Int. J. Production Economics ▮ (▮▮▮▮) ▮▮▮–▮▮▮

Contents lists available at SciVerse ScienceDirect

Int. J. Production Economics

journal homepage: www.elsevier.com/locate/ijpe

Critical barriers in implementing reverse logistics in the Chinese manufacturing sectors

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ARTICLE INFO

Article history:
Received 2 April 2012
Accepted 5 August 2012

Keywords:
Barriers
China
Manufacturing
Reverse logistics

ABSTRACT

Reverse logistics (RL) is gaining momentum worldwide due to global awareness and as a consequence of resource depletion and environmental degradation. Firms encounter RL implementation challenges from different stakeholders, both internally and externally. On the one hand, various governmental agencies are coming out with different environmental regulations while on the other hand academics and researchers are contributing solutions and suggestions in different country contexts. In a real sense however, the benefits of RL implementation is not yet fully realized in the emerging economies. This paper proposes a theoretical RL implementation model and empirically identifies significant RL barriers with respect to management, financial, policy and infrastructure in the Chinese manufacturing industries such as automotive, electrical and electronic, plastics, steel/construction, textiles and paper and paper based products. Key barriers from our study, with respect to these four categories, are: within management category a lack of reverse logistics experts and low commitment, within financial category a lack of initial capital and funds for return monitoring systems, within policy category a lack of enforceable laws and government supportive economic policies and, finally, within infrastructure category a the lack of systems for return monitoring. Contingency effect of ownership was carried out to understand the similarities and differences in RL barriers among the multinational firms and domestic firms investigated.

1. Introduction

Reverse logistics (RL) is considered by firms as an undervalued part of supply chain in general due to the following reasons: minimal interest of top management, insufficient time commitment, change in functional priorities among and within firms, a lack of integrated corporate supply chain design target towards RL, a lack of awareness of the high potential value of integrating operations (PricewaterhouseCoopers' report, 2008; Jindal and Sangwan, 2011; Gunasekaran and Ngai, 2012). In the real sense it has been highlighted that best reverse logistics operations would lead to higher sales revenue and reduced operational costs (PricewaterhouseCoopers' report, 2008; Frota Neto et al., 2008). Furthermore, researchers have also reported several benefits that could be achieved with RL, such as efficient resource utilization and environmental protection (Gunasekaran and Spalanzani, 2011; Fernández et al., 2009; Tsai et al., 2008).

Interestingly most of the prior research on the drivers and barriers of RL implementation are concentrated on developed countries, with relatively little attention being devoted to developing countries, such as China (see Rogers and Tibben-Lembke, 1999, 2001; Ferguson and Browne, 2001; Lau and Wang, 2009; Zhu and Geng, in press; Jindal and Sangwan, 2011; Miao et al., 2011). Of the few studies on developing countries, Lau and Wang (2009) investigated RL in Chinese electronic industry using case study on only four companies. The study by Jindal and Sangwan (2011) on RL barriers in India, on the other hand, was based on general organizational, market and government related barriers that are not related to any particular industry sector in India. Both studies acknowledged limitations in the scope of their studies and methodologies employed and encourage appropriate future large-scale empirical study within and across different industry sectors; the exact objective of the present study. That few RL studies focused on developing countries is hardly surprising because whereas RL is a mandatory part of supply chain in developed countries, it is still in its infancy state in developing countries (Zhang et al., 2011; Sarkis et al., 2011).

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http://dx.doi.org/10.1016/j.ijpe.2012.08.003

The on-going rapid industrialization and presence of 22% of the world population in China has led to enormous production and consumption in the Chinese economy. The downside of this unprecedented economic growth has been extremely high resource consumption and serious environmental pollution, such as contaminated water and solid waste per unit of GDP, which is much higher than in developed countries (Fang et al., 2007). The waste generated in different sectors of China's economy can be comprehended by the statistics reported by Ma (2004) which point to 5 million tons of waste steel, 200,000 t of non-ferrous metal, 14 million tons of waste paper, a large amount of waste plastics and glass which have been never recycled. Furthermore, China occupies the second position in the world, after the USA, in landfilling and incineration of e-waste residues (Zoeteman et al., 2009).

This motivated us to look into the issues related to RL implementation, specifically to identify the key barriers in different Chinese manufacturing sectors. Few studies have been carried out to understand RL implementation in general in the Chinese context but most of them are related to the e-waste sector. To the best of our knowledge they have used case study in particular as a method to study the issues, which has limitations such as small sample size which restricts the generalization of findings to reflect the circumstance of the whole population (Merriam, 1985).

The major intention of this study is to empirically understand various RL implementation barriers from manufacturing firms' perspective in different Chinese manufacturing sectors. RL barriers can be categorized into four major factors and they are internal and external to firms. The internal barriers are management, financial and infrastructure while policy is considered as an external barrier to a firm. Beyond this contingency analysis on the effect of ownership is carried out to understand the similarities and differences in barriers among multinational firms and Local (domestic) firms operating in China.

The rest of the paper is organized as follows: Background for the research is highlighted in Section 2. A theoretical model for RL implementation is discussed in Section 3. Methodology adopted to empirically study the implementation barrier is detailed in Section 4. The outcome of the study is reported in Section 5. The managerial implications are narrated in Section 6. Finally the paper concludes with a summary and outlines future scope of research.

2. Background for the research

Waste is considered as a valuable item in the Chinese context and the existence of an informal recycling network provides a large amount of employment in rural parts of China. A large proportion of China's waste comes from scrapped electrical and electronic products. For example, solid waste from waste electrical and electronics equipment (WEEE) in China is reported as being three times greater than common waste (Wang et al., 2009; Koh et al., 2012). About 20% of all e-waste in China is made of mostly scrapped electronic appliances and computers and this portion of the waste is growing at an annual rate of around 20% (Veenstra et al., 2009).

The European Union (EU) has made a substantial effort at creating awareness among the emerging economies' companies to realize the effect of WEEE regulatory norms. The EU also reported that China has a relatively good level of awareness of WEEE issues. It found that a legal framework similar to WEEE, which emphasizes three aspects, such as take-back issues, controls of hazardous substances and assurance of good environmental management was developed in around 2008 in China. While the Chinese regulations on take-back of End of Life (or end-of-use) products requirements and the associated financial responsibilities are vaguely defined, it gained popularity among the Chinese public in terms of its environmental concern (Chung and Zhang, 2011). According to Chung and Zhang (2011), that although a multiple enforcement agency approach prevents full and effective enforcement of the relevant legal requirements, China now has satisfactory resources available to enforce reduction in environmental pollution at Chinese WEEE plants.

2.1. *Significance of industries considered in this study*

China has become the world's top consumer of natural resources due to its rapid industrialization, urbanization and modernization. The resulting impact has, since 1993, shifted China from net exporter to net importer of raw materials such as steel, plastics and other minerals (Cunat, 2010). For example, China's steel consumption has increased by 15% p.a. over the last decade to reach a total of 556 million tons in 2009, accounting for 51% of total global consumption (Cunat, 2010). China's iron and steel sector is one of the largest in the world and plays a key role in China's economy with construction and manufacturing industries sustaining its growth. The iron and steel waste generation is enormous due to urbanization and therefore effective reuse of material should be mandatory. Similar pressures are placed on plastics and paper and paper based products sectors each of which has seen decades of tremendous growth. The paper industry provided 1.5 million employment in 2009, with a total export value of US $ 3.14 billion in the same year, while the plastics manufacturing sector employed 2.6 million workers and generated a total export value of US $ 14.40 billion in 2009. The literature indicates that other than WEEE (or e-wastes), China's waste stream is growing fastest in paper and plastics industries (World Bank, 2005; Veenstra et al., 2009; Zhang et al., 2010; Chi et al., 2011; Oliveira et al., 2012). These two sectors are therefore well-positioned to use recycled product.

China is also now the largest automobile producer in the world and a key market for global players in the automobile industry. China is "set to become a global point of reference in terms of technology and industry practices for the automobile industry" due to the huge domestic market potential for automobiles, aided by rapidly increasing high disposable income in China (CEIBS, 2011). The sector employs about 3 million people and pressure is building on them to reuse end of life (EoL) products. According to China's National Development and Reform Commission (NDRC), "by 2010, the recycling rate of all imported and domestic commercial vehicles in China should reach 85% and the rate of reusing the materials should reach 80% and from 2012 onwards, recycling rate of imported and domestics vehicles targets are at 90% and 80% of all materials reused" (Chinadaily report, 2012). Similarly, China's textile sector employed about 6.17 million people and generated total export value of US $ 167.02 billion in 2009. This industry is thinking of extracting valuable raw materials by reusing the recoverable waste in future.

These sectors will have different drivers, pressures, experiences and capability in coping with the sectors' exponential growth rates, upgrades and innovation, high rate of obsolescence and waste. Each sector will therefore have varying degrees of implementation of RL practices, which needs detailed investigation.

2.2. *RL studies in Chinese context*

We summarize several Chinese RL studies in Table 1. Our intention in this summary is to find out the type of RL study previously carried out, which industry sector are usually studied,