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Organizational learning in cleaner production among Mexican supply networks

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ABSTRACT

Cleaner Production was heralded as a promising concept for improving the environmental performance; however it has largely focused on technical aspects, which has limited its expected implementation. This article integrates organizational studies into cleaner production. A Mexican Sustainable Supply Chain Programme designed to improve environmental performance of small- and medium-sized firms provided the empirical setting for analysis. Organizational learning in cleaner production was measured by accessing differential performance among suppliers in their implementation of cleaner production projects. The findings revealed how the organizational characteristics, such as supply sector, firm size, and type of supplier, influenced organizational learning of preventive environmental practices in small firms. The participating managers' characteristics had substantial influence on the learning levels within and among firms; managers who combined both technical and administrative backgrounds fostered catalyzed higher learning levels among their employees than those with single technical, or single administrative, profiles. The conclusions of this study highlight that organizational learning is a crucial element of successful implementation of cleaner production. The recommendations emphasized that a blended learning method and supply networks are valuable dissemination approaches for stimulating of the implementation of cleaner production through organizational learning in small firms in emerging markets.

1. Introduction

In the 1990s, Cleaner Production (CP) was heralded as a promising concept for improving the environmental performance of firms with significant potential for cost effectiveness (Hirschhorn, 1995; Baas, 2006). In the following years, implementation efforts were pursued by international organizations, national and regional governments, universities, consultancies, foundations, business associations and numerous firms (Baas, 2006; Stone, 2006a; Ehrenfeld et al., 2002). Many demonstration projects, training and technical assistance programmes have confirmed the beneficial cost-benefit balance of the CP promise (Van Berkel, 1994, Nath, 2007; Shi et al., 2008; Dobes and De Palma, 2010). However, widespread application of cleaner production has not materialized, especially within small- and medium-sized firms (Stone, 2006a; Dieleman, 2007).

Theoretical insights as well as empirical data, suggest a reason why CP implementation has lagged behind potential improvement levels, i.e. a lack of attention to social factors (Zilahy, 2004; Stone, 2006a). Practical adaptation of CP efforts, it is argued, requires innovative behaviour at different organizational levels; acquisition of new knowledge; collaborative actions; and decision-making by managers (Clark and Roome, 1999; Montalvo, 2006). As long as the traditional approaches, mechanisms, and instruments for CP dissemination remain largely focused on the technical aspects, limited implementation is to be expected (Stone, 2006b).

Organizational learning theory has been employed to study the "missing link"[1] in the adaptation of CP (Zilahy, 2004, Baas, 2006; Stone, 2006a,b; Dieleman, 2007). This theory describes the complex and iterative processes where organizations acquire knowledge to create and redefine mental models (Senge, 1990; Zadek, 2004). Complementary models describe the different learning loops and organizational elements involved in learning (Argyris, 1998; Argyris and Schön, 1996). Furthermore, organizational learning is identified as a means to foster sustainability by institutionalizing new thinking (Lozano, 2011).

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[1] Zilahy (2004) defined a CP-gap as the lag between CP implementation rates and their potential improvement levels as suggested by both the theoretical CP possibilities and practical solutions.

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Findings from studies show how the learning process implied in applying CP practices entails key organizational features, such as leadership, cultural awareness, organizational structure (Baas, 2006; Zilahy, 2004), learning as a change perspective (Dieleman, 2007), and empowerment (Stone, 2006a,b). Other authors highlight insufficient organizational learning as the reason for limited outcomes of CP applications (Clark and Roome, 1999; Stone, 2006a).

So far, authors have focused largely on theoretical solutions to programme design and outcomes. New approaches that fully integrate organizational learning concepts within dissemination mechanisms have not been reported, and knowledge drawn from empirical evidence of organizational learning in CP is limited (Stone, 2006a,b). This study was designed to contribute to the literature by assessing the experience of a Mexican Sustainable Supply Programme (MSSP), designed to promote organizational learning in CP among suppliers of large manufacturing companies. Experience drawn from the Mexican programme provides a consistently measured empirical database for empirical research.

Three questions guided this research: (i) What organizational learning levels did suppliers taking part in the MSSP attain? (ii) What characteristics of suppliers and participating managers appear to have influenced the organizational learning process? (iii) How did organizational learning by suppliers in CP evolve? In order to address these questions, the research method included exploration of organizational learning theory and its fit vis-à-vis to the empirical data of the MSSP. In the following sections these questions are addressed.

2. Organizational learning in cleaner production

This study was built upon sociological perspective of organizational learning. Some consensus exists in this field about learning as a dynamic and complex concept that can unify various levels of analysis (Dodgson, 1993; Lam, 2000). Also, most models and theories perceive CP learning as an intentional process, aimed at purposeful innovation and adaptation to the environment (Huber, 1991); involving information-processing, accumulation, and sense making (Argyris and Schön, 1996); and, it is interactive, accumulative and auto-generative (Senge et al., 1999). Organizational learning is a main requirement for change towards sustainability, which is fairly easy to identify once it occurs, but more difficult to address while it is in process (Lozano, 2012).

Another underlying concept of this study was CP, defined as "…the continuous application of integrated, preventive environmental strategies to processes, products, and services to reduce risks to humans and the environment…" (Baas et al., 1990). This concept assumes that contamination is a result of the ineffective and inefficient use of raw materials, products or by-products. Examples of CP applications include improvements in the efficient use of raw materials, energy, and water by means of changes in management, improvements in operational procedures, recycling of waste materials, and installing cleaner technologies. The adoption of a CP strategy by firms implies an organizational change process, where management and key staff must learn how to develop, implement, and monitor improvements stemming from new operational routines (Vickers and Cordey-Hayes, 1999).

This paper's author reviewed inter-linkages among organizational theory and CP relevant to this research: ***Firstly***, 'organizational learning theory' relates to an epistemological dimension of human knowledge, distinguishing between explicit and tacit knowledge (Lam, 2000). Explicit knowledge in CP implies know-how on handling CP tools for diagnosis and identification of preventive alternatives. This type of explicit knowledge involves understanding and the skills to employ CP tools, including eco-maps, eco-balances, inefficiency cost calculations, and clean technology. In traditional dissemination approaches this type of knowledge is often provided by specialized technical assistance and/or via workshop training (Stone, 2006a).

Tacit knowledge can be understood as the practical experience needed to deal with "real life" situations of decision-making involved in CP implementation by firms. It is considered, experienced, grounded, intuitive, personal, context based, and unarticulated (Lam, 2000). It is generated by learning-by-doing and experimenting. This tacit knowledge is found in the experience of managers and staff attached to firms targeted for CP. Both tacit and explicit knowledge interrelate and are indispensable for successful CP implementation (Stone, 2006a).

Secondly, 'ontological dimensions of organizational learning theory' separates levels of learning by individuals, groups and communities, and examines their interactions (Lam, 2000; Dodgston, 1993). Individual knowledge corresponds to the knowledge of the organization that resides in the brain and skills of individuals, and involves human agency and complexity. Organizational knowledge refers to the way knowledge is distributed and shared among members of an organization; it is manifested in unique routines and knowledge bases, and represents more than the sum of individual learning (Dodgson, 1993). Group learning implies that the individuals involved change their shared mental models (Senge and Sterman, 1994).

Individual learning and organizational learning are interrelated in the way that individual learning facilitates group learning, and organizational learning and *vice versa* (Senge, 1990). Traditional technical assistance and training programmes in CP emphasize individual knowledge (Remmen and Lorentzen, 2000) paying little attention to empowerment of the organizational knowledge base (Stone, 2006a). This study assessed how training of individual managers affected organizational learning of firms (Vidal-Salazar et al., 2012).

Thirdly, 'organizational learning theory' reviews organizational learning levels, based on a model proposed by Argyris and Schön (1996), and subsequently extended by Hawkins and Torbert (Snell and Chak, 1998) and compatible with Senge (1990) and Senge et al. (1999). This model considers learning as a process of detecting and correcting errors and/or creating new situations (Senge, 1990). Learning involves extrinsic and intrinsic motivations and commitment, understood as "the human energy that activates the mind" (Argyris, 1998: p. 99).

Distinct systemic levels of learning were established. Zero organizational learning appeared when fresh imperatives were issued and no organizational action was taken. Personal commitment might be manifested, but contradictions between planning and control mechanisms in organizations interfered to make adaptive behaviour implausible in organizations (Argyris, 1998). For example, 'zero-learning' existed when staff ignored the implementation of CP measures, even when stakeholders ordered them to do so (Baas, 2006).

Single-loop learning implies simple, adaptive responses that do not affect underlying values or structures (Argyris and Schön, 1996). It follows a linear process, mainly motivated extrinsically, to cope with situations (Senge, 1990). Many organizations excel at single-loop learning and protect primary loops that inhibit learning (Argyris and Schön, 1996). Should a company experience a degree of single-loop learning in CP, little or no progress would have occurred beyond the initial phase of implementation of preventive measures as a part of the dissemination programme (Stone, 2006b). Explicit knowledge might have been acquired; however, tacit application of CP in practice did not materialize.

At the **double-loop** learning level, members begin to see new ways of solving problems and develop new core values (Argyris and Schön, 1996). By resolving immediate issues, double-loop learning