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Environmental management system ISO 14001: effective waste minimisation in small and medium enterprises in India

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ABSTRACT

Numerous empirical and conceptual studies describe waste minimisation as a key environmental performance indicator for industry. ISO 14001certification in this regard is widely considered the tool of choice for driving waste minimisation efforts. To this day, however, the evidence remains mixed as it pertains to the effectiveness of ISO 14001 in helping firms reduce waste, especially in developing countries. This paper explores the waste minimisation efforts among Indian small and medium enterprises. Specifically, improvements in waste minimisation are analysed from small and medium enterprises operating in the cities of Delhi and Noida. Our proposed model is tested for a model-fit, and the hypotheses are tested through regression coefficient (β) scores to determine the influence of ISO 14001 on the degree of waste minimisation among certified and non-certified companies. The data reveal that ISO 14001 certification alone helped account for a 25% increase in waste minimisation in certified companies after controlling for other critical factors (correlated to the variable 'waste minimisation') that may influence this relationship. The analytical tools described in this paper lend themselves to be applied to similar research problems in future studies. The study provides baseline data for further research into ISO 14001 effectiveness in the Indian SME context – a field with still only limited research insights – and offers policy prompts for targeted environmental management improvements in Indian firms.

1. Introduction

The Indian small and medium enterprise (SME) market is of great economic significance valued at US$5 billion (Basha, 2013). The country's 1.3 million SMEs constitute over 80% of the total number of industrial enterprises in India, account for over 35% of the gross value of output in the manufacturing sector and make up over 40% of total exports (Das et al., 2007; Goyal, 2013). India's small-scale industries help generate income and investment in the economy and provide employment to more than 32 million people, who account for 45% of the country's total industrial employment (Ravi, 2009).

However, at the same time, 70% of all industrial pollution is attributable to the nation's SME sector (Indian Ministry of Environment and Forests (MOEF, 2012), which explains growing calls for policy changes and improved production processes. Table 1 below lists India's most polluting sub-sectors amongst SMEs.

Industrial waste is particularly problematic in light of the fact that India lacks adequate waste treatment and disposal facilities for the hazardous wastes generated by the country's many manufacturing industries. The waste problem is compounded further by poor waste handling practices and illegal waste dumping, which have been found to be the cause of alarming rises in pollution to soil and groundwater, representing not only a human health hazard but also an increasingly pressing commercial concern for the SME sector in India (see Moturi et al., 2004; Saxena and Bhattacharyya, 2010; Wath et al., 2011; Hindustan Times, 2012).

Globally, ISO 14001 is the most widely recognised and most frequently used standard for environmental management systems (EMSs) (Székely and Knirsch, 2005; Bracke and Albrecht, 2007;

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Table 1
India's most polluting industries (Central Pollution Control Board, 2014).

- Aluminium Smelters
- Caustic Soda
- Cement
- Copper Smelters
- Distilleries
- Dyes & Dye Intermediates
- Fertiliser Plants
- Integrated Iron & Steel
- Tanneries
- Pesticides
- Petrochemicals
- Drugs & Pharmaceuticals
- Pulp & Paper
- Oil Refineries
- Sugar
- Thermal Power Plants
- Zinc Smelters

Montiel et al., 2012). Certification to the standard is purported to foster the development not only of cleaner, safer and healthier products and workplaces but also to lead to improved environmental outcomes and economic benefits (Lesourd and Schilizzi, 2001; Melynk et al., 2003; Tarí et al., 2012). In this regard, ISO 14001 certification could be regarded an ideal vehicle for waste mininmisation in India's SME sector. Empirically, however, the evidence of ISO 14001 efficacy remains mixed (Prajogo et al., 2012; Potoski and Prakash, 2013), and to this day still only little is known about the effectiveness of certified environmental management systems in developing countries in general and in India's SME sector in particular (Singh et al., 2014a).

It is against this background that this paper offers anevaluation of the impact of ISO 14001 certification on waste minimisation efforts in Indian SMEs and their overall environmental performance. To this end, a review is presented of the literature on the relationship between EMSs and waste minimisation to help formulate a set of research hypotheses, which are then tested against empirical data collected from both ISO certified and non-certified SMEs operating in the two large industrial Indian cities of Delhi and Noida. In recognition of the heterogeneity of the MSME[3] sector (see Hillary, 2004), the focus here will be restricted to SMEs with an annual turnover on sales above 10 million INR (~US$ 168 000). The results will then inform a discussion on ISO effectiveness as it pertains to waste minimisation and environmental performance as well as on policy implications.

2. Waste minimisation and the Indian context

Despite concerted policy efforts, volumes of industrial and municipal waste continue to grow globally due to a growing world population and rising per capita incomes and consumption (Worldwatch Institute, 2012; UNEP, 2012). Around 4 billion tons of waste are produced annually (Chalmin and Gaillochet, 2009), and this figure is expected to rise in future with solid waste volumes alone tipped to double by 2025 (Hoornweg and Bhada-Tata, 2012). Growing waste volumes are a key management concern for waste may be toxic, ignitable, corrosive or reactive and can thus prove hazardous to both human and environmental health (e.g. Giusti, 2009; Samuelson, 2009). Also, while business and industry were not overly concerned about waste generation in the past, waste generation today is often associated with high costs to firms' bottom line and increased legal compliance pressures (WBCSD, 2002; National Audit Office, 2010), not to mention growing environmental impacts (Worldwatch Institute, 2013); this explains the growing interest in waste minimisation techniques and practices in the business and policy realms (Wilson et al., 2012).

Waste minimisation (WM), also often referred to as source reduction, pollution prevention or green manufacturing, has a wide currency (Mulholland and Dyer, 1999). Whilst seen by some as any measure that reduces the amount of waste requiring final disposal (Kavanagh, 1994), WM is strictly defined in terms processes and practices that prevent or at least help reduce the actual generation of waste (UNEP, 2002) and is thus the preferred of all waste management options. Yet, WM commonly entails a combination of prevention techniques, quality improvements and recycling initiatives that serve to reduce the amount of waste produced and help eliminate the generation of harmful and persistent wastes. WM often includes product and process redesign but also extends to changes in societal patterns driving consumption and production and thus affecting waste generation (OECD, 1996; EEA, 2002; Sharp et al., 2010). Notwithstanding, the key emphasis is commonly placed on the adoption of Cleaner Production (CP) technologies as a means of bringing about waste reductions and achieving waste prevention. Staniskis and Stasiskiene (2005), for example, reveal in their review of WM programs that causes of waste generation are often ignored. Instead, WM programs are found to focus on waste and its analysis, identification, characterisation and sorting. In their study of Lithuanian SMEs, Staniskis and Stasiskiene (2005) show that the companies' waste minimisation efforts are largely technologically focused, entailing Cleaner Production practices such as technology modification, process optimisation, on-site recycling and energy recovery.

Firms can achieve effective waste minimisation by way of adopting and integrating waste minimisation programmes that institute organised, comprehensive and continual efforts to systematically reduce waste generation. Effective programmes critically rely on the commitment by senior management and good programme oversight as well as effective waste stream identification and analysis (Cheremisinoff, 2001; El-Halwag, 2012). Firms can use tailored prevention techniques to target critical waste streams, work towards the elimination of waste and bring about environmental management improvements with possibly considerable associated business savings (Granek, 2011). Various studies have linked effective waste minimisation to a whole raft of business benefits including improved financial performance, productivity and operational efficiencies (e.g. Nishitani et al., 2012; Testa et al., 2012; Albertini, 2013). In this context, the relevant question here is whether EMSs can help firms improve their waste minimisation efforts and outcomes.

2.1. Waste minimisation and ISO 14001 certification

There is a growing body of research pointing to a positive relationship between firms' environmental management systems and their success in improving their overall environmental performance (for an overview see Ferenhof et al., 2014). For example, studies by Kitazawa and Sarkis (2000), Iraldo et al. (2009) and Martín-Peña et al. (2014)demonstrate how ISO 14001 EMS and EMS like standards assist organizations in operating source reduction programs and help produce environmental benefits including improved waste processing. Especially for SMEs, ISO 14001 was found to be particularly valuable because of the standard's systematic nature (Granly and Welo, 2014) and in light of SME's varied production modes and great diversity of pollutants they produce (Seiffert, 2008).

With regards to waste minimisation, various European studies (see Steger 2000; Hillary, 2004; Agan et al., 2013; Testa et al., 2014) have shown that that resource efficiency and pollution prevention were rated highly among firms as a tangible outcome of EMS

[3] In India, enterprises are distinguished in terms of their investments in plant and machinery as well as investments in equipment. Companies with investments in plant and machinery of up to US$62 500 and investments in equipment of up to US$25 000 are considered micro enterprises. Small enterprises are those with investments in plant and machinery between US$62 500 and US$1.25 million as well as investments in equipment between US$25 000 and US$0.5 million. Medium enterprises have investments in plant and machinery between US$1.25 million and US$2.5 million and investments in equipment between US$0.5 million and US$1.5 million (SMBDCI, 2012).