



Strategy to derive benefits of radical cleaner production, products and technologies: a study of Indian firms



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ABSTRACT

Cleaner technology strategy is a firm's long term planning to avoid negative externality to the natural environment and remain competitive in future markets. The paper proposes a comprehensive definition of cleaner technology strategy and presents its important aspects to derive competitive advantages based on an empirical study of sixty firms across the industry sectors in India. A measure of cleaner technology strategy was constructed and, tested for its reliability and validity. Descriptive statistics was used to understand the relative importance of competitive aspects of cleaner technology strategy in Indian firms. The result shows that cleaner technology strategy derived from top management's vision of future technologies and ability to manage risk due to natural environment play a critical role in implementation of cleaner technology strategy. Firm's ability to pursue regulators for additional benefits, ability to manage risk associated with failures and imitation, and focus on up-gradation of in-house technological capabilities help in re-positioning to derive competitive advantages. The results also indicate that sustainable solutions offer differential competitive advantages across the industry sectors and firm's focus to update skill set of employees is also linked with industry sectors. The paper contributes to existing literature by making distinction between cleaner technology strategy and other strategies like pollution prevention and product stewardship. It further argues the strategic perspective of cleaner technology, cleaner production and eco-friendly products to develop necessary attributes for competitiveness. It also provides a measurement tool for the managers to check the performance of their firm to achieve the goals of cleaner technology strategy. Further, the paper provides important managerial, policy and research implications.

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1. Introduction

Firms must develop sustainable technologies and products that do not exist yet to reduce the burden on natural resources and build sustainable competencies (Hamel and Prahalad, 1991, 1994). Break-through product and process innovation is required to optimize the use of scarce and non-renewable natural resources in products (Bringezu, 2009) and eliminate wastes and emissions within and outside the organization boundary to take efficiencies to unprecedented level (Seuring and Muller, 2008; van Weenen, 1990). Sustainable firms are generally strategically proactive and undertake

development of disruptive products and processes and create new markets (Aragon-Correa, 1998; Roome, 1992).

To capture the market opportunities due to sustainable challenges, managers must re-conceptualize their prevailing approach on strategy, technology, and markets (Hart, 1995; Hart and Milstein, 1999). This requires an essential and radical shift from current processes, technologies and products to sustainable solutions for mankind's long term survival and well-being (Bolis et al., 2014). These solutions are not about marginal improvements over pollution prevention or control measure but a disruptive and significant departure from existing processes, knowledge and innovation (Vergragt and van Grootveld, 1994; Holton et al., 2010). Today's firm shall initiate the change process in their working in gradual way and prepare simultaneously for drastic change in use of technology to develop products, services and processes which are not only economically viable but also ecologically and socially justifiable (Boons and Lüdeke-Freund, 2013; Dunphy et al., 2003). But, the

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question arises is that what shall be the important ingredients of firm's strategy that firms can derive competitive benefits given risk prone investment and long-term commitment required for such radical changes (Hart and Milstein, 2003; Montalvo, 2008).

Research so far has been focused on identifying determinants or barriers to development/adoption of cleaner technology. Literature on cleaner production processes and technology has main theme around the factors affecting cleaner technology (CT) adoption (Montalvo, 2003, 2008), drivers and barriers of environmentally sound technology (EST) (Luken and van Rompaey, 2008), determinants of EST adoption (Luken et al., 2008), firm's willingness to adopt CT (Zhang et al., 2013), CT adoption for climate change proactivity (Sangle, 2011), organisational aspects leading to successful cleaner production (CP)/pollution prevention (Stone, 2006a, 2006b), barriers to dissemination of the concept of CP (Baas, 2007). An another similar stream of literature on determinants to adoption of proactive environmental strategies, which also cover the aspects of cleaner production and technology strategy, have identified parameters as pressure from non-governmental organizations, external and internal factors of organization, managerial and strategic aptitude (Gonzalez-Benito and Gonzalez-Benito, 2006; Gunningham et al., 2003) and, regulations and competitive forces (Christmann, 2000; Sharma and Vredenburg, 1998).

Based on the studies mentioned above, it is not clear that what firms shall plan to maximize the desired benefits from risk prone initiatives of cleaner technology strategy (CTS); given that firms have taken a decision to adopt cleaner production/technologies or have taken some steps in this direction based on determinants identified in literature. Also, it remains unexplored that what preparations a firm shall do to achieve transformation from current practices so that efforts can lead to fulfilment of the objectives of a CTS.

This article presents outcome of empirical study based on data of sixty firms located in India that have a track record of implementing or developing radical sustainable solutions in the last three years. A measure of CTS was constructed and tested for its validity and reliability. The literature on environmental strategies and radical sustainable solutions in India is mostly found in sustainability/environmental reports, business articles in professional and business publications, and project design documents on IPCC (Intergovernmental Panel on Climate Change) website. These publications report on strategies, products, services and processes of individual firms and few of them are audited by third parties. These publications along with the track record of firm's outlook and approach towards sustainable solutions have helped in identifying firms suitable for sampling requirement of current research work.

Based on data analysis, the attributes of CTS in Indian firms were identified. These attributes were then discussed to understand the current status of CTS implementation and attempt has been made to link them to the content of existing literature to understand the capabilities that may help in successful development and implementation of sustainable solutions in form of cleaner production, technologies and products to exploit future markets. The discussion provided in this paper shall guide other firms to design a system that is more adaptable to future markets and may help in achieving strong market reposition against the competition.

This paper is organized in 6 sections. Section 2 presents literature on clean technology, environmental strategy and helps in defining a comprehensive definition of cleaner technology strategy to deliver radical sustainable solutions. The literature review also explores the way to extract advantages of radical sustainable solutions. Section 3 is based on research method and covers the topics on operationalization of research, measurement instrument, sample, data collection and data analysis. Section 4 presents research findings. Section 5 discuss the outcome of this study and provide

managerial implications. Section 6 provides implications for policy makers and section 7 concludes the study.

2. Literature review

This section reviews the existing literature to derive a definition of CTS and identifies the drivers and barriers of this strategy. Further, it extracts important points from literature that can be useful in deriving competitive benefits of a CTS.

2.1. Defining cleaner technology strategy

Researchers have given different names to various products/service developments which are geared towards objective of natural environment protection. Some of them have technological aspects linked with them, like environmental new product development (Pujari et al., 2003); eco-innovation (Young, 2006); sustainable product development or design for environment (van Weenen, 1995); design for sustainability (Spangenberg et al., 2010); cleaner technology (Montalvo, 2008); cleaner production (Glavi and Lukman, 2007). While other concepts like industrial ecology (Desrochers, 2004; Ehrenfeld, 2004) and product–service system (Mont, 2002; Morelli, 2006) are based on new business models.

Cleaner technologies can belong to any industry sector like geonomics, bio-mimicry, information technology, nanotechnology, and renewable energy technologies which essentially delink economic prosperity with burden on natural resources like minerals, water, soil etc. (Hart and Milstein, 1999) and helps in maintaining the capacity of eco-system to absorb harmful outputs due to human activities. CP is a “systematically organized approach to production activities, which has positive effects on the environment. These activities encompass resource use minimization, improved eco-efficiency and source reduction, in order to improve the environmental protection and to reduce risks to living organisms” (Glavic and Lukman, 2007). Eco-friendly products (EFP) integrate environmental aspects to enhance recycling, reuse, repair, regeneration, recovery, remanufacturing, product durability and upgradeability to reduce environmental impact throughout the product's life cycle (Glavic and Lukman, 2007; Young, 2006). Although, CT and CP may have a role to deliver EFP; CT and CP are related to firm level aspects (business to business or within firm) while EFP pertains to technology oriented products which are delivered to final consumers. EFP are driven by psychograph and behaviour of final consumers.

We propose a definition of CTS as a long term planning to transform the firm radically towards eco-effectiveness to incorporate or provide technology enabled competitive products, processes and services in form of cleaner technology, cleaner production process and eco-friendly product and, any other services thus leading to the most optimal use of natural resources; hence avoidance of negative externalities to natural environment. CTS aims beyond removing negative impacts on society and natural environmental due to production and consumption by a drastic shift from eco-efficiency measures to eco-effective solutions (Dyllick and Hockerts, 2002; McDonough and Braungart, 2002; Young and Tilley, 2006). CTS belongs to corporation looking for long term advantages and wants to strengthen their competitive position in future markets that are going to be full of sustainability challenges.

2.2. Drivers and barriers to CT adoption and environmental strategy

Many studies have discussed and identified various drivers and barriers for CT adoption as technological capabilities of a firm and the perceived economic risk to firm as major determinants to

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