An Empirical Study on Relationship between Green Supply Chain Management and SME Performance in China

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Abstract: Conventional theory holds that green supply chain management will cause more cost to SMEs, which is lack of resources. This subsequently leads to lower firm performance of SMEs. While researchers have explored the relationship between green supply chain management and business performance in different organizations, such studies in SMEs are scarce. This study investigates potential influences of GSCM on the performance of SMEs in China. Data for this study were collected through personal interviews, and the study developed a scale to specify the dimensions of a GSCM. Results indicated that the scale in this study provided a good measure of market orientation in this setting. Also, the results of analyses indicated a significant link between GSCM and the performance of SMEs in China.

Key words: Green supply chain, management, performance, SME

1 Introduction

The concepts pertaining to greening the supply chain or supply chain environmental management are usually understood by industry as screening suppliers for their environmental performance and then doing business with only those that meet the regulatory standards. The driving forces for implementing the concept into the company operations are many and comprise a range of "reactive regulatory reasons to proactive strategic and competitive advantage reasons" (Sarkis, 1999). Green supply chain management (GSCM) has emerged as a key approach for China’s SMEs seeking to become environmentally sustainable. Balancing economic and environmental performance has become increasingly important for organizations facing competitive, regulatory, and community pressures. With increased pressures for environmental sustainability, it is expected that enterprises will need to implement strategies to reduce the environmental impacts of their products and services (Lewis and Gretskasik, 2001). To establish their environmental image, enterprises have to re-examine the purpose of their business (Hick, 2000). Success in addressing environmental items may provide new opportunities for competition, and new ways to add value to core business programs (Hansmann and Claudia, 2001). Environmental influence appears at all stages of a product’s life cycle. Therefore, GSCM has emerged as an important new archetype for companies to achieve profit and market share goals in terms of lowering their environmental risks and influence while raising their ecological efficiency (van Hock and Erasmus, 2000).

It is generally perceived that green supply chain management promotes efficiency and synergy among business partners and their lead corporations, and helps to enhance environmental performance, minimize waste and achieve cost savings. This synergy is expected to enhance the corporate image, competitive advantage and marketing exposure. However, if green supply chain management practices are to be fully adopted by SMEs in China, a demonstrable link between such measures and improving economic performance is necessary. Bowen et al. (2001) state that organizations will adopt green supply chain management practices if they identify that this will result in specific financial and operational benefits. Thus, it is necessary to establish the potential link between green supply chain initiatives and increased economic performance, to provide an impetus for China’s SMEs to green their supply chains. There have been many China’s SMEs that have undertaken significant efforts towards establishing green supply chain management initiatives. No previous research has tested an empirical link between such
efforts and subsequent improvements in economic performance. Therefore, this paper presents the results of a survey of SMEs in China to investigate the proposition that there is a significant correlation between greening certain phases of the supply chain and the performance of the SMEs involved.

2 Green Supply Chain Management

The concept of supply chain environmental management has been observed as a recent and novel managerial principle. The novelty of this topic makes it difficult to truly determine contradictory and conflicting issues that could be considered true "debates". In fact, Sarkis provides a comprehensive view of the state of research in this evolving topic, tracing the work of researchers who have investigated the issues involved, the reasons for incorporating these practices and also the way they have been practiced in different organizations. According to him, the supply chain system should include purchasing and inbound logistics, production, distribution and reverse logistics. He also shows how firms focus on total quality management (TQM), with its emphasis on improving product quality, zero defects, customer satisfaction, training and employee empowerment, etc., and integrate it with environmental management resulting in total quality environmental management (TQEM). This integration to TQEM enables organizations to move towards the source reduction of pollution philosophies and improves environmental performance, marketing advantage and corporate image so that the company moves on to the world class status.

Different researchers have defined Green Supply Chain Management from different perspectives, driving forces and purposes. Sarkis (1999) refers to the supply chain as a system which includes purchasing, production, distribution and reverse logistics. A recent definition (Handfield and Nichols, 1999) goes as follows: The supply chain encompasses all activities associated with the flow and transformation of goods from raw materials (extraction) through the end user, as well as associated information flows. Many authors are exploring environmental initiatives within each of the major phases of the supply chain. In this study, green supply chain management is divided into three phases: green purchasing, green production and green marketing.

3 Green supply chain management and performance

Previous research has explored the relationships between GSCM practices and performance including environmental, economic and operational performance. Literature has offered insight on potential patterns of supply-chain relations for improving environmental performance (Handfield et al., 2002). The literature for supporting such positive relationships is relatively strong. For example, Frosch (1994) argued that an inter-firm linkage facilitated by proximity could lead to improvement in environmental performance. Dodgson (2000), Dyer and others argued that inter-firm relations provide formal and informal mechanisms that promote trust, reduce risk and in turn increase innovation and profitability. However, through examination, Bowen et al. (2001) suggested economic performance is not being reaped in short-term profitability and sales performance.

It is still not clear whether benefits or costs dominate when adopting GSCM practices in China. Given the strength of the overall literature in supporting the "win-win" scheme, even though it is still mixed, This study is going to test the relationship between GSCM and the performance of the SMEs in China.

4 Research Hypotheses

In this study, we attempt to test the links among three dimensions of green supply chain management, as well as the link between green supply chain management and performance. Figure 1 shows the model used in the study.

The diagram depicts that GSCM is linked to green purchasing, green production and green marketing. Also, the model shows the link between GSCM and performance. The first three hypotheses test the relationship between GSCM and green purchasing, green production and green marketing. The
fourth hypothesis tests the relationship between GSCM and performance.

4.1 Green purchasing

Greening the supply chain has numerous benefits to an organization, ranging from cost reduction, to integrating suppliers in a participative decision-making process that promotes environmental innovation (Rao, 2002). Green purchasing strategies are adopted by organizations in response to the increasing global concerns of environmental sustainability. Green purchasing emphasizes on reduction of waste produced, material substitution through environmental sourcing of raw materials, waste minimization of hazardous materials and so on. The involvement and support of suppliers' is crucial to achieving such goals. Therefore, companies are increasingly managing their suppliers' environmental performance to ensure that the materials and equipments supplied by them are environmentally-friendly in nature and are produced using environmentally-friendly processes.

Min and Galle (1997) study "green purchasing" to determine the key factors affecting an enterprise's choice of suppliers, the key barriers and the obstacles to green purchasing initiatives. They also investigated the influence of green purchasing on a corporation's environmental goals. Sroufe (2003) presents a framework involving performance indicators and supplier assessment metrics. It is found that environmental initiatives such as strategic environmental sourcing improve an organization's competitive position and reduce risks. Min and Galle consider selected industry groups (heavy producers of scrap and waste materials) and identify that green purchasing contributes significantly towards source reduction of pollution in terms of recycling, re-use and low-density packaging, and towards waste elimination in terms of scrapping or dumping, recycling and sorting for non-toxic incineration and bio-degradable packaging. They also propose that the high cost of environmental programs, uneconomical recycling and uneconomical re-use are the three most important barriers and obstacles to green purchasing. Lack of management commitment, lack of buyer awareness, lack of supplier awareness, deficient company-wide environmental standards or auditing programs and lack of state and federal regulations are also important issues.

Hines and Johns (2001) identify the mentoring role within green supply chain management as an emerging concept that promotes a more significant relationship between the customer and the supplier. This mentoring culture goes beyond monitoring and evaluation, towards guiding and supporting suppliers and requires a substantial change in the attitude of the lead corporations in a supply chain. Specific operational initiatives involved in the mentoring process might include holding environmental awareness seminars for suppliers and vendors, undertaking educational program to explain the benefits and relevance of green supply chain management initiatives, setting up environmental teams to guide suppliers in their development of environmental programs, visiting supplier premises to provide on-site recommendations and assisting in the set up of their environmental programs.

Hines and Johns (2001) also examine the strengths and weaknesses of the mentoring and partnering approach within green supply chain management. From a positive perspective, supplier mentoring is proactive, non-threatening, shares potential benefits, and builds teamwork. However, they also identify...
the critical weaknesses of this approach as resource and cost implications, lack of physical facilities, lack of mentoring skills, and trained personal to deliver such mentoring initiatives. Thus, we propose the following hypothesis:

H1: For SMEs, green purchasing (including reduction of waste produced, material substitution through environmental sourcing of raw materials, waste minimization of hazardous materials and so on) will be a positive indicator of green supply chain management.

4.2 Green production

Much of the previous research on environmental issues in business has focused on the internal operational practices an organization may adopt, such as waste management and eco-efficiency. However, green production is also an important stage within a green supply chain management program. For instance, over 75 percent of respondents to a survey of 212 US manufacturing firms identified pollution prevention as important to their overall corporate performance, with 49.1 percent of the firms identifying suppliers as a key component in pollution prevention efforts, and 37.7 percent identifying customers as the key players in pollution prevention efforts (Florida, 1996). It is noticed that some of them pursued specific initiatives with suppliers to reduce wastes, prevent pollution, develop new products and specifications and held regular meetings with their suppliers to discuss their pollution prevention strategies.

In the production phase of a green supply chain, there are a number of concepts that can be explored, such as cleaner production, design for environment, remanufacturing and lean production. Florida and Davison (2001) surveyed 580 manufacturing plants in the US adopting cleaner production techniques. Their research reveals that green corporations are innovative in their environmental practices, and these strategies emerge from a real commitment towards reducing waste and pollution. Lean production/manufacturing is also an important consideration in reducing the environmental impact of the production phase. Sanches and Ferez (2001) also investigate the link between lean production practices in manufacturing organizations and resultant enhanced competitiveness. Lean production is also expected to improve environmental performance of the firms through good housekeeping practices, such as general waste reduction and minimizing hazardous wastes. King and Lenox (2001) concludes that lean production is complementary to improvements in environmental performance and it often lowers the marginal cost of pollution reduction thus enhancing competitiveness. The success of lean production emanates from three major factors: minimization of non-value adding activities, efficient work systems, and applicable human resource management. Rothenberg et al. (2001) identify that lean plants aim to minimize waste and buffers, leading not only to reduce buffers in environmental technology and management, but also in an overall approach to manufacturing that minimizes waste products. Thus, we propose the following hypothesis:

H2: For SMEs, green production (including cleaner production, design for environment, remanufacturing and so on) will be a positive indicator of green supply chain management.

4.3 Green marketing

Green marketing includes environment-friendly packaging, environment-friendly distribution and so on. They are all initiatives that might improve the environmental performance of an organization and its supply chain (Rao, 2003). Management of wastes in green marketing such as reverse logistics and waste exchange can lead to cost savings and enhanced competitiveness (Rao, 2003). Many of these initiatives involve compromises between various logistics functions and environmental consideration in order to improve the environmental performance of an organization (Wu and Dunn, 1995).

Currently, it is quite common to use packaging that prevents the product from damage and makes it easy to handle. The use of packaging whatever it is made of; for example glass, metal, paper or plastic, mainly leads to the solid waste stream. In order to emphasize these environmental impacts of packaging, many nations now develop programs and laws that aim to minimize the amount of packaging that enters the waste stream, such as the Packaging Directive in the EU.

In China, many SMEs are facing the problem of how to dispose of the waste from their production process. Lack of strict waste management law may lead to unregulated. However, more environmentally
engaged SMEs are adopting on-site waste management treatment facilities and waste exchange networks. To address the problem of industrial waste management in China, many government agencies are trying to promote the concept of industrial ecology for corporations, especially for SMEs where a "closed loop" approach (Frios, 1999) utilizes all waste through the recycling and reuse of energy and materials.

The impact of green marketing on customer relationships, and the impact of corporate customers on suppliers, had also been widely investigated (Kama and Heiskanen, 1998). Encouraging suppliers to take back packaging is a form of reverse logistics that can be an important consideration in green marketing, with a study by Dorn (1996) identifying an increase in market share amongst companies that implemented an environmentally-friendly packaging scheme. Wu and Dunn (1995) identify warehousing and packaging design as the two most important issues in outbound logistics and distribution. They argue that standardized reusable containers, good warehousing layouts, and easy information access reduce storage and retrieval delays which lead to savings in operating costs.

In an environmentally-friendly transportation system, essential elements of a transportation system such as type of transport, fuel sources, infrastructure, operational practices and organization, can be considered. These elements and the dynamics that connect them, determine the environmental impact generated in the transportation logistics phase of the supply chain (Kam et al, 2003). Thus, we propose the following hypothesis:

H3: For SMEs, green marketing (including environment-friendly packaging, environment-friendly distribution and so on) will be a positive indicator of green supply chain management.

4.4 Green supply chain management and performance of SMEs involved

There have been credible research efforts to explore green supply chain management initiatives, little research has been undertaken on the impact of these on economic performance. Perhaps it would be encouraging for industry to adopt green supply chain management if there is a demonstration of a clear, significant and observable correlation between these efforts and economic performance.

Whether GSCM practices cause or relate to positive or negative economic performance is still mixed (Wagner et al., 2001). Dodgson (2000), Dyer and Singh (1998), von Hippel (1988) and others argued that inter-firm relations provide formal and informal mechanisms that promote trust, reduce risk and in turn increase innovation and profitability. However, through examination, Bowen et al. (2001) suggested economic performance is not being reaped in short-term profitability and sales performance.

The study by Rao (2003) does identify that organizations in South East Asia believe that greening the inbound logistics function has led to using environmentally-friendly raw materials, greening of production to cleaner production, prevention of pollution as well as waste at the source; whereas greening outbound logistics led to environmentally-friendly waste disposal and mitigation of the effects of pollution through waste water treatment and abatement of emissions (Rao, 2003). Such initiatives lead to improvements in environmental performance, and reduce the risk of non-compliance, penalty and threat of closure. At the same time, the link between green supply chain initiatives and improvements in competitiveness and economic performance for organizations in this region remains unclear.

This observation holds true not only for corporations in South East Asia but also, to a certain extent in the US and Europe. Thus, we propose the following hypothesis:

H4: GSCM practice adoption in SMEs has improved their performance.

5 Methodology

The survey instrument consisted of three sections. Section 1 asked the respondents to answer 32 green supply chain management questions to measure their green supply chain management degree. These questions were structured in a Likert scale model (1 to 5) with "strongly disagree," "disagree," "neither agree nor disagree," "agree," and "strongly agree" as the choices.

This section of the questionnaire also included a validation scale where respondents were asked to distribute 100 points between two business units that resembled their organization. Thus, if an SME was
primarily like Organization A (using green supply chain management) and only remotely like Organization B (non-green supply chain management), the respondent might allocate more points to Organization A and fewer points to Organization B. Section 2 of the questionnaire included questions about performance such as current and past three year sales in dollars, revenue growth, and market share, and return on investment in the last three years that managers evaluated the performance of their organizations. Section 3 included demographic information.

6 Data Collection

The study participants were SMEs’ owners and managers from 127 enterprises located in three major states located in China (Guangdong, Zhejiang, and Hubei). All of the participants were recruited randomly on the basis of convenience and participated voluntarily. Data were collected through personal interviews by contacting each organization and seeking permission to collect data. The survey process consisted of two or more visits to the business. In almost all cases, the first visit consisted of leaving the survey with the owner/manager for them to complete. In the second or follow-up visit, questions were answered and the completed survey was collected. Generally, data were collected during business operations; however, sometimes it was necessary to collect the completed surveys while the business was closed or at a convenient time that met the business owner/manager’s schedule.

7 Analysis and Results

The average age of the respondents was 45.3. The average number of years of managerial experience was 13.4 years, and the average number of years employed in the current job was 8.7 years.

7.1 Cronbach Alphas

Although not as strong as one might prefer, the Cronbach alpha reliabilities of the scale for SMEs were adequate for this sample: ten-item green purchasing scale, $\alpha = 0.69$; eight-item green production scale, $\alpha = 0.74$; and 13-item green marketing, $\alpha = 0.83$.

7.2 Structural Equation Analysis

Because of the size of the sample and number of variables in the model, a path diagram based on observable means of the three green supply chain management dimensions was used in the analyses of data. The results of the structural equation analysis indicate that the overall fit of the model was good ($\chi^2 = 11.19$, d.f. = 8.0; $p > 0.19$, RMSEA = 0.05).

Tests of Hypotheses for Green supply management Model

Hypothesis 1 predicts that green purchasing will be a positive indicator of market orientation. As Figure 2 illustrates, the lambda coefficient for the relationship between green purchasing and green supply chain management is positive and significant ($\lambda_{x11} = 0.34$, $t = 6.57$, $p < 0.001$), supporting Hypothesis 1.

Hypothesis 2 predicts that green production will be a positive indicator of market orientation and as illustrated in Figure 2, the lambda coefficient for the relationship between green production and green supply chain management is positive and significant ($\lambda_{x12} = 0.61$, $t = 10.69$, $p < 0.001$), supporting Hypothesis 2.

Hypothesis 3 predicts that green marketing will be a positive indicator of green supply chain management. As Figure 2 illustrates, the lambda coefficient for the relationship between green marketing and green supply chain management is positive and significant ($\lambda_{x13} = 0.33$, $t = 8.08$, $p < 0.001$), supporting Hypothesis 3.

Hypothesis 4 predicts that performance in SMEs will be positively associated with green supply chain management ($\gamma_{x1} = 0.36$, $t = 8.08$, $p < 0.01$), supporting Hypothesis 4.

7.3 Discussion and Conclusions

The results of this study demonstrate that the overall green supply chain management scale is a
valid and reliable measure of green supply chain management in SMEs. When presented with the scale, executives had little difficulty relating to its items. Also, the discussions during the in-depth interview phase of the research suggest that the constructs maintained its face validity. The reliability coefficients for the green supply chain management constructs indicate that the scale was sufficient based on criteria used in the literature.

The empirical evidence demonstrates the universal applicability of the scale in different settings. The analyses conducted in this study indicate that green purchasing, green production, and green marketing were the three dimensions that influenced the green supply chain management of SMEs in China, which in turn, impacts the organization’s performance measured by multiple financial variables. Therefore, these factors are generally considered critical to the success of SMEs. Their presence in these organizations may suggest that SMEs’ managers recognize the need to evaluate their green supply chain management systems to determine if the operations carried out are actually effective. If managers identify problems that are obstructing the green supply chain management, corrective action can be initiated to solve the problem. The result is significant in that it demonstrates that formal green supply chain management practice exists in some of the SMEs in China.

Similarly, green production and green marketing are critically linked to any successful green supply chain management program. Based on the demographics of the sample, we believe that a large proportion of the executives that participated in the study had higher levels of green supply chain management. This finding is encouraging as there is a large body of literature that supports the argument that higher levels of green supply chain management would lead to a better organizational performance. Although the relationship between the green supply chain management of SMEs and different performance measures may be complex, this study provides some empirical evidence to suggest that better performance will be achieved by the green supply chain management of SMEs in China. SMEs’ managers should emphasize green purchasing, green production and green marketing because this will enhance the level of green supply chain management, which in turn may lead to improved performance.

References