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Green operations and the moderating role of environmental management capability of suppliers on manufacturing firm performance

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ABSTRACT

The increased pollution arising from different stages of producing, distributing, and disposing of electronics products highlights the importance of green operations (GO) in terms of process and product stewardship to mitigate environmental damages and satisfy the escalating social expectation for environmentally friendly operations in the electronics industry. Drawing on the natural-resource-based view, the purpose of this paper is to examine the boundary spanning role of GO and investigate the influence of environmental management capability (EMC) of suppliers on firm performance and pollution reduction. The findings from a survey of 122 manufacturing firms indicate that the success of GO is contingent on the EMC of suppliers. In addition, we found that process stewardship has a positive influence on performance outcomes and that the EMC of suppliers moderates the relationship between process stewardship and financial performance. These findings indicate that manufacturers should emphasize the EMC of suppliers in their GO to reap financial as well as environmental benefits.

1. Introduction

According to a study conducted by the Office of Solid Waste U.S. Environmental Protection Agency in 2008, only 18% of the end-of-life electronics products, ranging from computers to home appliances, were collected for recycling while 82% of them were disposed to landfills. There are hazards caused by electronics wastes ranging from polluting the environment and damaging the health of workers, to losing production capability (Economy and Lieberthal, 2007) due to the release of toxic substances including lead, mercury, cadmium, beryllium arsenic, barium, chromium, and various flame-retardant chemicals. The importance of a pro-environmental reputation for enterprises to compete internationally has been widely acknowledged (Cole et al., 2006). These electronics wastes highlight the lack of direction by electronics manufacturers on environmental protection in the globalization of their production and marketing activities to gain financial benefits.

Nowadays, environmental consequences are considered strategically essential for business operations with the aim to reduce costs and develop quality products (Atasu et al., 2008; Kleindorfer et al., 2005). The scope of green operations (GO) spans from product development to management of the entire product life cycle involving such environmental practices as eco-design, clean production, recycling, and reuse with a focus on minimizing the expenses associated with manufacturing, distribution, use, and disposal of products (Lai and Wong, 2012; Guide and Van Wassenhove, 2001; Kleiner, 1991). According to the environmental management literature, GO is concerned with both product- and process-oriented environmental practices (Ferguson and Toktay, 2006; Gilley et al., 2000; Rogers and Tibben-Lembke, 2001) to reduce the damage of products and supply chain processes on natural resources (Dechant and Altman, 1994; Porter and van der Linde, 1995a, 1995b).

In product management, GO ensures quality and environmental conformance, preventing negative corporate reputation by environmentally negligent products. In process management, GO emphasizes closed-loop operations involving practices like recuperation and recycling with the objective to reduce waste, capture residual value of products (Ferguson and Toktay, 2006; Rogers and Tibben-Lembke, 2001), and deploy environmental technology and cleaner transportation in the downstream supply chain for pollution prevention. These two distinct components of GO are helpful for firms to comply with environmental regulations, reducing the risk of legal fees, liability costs, and fines (Hunt and Auster, 1990). By embracing GO, firms will reap financial gains by capturing the residual values of their products and

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promote product innovation through analysis of the returned products for possible design improvement (Rogers and Tibben-Lembke, 2001).

Past research on GO is confined to identifying the antecedents (e.g., institutional pressures, regulations, and customer requirements), their influences on the implementation (Lai et al., 2011; Zhu et al., 2011), and the business and environmental values of implementing GO (King, 2007; Min and Galle, 2001; Rothenberg et al., 2001; Zhu et al., 2007). There is a general belief on organizational capability for successful environmental practices and sustainable operations (Bowen et al., 2001; Christmann, 2000; Handfield et al., 1997; Russo and Fouts, 1997; Sarkis et al., 2011), without which the performance outcomes of GO can be compromised (Kovacs, 2008; Porter and van der Linde, 1995a). The literature has acknowledged the value of GO and the internal capability of firms for its success (Corbett and Klassen, 2006; Dechant and Altman, 1994; Handfield et al., 1997; Lai et al., 2010), but the complementary role of upstream suppliers to enhance performance remains under-explored (Pagell et al., 2007; Vachon and Klassen, 2007). A recent study by Lee and Klassen (2008) highlighted the importance of environmental management capabilities (EMC) of suppliers, which reflect the ability of suppliers to improve their performance on environmental issues. Nevertheless, how such capability influences the GO of buying firms was not considered. While the negligent behaviors of suppliers can devastate the GO of their downstream partners (Preuss, 2001), a systematic investigation on supplier role in GO is timely and an important environmental management topic.

Drawing on the natural-resource-based view (NRBV) of a firm, this study examines the boundary spanning role of GO and investigates the influence of EMC of suppliers on manufacturing firm performance and pollution reduction with empirical data collected from electronics manufacturers in Taiwan. A structural equation model and multi-group analysis were used to test these practice–performance relationships. By doing so, this study makes two major contributions to the literature. First, we address the increasing public concern on the electronics wastes causing air, soil, and water pollution by examining the performance implications of GO in terms of product- and process-oriented environmental practices in lessening the environmental damages. Furthermore, we evaluate the EMC of suppliers and determine how it can facilitate the product- and process-related practices of GO in contributing to environmental and financial performance. This study advances theoretical and practical knowledge on evaluating GO and EMC, as well as the environmental practices that form these two organizational capabilities essential for performance gains. The study results will provide managerial insights and useful reference for electronics manufacturers to embark on GO and leverage the EMC of suppliers to succeed. Second, we examine the supplier role in support of their downstream partners for environmental protection, where the EMC of the former is not adequately addressed in prior studies. There is evidence that suppliers are instrumental in complementing the environmental management practices of their downstream partners by offering environmentally friendly inputs and facilitating pollution prevention processes (Corbett and Klassen, 2006). This supplier role sheds light on the importance of EMC in suppliers as external complementary assets for successful implementation of GO, particularly in the electronics industry characterized with highly interrelated and complex manufacturing operations(Yeung et al., 2005).

2. Theoretical development

2.1. Natural-resource-based view

Many studies have sought to define resources, capabilities, and/or competencies based on the resource-based view (Barney, 1991; Marino, 1996; Wernerfeit, 1994), however, a review of the literature suggests concepts such as resources, capabilities, competencies, and core competencies are not clearly identified. Barney (1991) and Marino (1996) attributed a wide range of meanings to resources, including physical resources (e.g. raw materials, equipment, financial endowment, etc.), human resources (e.g. training, experience, skills, etc.), and organizational resources (e.g. firm image, process, routines, etc.). Some resources are tangible and physical including plant and equipment, while others are intangible such as a brand name. While some scholars suggest capabilities are part of resource, others hold opposite views and have therefore sought to differentiate between resources and capabilities (Amit an Schoemaker, 1993; Grant, 1996; Lu, 2007). Capabilities use resources and should thus be viewed as independent of resources (Amit and Schoemaker, 1993). Hart (1995) proposed the NRBV, suggesting that businesses are constrained by and dependent on the conditions and resources of their natural environment to prosper and flourish. NRBV is an adaptation of the resource-based view of the firm, which entails that organizational resources and capabilities that are valuable, rare, and inimitable determine the competitive position of firms with environmental management considerations (Barney, 1991). A firm can achieve superior performance if it has the capability to exploit as well as preserve natural resources in its operating environment. Such capability is either casually ambiguous or socially complex. The casually ambiguous capability is a skill-based resource of firms, suggesting that firms can gain experience and learn skills through repeated practices (Hart, 1995) or develop complementary assets (e.g., technological knowledge) with their environmental management practices for better performance gains (Milgrom et al., 1991). A firm skilled at experience learning and leveraging complementary assets commands an advantageous position in competition due to the barrier of imitation and better use of organizational resources (Das and Teng, 2000). On the other hand, the socially complex capability of firms aimed at preserving their natural resources is developed where partner firms are engaged in coordinated organizational actions to excel. Such capability allows firms to access the resources of their partners. The inherent complexity in the inter-organizational coordination and collaboration are difficult to imitate. The NRBV is useful for explaining the performance outcomes of GO of firms, and in particular the EMC of suppliers as a complementary asset to perform inter-organizational coordinated actions in the process.

2.2. The role of EMC of suppliers

Environmental management capability (EMC) of suppliers is concerned with their ability to perform business activities in an environmentally friendly manner while attaining financial gains (Klassen and Vachon, 2003). EMC of suppliers is generally viewed as their ability to respond to the environmental concerns of their operations as well as the environmental requirements of their buying firms (Lu et al., 2007). Such capability of suppliers is often characterized with their adoption of an environmental management system standard (e.g., ISO 14000), evaluation of their upstream suppliers' environmental performance, and development of an environmental policy to mitigate negative environmental impacts in their operations (Corbett and Kirsch, 2001; Klassen and Vachon, 2003). EMC of suppliers is valuable to electronic manufacturers as the success of electronics manufacturers relies heavily on their supply network to develop complicated electronics products, provide value-added services, implement complex business processes, and meet higher customer expectations (Fawcett and Clinton, 1996; Gunasekaran et al., 2008; Koufteros et al., 2007a, 2007b; Yang et al., 2008, 2009).