

A Critical Study of Environmental Control Technologies and Practices in Small and Medium Enterprises in India

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Abstract. The role of Small and Medium Enterprises (SMEs) in the industrial sector is growing rapidly. This paper aims at understanding the environmental management perspective of SMEs. A questionnaire was developed and administered to 63 randomly chosen SMEs in and around Thane and Mumbai city, Maharashtra, India through personal visits, email, and few through telephone calls. The study was conducted to analyze the approach of the Indian SMEs towards environment; especially their impact and responsibilities towards society with regards to environment. Out of the 63 SMEs visited, 19% (12) of the units used contemporary (new) technology that minimized waste, reduced pollution, and protected human life and the environment, old technology with some retrofitting or up-gradation was being practiced by 22% (14) of the units.. The adoption of new technology was far less as these were small enterprises with financial issues. Resistance to change and ignorance were other concerns. Another 13% (8) of the units studied used old technology with some improvements. This study will help understand the current environmental practices pursued by SMEs in India using available resources. The study also looked into the barriers and drivers for technology innovation in environmental aspects. The study concludes that dedicated fund for environmental management, environmental education and training are of the utmost necessity to communicate environmental standards and the associated changes in practice and processes to business and industry. The necessity to initiate and invigorate research to provide SMEs with more affordable green technologies is also stressed.

Keywords: Small and Medium Enterprises (SMEs), environmental management practices, drivers and barriers, safe and clean technology, environmental compliance, control technologies.

1. Introduction

Small and Medium Enterprises (SMEs) sector of India is considered as the backbone of the economy, contributing to 45% of the industrial output, 40% of India's exports, employing 60 million people, creating 1.3 million jobs every year and producing more than 8000 quality products for the Indian and international markets. The SMEs alone contribute to 7% of India's Gross Domestic Product (GDP) [1].

The Government of India has consistently encouraged and supported the SMEs through its various policy initiatives since 1951. SMEs are looked upon as the breeding ground for successful entrepreneurs of the future. In 2013, the total number of enterprises in MSME sector was estimated to be 361.76 lakh of which registered sector had 15.64 lakh and the unregistered sector had 346.12 lakh enterprises with a total employment of 805.24 lakh. In the MSME sector of India, rural and urban areas have 200.19 lakh and 161.57 lakh working enterprises, respectively. Of all enterprises, 31.79% of the enterprises were engaged in manufacturing, whereas 68.21% of the enterprises were engaged in providing services [2].

1.1. Cleaner production

Various types of organizational training imparted in Indian industries while implementing cleaner production has been analyzed [3]. The study was carried out in two industrialized states of India, with the

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participation of eight firms from each state. It was found that more than half of the industrial units gave importance to training during the implementation of cleaner production.

[4] Evaluated the environmental and economic benefits and costs of cleaner production projects organized by SMEs involved in a sustainable supply program in Mexico. The study analyzes various project benefits regarding the use of different types of cleaner production applications, company characteristics and participant profiles. The results suggested that waste recycling and waste prevention projects yielded higher economic and environmental value than energy efficiency and water conservation projects. Also, waste reduction applications were found to be more encouraging than technology innovations. This study also highlighted potential costs and benefits of sustainable supply efforts.

1.2. ISO 14001 implementation in SMEs in India

An Environmental Management System (EMS) provides the internal framework necessary to control an enterprise's environmental impacts and to integrate environmental considerations into business operations. SMEs get benefits from International Organization for Standardization (ISO), but implementing an environmental management system in SMEs can be challenging [5]. Obstacles to obtaining ISO 14001 Certification include a lack of transparency, weak regulatory compliance and certification schemes and the large costs associated with ISO14001 certification and continuous improvement [6]-[8].

In recognizing the importance of the cost dimension for MSMEs in connection with ISO certification [9]-[12], the Indian government shares the financial burden of firms. The government introduced the ISO 9000/14001 Certification Fee Reimbursement Scheme to incentivize technological upgrades, quality improvement and better environmental management practices among MSMEs [13].

There is a growing number of Indian MSMEs moving towards ISO14001 certification not only with a view to improving their environmental performance but also their innovativeness and international competitiveness [14]. In the upcoming new standards, ISO 14005 will provide guidelines for the phased implementation of an EMS to facilitate the take-up of EMS by small and medium-sized enterprises. It will include the use of environmental performance evaluation [15].

1.3. Schemes for environmental control technologies for SMEs

SMEs have historically been observed to be "head in the sand" when it comes to the environment and their environmental impacts and responsibilities [16]. At the same time, despite 91% of SMEs struggling to visualize or acknowledge the environmental impacts of their activities and businesses without prompting, it may be highlighted that SMEs report some environmental initiatives in areas such as waste minimization and resource efficiency [17].

Monitoring and inspection are key functions of State Pollution Control Boards (SPCBs). The central and state governments have introduced a number of subsidies for pollution control equipment and treatment installations for SMEs. Under the Credit Linked Capital Subsidy Scheme, the Ministry of Small Scale Industry is providing assistance to small industrial units for adoption of cleaner production technologies and installation of pollution control units [18].

Financing Schemes for Sustainable Development including Energy Efficiency and Cleaner Production in MSMEs. Its objective is to enable climate and environmental friendly investments to Promote energy saving in SMEs in India, by providing financial assistance to MSMEs, directly by SIDBI as well as through refinance to Primary Lending Institutions (PLIs) and Non-Banking Financial Companies (NBFCs). Reduce the emission of greenhouse gases, especially Carbon Dioxide (CO₂) to contribute towards climate change mitigation and achieve a reduction or avoidance of emissions and pollution through the introduction of financial products. Support MSMEs towards development, up-scaling, demonstration and commercialization of innovative technology based project [19].

To promote environmental compliance among small-scale industries, some states like Andhra Pradesh, Uttar Pradesh, West Bengal, and Maharashtra have initiated innovative economic incentive schemes that promote compliance with environmental requirements. The West Bengal PCB adopted strict particulate emission standards and intensified enforcement efforts targeting the pollution sources. In order to facilitate fuel conversion from coal to oil or gas in small boilers and ceramic kilns, the WBPCB launched a project in

2001 to provide financial assistance to these industries with support of the India-Canada Environment Facility (ICEF) [20].

2. Materials and Methods

The questionnaire was administered to 63 SMEs in and around Thane and Mumbai, Maharashtra, India randomly chosen for conducting the study. The methods of research followed is as follows:

- Administration of questionnaire to subject experts and take their inputs in finalizing the questionnaire [21], [22].

- Visit of selected industries for primary data collection
 1. Study and evaluate the environmental impacts of existing processes
 2. Evaluation of safe and clean technology - environmental impact
 3. Environmental Impacts due to present technology
 4. Drivers and barriers for clean technology

- Secondary data collection of the best technologies in the sector and Comparative Analysis of data
- Advising industries on the best possible clean technology and practices from the environmental point
- The study looked into the barriers and drivers for clean technology innovation and recommended best practices on environmental issues. SMEs were selected by the groups of students based on the SMEs willingness to participate in the survey.

- Primary data collection was done in 63 units during 2013-14 and 2014-15 through a combination of personal visits, through interviews, email and a few through telephone calls. Most of the industries that participated in the study were from the Thane-Belapur Industrial Area in Mumbai, Talaja, Raigad district, Maharashtra, Wagle Industrial Estate in Thane city and few are located in and around Mumbai region.

The questionnaire consisted of open-ended as well as close-ended questions, of which the latter were fewer in number.

Secondary data were also collected from reports from organizations, and electronic databases such as Scencedirect and Open Access Journals.

In India, MSME-related criteria are defined separately for manufacturing and services-based enterprises [13]. For the former, investment in plant and machinery for micro enterprises is up to INR 25 lakh, that of small enterprises is INR 25 lakh-5 crore and that of medium enterprises is above INR 5 crore and up to INR 10 crore. For services-based enterprises, investment in equipment for micro-enterprises is up to INR 10 lakh, that of small enterprises is in the range INR 10 lakh - 2 crore and medium enterprises is INR 2-5 crore [23]. The Fig. 2 shows the stratification of Units studied as per scale. The evaluation of strata was done on the basis of capital investment of the company. The strata is considered to be representative as more than 60 units have participated in the survey. There are Over 46,000 Small & Medium Enterprises (SME's) in Maharashtra [24]. As per our survey of 63 SMEs 75% are small scale and 22% are medium scale industries, remaining 3% have not mentioned their scale.

In this study we have covered different sectors and this has led to lot of awareness building in SMEs. As per Maharashtra Industry Directory (MID) SME sectors are classified as: Engineering and machine tools, electrical, chemical, machinery etc. [25]. As per the present survey, the SME sectors has been classified as chemicals and allied sector, engineering sector, electrical and electronics, manufacturing sector etc.

3. Results and Discussion

The operate of the research done through random convenience sampling is to analyze the approach of the Indian SMEs towards environment; especially their environmental impact and responsibilities towards society. The respondents were questioned about the unit, technology adopted, operations of the company, safe and clean technology from the environmental point of view and environmental issues and practices implemented to reduce the problems faced by the units. The data of respondent units have been analyzed in this section.

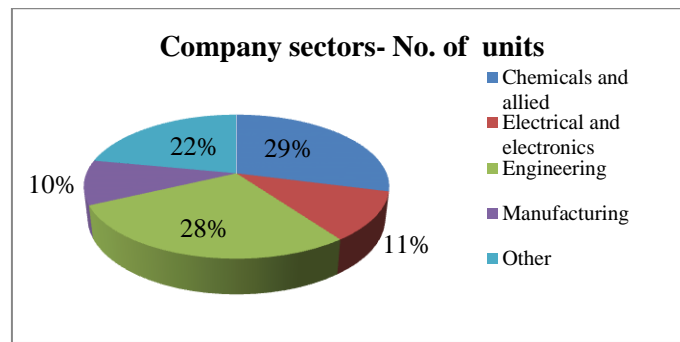


Fig. 1. Distribution of Sectors

Fig. 1 shows Distribution of units in different sector; 29% of units belonged to chemicals and allied sector manufacturing different products like specialty chemicals, rubber, adhesives, dyes, lubricating oils etc. 28% industries belonged to engineering sector manufacturing a variety of products like pressure valves, ball bearings, pressure vessels, reactors etc.

11% units belonged to electrical and electronics manufacturing products like power protection relays, electrical automation, control and relay panels, printed ID cards and electric control panels. 10% belonged to manufacturing sector producing products like Copper Bus Bars, Leather bags chairs etc., 28% units belonged to other sector such as bread crumbs production, packaged drinking water etc. It manufactures liquid paraffin and transformer oils.

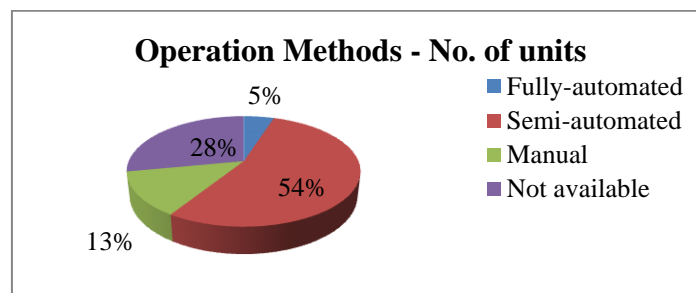


Fig. 2. Mode of Operation

Fig. 2 shows that 5% of the units carrying out fully automated operations and 54% (34) of the units were carrying out semi-automated operations. Both fully automated and semi-automated process are an achievement in SMEs. 13% (8) of units functioned manually because of their low financial budget.

Fig. 3 represents the technologies being opted for in the companies for their production and operation. Out of the 63 SMEs visited, 19% (12) of the units used contemporary (new) technology that minimized waste, reduced pollution, and protected human life and the environment, old technology with some retrofitting or up-gradation was being practiced by 22% (14) of the units. The adoption of new technology was far less as these were small enterprises with financial problems. Resistance to change and ignorance were other concerns. Another 13% (8) of the units studied used old technology with some improvements and up-gradation such as cleaner production methods.

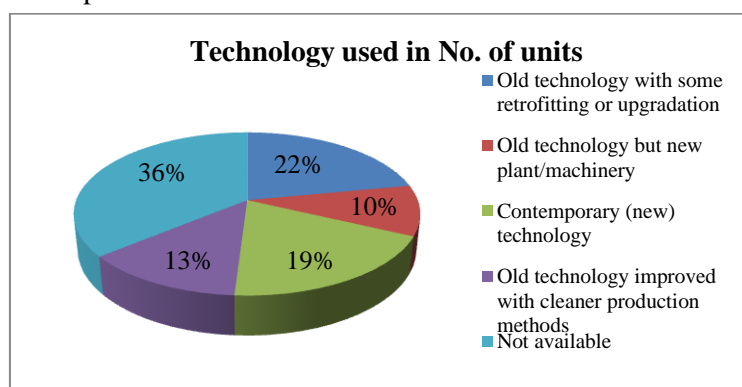


Fig. 3. Technologies used in Units

Fig. 4 shows evaluation of safe and clean technology in which the environmental impacts were evaluated using a five point likert scale. It can be seen that out of the 63 SMEs assessed, environmental impacts were low in 57% of the units. It is also seen that high adverse impact was reported only by 3 % of units, but in other units the environmental impact was mostly medium.

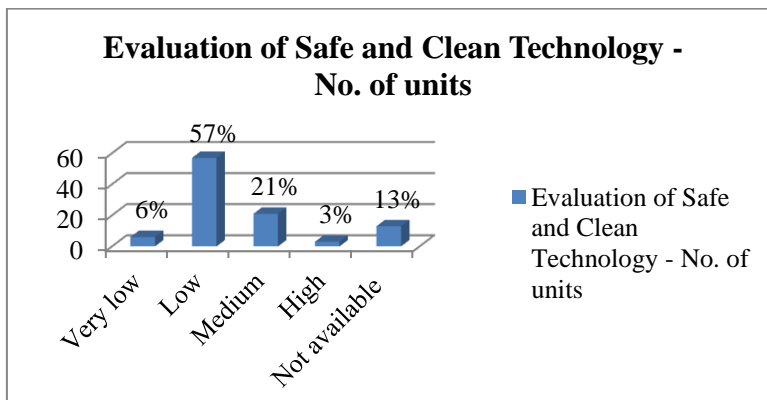


Fig. 4. Evaluation of safe and clean technology - environmental impact

Use of old technologies, increased business activities, aged workforce, and less concern for Environment, Health, and Safety standards have increased the risk factors for the workers .

3.1. Evaluation of safe and clean technology

3.1.1. Historical data of last three years and the associated risk pattern

There were various Environmental issues observed and reported by the industries in the survey. Many industries had some common issues while some of them did not maintain any data regarding this. A few were reluctant to share this information. Out of 63 SMEs, only 38 responded with complete historical data of last three years and the associated risk pattern. As per the survey, it can be perceived that in a few SMEs, the risk has decreased due to the use of new technologies and better effluent treatment and management. Many of the industries belonging to engineering and electronics sector did not produce any hazardous waste; few industries in which the waste generated was either recycled or sent to Hazardous Waste Treatment Facility around their area

Also it was observed that environmental problems such as noise pollution, untreated waste dumping and also groundwater pollution, have been encountered in different sectors of SMEs. There are 25 SMEs that have not maintained any record of the environmental issues in their unit. Understandably, SMEs with a low financial budget have failed to take major steps towards good environmental practices while units with a healthy financial budget have initiated environmental practices in their units. This indicates the clear correlation between financial health of an SME unit and its expenditure in environmental management systems.

Table 1: Environmental Impacts due to present technology

IMPACTS	MEAN VALUES	RANK
Impact On Noise Quality	2.26	1
Impact On Energy Efficiency	2.06	2
Impact On Air Quality	1.96	3
Impact On Water Quality	1.92	4

Table 1 shows the current technology's impact on environment and safety. The mean values of various impacts reveal that the impact due to noise quality is the highest. This is followed by impact on energy efficiency, impact on air quality and impact on water quality. The least impact was that on water quality as reported by the industries.

The harmful effects of noise pollution are often ignored or the management is unaware of the noise abatement techniques which explain why impact on noise quality is maximum as compared to energy

efficiency, air or water quality. Most of the SMEs are using upgraded technology due to which the impact on energy efficiency reported is quite normal.

3.1.2. Drivers and barriers for clean technology

Out of the 63 SMEs, 45 responded to the drivers and barriers for adopting safe and clean technologies. 18 units did not provide any information about their drivers and barriers. From the study it was seen that strict government regulations and payment of fines due to non-compliance were the main reasons for adopting safe and clean technologies by most of the units. High competitiveness amongst the SMEs drives the management to continually improve their brand name and image. The most significant drivers as per survey are market competitiveness, better efficiency, less risk to life and environment and stringent laws. Environmental audits, leadership commitment and senior management motivation are the other important motivators for such practices.

The main barriers to introduction of new safe and clean technologies are financial constraints as management is not ready to invest capital, since most of the SMEs have a small annual turnover there are major financial constraints that discourage the firms to take up clean technologies. Resistance to change, lack of attitude and lack of training of employees in the field of environment are other barriers. Another barrier that was commonly reported was the lack of awareness. Awareness was found to be lacking even in the top management in some cases. Lack of awareness amongst the workers was also a serious concern.

Based on the survey it may be perceived that environment-friendly practices are implemented only in few of the SMEs. Out of the 63 units surveyed, only 35 units had implemented well-defined environmental goals in their units while 21 units had not implemented such goals; 7 units did not provide data on the same. Documented environmental policy was implemented by 35 units and 25 units did not report the data on same. Green purchasing policy practices were initiated only in 4 units - too less a number; and 47 units had still not implemented such policies.

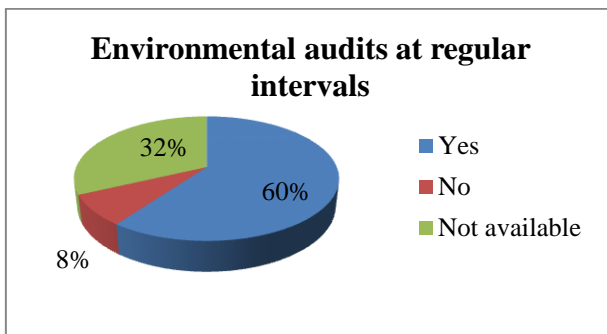


Fig. 5. Environmental Audits at regular intervals

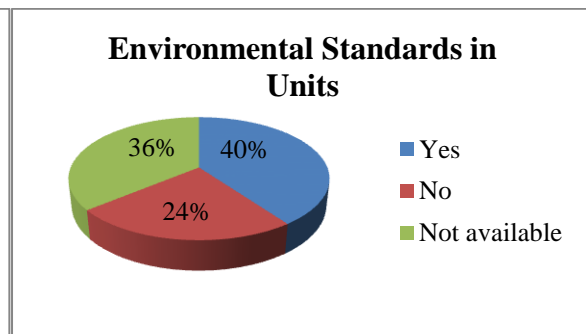


Fig. 6. Internal Environmental Standards

Fig. 5. show that 8% of the industries that were surveyed did not conduct environmental audits at regular intervals while 60% of the units have regular environmental audits. This may be due to the fact that it is mandatory by law. The government rules and regulations state that periodic safety audits must be carried out by the industries to check the compliance and efficiency of the technology along with the safety and environmental impact.

Fig. 6 shows that out of the 63 industries 24% of units do not have any internal environmental standards. An internal environmental standard is one of the important aspects found to have been implemented in 40% of units, which is notable as compared to other aspects mentioned above.

The reason for not implementing and initiating environment-friendly practices in some of the SMEs may be enlisted as lack of interest, financial constraints, lack of awareness, myopic vision, concern only towards current productivity and narrow-minded top management behavior. The study indicates that few SMEs are mostly unaware of the policies and other beneficial schemes introduced for them, thus, remaining financially weak and suffering under a burden of loan. The top management is usually hesitant to change, though this behavior is changing slowly. The perceptions of SMEs are changing with respect to environment and now SMEs are taking initiatives to comply with the environmental issues. Environmental management strategies should be developed, which may inspire export intensity and benefit the SMEs financially.

4. Recommendations

SMEs form an integral part of a nation's economic development and hence, they should have a significant status in every governmental policy. In developing economies like India, SMEs need immense assistance from the government and other bodies for their sustenance and development. Governmental support not only includes the direct financing and low interest loans and subsidies, but also the provision of infrastructure building and maintenance. The Government or the PCBs can provide subsidies to SMEs that use clean fuel. SMEs can form groups to overcome the barriers (e.g. waste management and recycling). By becoming members of environmental bodies, SMEs can keep themselves updated on the latest progress in the field. SME bodies or industrial associations can promote the use of clean fuels by bringing in a dedicated pipeline.

Promoting Cleaner technology and Cleaner production (CP) is another useful tool that can be employed by SMEs. It is an approach to environmental management focused on preventing pollution, reducing resource use and generally minimizing environmental impact within existing technological and economic limits. Apart from mere compliance there are several proactive measures that can be taken up by SMEs to reduce their load on the environment. One such example of this is Design for Environment which involves designing a product or a process in such a way so as to reduce the total environmental load it may cause in its entire life cycle.

In the era of sustainable development, the Governments all over the world are undertaking several measures for the benefit of SMEs. The National Manufacturing Policy of India unveiled in 2012 has a chapter dedicated to SMEs. The Policy plans to give SMEs access to the patent pool and/or part reimbursement of technology acquisition cost for the purpose of acquiring appropriate technology -such initiatives will help the SMEs to manage their resources efficiently and cause less harm to the environment. It also plans to bring in new mechanisms to promote green technologies and offer grants for expenditure on environmental and water audits. Lack of environmental awareness is a factor that prominently arises from this study. Apart from awareness creation and dissemination, Governments should also promote training and ensure that SMEs have easy access to information, new technology, and innovations.

5. Conclusion

From the literature and our survey, it was found that despite a number of promising initiatives, financial incentive packages are insufficient for small-scale industries that are often unable to bear the cost of cleaner technologies. In the absence of a well-structured and need-based grant or loan system, few of these units will continue to violate environmental requirements. Also, it can be said that only a few SMEs are aware of environmental issues and follow the environmental regulations. Cleaner production is yet another aspect of environmental management practices, which has been considered to be important. The major contribution of the study has been awareness building on environmental issues and its management in the small and medium scale enterprises that participated in the survey.

To collect the primary data, random and convenient sampling was done using a questionnaire-based survey from the SMEs with voluntary participants. Some of the limitations of this study were that the survey was conducted in and around Thane and Mumbai city and the sample size was small. With a larger sample size and survey of SMEs from all over the country a much better understanding or insight into SMEs may be achieved.

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