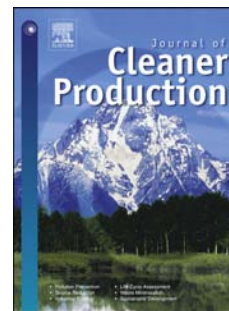


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Insights into the state of ISO14001 certification in both small and medium enterprises and industry best companies in India: the case of Delhi and Noida

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Insights into the State of ISO14001 Certification in Both Small and Medium Enterprises and Industry Best Companies in India: The Case of Delhi and Noida

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Insights into the State of ISO14001 Certification in Both Small and Medium Enterprises and Industry Best Companies in India: The Case of Delhi and Noida

Despite growing interest in, and government support for, ISO14001 certification across Asia in recent years, little is known about issues surrounding the uptake and the effectiveness of environmental management systems in this region. There is a particular void of academic work in relation to ISO certification in India and the country's large number of small and medium enterprises; a field of inquiry this paper seeks to advance. Specifically, as a means of providing a basis for classification of firms for an analysis of the state of ISO14001 in India we test the adequacy of critical factors such as nature of business, size, year of establishment and internationalisation among small and medium enterprises and industry best companies. An analysis is presented of secondary data derived from the websites of a sample of ISO14001 certified firms located in the cities of Delhi and Noida. The data show that in the area of manufacturing the highest number of ISO14001 certifications can be recorded and that established small and medium enterprises with high turnover are more likely to adopt ISO14001 certification compared to low turnover firms. The findings inform the status of environmental management systems in India and have implications for government policy intended to foster ISO14001 uptake by Indian firms.

Keywords: Environmental Management System, ISO14001, Developing Nations, Environmental Policy, India

1. Introduction

Much interest can be recorded of late in environmental management systems (EMSs) among Indian companies. Both, India's recently released 4th census report on MSMEs¹ (DCSME, 2009) and the 2011 ISO survey (ISO Survey, 2011) have documented a significant uptake in ISO14001 certifications among small and medium-sized Indian companies. This positive trend is somewhat surprising in that previous studies on environmental management systems in India have identified a number of obstacles affecting their uptake and effectiveness in Indian firms (Dasgupta, 2000; Padma et al., 2008; Qadir and Gorman, 2008). These obstacles include a lack of transparency, weak regulatory compliance and certification schemes and the large costs associated with

¹ Enterprises in India are classified into *micro, small and medium enterprises* (MSMEs) based on their investment in plant and machinery (for manufacturing enterprises) or on equipment (for service providers) (see DCMSME, 2009, p.2).

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ISO14001 certification as it pertains to the standard's requirement for continuous improvement. While Qadir and Gorman (2008) regard ISO14001 a useful tool for the improvement of firms' environmental performance in the face of weak government-enforced regulatory systems in the developing world, the ISO standard has many limitations in a developing country context. These limitations refer to problems surrounding peer benchmarking, industry-wide benchmarking, required minimum legal standards of environmental performance, and public disclosure requirements. Amin and Banerjee (2010) proposed a country-specific model of environmental management systems to address the limitations of ISO14001. Yet, as their work was focused chiefly on larger steel manufacturing companies (e.g. Tata and the Steel Authority of India) and did not address the cost dimension of ISO certification, the model arguably lacks applicability and relevance to the Indian MSME sector.

It is through a developing country lens that this paper wishes to shed light on the status of ISO14001 in India by way of comparing company data derived from ISO-certified companies operating in the cities of Delhi and Noida with previous research on ISO14001 in the Indian and international context. Reported on here are the preliminary findings of a larger, on-going investigation into ISO certification in India, providing the basis for needed comparative research in the Indian EMS space. This work has policy implications for the advancement of the environmental management agenda in this country.

2. Environmental management issues in India

"... no wonder that developing Asia now counts among the fastest "waste creators" globally. But, initiatives to address this massive problem at the regional and global levels have somehow remained muted."

(Ray, 2008, p.6)

Over many years the pursuit of economic growth by successive Indian governments has

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incurred significant environmental losses. Recent decades witnessed the decline in India's environmental quality, growing shortages of critical natural resources and ecosystem services as well as biodiversity losses in many ecosystems (Singh and Bagchi, 2013). Today, India is home to some of the world's most polluted cities as a result of air and water pollution and resource degradation (Sims, 2003). Various studies have shown that major industrial regions in India are rated as critically polluted with dangerously high pollution loads (see Ministry of Environment and Forests, 2009). Environmental problems in India are also driven by the overuse of key resources such as timber and water giving rise to grim predictions about future resource availability (Ministry of Environment and Forests, 2009) and growing concerns about associated human health costs (Taylor and Rahman, 1996).

India's environmental regulation has thus far been unable to arrest the rate of environmental deterioration driven by the growth of the country's economy and population (Dasgupta, 2000). While India has a rich history of environmental policy making there are serious questions concerning the efficacy of the country's environmental laws and their enforcement. Calls for tighter environmental regulation and improved enforcement are commonplace, for instance, in the areas of hazardous waste treatment and toxic emissions (Misra and Pandey, 2005), water pollution (Greenstone and Hanna, 2011) and electronic waste in the context of a dramatically expanding electronics industry with short innovation cycles and resultant product obsolescence (Wath et al., 2011). Poor implementation of environmental policies is also seen as an obstacle to good environmental management in India. While many environmental laws exist, policy implementation, monitoring and enforcement are often poor and ineffective (Bowonder, 1986; Dasgupta, 2000), which in many ways can be seen as a function of insufficient resourcing of environmental agencies. Air pollution in

1 India, for example, falls under the jurisdiction of state boards. Yet, state boards have no
2 power of imposing fines on violators, boards tend to be under-staffed, lack complete
3 information of polluting industries and face on-going political pressure, resulting overall
4 in poor enforcement (Qadir and Gorman, 2008). For reasons such as these Dasgupta
5 (2000) considers India's environmental enforcement ad hoc and ineffective.
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12 It is plain that business is implicated in India's environmental problems, and especially
13 MSMEs are known to have serious environmental impacts. The MSME sector is vital to
14 India's economy, employing close to 60 million people and contributing 35% to the
15 nation's exports (DCMSME, 2009). It is the country's fastest growing sector with
16 MSMEs constituting more than 90% of the total number of industrial enterprises in
17 India, but it is also the least controlled and most poorly organized (Rao, 2008). Almost
18 unsurprisingly therefore, the MSME sector contributes as much as 70% to the nation's
19 industrial pollution load (DCSME, 2009; Ministry of Environment and Forests 2009).
20 Regulatory efforts have thus far only shown mixed results, and as argued by Dasgupta
21 (2000) clear gaps exist between policy-making and its integration into the MSME sector
22 for which – as mentioned previously – the regulatory oversight is affected by poor
23 enforcement and compliance.
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43 India's environmental problems present serious regulatory, scientific, engineering and
44 organizational challenges, which according to Wath et al. (2011) could be met in part by
45 improved management processes at the firm level. This may explain a growing interest
46 in ISO14001 certification among Indian firms. Also more interactive, participatory
47 approaches are called for on the regulatory side to manage environmental issues in
48 MSMEs and to avoid the costly and largely ineffective command-and-control
49 approaches to regulation favoured in the past (Dasgupta, 2000). Recent attempts by
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1 government to actively support ISO14001 uptake among MSMEs can be seen as a step
2 in this direction. In recognizing the importance of the cost dimension for MSMEs in
3 connection with ISO certification (see Hillary, 2004; Rao et al., 2006; Ravell et al.,
4 2010; Zorpas, 2010), the government shares the financial burden of firms' transitions to
5 cleaner modes of production and improved waste management processes. The
6 government introduced the ISO 9000/14001 Certification Fee Reimbursement Scheme
7 to incentivize technological upgrades, quality improvement and better environmental
8 management practices among MSMEs. The scheme provides incentives to firms who
9 have acquired ISO 9000/ISO14001/HACCP certifications by way of reimbursing up to
10 75% of expenditures associated with obtaining ISO-9000/ISO-14001/HACCP to a
11 maximum of Rs. 75 000 (~ \$US1370). As a result of the Scheme, 13602 EMS-
12 ISO14001 certificates were obtained by SMEs. Out of 13602 certificates, 9323 were
13 ISO14001 certifications only whereas 4279 certificates were obtained for both
14 ISO14001 and ISO 9000 in the 2006-07 survey period (DCSME 2009, p. 20).

15 Both the Indian government and MSMEs have recognized the importance of improving
16 the state of environmental management in the country and begun to appreciate the role
17 EMSs can play in helping reduce and manage environmental impacts. Today, there is a
18 growing number of Indian MSMEs moving towards ISO14001 certification not only
19 with a view to improving their environmental performance but also their innovativeness
20 and international competitiveness (Singh et al., 2012).

21 Little is known, however, at this stage whether ISO uptake among Indian firms leads to
22 tangible environmental improvements due to a general paucity of research in this area
23 and limitations of available data. To illustrate, the work by Khanna (2008, 2010), for
24 example, draws on the responses from only a small and select number of companies (62

1 out of 400 companies and 56 out of 1500 ISO14001-certified companies from across
2 India respectively), thus offering limited insights into EMS effectiveness in India. In
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4 this regard, also owing to a small sample size, we do not set out in this paper to offer an
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6 evaluation of the environmental performance of ISO14001-certified companies vis-à-vis
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8 non-certified firms. Instead, the intention is to offer insights into ISO14001 penetration
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10 among Indian firms and the factors explaining ISO uptake as a preliminary step towards
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12 on-going research into the success and effectiveness of EMS implementation in India.
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17 In what follows, a literature review will provide insights into India's and the
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19 international ISO14001 experiences to date, drawing attention to progress made as well
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21 as problems encountered. The review delivers the requisite context for the ensuing
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23 analysis of ISO14001 certification in the cities of Delhi and Noida.
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27 28 29 **3. ISO14001 in India**

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31 According to the latest ISO survey (ISO 2011), by 2011 just under 300 000
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33 certifications had been acquired across 158 countries. East Asia and the Pacific regions
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35 were shown to have experienced the largest growth in adoption of ISO14001 with China
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37 registering the largest number of ISO14001 certifications. For India the ISO survey
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39 presents a total of 4147 ISO14001 certifications (see Figure-1), showing a relatively
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41 slow certification uptake especially when compared countries such as Thailand and
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43 China. An industry-based distribution of ISO14001 certifications is presented in Table-1
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45 for 2022 out of 4147 certified companies. The data show that the largest number of
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47 certifications was obtained in the basic metal and fabricated metal products industry
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49 followed by the chemical, electrical and auto equipment industries (ISO 2011). It bears
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51 note, however, that the ISO data are based only on organizations participating in the
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53 survey. According to the DCMSME (Quick Results, 2009) census results around 13600
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ISO14001 certificates were obtained by MSMEs alone by the 2006-07 survey period.

As this figure does not include larger organizations, the total number of ISO certifications in India is likely to be higher.

Place Figure-1: 2011-ISO Survey (Total Number of ISO14001 Certifications in India)
Table-1: Industry-wide distribution of ISO14001 certifications in India

4. Experience of ISO14001 uptake and implementation in India and internationally

Past studies exploring the motivations underlying ISO14001 certification identified both external and internal drivers. The key external driver was organizations' improved environmental management performance as a result of ISO14001 implementation (Anton et al., 2004; Comoglio and Botta, 2012; Ilomaki and Melanen, 2001; Melnyk et al., 2003; Morrow and Rondinelli, 2002). Important internal drivers were found to relate mainly to an improved corporate image, marketing advantages or improved relations with stakeholders (Hillary, 2004; Poksinska et al., 2002; Potoski and Prakash, 2005; Zorpas, 2010). For larger firms such as the S&P 500 companies studied by Anton et al. (2004) improved environmental performance was also found to be a key motivator. As for India, however, according to Qadir and Gorman (2008), the factors motivating firms to pursue ISO14001 certification remain unclear.

On the relationship between government regulation and ISO14001 uptake Qadir and Gorman (2008) and Mikulich (2003) found ISO14001 certification to be a useful tool for the improvement of firms' environmental performance operating within weak regulatory environments in developing countries; certified companies are seen to exceed legal requirements. In contrast, in well-regulated contexts, governments were found to

1 play a vital role in promoting ISO certification. For example, an analysis of Japanese
2 facilities revealed that assistance programs/schemes provided by local governments
3 were effective in promoting companies to adopt ISO14001 (Arimura et al., 2008). Yet,
4 while incentive schemes by government as well as more directive regulatory approaches
5 may help drive ISO uptake, these measures are no guarantee for EMS effectiveness.
6
7 Firstly, environmental improvements as noted by Narwoka and Parker (2009) take time.
8
9 In addition, the certification context such as companies' goals, internal structure and
10 culture as well as the broader economy and the legislative environment all have a
11 bearing on the shape of EMS implementation in firms and their resultant environmental
12 performance (Amin and Banerjee, 2010; Narwoka and Parker, 2009). India, as
13 discussed previously, has weak certification and monitoring processes (Sunderasan,
14 2013; Qadir and Gorman, 2008), allowing firms to implement, and take advantage of
15 ISO14001 certification, albeit possibly with little commitment to environmental causes.
16
17 Problems surrounding the dualism of perceived environmental improvement versus
18 firms' real performance is well documented and also reflected in the international
19 experience (e.g. Barla, 2007; Blackman, 2012; Johnstone and Labonne, 2009; Khanna,
20 2010; King et al., 2005).

21
22 Sincere greening efforts by companies, however, can be observed in response to
23 stakeholder pressure. Anton et al. (2004) found, for example, that customer and investor
24 pressure determined the extent of EMS adoption among companies. While not directly
25 contributing to firms' environmental performance improvements (e.g. reductions in
26 toxic emissions), stakeholder pressure can trigger institutional changes in management
27 and thus indirectly drive EMS excellence. As noted by Qi et al. (2011), firms respond to
28 external pressures and use ISO14001 certification as a means of signalling sound
29 environmental management performance to their key stakeholders. Especially larger

1 firms have been among the first to adopt ISO14001, which is attributed chiefly to their
2 public visibility and pressure from stakeholders and/or regulatory agencies to enhance
3 their environmental performance (see Blackman and Gerreo, 2012; Christmann and
4 Taylor, 2001; Khanna, 2010; Montiel and Husted, 2009).
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10 Firm size is related also to ISO14001 adoption for financial reasons (Nishitani, 2009).
11 EMS setup and maintenance costs can initially be high due to the necessary changes to
12 company structures and processes (Arimura, 2008; Melnyk, 2003; Nakamura, 2001;
13 Nishitani, 2009). For cost is a key certification issue, unsurprisingly many studies found
14 ISO uptake to occur primarily among larger firms with the requisite financial means
15 (del Brio et al., 2001; Hillary, 2004; Khanna, 2010; Lagodimos et al., 2007; Nishitani,
16 2009). Also, larger and more experienced firms are seen to be more likely to achieve
17 effective EMS implementation and to realize long-term benefits from ISO14001
18 certification (Padma et al., 2008).
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33 Overall, there is general support in the literature for the uptake of ISO14001
34 certification by industry despite mixed results concerning the environmental
35 performance of ISO certified firms (see Hamschmidt and Dyllick, 2001; Hertin et al.,
36 2008; Lesourd and Schilizzi, 2001; Melynk et al., 2003; Rodinelli and Vastag, 2000;
37 Yoxon and Sheldon, 2008). Certification on the whole is seen to drive environmental
38 improvements as found by Potoski and Prakash (2013) who identified a 1% increase in
39 aggregate levels of ISO14001 adoption being associated with 0.064% reductions in air
40 pollution (SO₂) but not water pollution (BOD (biochemical oxygen demand)) in 138
41 countries for the period 1991-2005. Despite the modest improvements in air pollution
42 (0.064%), the study can be regarded significant for it could isolate the effect of
43 ISO14001 on air pollution using various controls for domestic and international factors.
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In the Vietnamese and Brazilian context recent studies also found that ISO14001 uptake was positively correlated with improvements in environmental performance. Nguyen and Hens (2013) examined 56 cement plants in Vietnam (both ISO14001 certified and not certified) and established a significant reduction in the concentration of dust (0.40 to 0.30mg/m³), SO₂ (0.32 to 0.19mg/m³), NO₂ (0.1 to 0.09mg/m³) and noise (75.4db to 73.8db) over a period of two years. Similarly, J de Oliveria et al. (2010) found in their study of 69 ISO14001 certified companies in Brazil environmental benefits in the form of reductions in the consumption of power, water, gas and fuel oil as a result of preventive measures taken following ISO14001 certification.

Consistent with other studies, however, good country results are attributed to good program designs generally found in high-income countries, which may be indicative of only limited ISO14001 effectiveness in the developing world, relating back to the impact contextual variables have on EMS design and implementation (see Amin and Banerjee, 2010; Narwoka and Parker, 2009). This is echoed also in the most recent work by Potoski and Prakash (2013) who found that stringent (thus often high cost) programs are likely to discourage participants from joining, suggesting that policy program design affects the number and quality of participants attracted to a program.

The literature review points to a vulnerability of ISO14001 in a developing country context as it relates to ISO14001 uptake and EMS effectiveness. It is thus necessary, as suggested by Amin and Banerjee (2010), to determine the role contextual factors play in this context to arrive at a better understanding of the state of ISO14001 in developing nations. Stevens et al. (2012) reviewed existing classification methodologies based on organizational size, cladistics and quality management concepts to analyse data related to barriers affecting to EMS certification and management. Yet, the findings proved

1 inconclusive, which was attributed to the different firm requirements and desired
2 outcomes that go beyond firms' legal compliance. The work by Stevens et al. (2012)
3 also points to a paucity of empirical evidence available and suggests that the discussion
4 to date is largely based on opinions and theoretical assumptions. Similarly, Blackman
5 (2012) identifies only three studies undertaken on the drivers of ISO14001 in
6 developing nations, all of which reported that larger firms trading internationally were
7 more likely to adopt ISO14001. Against this background, the aim of the research
8 underlying this paper was to test the adequacy of critical factors (Padma et al., 2008)
9 such as nature of business, size, year of establishment and internationalization as the
10 basis for classification of firms for an analysis of the state of ISO14001 in developing
11 countries based on a sample of ISO14001 certified companies located in the cities of
12 Delhi and Noida.

30 **5. Case selection**

31 The Indian cities of Delhi and Noida are two of the country's significant economic hubs
32 that have been selected for the purposes of this study. They were chosen due to the
33 large number of industries operating in the two respective areas, which are well
34 connected to the Indian and global market place through roads, railways and access to
35 air transport.

36 Chemicals, toys, packaging materials and plastic products as well as electronic goods
37 and electrical engineering equipment are the growing industries in Noida in Uttar
38 Pradesh (Geographical Clusters, n.d.). Uttar Pradesh overall has a flourishing
39 electronics industry, especially along the UP-Delhi-NCR and Lucknow-Kanpur
40 corridors.

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In contrast, Delhi has seen the growth in industries such as stainless steel utensils and cutlery, chemicals and electrical engineering equipment as well as food products, furniture and packaging products. According to Thomex.com, the B2B portal (an online industrial business directory of Indian manufacturers, suppliers, exporters, buyers in India), industries such as electronics, telecommunications, software industries and IT enabling services are given priority in Delhi's new millennium industrial policy, and SMEs are encouraged to venture into these industries. The Bawana Industrial area, which is India's largest industrial park, as well as other industrial sites in the Delhi region are promoted as locations of choice for established and newly forming SMEs.

The governments of both Delhi and Noida, under their Master Plan 2021, proposed plans for further infrastructure development to facilitate economic growth. These include the economic corridors in Haryana around Delhi and the KMP Expressway. The 2021 Delhi Master Plan also envisages a 100-meter expressway connection to the 4 NHs and a 150 meter road connecting Dwarka-NH8-Manesar with Metro connectivity (Economic Corridors, 2013). The work for the development of exposition marts for the cottage and handicraft sector in Greater Noida is part of Noida's Master plan 2021, together with the proposed Taj expressway to connect the Taj Economic Zone with the International Airport and the region's aviation hub. This will also enable access to New Delhi via the DND Flyway and Greater Noida expressway. A new multimodal transport hub (spread across 600 acres) is also being proposed which will include an inter-state bus terminus and a railway station as well as car parking and warehousing facilities (New Initiatives, 2013).

It is plain that both Delhi and Noida are laying the foundations for further industrialization and economic development. A growth in attendant environmental

1 impacts in this context is reasonable to expect. The authorities of both cities have also
2 recognized this problem and developed plans for waste treatment plants and the
3 establishment of pollution control boards to monitor air and water pollution.
4 Irrespective, an emphasis on environmentally sound business practices will be
5 paramount to help curb the environmental impacts the economic expansion of the two
6 regions is likely to entail. In this regard, environment management systems could play
7 a critical role in source reduction.
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10 11 12 13 14 15 16 17 18 **6. Methodology**

19 This paper presents a quantitative analysis of secondary data derived from the websites
20 of companies included in the study. Companies were identified through a database
21 provided by Sunrise Consultancy Services (www.fundoodata.com) recognised for its
22 service quality by many of its over 2500 national/international clients such as SBI
23 Capital Market Limited, Google, HP, ORACLE and others. For the purposes this study
24 an online subscription was obtained from Fundoo for a period of six months (15
25 February - 15 August, 2013). The database provided access to the names of all
26 registered businesses in the Delhi-NCR region as well as the contact details of the
27 companies key personnel (National Capital Region: Gurgaon, Faridabad, Noida, Greater
28 Noida).
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47 In Delhi, the total number of SMEs and Industry Bests (I.Bests) was 4930 and 1727
48 respectively whereas the numbers for SMEs and I.Best were 922 and 406 respectively
49 for Noida. Thus, for this study the total population of SMEs in the two cities was 5852
50 and 2133 for I.Bests. Stratified random sampling was used to select companies from
51 each stratum (both from SMEs and I.Bests) based on simple random sampling where
52 there is an equal chance of inclusion of each company in the sample in a finite
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1 population (Kothari, 2004, p. 16). The sample size was selected at a 95% confidence
2 level with a 5.08% error level for SMEs and 5.25% error level for I.Bests. Respectively,
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4 a total 350 and 300 websites of SMEs and I.Bests were randomly chosen from the
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6 Fundoo database. Out of this company pool an experimental group of 60 companies
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8 with ISO14001 certification was identified by way of visiting the websites of all
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10 companies included in the study sample. Companies' ISO14001 certification status was
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12 ascertained from their websites by viewing their ISO certificates made available online.
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14 Companies ISO certification status was crosschecked with the IndiaMART.com
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16 database which is India's largest B2B marketplace. A total of a further 11 companies
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18 was found to be either in preparation for ISO14001 certification or claiming to be
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20 ISO14001 certified without proof. These firms were excluded from the study. The
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22 ensuing quantitative data analysis, described in further detail below, was carried out
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24 using SPSS.
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32 According to the Small & Medium Business Development Chamber of India (SMBDCI,
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34 2012), small enterprises in India are firms whose investment on plant and machinery is
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36 above Rs.25 lakhs (US\$62, 500) and up to Rs.5 crores (US\$1.25 million) and above
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38 Rs.10 Lakhs (US\$25,000) and up to Rs.2 crores (US\$ 500,000) in the service sector;
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40 medium enterprises in India are firms whose investment on plant and machinery is
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42 above Rs.5 crores (US\$1 million) and up to Rs.10 crores (US\$2 million) and above Rs.2
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44 crores (US\$0.40 million) and up to Rs.5 crores (US\$1 million) in the service sector.
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46 The research also drew on companies outside the above SME definition, whose
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48 investment on plant and machinery is above Rs.10 crores (US\$2 million) and above
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50 Rs.5 crores (\$1 million) in the service sector. These companies are referred to here as
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52 'Industry best' organizations, which have been included to allow for inter-group
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54 comparisons.
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1 The above SME classification is followed by the Fundoo database, and the same
2 classification criteria were used for the purposes of this study. In addition, companies'
3 turnover on sales, type of ISO certification and employee numbers were used for the
4 clustering of firms. Overall, the sample of 60 firms was divided into the categories of a)
5 1-5 crores, b) 5-10 crores and c) over 10 crores. In terms of certification, firms were
6 clustered along the following categories: a) ISO14001, b) ISO 9001 & ISO14001, c)
7 ISO14001 & others, and d) ISO 9001, ISO14001 and others. With regards to
8 employment numbers three categories were devised; namely a) 0-50, b) 51-100, c) 101-
9 250 and d) above 250 employees.
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22 Firms were also categorised on the basis of the year of their establishment; firms were
23 either established before or after 2002. The year 2002 was chosen to investigate the
24 impact of the introduction of the aforementioned SME-Reimbursement Scheme for
25 ISO14001 certification by the Government of India in 2002.
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34 **6.1. Research Design**

35 From the literature survey the following five hypotheses were drawn.
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37 Hypothesis 1: Manufacturers are more likely to adopt 14001 certification when
38 compared to service providers and companies engaged in both
39 manufacturing and service.
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45 Hypothesis 2: Industry Bests are more likely to take up ISO14001 certification when
46 compared to SMEs.
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50 Hypothesis 3: Companies with higher turnover (over 10 crores) are more likely to take
51 up ISO14001.
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55 Hypothesis 4: Companies with over 250 employees are more likely to uptake
56 ISO14001.
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Hypothesis 5: Older and more experienced SMEs are more likely to take up ISO14001.

Hypothesis 6: Internationally trading companies are more likely to take up ISO14001 when compared to companies trading domestically.

The above hypotheses were tested using descriptive data analysis and nonparametric tests in the absence of a model (Chi-square test of goodness of fit (Kothari, 2004)). Use of the Chi-square test enabled comparisons between the assumed theoretical distribution and the observed data. Chi-square was calculated as follows:

$$\chi^2 = \frac{\sum (O_{ij} - E_{ij})^2}{E_{ij}}$$

Where:

O_{ij} : Observed frequency of the cell in i^{th} row and j^{th} column

E_{ij} : Expected frequency of the cell in i^{th} row and j^{th} column

Place Table 2: Chi-square Distribution Table (in a probability less than 5%)

7. Data Analysis

Our experimental group of 60 ISO14001 companies comprised 32 companies (53.3%) from Delhi and 28 companies (46.7%) from Noida. Industry-wide data distribution of the sample shows that nine different types of industries have adopted ISO14001 certification. As shown in Figure-2, just under a quarter of firms surveyed were operating in the automotive components and aviation industries while firms in the electrical and electronics industries made up just over a fifth of all selected companies. Overall, 13 SMEs and 19 Industry best companies were based in Delhi while 10 SMEs and 18 Industry best companies were operating in Noida.

Place Figure-2: Percentage of ISO14001 Companies in Different Industries

As shown in Table-3, a high percentage of companies (34/60 or 56.70%), including

SMEs, acquired both ISO 9001 and ISO14001 certifications.

Place Table-3: Distribution of different certifications among different sizes of companies

7.1 Hypothesis 1: Manufacturers are more likely to adopt ISO14001 certification when compared to service providers and companies engaged in both manufacturing and service.

Place Table-4: Test Result for Hypothesis-1

H0: There is no significant difference in the frequency of nature of business of ISO14001 certified companies

Ha: There is a significant difference in the frequency of nature of business of ISO14001 certified companies

The calculated value of $\chi^2 = 21.700$ (in Table 4C) is greater than the table value (in Table-2) of 5.99 at 5% significance level at 2 d.f. Consequently, H0 is rejected and Ha is accepted, implying that manufacturers are more likely to adopt ISO14001 certification. Nature of Business and Industry Type crosstab results reveal that more manufacturers (37/60 or 61.70%) are adopting ISO14001 when compared to service providers and companies engaged in both manufacturing and service (see Table 4-b). Crosstab results of nature of the business and company size (Table 4-a) show similar results for both SMEs and 'Industry best' organizations. Manufacturers were found to be the leading adopters in both cases. Table 4-b makes evident that automotive component (12/37) and electrical and electronics (9/37) manufacturers are the leading businesses that are ISO14001 certified. Most of the companies from the third category (manufacturer & service provider shown in Table-4a and 4b) are manufacturers with service provision largely limited to exporting or acting as supply chain for sending products to domestic or international markets. As firms in category 3 are involved in service provision as well as manufacturing, it can be concluded that companies involved in the service area only are less likely to take up ISO14001 certification. This adds

weight to the Hypothesis-1 test results.

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4 **7.2 Hypothesis 2: Industry Bests are more likely to take up ISO14001 when**
5 **compared to SMEs**
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9 Place Figure-3: Size of Companies (in %) with ISO14001

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12 Place Table-5: Test Result for Hypothesis-2

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14 H0: There is no significant difference in the frequencies of size of ISO14001 certified
15 companies.

16 Ha: There is a significant difference in the frequencies of size of ISO14001 certified
17 companies.
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21 Frequencies shown in Table-5 and Figure-3 highlight that 23 (38.3%) SMEs compared
22 to 37 (61.7%) 'Industry best' companies acquired ISO14001. The calculated value of
23 $\chi^2 = 3.267$ (Table5) is less than the table value (Table-2) of 3.84 at 5% significance
24 level at 1 d.f. As a result, the null hypothesis is accepted. Observed difference may have
25 arisen due to sampling error. There is insufficient evidence to support hypothesis H2
26 that the 'Industry best' companies are more actively seeking ISO14001 adoption when
27 compared to SMEs. SMEs and 'Industry best' company results are similar in terms of
28 ISO14001 certifications. Yet, the test does not include the percentage of SMEs with
29 ISO14001 certification in relation to the total population of SMEs. Thus, further
30 analysis was made focusing on another factor to represent company size (i.e., turnover
31 on sales).
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50 **7.3 Hypothesis 3: Companies with higher turnover (over 10 crores) are more**
51 **likely to take up ISO14001.**
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55 Place Figure-4: Distribution based on Turnover of Sales (in %)

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57 Place Table-6: Test Result for Hypothesis-3
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H0: There is no significant difference in the frequencies of Turnover on sales of ISO14001 certified companies

Ha: There is a significant difference in the frequencies of Turnover on sales of ISO14001 certified companies

The calculated value of $\chi^2 = 58.211$ (Table 6b) is greater than the table value of 3.84 at 5% significance level at 1 d.f. Thus, H0 is rejected, as the distribution does not come from a normal population, and significant differences exist among frequencies of all categories. It is therefore accepted that companies with higher turnover (over 10 crores) are more likely to adopt ISO14001 certification. Data shown in Figure-4 and Table-6-a suggest that companies (both SMEs and 'Industry best') with a turnover of above 10 crores are more likely to take up ISO14001 certification.

7.4 Hypothesis 4: The Companies with over 250 employees are more likely to take up ISO14001

Place Figure-5: Distribution of Companies based on number of Employees (in %)

Place Table-7: Test Result for Hypothesis-4

H0: There is no significant difference in the frequencies of number of employees of ISO14001 certified companies

Ha: There is a significant difference in the frequencies of number of employees of ISO14001 certified companies

The calculated value of $\chi^2 = 31.429$ (Table7) is greater than the table value of 7.81 (Table-2) at 5% significance level at 3 d.f. There is insufficient support for the null hypothesis (H0) and Ha is accepted. As shown in the Figure-5 and Table-7, companies with over 250 employees are more likely to take up ISO14001 certification.

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7.5 Hypothesis 5: Older and more experienced SMEs are more likely to take up ISO14001

Table-3, as discussed above, indicates that companies (both SMEs and 'Industry best') with experience in other quality certifications (example: ISO 9001) are more likely to adopt ISO14001 certification.

Place **Figure-6: Distribution of companies (in %) based on Year of Establishment (2002 as benchmark)**

Place **Table-8: Test Result for Hypothesis-5**

H₀: There is no significant difference in the frequencies of SME reimbursement scheme of ISO14001 certified companies

H_a: There is a significant difference in the frequencies of SME reimbursement scheme of ISO14001 certified companies

The calculated value of $\chi^2 = 5.261$ (Table-8-b) is greater than the Table value (Table-2) of 3.84 at 5% significance level at 1 d.f. Therefore, H₀ is rejected. As shown in Tables-8-a and 8-b, there is insufficient evidence to accept the null hypothesis (H₀) and thus hypothesis H_a is accepted. In other words, older and more experienced SMEs were found to be more likely to take up ISO14001 certification. Tables-8-a and 8-b together with Figure-6 show a larger number of SMEs with ISO14001 were established prior to 2002, and the turnover of most of the SMEs (9/15) was above 10 crores. There are 4 (~19%) SMEs with less than 5 crores (established after 2002) certified with ISO14001, which may be related to the introduction of the Indian government's SME-Reimbursement Scheme for ISO14001 certification.

7.6 Hypothesis 6: Internationally trading companies are more likely to uptake ISO14001 when compared to companies trading domestically.

Place **Figure-7: Distribution of Companies (in %) based on Companies' Internationalization**

Place **Table-9: Test Result for Hypothesis-6**

H₀: There is no significant difference in the frequencies of domestically trading and both domestic and internationally trading ISO14001 certified companies

Ha: There is a significant difference in the frequencies of domestically trading and both domestic and internationally trading ISO14001 certified companies

The calculated value of $\chi^2 = 15.000$ (Table-9-a) is greater than the Table value (Table-2) of 3.84 at 5% significance level at 1 d.f. There is insufficient support for the null hypothesis and H_0 is therefore rejected. The expected frequencies of all categories are significantly different which supports H_a that internationally trading companies are more likely to take up ISO14001. As per the Table-9-a and Figure-7, most of the companies with ISO14001 are engaged in both domestic and international trade (45/60). Company ownership data shown in Table-9-b reveal that mostly private companies that go global have acquired ISO14001 certification.

8. State of ISO14001 Certification in Delhi and Noida

Table-10 below provides a summary of the results from the hypothesis testing, which are explored further in light of the test criteria in the ensuing discussion, which addresses each hypothesis in turn.

Place Table-10: Results from hypothesis testing

8.1 Nature of Business

The relationship between firms' industrial activities and certification decisions is evident from the hypothesis-1 test results. Manufacturers, especially manufacturers of automotive components (12/37) and electrical and electronics (9/37), are chiefly among ISO14001 certified companies in the cities of Delhi and Noida. This comparatively high level of ISO14001 penetration in manufacturing can have a number of different explanations. For example, Lagodimos et al. (2007) referred to a sector-related

certification culture with regards to ISO14001 certification in manufacturing. Studies by King et al. (2005) and Blackman (2012) speculate whether the regulatory burden on manufacturing may be higher due to the sector's relatively larger environmental impacts; certification would therefore be a response to compliance pressures. Certification drivers in Delhi and Noida thus require further investigation.

8.2 *Size*

The relationship between size and the choice of EMS-ISO14001 certification was analysed using the traditional definition of SMEs and 'industry best' (Hypothesis-2), turnover on sales (Hypothesis-3) and employee size (Hypothesis-4). While a similar rate of ISO14001 adoption was found among SMEs and 'industry best' firms, high turnover companies (over 10 Crores) and those with more than 250 employees were found to be most likely to take up ISO14001 certification. These results correspond with findings of Johnstone and Labonne's (2009) study on seven OECD countries that suggest that certification is used by firms as a signal to regulating authorities. Signalling was found predominantly to occur among large facilities with over 250 employees, while for smaller firms cost factors were found to matter more.

8.3 *Experience of long establishment and other quality certifications*

It was found in this study that firms with experience and a certification history are more likely to take up ISO14001. India's SME-reimbursement scheme for ISO14001 certification commenced in 2002, which was used here as a benchmark for the analysis of the establishment of SMEs. It was discovered that SMEs established before 2002 with a turnover of over 10 crores were more likely to have acquired ISO14001

certification compared to lower turnover firms that were established in later years. Nonetheless 4 out of the 23 SMEs surveyed (~17%) were established post 2002 with a turnover of less than 5 crores have also adopted ISO14001, which may be attributable to the certification reimbursement scheme. Nishitani (2009) found that the determinants of initial ISO14001 adoption differed among the years of adoption. The positive relationship between company size and initial ISO14001 adoption weakened until 2004, which was reflected in Hypothesis 2. Nishitani (2009) suggest that larger firms that seek early certification (in this case 1996-2004) are also better economic performers than those adopting in later years. This also indicates that the government's assistance schemes for SMEs with comparatively lower turnover facilitated the uptake of ISO14001 from 2002-2004 onwards. Neumayer and Perkins (2004), in a study on 142 developed and developing countries, analysed the relationship between ISO14001 uptake driving critical and contextual factors. One of their findings suggests that lower levels of government intervention correspond with larger numbers of ISO14001 uptake. While this finding would lend support to arguments for less government engagement the study did not establish whether voluntary certification is a sufficient substitute for exacting regulation. In the case of India, it will therefore be vital to explore further the role of government in the EMS space to ascertain (a) whether the provision of financial assistance translates into higher numbers of voluntary ISO14001 certifications and (b) whether in terms of firms' environmental performance certification is preferable over government regulation.

8.4 *Internationalisation*

Hypothesis – 6 test results matched the findings by Zeng et al. (2009), Christmann and

1 Taylor (2001), Montiel and Husted (2009) and Blackman and Guerrero (2012) whose
2 work on other developing countries confirmed that large companies trading
3 internationally are more likely to be certified. Analogously, in this study most of the
4 larger firms with high turnover (both SMEs and 'industry best' organizations) and
5 international trade relations obtained ISO14001 certification, highlighting the
6 importance of ISO14001 for companies operating in the international marketplace.
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16 **9. Discussion and Conclusion**

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18 This study sought to bridge existing knowledge gaps concerning critical factors
19 affecting ISO14001 uptake among SMEs in a developing country context. Overall, this
20 paper has shed light on the state of ISO certification in the cities of Delhi and Noida,
21 and the findings were shown to mirror the international ISO experience of SMEs. While
22 further analysis and comparative work is needed on ISO 140001 in India and other
23 developing countries, we hope to have offered a platform for future research. In light of
24 the certification figures revealed, India's manufacturing sector shows the most potential
25 for future work to be undertaken, especially as it pertains to questions surrounding ISO
26 uptake.
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40 This paper has remained silent, however, on a potentially important factor motivating
41 ISO14001 uptake; this is the potential use of ISO14001 as a market signalling device by
42 particular groups of companies (e.g., manufacturers with high pollution rates,
43 comparatively larger firms who underperform post ISO14001 certification and others).
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1 firms. Whilst methodological concerns exist around research on market signalling (see
2 Zobel, 2013), it is recognised that signalling (to buyers, regulators) is a strong
3 motivation for EMS adoption, certification and public policy influence (see Johnstone
4 and Labonne, 2009). In developing countries the importance and use of ISO14001
5 certification as a signalling device for foreign customers and environmental
6 stakeholders is also noted (Qi et al., 2011). Despite the obvious attraction of using
7 ISO14001 credentials to gain recognition and market access, market signals, as noted by
8 Spence (1973, p. 373) are alterable and thus potentially subject to manipulation, relating
9 back to firms' motives underlying ISO14001 uptake. These and related issues warrant
10 further investigation to gain better insights into companies' motivations with regards to
11 ISO14001 certification and to establish whether beyond signalling ISO14001 uptake is
12 effective in helping reduce firms' environmental impacts.
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31 Especially with regards to ISO14001 effectiveness, future research may also need to
32 address questions of waste minimization and improved environmental management
33 performance amongst certified firms and the concerning trend of ISO14001 withdrawal
34 in developing countries where in 2011, 4147 ISO certifications were obtained (ISO
35 survey, 2011), while 194 certifications were withdrawn (4.6% as compared to
36 adoptions). In the Indian context, this warrants further investigation in connection with
37 the country's EMS Reimbursement Scheme and its effectiveness as a voluntary
38 approach.
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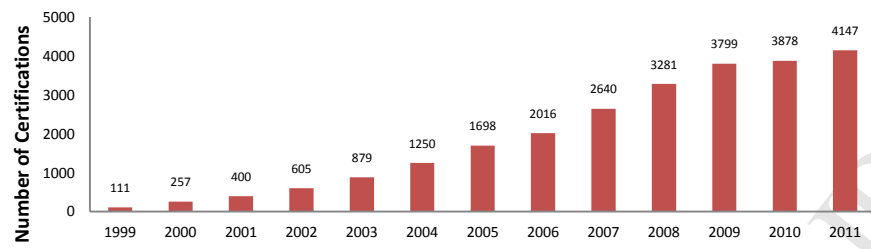
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Figure-1: 2011-ISO Survey (Total Number of ISO 14001 Certifications in India)

Source: Adapted from ISO Survey 2011

Figure-2: Percentage of ISO 14001 Companies in Different Industries

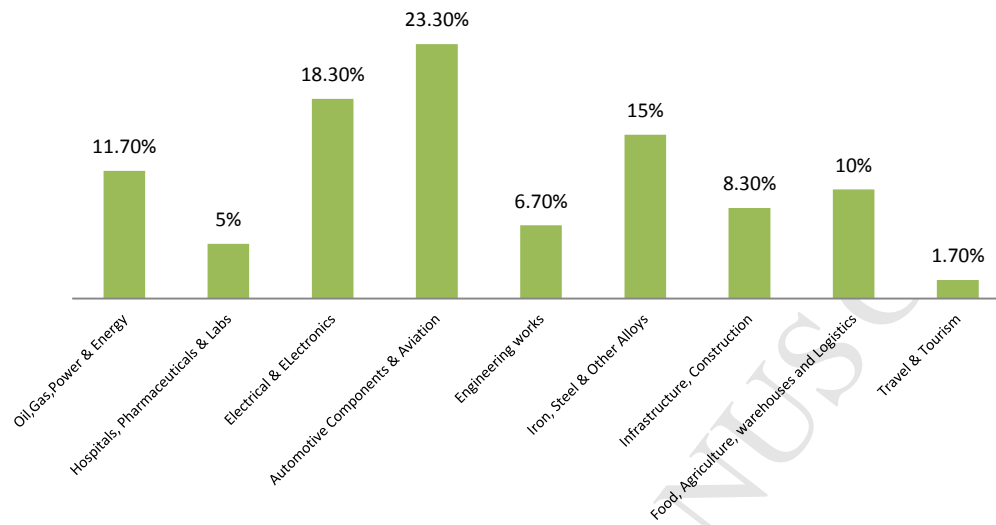


Figure-3: Size of Companies (in %)
with ISO 14001

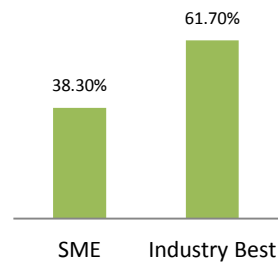


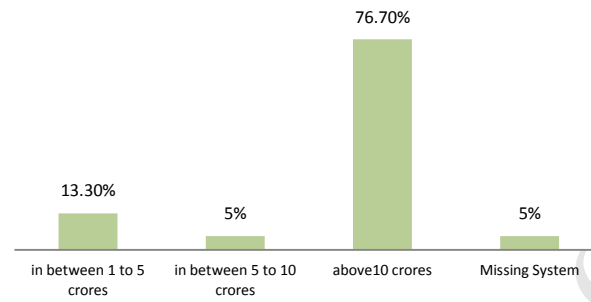
Figure-4: Distribution based on Turnover on Sales (in %)

Figure-5: Distribution of Companies based on number of Employees (in %)

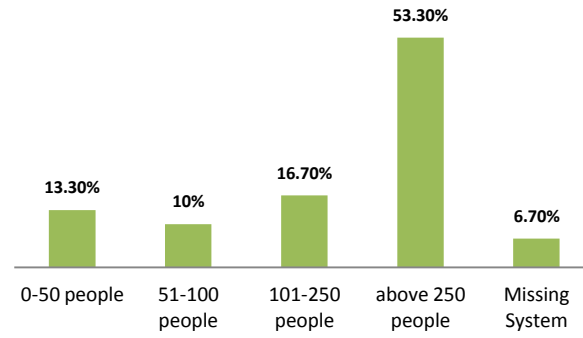


Figure-6: Distribution of companies (in %) based on Year of Establishment (2002 as benchmark)

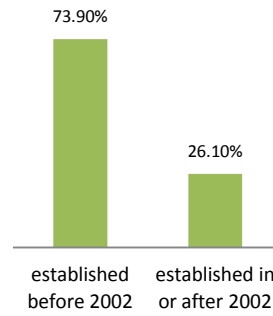


Figure-7: Distribution of Companies (in %) based on Companies' Internationalization

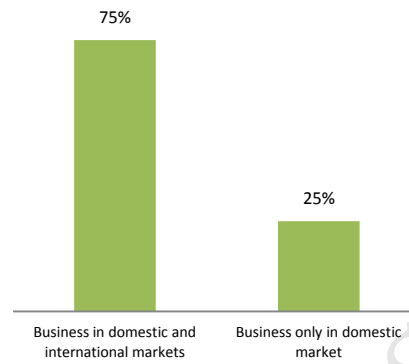


Table-1: Industry-wide distribution of ISO 14001 certifications in India

Industry	No. of ISO 14001 Certifications
Basic metal & fabricated metal products	338
Chemicals, chemical products & fibres	262
Electrical and optical equipment	228
Other transport equipment	168
Machinery and equipment	154
Rubber and plastic products	107
Food products, beverage and tobacco	81
Pharmaceuticals	73
Construction	74
Textiles and textile products	65

Source: Adapted from ISO Survey 2011

Table 2: Chi-square Distribution Table (in a probability less than 5%)

<i>df</i>	$\chi^2_{.05}$
1	3.841
2	5.991
3	7.815
4	9.488
5	11.070

Source: drawn from statistical Table "critical value of chi-square (χ^2)" [Kothari, 2004:378]

Table-3 : Distribution of different certifications among different sizes of companies**Certifications * Size Cross Tabulation**

Count

		Size		Total
		SME	Industry Best	
Certifications	ISO 14001	1	0	1
	ISO 9001 & ISO 14001	18	16	34
	ISO 14001 & Others	1	6	7
	ISO 9001, ISO 14001 and Others	3	15	18
Total		23	37	60

Table-4 : Test Result for Hypothesis-1

a. Nature of Business * Size Cross Tabulation										
Count		Size			Total					
		SME	Industry Best							
Nature of Business	Manufacturer	11	26	37						
	Service	2	10	12						
	Manufacturer & Service provider	10	1	11						
Total		23	37	60						

b. Nature of Business * Industry Type Cross Tabulation											
Count		Industry Name									Total
		Oil,Gas ,Power & Energy	Hospitals, Pharmaceuticals & Labs	Electrical & EElectronics	Automotive Components & Aviation	Engineerin g works	Iron, Steel & Other Alloy s	Infrastructur e, Construction	Food, Agricultur e, warehouse s and Logistics	Travel & Touris m	
Nature of Business	Manufacturer	3	1	9	12	3	6	0	3	0	37
	Service	3	0	0	0	0	2	5	1	1	12
	Manufact urer & Service provider	1	2	2	2	1	1	0	2	0	11
Total		7	3	11	14	4	9	5	6	1	60

c. Chi-Square Test					
Frequencies				Test Statistics	
Nature of Business				Nature of Business	
	Observed N	Expected N	Residual		
Manufacturer	37	20.0	17.0	Chi-Square	21.700a
Service	12	20.0	-8.0	df	2
Manufacturer & Service provider	11	20.0	-9.0	Asymp. Sig.	.000
Total	60			a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 20.0.	

Table-5 : Test Result for Hypothesis-2

Chi-Square Test			
Frequencies Size			
	Observed N	Expected N	Residual
SME	23	30.0	-7.0
Industry Best	37	30.0	7.0
Total	60		

Test Statistics	
	Size
Chi-Square	3.267 ^a
df	1
Asymp. Sig.	.071

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 30.0.

Table-6: Test Result for Hypothesis-3

a. Turnover1 * Size Crosstabulation				
Count				
		Size		Total
		SME	Industry Best	
Turnover1	in between 1 to 5 crores	8	0	8
	in between 5 to 10 crores	2	1	3
	above10 crores	11	35	46
Total		21	36	57

b. Chi-Square Test			
Frequencies			
	Turnover1		
	Observed N	Expected N	Residual
in between 1 to 5 crores	8	19.0	-11.0
in between 5 to 10 crores	3	19.0	-16.0
above10 crores	46	19.0	27.0
Total	57		

Test Statistics	
	Turnover1
Chi-Square	58.211 ^a
df	2
Asymp. Sig.	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 19.0.

Table-7: Test Result for Hypothesis-4

Chi-Square Test				Test Statistics	
Frequencies People_1				People_1	
	Observed N	Expected N	Residual	Chi-Square	31.429 ^a
0-50	8	14.0	-6.0	df	3
51-100	6	14.0	-8.0	Asymp. Sig.	.000
101-250	10	14.0	-4.0	a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 14.0.	
above 250	32	14.0	18.0		
Total	56				

Table-8: Test Result for Hypothesis-5

a. SME_reimbursement_scheme_benchmark_2002 * Turnover1 (Cross Tabulation)					
Count					
		Turnover1			Total
		in between 1 to 5 crores	in between 5 to 10 crores	above10 crores	
SME_reimbursement_scheme_benchmark_2002	established before 2002	4	2	9	15
	established in or after 2002	4	0	2	6
Total		8	2	11	21

b. Chi-Square Test				
Frequencies				
SME_reimbursement_scheme_benchmark_2002				
	Observed N	Expected N	Residual	
established before 2002	17	11.5	5.5	
established in or after 2002	6	11.5	-5.5	
Total	23			

Test Statistics	
	SME_reimbursement_scheme_benchmark_2002
Chi-Square	5.261 ^a
df	1
Asymp. Sig.	.022

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 11.5.

Table-9: Test Result for Hypothesis-6

a. Chi-Square Test				Test Statistics	
Frequencies				Internationalization	
Internationalization					
	Observed N	Expected N	Residual	Chi-Square	15.000a
Business in domestic and international markets	45	30.0	15.0	df	1
Business only in domestic market	15	30.0	-15.0	Asymp. Sig.	.000
Total	60			a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 30.0.	

b. Sector * International Venture Cross Tabulation			
Count	International Venture		Total
	Business in domestic and international markets	Business only in domestic market	
Sector Private Limited	33	6	39
PSU/Govt. Owned	2	5	7
Subsidiary of MNC/ IJV	3	0	3
Public Limited/ Publically listed or held	7	2	9
Public-private	0	2	2
Total	45	15	60

Table-10: Results from hypothesis testing

Hypotheses	Description of Hypotheses	Chi Square results (Where, N is the sample size and d.f =n-1 where n is the number of items in the sample)	Hypotheses Test Results
1	Ha: Manufacturers are more likely to adopt 14001 certification	$\chi^2(2, N=60) = 21.700, p < .05$ Thus, H0 Rejected	ACCEPTED
2	Ha: Industry Bests are more likely to take up ISO 14001 certification when compared to SMEs	$\chi^2(1, N=60) = 3.267, p > .05$ Thus, H0 Accepted	REJECTED
3	Ha: Companies with higher turnover (over 10 crores) are more likely to take up ISO 14001.	$\chi^2(2, N=57) = 58.211, p < .05$ Thus, H0 Rejected	ACCEPTED
4	Ha: Companies with over 250 employees are more likely to take up ISO 14001	$\chi^2(3, N=56) = 31.429, p < .05$ Thus, H0 Rejected	ACCEPTED
5	Ha: Older and more experienced SMEs are more likely to take up ISO 14001	$\chi^2(1, N=23) = 5.261, p < .05$ Thus, H0 Rejected	ACCEPTED
6	Ha: Internationally trading companies are more likely to take up ISO 14001	$\chi^2(1, N=60) = 15.000, p < .05$ Thus, H0 Rejected	ACCEPTED