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Environmental benchmarking practices in Indian industries: Evidences from an empirical study

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Evidences from an empirical study

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Abstract

Purpose – The purpose of this paper is to understand whether the adoption of environmental management practices and firm characteristics influence the environmental benchmarking in Indian firms. It further looks into the impact of environmental benchmarking practices on firms' environmental performance.

Design/methodology/approach – The study conducts a research survey to obtain the practitioner's responses on the different aspects of environmental benchmarking. The survey data of 104 firms provide an empirical basis to investigate different research hypotheses using statistical techniques.

Findings – The results indicate that the firms which implement environmental management practices are more likely to adopt environmental benchmarking in one or more areas of their operations. The findings signify that firms which benchmarks for environmental purposes are more likely to have better environmental performance. The study confirms that large firms have significant chances of having environmental benchmarking compared to small and medium sized firms. The firms in different sectors have different relative preference to eight different areas of environmental benchmarking. However, all these preferences are not significant at 95 per cent confidence level.

Research limitations/implications – The research use only qualitative responses on environment management aspects and could be further extended by incorporating the quantitative (emission) data of different industries.

Practical implications – The study provides an insight into the environmental benchmarking practices of Indian firms for better management of environmental performance of the firms.

Originality/value – The study investigates the experience and attitude of Indian firms to environmental benchmarking based on an empirical research. It adds to the knowledge in the field of environmental benchmarking in developing countries with specific focus on India.

Keywords Performance measurement, Industrial performance, Benchmarking

Paper type Research paper

1. Introduction

The consistent pressure on industries from varied sources to integrate business operations and natural environment has been significant over the years and firms are increasingly adopting different measures at management and operational level to reduce the environmental impact of their processes. At the same time, the firms are also starting to perceive, environmental performance as a key aspect of their competitive profile to have higher potential strategic benefits (Rothenberg *et al.*, 2005). The firms compare environmental performances both across industries and among their own facilities to find leaders (and laggers) for moving businesses closer to best practices by benchmarking their environmental practices (Matthews, 2003).

Benchmarking is recognized as a management tool essential for continuous improvement of quality (Singh *et al.*, 2014; Dattakumar and Jagadeesh, 2003; Zhao *et al.*, 1995). However, over the years there has been a significant development of benchmarking techniques and a variety of benchmarking practices evolved in the course of the changes in business trends over time (Hong *et al.*, 2012). The most commonly accepted aspect of

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benchmarking is comparing firms' performance within or between companies (Watson, 1993). As consumer and market requirements become more complex in nature, the emerging research issues in benchmarking are related to the complexity of increasingly intertwined business practices. Increasingly, the demand for complex environmental and operational sustainability indicators requires firms to devise effective assessment and evaluation measure (Hong *et al.*, 2012; Nunes and Bennett, 2010; Presley and Meade, 2010; Zhu and Liu, 2010).

Unlike quality, environmental performance of a firm cannot be easily measured through market base feedbacks such as product sales and quality perception. Different measures have been evolved to assess environmental performance using publically available annual data on releases of toxic chemicals (Toxic Release Inventory of the US Environmental Protection Agency), which allow firms to compare their operations within the same industry. However, such data are limited and even non-exist in many of the developed and developing countries. The availability and usefulness of the common environmental data in fact limits the environmental benchmarking with competitors. In addition, there has been no consensus on choosing variable which represent "good" environmental performance. The challenges come from choosing which variables to measure, how to physically measure them, and, if they cannot be physically measured, what other variables are close enough as proxy for the desired variables. As pressures from various stakeholder increases to demonstrate environmental performance, the interpretation and relevance of these variables becomes more important (Rothenberg *et al.*, 2005; Matthews, 2003; Sarkis, 2003). Sarkis (2003) in his guest editorial (*Benchmarking: An International Journal*) talked about the changed approach of organization towards the process of benchmarking for environmental purpose and mentioned that the requirements, process and reasons for data and information gathering and use have changed over the time. This is mainly attributed to the increased awareness in society about the environment; changing stance by regulators from one of command and control to cooperation and a general change in firms' approach from reactive to proactive environmental strategies.

The environmental benchmarking is an environmental management tool which follows the same general principle of "plan, do, check, act" of environmental management system (EMS) for continuous improvement of environmental performance. Matthews (2003) suggested that while the availability and usefulness of the common environmental data limits the environment benchmarking, the internal (corporate) environmental benchmarking can be achieved through EMS.

Benchmarking as a quality management tool has been a topic of much research, however the use and practice of environmental benchmarking has had limited study (Sarkis, 2003; Hong *et al.*, 2012). The present study aims to determine the experience of and the attitudes of Indian firms towards environmental benchmarking with the aim to investigate the following specific research questions:

RQ1. Is the status of EMSs implementation, effects the adoption of environmental benchmarking practices?

RQ2. Is environmental benchmarking improves the overall environmental performance of firm compared to their peers in the business?

RQ3. What are the prevalent environmental benchmarking areas in different industrial sectors?

RQ4. Is a firm size effect the adoption of environmental benchmarking practices?

The study postulate different hypotheses to investigate the empirical evidences for the above research questions based on the responses of 104 firms on a comprehensive research questionnaire on EMS and environmental benchmarking.

2. Literature review and hypothesis development

2.1 EMS and environmental benchmarking

An extensive review of literature on environmental benchmarking explaining specific areas of application, outcomes and gaps has been provided by various authors (Dattakumar and Jagadeesh, 2003; Yasin, 2002; Dorsch *et al.*, 1998; Zairi and Youssef, 1995a, b, c, 1996; Vig 1995; Czuchry *et al.*, 1995; Jackson *et al.*, 1994). The demand to assess companies' performances rather than their policies, have resulted in different form of internal and external benchmarking, focusing mainly on health, safety and environment (Kolk, 2004; Kolk and Mauser, 2002). Hong *et al.* (2012) have studied how the nature and the scope of benchmarking changed over years and what are the emerging benchmarking issues in a rapidly changing business practices environment. The review of articles shows interesting patterns with majority of articles related to micro-level analysis of various benchmarking patterns. These articles put emphasis on performance measurement, macro-level analysis of industries and the global competiveness. As the requirements of benchmarking become more complex and dynamic, the research methods have come to include case studies (Rajagopal *et al.*, 2009; Singh *et al.* 2007), empirical studies (Panwar *et al.*, 2013; Hong *et al.*, 2010a, b; Magd, 2008) conceptual framework studies (Jain *et al.*, 2008; Wait and Nolte, 2005), and mathematical and statistical modelling (Sreekumar and Mahapatra, 2011).

Dattakumar and Jagadeesh (2003) in their review of 382 studies on benchmarking cited only two publications related to environmental benchmarking (Bhat, 1995; Karch, 1992). The limited research studies on environmental benchmarking have been attributed mainly to the availability of requisite information and data which were virtually nonexistent (Sarkis, 2003). Matthews (2003) mentioned that environmental benchmarking is difficult with the range and inconsistency of environmental information available. For example, Hooper and Greenall (2005) have mentioned that the available sustainability-related data from European airlines industry lacks standards of comparison, which makes it difficult to benchmark. Rothenberg *et al.* (2005) propose four discernible patterns of environmental benchmarking approaches based on regulatory, gross emissions, efficiency and life cycle approaches.

Although there has been limitations on the availability of environmental-related data (specially at firm level) many researcher consider certified EMS (ISO 14001) as well as similar voluntary programs (Global Reporting Initiative; EMAS) ideal for environmental sustainability and benchmarking in industries (Amin and Benerjee, 2010; Padma *et al.*, 2008; Corbett and Kirsch, 2004; Kolk, 2004; Poksinska *et al.*, 2003; Matthews, 2003). Matthews (2003) focuses on the issue of how to get EMS to be more effective environmental benchmarking tools. She provides an overview of ISO 14000 environmental management standards and its relationship to benchmarking and emphasized that while the availability and usefulness of available environmental data limits environmental benchmarking with competitors, internal environmental benchmarking can be achieved through EMS. It has been further affirmed that although ISO 14001 certification bring many benefits but does not address many aspects of benchmarking process which include peer benchmarking, minimum standard of environmental performance and public disclose, however it allows for internal benchmarking (Amin and Banerjee, 2010; Rondinelli and Vastag, 2000).

However, it has been argued that these management systems have a presumptive value in the sense that firms which have implemented an EMS (ISO 14001) are more likely to practice environmental benchmarking (internal and external) (Singh *et al.*, 2014). Accordingly the following hypothesis is proposed:

H1. The firms which either implemented or currently implementing EMS are more likely to benchmark for environmental purposes.

The firms perceive their environmental performance as a key aspect of their competitive profile (Rothenberg *et al.*, 2005). Therefore, firms are first expected to benchmark with similar companies in the same sector, accordingly the following hypothesis is proposed:

H2. The firms which benchmark for environmental purposes are more likely to benchmark with similar companies in the same sector.

2.2 Environmental performances

An EMS consists of systematic management practices aimed at creating internal mechanism that ensure continual improvement of overall environmental performance (Martin, 1998). The development and operation of an EMS follows the plan, do check, act model and typically define a set of policies, goals, strategies and administrative procedures to reduce environmental pollutions (Coglianese and Nash, 2001). The existing EMS frameworks do not require data collection and collection of similar measures of environmental performance which would allow firms to benchmark their operations. The necessary changes are fairly simple in practice and can be easily being incorporated into the existing EMS at facilities (Matthews, 2003). There are conceptual reasons for believing that EMSs are critical in improving overall environmental performance of firms. Without having comprehensive EMSs, firms are unlikely to take systemic approaches for improving their environmental performances (Coglianese and Nash, 2001). As benchmarking is the process of identifying, understanding and adopting outstanding practices from other organizations to improve its performance and follows the "plan, do, check, act" model for continuous improvement, it is expected that environmental benchmarking would result in improved environmental performances of the firms compared to their peers in the business:

H3. The firms which benchmark for environmental purposes are more likely to have better environmental performance compared to their peers.

2.3 Firms' characteristics

The firms' characteristics are also important determinants of its environmental management performance levels. Previous studies showed significant positive correlation between firm size and its environmental performance as larger firms are more likely to improve its environmental performance to reduce their operational impact on natural environment (Darnall *et al.*, 2009; Etzion, 2007). The following hypothesis is therefore proposed:

H4. The larger firms are more likely to adopt the benchmarking in environmental practices compared to SMEs.

Additionally, various industrial sectors using different natural resources in their manufacturing process may be sensitive to their potential impact on the environment

and may adopt different level of environmental management and benchmarking practices to avoid environmental risks associated with their operations. The manufacturing, chemical and agriculture industries have greater environmental impact of their operations compared to the service industry (Gonzalez and Gonzalez, 2006). It is therefore expected that different industry sectors would have different priority to environmental benchmarking in different areas to reduce their potential environmental impact. The following hypothesis is therefore proposed:

H5. Different industrial sectors have different level of priority to various areas of environmental benchmarking.

The study investigates the empirical evidences about the extent to which a sample size of Indian firms have adopted environmental benchmarking using responses from 104 firms on a structured questionnaire. It looks at whether benchmarking has led to improved environmental performance in the sample. The preference to specific areas of environmental benchmarking by different industrial sectors as well as factors (firms' characteristics) associated with adoption of environmental benchmarking practices has been examined empirically.

3. Research methodology

3.1 Survey questionnaire

In order to investigate the research hypothesis a questionnaire was developed to conduct a survey. The questionnaire contains general information about the firm (sector, number of employees, total turn-over, size of the firm, etc.) and the research issues as hypothesized above (enclosed as the Appendix). The design process for the questionnaire was in accordance with the objectives of the study and consists of different stages. The initial questionnaire was designed based on the review of the literature, which was further validated by conducting personal interviews with different stakeholders (managers, academicians, industrial institution like, CII, FICCI, etc.). The questionnaire was pretested and the definitive version of the questionnaire was then finalized. This development approach to the design of the questionnaire ensured accuracy and content validity and widely used in the field (Forza, 2002).

3.2 Sample and data collection method

The final research questionnaire focusing on different aspect of environmental benchmarking was sent to randomly selected firms listed by Indian Product Promotion Center, members firms of Business Counsel for Sustainable Development, The Energy and Resources Institute, and complemented by field interview of firms from industrial areas in National Capital Region and neighbouring states. Multiple industries has been chosen to investigate the environmental behaviour of several industries for generalization rather than being limited to isolated cases of particular industry segment as examined in previous studies (Amin and Banerjee, 2010; Padma *et al.*, 2008; Singh *et al.*, 2006; Rothenberg *et al.*, 2005). The research questionnaire was sent to 1,225 firms belonging to different industrial sectors. A total of 187 responses were received, out which 104 were found to be complete and valid constituting a response rate of 8.5 per cent, which is consistent with previous studies (Liu *et al.*, 2010; Melnyk *et al.*, 2003; Christman, 2000; Alreck and Settle, 1995).

3.3 Measures

The firm perception on several aspects of the environmental benchmarking was measured to investigate the experience and attitude of Indian firms towards environmental benchmarking. In the survey the status of implementation of EMS and environmental benchmarking were determined with responses "yes" and "no". These responses have been used to test the first hypothesis using proportion test (at 95 per cent significance level). The responses (yes, no) of the firms for benchmarking between companies in the same sector or another sector are considered to test the second hypothesis.

The evaluation of the firm environmental performance compared to their peers was measured through four-point Likert scale (excellent, average, poor, cannot say) to evaluate the third hypothesis. In addition, the firm characteristics were also included to the test the fourth and fifth hypotheses regarding firm size and sector and their relationship with environmental benchmarking practices.

The firm size is measured through responses on various indicators to categorize them into large, medium and small segments. In the present study the size of the firm is measured by using different indicator variables using total number of employees (Darnall *et al.*, 2009), capital cost (Zeng *et al.*, 2011) and the total turn-over (Liu *et al.*, 2010). The respondent also requested to categorize their firm as small, medium and large. The exploratory factor analysis shows that these indicator variables for firm size can be represented by a single factor as shown in Table I. The natural logarithm of employee numbers is used in the analysis to transform the skewed distribution to yield consistent results. The first factor has large positive eigenvalue (3.74) and account for 74.80 per cent of the total variance. The communalities indicate the total variance of a variable that is explained by the factors. The Cronbach's α (reliability) is 0.91 indicating adequate internal consistency of the factor "firm size". The details of factor analysis and summary statistics of variables are shown in Table I.

The sector in which the firm operates is based on the division of sectors as manufacturing, chemical, agriculture and service. The responses (yes, no) of the firms regarding their areas of environmental benchmarking (eight different areas of benchmark) have been used to test the fifth hypothesis.

4. Analysis and results

The sample firms include respondents from 16 different industries grouped into four sectors, i.e. manufacturing, agriculture, chemical and service. In term of firm size,

Variable	Factor loadings Factor 1 (firm size)	Mean	SD	Max	Min
Total capital	*0.93*	2.63	0.61	3.00	1.00
Size scale	*0.92*	2.47	0.67	3.00	1.00
Log (total employee)	*0.85*	2.62	0.66	3.85	1.00
Turn-over	*0.84*	2.77	0.53	3.00	1.00
Log (full-time employee)	*0.77*	1.08	0.36	1.57	0.00
Variance	*3.74*				
% Var	*74.80*				
Cronbach's α	*0.91*				

Notes: Loadings stronger than ±0.50 are in italics. Extraction method: principal component analysis; rotation method: Quartimax

Table I.
Factor analysis of firm size

the sample is further divided as small, medium and large enterprises (SMEs). The respondents include 43 per cent from Small and Medium scale Enterprises (SMEs) and 57 per cent from large Indian enterprises. The firms from manufacturing sector have maximum number of respondents followed by agriculture, service and chemical sector. The size scale wise and sector-wise distribution of 104 valid responses from different industries has been shown in Figure 1.

The responses of the 104 firms on survey questionnaire shows that the firms which either implemented or currently implementing any EMS prefer benchmarking for environmental purposes. The survey demonstrate that of the 71 firms, which either implemented or currently implementing EMS, 63 firms are benchmarked for environmental purposes. Figure 2 shows the number of firms which have benchmarked for the environmental purpose. All these firms have benchmarked with firms within the same sector, however eight firms have also benchmarked with the firms in other sectors for environmental purposes.

To test *H1* and *H2*, "confidence interval for one proportion test" has been performed for $p = 0.5$ vs $p > 0.5$. The results shows empirical evidences at 95 per cent level of confidence are significant for both the hypotheses.

The responses of the firms to rate their environmental performance compared to other firms in the field on the four-point Likert scale (excellent, average, poor and cannot say) are shown in Figure 3. The results indicates that no firm (either benchmark or not) assessed its performance as poor compared to other firms although 13 firms are inconclusive to rate

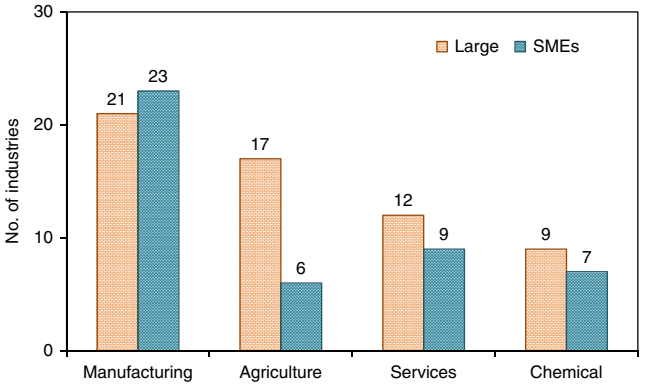

Figure 1.
Sector and size scale wise distribution of industries

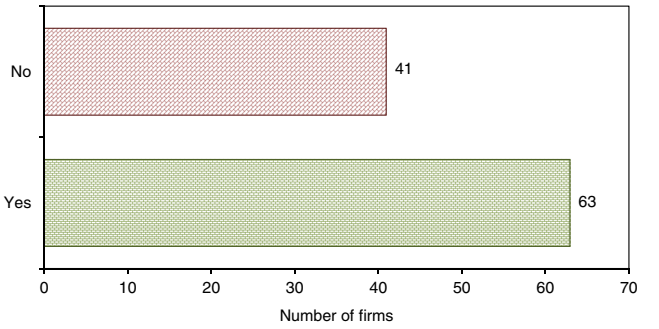

Figure 2.
Number of firms benchmarked for the environmental purpose

their environmental performance. This may be because firms do not want to be recognized as poor environmental performer and opted either for "cannot say" or "average" category. However, a sizable number of firms rate their environmental performance either excellent (45 firms) or average (46 firms) compared to other companies. The results further indicate that firms which benchmarked (63) their environmental performance assessed their performance either as excellent (34) or average (28) with one firm remain inconclusive. However, the firms which have not benchmarked environmental practices (41) assessed their performance either as average (18) or remain inconclusive (12). To test *H3*, proportion test has been performed for $p = 0.5$ vs $p > 0.5$. The results indicate that empirical evidences at 95 per cent level of confidence are significant for *H3*.

The survey responses also illustrate that 42 firms of the 63 firms which benchmark in environmental practices are large firms compared to 21 SMEs (small and medium scale enterprises). It also signifies that 17 large firms and 24 SMEs do not follow any benchmark environmental practices in their business operations. The distribution of large and SMEs firms which follows benchmarking in environmental practices are shown in Figure 4. To test *H4*, proportion test has been performed for $p = 0.5$ vs $p > 0.5$. The results indicate that empirical evidences at 95 per cent level of confidence are significant for *H4*. All these results have been summarized in Table II.

The firms were further asked to mention the areas in which the firms have benchmarked for environmental purposes. The summary details of responses of all the 63 firms which have considered benchmarking for environmental purposes in different

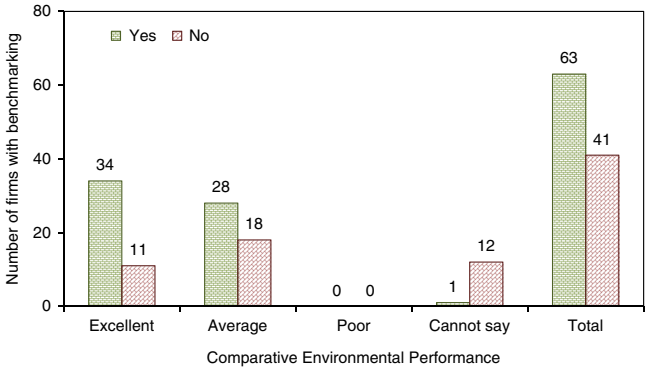

Figure 3.
Environmental performance of the firms compared to other companies in the field

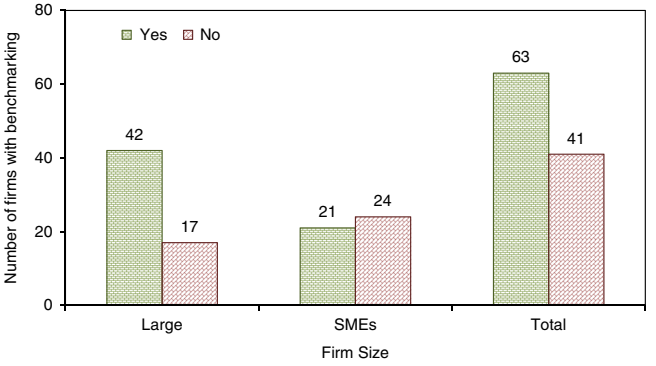

Figure 4.
Size wise distribution of firms which follow benchmarking for environmental purposes

areas are given in Table III. Table III demonstrate the relative preference of benchmarking areas by the firms and reveals that firms which have benchmarked for environmental purposes consider "reducing energy consumption" (mean 0.68) as one of the most sought area followed by "using environmental friendly product/suppliers" (supply chain) (mean 0.60) for benchmarking. Minimizing air (mean 0.57) and water pollution (mean 0.57) are also important areas of benchmarking. However firms consider "recycling materials" (mean 0.41) as one of the least sought areas for benchmarking followed by "minimizing physical impacts of operations" (mean 0.46). However the statistical analysis shows that only benchmarking in the area of "reducing energy consumption" is significant at 95 per cent confidence level. Table III shows the *p*-value for the sample mean for each of the eight different benchmarking areas. Further investigations of sector-wise benchmarking practices have been provided in Table IV for manufacturing, agriculture, chemical and service sectors, respectively. These tables show that relative preference of the benchmarking areas of firms (which have benchmarked for environmental purposes) is different for different sectors.

The 63 firms which have benchmarked for environmental purposes consist of 25 firms from manufacturing; 16 firms from agriculture; 10 firms from chemical; and 12 firms from service sector. Table IV shows relative preference of manufacturing sector for different environmental benchmarking areas. However, the sample mean for benchmarking areas in manufacturing sector is significant only for "reducing energy consumption" at 95 per cent confidence level, showing that benchmarking in other areas is not significant in manufacturing sector. Altham (2007), while reporting on the critical success factors for environmental benchmarking in small businesses mentioned that besides reduction in waste generation, such practices also resulted in improved energy efficiency. Morrow *et al.* (2014) revealed that significant energy efficiency opportunities exists for Indian cement and steel industry while investigating the energy efficiency potential and its associated costs over the next 20 years (2010-2030).

Table II.
Empirical evidences for hypothesizes

Hypothesis	X	n	Sample p	95% lower bound	Exact p-value	Evidence at 95% level of significance
H1 ($p = 0.5$ vs $p > 0.5$)	63	71	0.887	0.806	0.000	Significant (accepted)
H2 ($p = 0.5$ vs $p > 0.5$)	63	63	1.000	0.953	0.000	Significant (accepted)
H3 ($p = 0.5$ vs $p > 0.5$)	62	63	0.984	0.927	0.000	Significant (accepted)
H4 ($p = 0.5$ vs $p > 0.5$)	42	63	0.667	0.556	0.006	Significant (accepted)

Table III.
Areas of environmental benchmarking (all sectors)

Benchmarking areas	n	Max	Min	Mean	SE mean	p-value
Using environmentally friendly products/suppliers	63	1	0	0.60	0.062	0.051*
Minimizing physical impacts of operations				0.46	0.063	0.733
Reducing energy consumption				*0.68*	*0.059*	*0.002**
Minimizing or reducing air pollution				0.57	0.063	0.130
Minimizing or reducing water pollution				0.57	0.063	0.130
Minimizing the use of hazardous materials and chemicals				0.51	0.063	0.450
Recycling materials				0.41	0.062	0.916
Reducing amount of waste produced				0.52	0.063	0.354

Notes: Test of mean = 0.50 vs > 0.5. *Significant at 0.05

Sector	Benchmarking areas	*n*	Max	Min	Mean	SEM	*p*-value
Manufacturing	Using environmentally friendly products/ suppliers	25	1	0	0.60	0.100	0.164
	Minimizing physical impacts of operations				0.40	0.100	0.836
	Reducing energy consumption				*0.76*	*0.087*	*0.003**
	Minimizing or reducing air pollution				0.56	0.101	0.280
	Minimizing or reducing water pollution				0.60	0.100	0.164
	Minimizing the use of hazardous materials and chemicals				0.44	0.101	0.720
	Recycling materials				0.36	0.098	0.917
	Reducing amount of waste produced				0.52	0.101	0.423
Agriculture	Using environmentally friendly products/ suppliers	16	1	0	0.56	0.128	0.316
	Minimizing physical impacts of operations				0.50	0.129	0.500
	Reducing energy consumption				0.62	0.125	0.167
	Minimizing or reducing air pollution				0.56	0.128	0.316
	Minimizing or reducing water pollution				0.50	0.129	0.500
	Minimizing the use of hazardous materials and chemicals				0.50	0.129	0.500
	Recycling materials				0.37	0.125	0.833
	Reducing amount of waste produced				0.56	0.128	0.316
Chemical	Using environmentally friendly products/ suppliers	10	1	0	0.60	0.16	0.278
	Minimizing physical impacts of operations				*0.80*	*0.13*	*0.026**
	Reducing energy consumption				*1.00*	*0.00*	*0.000**
	Minimizing or reducing air pollution				*0.80*	*0.13*	*0.026**
	Minimizing or reducing water pollution				*0.80*	*0.13*	*0.026**
	Minimizing the use of hazardous materials and chemicals				0.70	0.15	0.111
	Recycling materials				0.60	0.16	0.278
	Reducing amount of waste produced				0.70	0.15	0.111
Services	Using environmentally friendly products/ suppliers	12	1	0	0.66	0.142	0.133
	Minimizing physical impacts of operations				0.25	0.130	0.959
	Reducing energy consumption				0.33	0.142	0.867
	Minimizing or reducing air pollution				0.41	0.148	0.707
	Minimizing or reducing water pollution				0.41	0.148	0.707
	Minimizing the use of hazardous materials and chemicals				0.50	0.150	0.500
	Recycling materials				0.41	0.148	0.707
	Reducing amount of waste produced				0.33	0.142	0.867

Notes: Test of mean = 0.50 vs > 0.5. *Significant at 0.05

Table IV.
Sector-wise distribution of benchmarking areas of firms practicing environmental benchmarking

Table IV shows similar statistical analysis for agriculture sector. The sample mean for different benchmarking areas shows that benchmarking in not significant (at 95 per cent confidence level) in any of the benchmarking area in agriculture sector. Table IV shows the preference of benchmarking areas for chemical industry. It shows that chemical industry significantly benchmark in maximum number of areas with sample means of "reducing energy consumption", "minimizing or reducing air and water pollution" and "minimizing the physical impact of operation" are significant at 95 per cent confidence level. Table IV reports that service sector do not have significant environmental benchmarking in any of the areas.

5. Conclusion

The study investigates the link between status of EMS implementation and environmental benchmarking practices in Indian firms. It further examined the performance implications of these benchmarking practices and (relative) preferences of various industry sectors for eight different environmental benchmarking practices. The analysis reveals that status of EMS implementation significantly affects the adoption of environmental benchmarking practices. The results signify that firms, which are practicing environmental benchmarking, expected to have significantly improved environmental performance compared to their competitors. The study also emphasizes that size of the firm is a significant determinants of firms' benchmarking practices, as larger firms are more likely to follows environmental benchmarking compared to SMEs. The study indicates that pollution intensive industries are expected to benchmark (environmentally) in more areas of operation compared to green industries. However, results suggest that "reduction in energy consumption" is the significantly preferred choice of all sampled firms at 95 per cent confidence level, although the adoption of other practices and their significance level are more industry specific. These research findings have possible implications for managers and policy makers as EMS implementation and environmental benchmarking activities are expected to improve firm's environmental performance, which would probably produce financial and competitive advantages. However these issues should be more comprehensively investigated given the possibility that expected benefits might also be influenced by many other factors and therefore provides an excellent research opportunity for future investigation.

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Appendix. Research Questionnaire

I General Information

1.1 What is the name of the company?

1.2 To which sector of industry does your company belong?

1.3 To which size scale does your industry belong?

Large scale
Medium scale
Small scale

1.4 What is the total number of employees of your company?

1.5 How many full-time employees are working in your company?

1.6 What is the total capital investment of your company?

1.7 What is the total turn-over of your company?

II Environmental Management Benchmarking

2.1 Has your company actually implemented an environmental management system?

Yes (If yes, then please specify the year)
In progress
No

2.2 Please evaluate the overall effectiveness of your company's environmental management process?

No process
Not effective at all
Moderately effective
Extremely effective

2.3 Compared with other companies in the field, how would you assess your Environmental performance?

Excellent
Average
Poor
Cannot say

2.4 Have you benchmarked for environmental purposes? Please tick all that apply.

Yes
No

If yes, between companies in the same sector	*If yes, between companies in the another sector*
Yes	*Yes*
No	*No*

2.5 Please tick the area in which you have benchmarked.

Using environmentally friendly products/suppliers	
Minimizing physical impacts of operations	
Reducing energy consumption	
Minimizing or reducing air pollution	
Minimizing or reducing water pollution	
Minimizing the use of hazardous materials and chemicals	
Recycling materials	
Reducing amount of waste produced	

Any other, please specify

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