \tag{2}$$

For M = 6, the dominance matrix (D^1) of PG_1 can be computed by:

$$D^1 = PG_1^1 + PG_1^2 + PG_1^3 + PG_1^4 + PG_1^5 \tag{3}$$

Using (3), D^1 of PG_1 is obtained as:

$$D^1 = \begin{bmatrix} 0 & 2 & 3 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 2 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix} \tag{4}$$
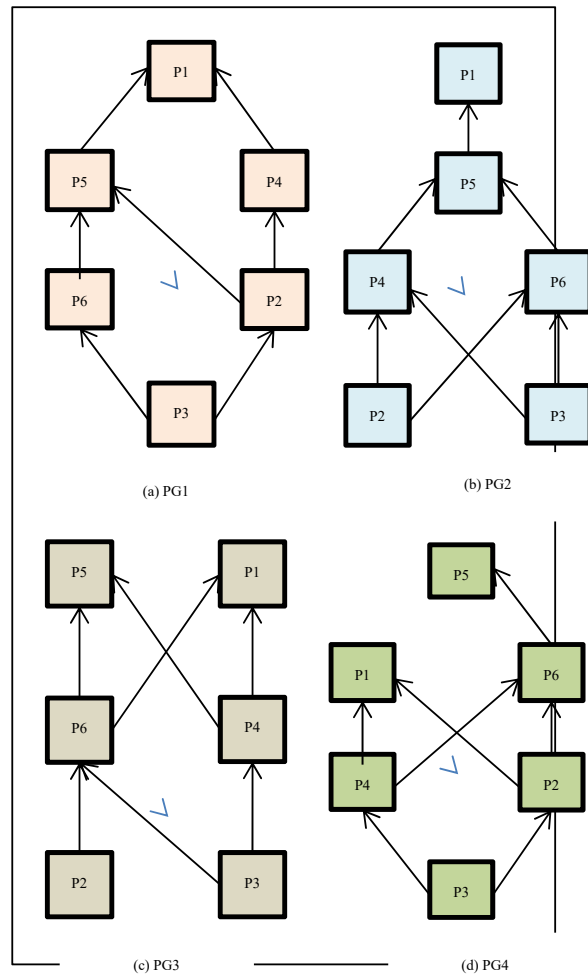

Fig. 1 Representation of relative importance of CSR practices

Then, sum of entries of (4), has been calculated as: $d_1^1 = 8$, $d_2^1 = 1$, $d_3^1 = 0$, $d_4^1 = 2$, $d_5^1 = 4$ and $d_6^1 = 1$. In other words, CSR practice P_1 has dominated nature in 0+2+3+1+1+1 = 8 ways, P_2 has a dominated nature in one way, P_3 in zero way, P_4 in two ways, P_5 in four ways, P_6 in one way. Similarly repeat the above computation procedure for PG_2, PG_3 and PG_4.

Dominance matrix (D^2) of PG_2 can be computed by:

$$D^2 = PG_2^1 + PG_2^2 + PG_2^3 + PG_2^4 + PG_2^5 \tag{5}$$

Using (5), D^2 of PG_2 is obtained as:

$$D^2 = \begin{bmatrix} 0 & 2 & 2 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 2 & 2 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 \end{bmatrix} \tag{6}$$

Then, sum of entries of (6), has been calculated as: $d_1^2 = 7$, $d_2^2 = 0$, $d_3^2 = 0$, $d_4^2 = 2$, $d_5^2 = 6$ and $d_6^2 = 2$.

The relative degree of preference (RDP) of each expert (n) can be obtained by the following expression to be the maximum of 1 as:

$$\text{rdp}_m{}^k = \frac{(1 + d_m^k)}{\max\limits_{m=1\ldots M}(1 + d_m^k)} \qquad (7)$$

For the illustrative convenience, let us denote the RDP of each expert (n) as a vector:

$$RDP_n = (rdp_1{}^n, rdp_2{}^n, \ldots rdp_m{}^n, \ldots.. rdp_M{}^n) \qquad (8)$$

The relative degree of preference (RDP) for PG_1, PG_2, PG_3 and PG_4 are calculated and are summarized as:

$$RDP_1 = \left(\frac{9}{9}, \frac{2}{9}, \frac{1}{9}, \frac{3}{9}, \frac{5}{9}, \frac{2}{9}\right)$$

$$RDP_2 = \left(\frac{8}{8}, \frac{1}{8}, \frac{1}{8}, \frac{3}{8}, \frac{7}{8}, \frac{3}{8}\right)$$

$$RDP_3 = \left(\frac{6}{6}, \frac{1}{6}, \frac{1}{6}, \frac{2}{6}, \frac{6}{6}, \frac{3}{6}\right)$$

$$RDP_4 = \left(\frac{5}{6}, \frac{2}{6}, \frac{1}{6}, \frac{2}{6}, \frac{6}{6}, \frac{5}{6}\right)$$

Based on the RDP of each company, we can obtain the relative importance ratings of the issues. Since K companies are taken into account, the relative importance rating (RIR) of each issue is determined by the following normalization to be the maximum of 1, and its vector expression can be also denoted as:

$$\text{rir}_m = \frac{\sum_{k=1}^{K} rdp_m^k}{\max\limits_{m=1\ldots M}(\sum_{k=1}^{K} rdp_m^k)} \qquad (9)$$

$$RIR = (rir_1, rir_2, \ldots. rir_m, \ldots\ldots, rir_M) \qquad (10)$$

The relative importance ratings (RIR) of issues are determined and summarizes as in (11):

$$RIR = (1.0000, 0.2209, 0.1485, 0.3586, 0.8947, 0.5035) \qquad (11)$$

IV. RESULTS

Equation (11) gives the summary of relative importance rating of CSR practices. From this equation, it is clear that the practice 'P_1' (with a relative importance rating of 1.00) is considerably more important and practice 'P_3' is least important (with a relative importance rating of 0.5035) as compared to the other considerable practices.

V. CONCLUSIONS

During present research work, an EPR approach is used to analyze the interaction among the considered CSR practices. PG's are used to collect the uncertain opinions of the decision makers in order to improve the supply chain performance under CSR context. On the basis of four PG's as shown in Fig. 1, the relative importance rating (RIR) of each CSR practice has been calculated and are summarized in (11). This particular equation provides a transparent picture about the importance level of considered practices. The analysis reveals that the CSR practice namely 'top management and employee awareness about CSR' is very important and plays a significant role in improving the supply chain performance system under CSR context. The overall prioritization order for considered CSR practices may obtained as $P_1 > P_5 > P_6 > P_4 > P_2 > P_3$.

REFERENCES

[1] Carroll, "Corporate social responsibility: evolution of a definitional construct", Business & Society, Vol. 38 No. 3, pp. 268-295, 1999.
[2] McWilliams, and D. Siegel, "Corporate social responsibility and financial performance: Correlation or misspecification?", Strategic Management Journal, Vol. 21, pp. 603-609, 2000.
[3] J. M. Cruz, and T. Wakolbinger, "Multi-period effects of corporate social responsibility on supply chain networks, transaction costs, emissions, and risk", International Journal of Production Economics, Vol. 116, No. 1, pp. 61-74, 2008.
[4] M. Tyagi, P. Kumar, and D. Kumar, "Analysis of importance rating of CSR challenges in order to improve the supply chain performance", International Journal of Intercultural Information Management, Vol. 4, No. 1, pp. 34-50, 2014.
[5] A. K. Yilmaz, "The Corporate Social Responsibility Practice in the Turkish Automotive Distribution Companies", International Journal of Business and Management, Vol. 3, pp. 139-147, 2008.
[6] J. Vicianova,) "Corporate Social Responsibility in the Automobile Industry in Slovak Republic" Seria Ştiinţe Economice Anul ParteaI, Matej Bel University, 2011.
[7] S. C. Afonso, P. O. Fernandes, and A. P. Monte, "CSR of Top Portuguese Companies: Relation between Social Performance and Economic Performance" World Academy of Science, Engineering and Technology, Vol. 66, pp. 853-857, 2012.
[8] Y. E. Nahm, H. Ishikawa, and M. Inoue, "New rating methods to prioritize customer requirements in QFD with incomplete customer preferences", International Journal of Advanced Manufacturing Technology, Vol. 65, No. 9-12, pp. 1587-1604, 2013.
[9] Y. E. Nahm, and H. Ishikawa, "Representing and aggregating engineering quantities with preference structure for set-based concurrent engineering", Concurrent Engineering: Research and Applications, Vol. 13 No. 2, pp. 123-133, 2005.
[10] Y. E. Nahm, and H. Ishikawa, "A new 3D-CAD system for set-based parametric design", International Journal of Advanced Manufacturing Technology, Vol. 29 No. 1-2, pp. 137-150, 2006.
[11] F. E. Bowen, P. D. Cousins, R. C. Lamming, and A. A. Faruk, "Horses for courses: explaining the gap between the theory and the practice of green supply", Greener Management International, Vol. 35, pp.41-60, 2002.
[12] P. A. Heslin, and J. D. Ochoa, "Understanding and developing strategic corporate social responsibility", Organizational Dynamics, Vol. 37, No. 2, pp.125-144, 2008.
[13] S. G. Azevedo, K. Govindan, H. Carvalho, and V. Cruz-Machado, "Ecosilient Index to assess the greenness and resilience of the upstream automotive supply chain", Journal of Cleaner Production, Vol. 56, No. 1, pp.131-146, 2013.
[14] G. J. Benston, "An analysis of the role of accounting standards for enhancing corporate governance and social responsibility", Journal of Accounting and Public Policy, Vol. 1, No. 1, pp. 5-17, 1982.
[15] D. P. Baron, "Managerial contracting and corporate social responsibility", Journal of Public Economics, Vol. 92, Nos. 1-2, pp.268-288, 2008.
[16] J. Bond, "Professional ethics and corporate social responsibility", Process Safety and Environmental Protection, Vol. 87, No. 3, pp.184-190, 2009.
[17] R. D. Klassen, and A. Vereecke, "Social issues in supply chains: Capabilities link responsibility, risk (opportunity), and performance", International Journal of Production Economics, Vol. 140, No. 1, pp.103-115, 2012.
[18] J. Cruz, and D. Matsypura, "Supply chain networks with corporate social responsibility through integrated environmental decision-making", International Journal of Production Research, Vol. 47, No. 3, pp.621-648, 2009.

[19] F. Ciliberti, J. D. Haan, G. D. Groot, and P. Pontrandolfo, "CSR codes and the principal-agent problem in supply chains: four case studies", *Journal of Cleaner Production*, Vol. 19, No. 8, pp.885-894, 2011.

[20] L. Becchetti, R. Ciciretti, I. Hasan, and N. Kobeissi, "Corporate social responsibility and shareholder"s value", *Journal of Business Research*, Vol. 65, No. 11, pp.1628-1635, 2012.

[21] J. Ammenberg, O. Hjelm, and P. Quotes, "The connection between environmental management systems and continual environmental performance improvements", *Corporate Environmental Strategy*, Vol. 9, No. 2, pp.183-192, 2002.

[22] W. Chapple, C. J. M. Paul, and R. Harris, "Manufacturing and corporate environmental responsibility: cost implications of voluntary waste minimization", *Structural Change and Economic Dynamics*, Vol. 16, No. 3, pp.347-373, 2005.

[23] P. Trowbridge, "A case study of green supply-chain management at advanced micro devices", *Greener Management International*, Vol. 35, pp.121–135, 2001.

[24] B. Ageron, A.Gunasekaran, and A. Spalanzani, "Sustainable supply management: An empirical study", *International Journal of Production Economics*, Vol. 140, No. 1, pp.168-182, 2012.

[25] K. Sahlin-Andersson, "Corporate social responsibility: A trend and a movement, but of what and for what?", *Corporate Governance*, Vol. 6, No. 5, pp. 595-608, 2006.

[26] D. Murillo, and J. M. Lozano, "SMEs and CSR: An Approach to CSR in their Own Words", *Journal of Business Ethics*, Vol. 67, No. 3, pp.227-240, 2006.

[27] D. E. Boyd, R. E. Spekman, J. W. Kamauff, and P. Werhane, "Corporate Social Responsibility in Global Supply Chains: A Procedural Justice Perspective", *Long Range Planning*, Vol. 40, No. 3, pp.341-356, 2007.

[28] D. S. Siegel, and D. Vitaliano, "An empirical analysis of the strategic use of corporate social responsibility", *Journal of Economics & Management Strategy*, Vol. 6, No. 3, pp.773-792, 2007.

[29] I. D. Sardinha, L. Reijnders, and P. Antunes, "Using corporate social responsibility benchmarking framework to identify and assess corporate social responsibility trends of real estate companies owning and developing shopping centres", *Journal of Cleaner Production*, Vol. 19, No. 13, pp.1486-1493, 2011.

[30] J. M. A. Valiente, C. G. Ayerbe, and M. S. Figueras, "Social responsibility practices and evaluation of corporate social performance", *Journal of Cleaner Production*, Vol. 35, November, pp.25-38, 2012.

[31] A. McWilliams, and D. Siegel, "Corporate social responsibility: a theory of the firm perspective", *Academy of Management Review*, Vol. 26, No. 1, pp.117-127, 2001.

[32] D. Hess, "The three pillars of corporate social reporting as new governance regulation: disclosure, dialogue, and development", *Business Ethics Quarterly*, Vol. 18, No. 4, pp.447-482, 2008.

[33] F. Ciliberti, P.Pontrandolfo, and B. Scozzi, "Investigating corporate social responsibility in supply chains: a SME perspective", *Journal of Cleaner Production*, Vol. 16, No. 15, pp.1579-1588, 2008.

[34] X. Font, A. Walmsley, S. Cogotti, L. McCombes, and N.Häusler, "Corporate social responsibility: The disclosure-performance gap", *Tourism Management*, Vol. 33, No. 6, pp.1544-1553, 2012.

[35] M. Tyagi, P. Kumar, D. Kumar, "Analyzing CSR issues for supply chain performance system using preference rating approach", *Journal of Manufacturing Technology Management*, Vol. 26 Iss 6 pp. 830 – 852, 2015.

[36] M. L. Lial, R. N. Greenwell, and N. P. Ritchey, *Finite mathematics*, Addison Wesley, New York, 2002).