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Green logistics management and performance: Some empirical evidence from Chinese manufacturing exporters

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ABSTRACT

The value chain of many business enterprises is increasingly required to demonstrate the profitability of their primary activities, starting from inbound logistics to operations, outbound logistics, marketing sales, and finally to services. The adoption of green logistics management (GLM) presents an opportunity for Chinese manufacturing exporters to competently respond to the escalating expectation of the international community for resources conservation and to achieve environmental performance profitably. This study makes several important contributions to the literature on managing logistics with environmental considerations. First, the authors identify the components of GLM: (i) procedure-based practices, (ii) evaluation-based practices, (iii) partner-based practices, and (iv) general environmental management practices. Second, they relate GLM to environmental and operational performance in a developing country context. Third, they identify the institutional and operational antecedents that prompt the adoption of GLM by export-oriented manufacturing enterprises in China. Fourth, they examine the moderating effect of environmental regulatory pressure on the GLM-performance linkage. The results are based on a survey of manufacturing exporters in China. The commonly held view that economic motivation is related to the adoption of GLM is not supported. However, GLM positively affects both environmental and operational performance, and regulatory pressure enhances the GLM-performance relationship.

1. Introduction

Business enterprises in newly industrialized countries such as the BRICs (Brazil, Russia, India, and China) are increasingly expected to comply with environmental standards such as the Waste Electrical and Electronic Equipment (WEEE), the End of Life Vehicle (ELV) Directive, and the Restriction of Hazardous Substances (RoHS) if their merchandises are to reach international markets successfully. Such environmental-based trade barriers have also aroused the awareness of customers, firms, and government bodies for protecting the environment. Meanwhile, there are growing international concerns on the environmental damages associated with the accelerated industrial activities in the BRICs and China in particular [1,2]. As global suppliers of manufactured products, manufacturing enterprises in China need to seek sustainable solutions such as green logistics management (GLM) in pursuit of profitable growth without inflicting environmental damages to other countries through managing the logistics cycle of their merchandises, i.e., spanning sourcing, manufacturing, distribution, and disposal [3]. Such a solution should be able to improve business performance, while preserving the local, as well as the global environment.

Nowadays, the majority of products consumed in developed countries have their resource materials or part of their manufacturing processes served by developing countries. The globalization of production highlights the importance of GLM on prevention of environmental harm arising from product manufacturing and distribution activities. Serving as the world's factory, Chinese manufacturing exporters are encountering international pressure to conserve resources and reduce their environmental consequences [4]. The circular economy law in China, which promotes conservation of resources, reflects organizational responsibility towards achieving this goal [5]. According to the China's National Development and Reform Commission, a circular economy is a scientific development model, where resources become products and the products are designed in such a way that they can be fully recycled for sustainable development of a country with a focus on balancing economic development and environmental protection. Resource depletion and an increasingly detrimental environmental burden caused by organizational production operations have led the Chinese government to impose

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stricter regulatory policy. This law took effect on 1 January 2009 and China is one of the pioneer emerging countries implementing circular economy-oriented legislation to redress the environmental harms arising from the rapid growth of its industrial activities in recent decades. The circular economy initiative of China has major strategic importance for Chinese enterprises, particularly those in the manufacturing sector which are considered a major polluting source to the environment. Thus, profitable growth, increasing environmental awareness, and stringent regulatory policies all suggest that Chinese manufacturing exporters need a management approach to tackle these challenges. Managing the logistics cycle of products in an environment-friendly manner and the different facets of these environmental management practices are increasingly embraced as a source of lasting competitive advantage by many Chinese manufacturers [6].

As China aspires to develop a circular economy to promote continuous economic development without generating significant environmental and resource challenges, GLM is congruent with this goal featuring a focus on the three Rs (i.e., recycling, reuse, and reduce) to improve internal procedures and external conformances in managing product movements. To reach this circular economy objective, the important role of logistics management should not be neglected. Considerable opportunities exist along the logistics chain to reduce a firm's environmental impact; for example, substituting chemicals that might reduce the generation and handling of hazardous waste or by reducing the packaging waste that must be managed and disposed. GLM is novel and unique relative to concepts such as reverse logistics and closed-looped supply chain, which are confined to an emphasis on mitigating the environmental damages through managing the forward and reverse physical movements of goods among trading partners. Reverse logistics focuses on planning, implementing, and controlling efficient flows of materials, in-process inventory, finished goods from the point of consumption to production for the purpose of recapturing value or conducting proper disposal [7]. Similarly, closed-loop supply chain consists of a forward as well as reverse supply chain, such that the loops of product flow is closed by reusing the product as itself, its components, or its materials [8]. Although these concepts are helpful for environmental protection by reducing the disposal to landfill with focus on processes in handling end-of-life or returned products, e.g., by recycling and remanufacturing, they neglect the management practices that are useful for mitigating the environmental damages caused by products throughout their life-cycle. In comparison, GLM is a management approach that considers product return and recycling, environmental management systems, and eco-efficiency as viable ways to comply with environment-based regulations in international trade [9,10]. While environmental impacts occur at all stages of a product's life cycle [11], GLM can contribute to integrate these factors in organizational logistics operations particularly on meeting market expectations, managing environmental risks, complying with regulations, and improving business efficiency. In particular, product distribution requires partner participation and performance monitoring if the recovery of products and materials in an environmentally sound manner can succeed.

GLM reflects organizational ability to conserve resources, reduce waste, improve operational efficiency, and satisfy the social expectation for environmental protection. Other than internal activities such as product development and manufacturing processes, managing physical product flows is considered essential for environmental protection from the logistics and international business perspectives [12,13]. While there are studies linking logistics elements including procurement, distribution, packaging, reserve logistics, to environmental preservation [14,15], the literature is void of a theoretical construct that captures the key elements of GLM. Thus, this study fills this research gap by developing GLM as a composite construct reflecting an organization's strive to balance economic growth and environmental protection in logistics management as well as the structure (i.e., the procedures), relevant processes (i.e., the evaluation), and strategy (i.e., partner and management focus) that supplement this goal. Thus, at the core of GLM is the belief that firms can improve both environmental and operational performance by managing the logistics cycle of their products.

We examine two performance measures for evaluating the outcomes of GLM: (1) environmental performance, which is related to reduction in emission, waste, and pollution incurred from logistics activities, and (2) operational performance, which is concerned with improvement in product development and delivery. Based on the theory of structuration, we investigate the antecedent economic and institutional factors pressurizing the adoption of GLM by Chinese manufacturing exporters. Finally, we evaluate the effect of regulatory pressure moderating the links between the antecedent factors and performance outcomes.

We develop new measurement items and adapt existing scales for evaluating GLM in manufacturing as well as the antecedent and outcome factors experienced by Chinese manufacturing exporters. The survey-based data were analyzed using confirmatory factor analysis (CFA), structural equation modeling, and multi-group analysis for moderating effect. Our empirical results establish that GLM can be embraced as a manufacturing resource to make the logistics cycle less wasteful and regulation plays a role to strengthen the implementation of GLM due to customer pressures as well as the performance outcomes in both economic and operational aspects.

2. Conceptualization and developing the GLM construct

We conducted exploratory interviews to understand environmental concerns of manufacturing enterprises in China. Specifically, we explored attributes constituting GLM and the pressures that are experienced by the manufacturers. The details of the exploratory interviews are summarized in Appendix B. We now proceed to elaborate on these four attributes of implementing GLM.

Procedure-based practices: Policy guidelines are needed to implement any organizational practices such as GLM. We define procedure-based practices as the management practice to perform GLM activities based on company structure and reporting systems in manufacturing enterprises. The procedure-based practices in GLM help manufacturers to detail and rationalize the actions to be taken in GLM, and serve as a communication tool between organizational functions on their responsibility in GLM.

Evaluation-based practices: Periodic performance evaluation is desired for manufacturing enterprises to identify areas for improvement. These practices reflect organizational ability to evaluate, monitor, and improve performance on a continuous basis. The purpose of evaluation-based practices is to provide formal documents and reports to managers, reducing equivocality on the success of GLM.

Partner-based practices: A logistics chain requires the support and knowledge of internal staff members to work beyond organizational boundaries for any initiative such as environmental management to take effect. Staff communication and training on GLM is therefore needed to achieve the targeted implementation outcomes. A firm should not act unilaterally and partnership, backward with suppliers and forward with customers, is instrumental to competently mitigate the environmental impact arising from inter-organizational activities and product flows. The partner-based practices reflect