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Managing reverse logistics to enhance sustainability of industrial marketing

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ABSTRACT

In this paper, a sustainable industrial marketing framework of latest requirement of green and sustainable operation is proposed. When literatures in strategy, marketing and operation have provided insight about the efficiency of reverse logistics and business value for the customer, the interrelationship is still under explored. This raises the question whether manufacturers could determine ecological friendly strategies to address their customer's environmental conscious needs and design the suitable solution to strike the balance between ecology and economics. Based on the case study of a medical product manufacturer, this study addresses this question by investigating how manufacturers identify the problem of reverse logistics; design and develop of sustainable product and service by enhancing the efficiency of operations, and market competencies that add value to their customers' business processes. Within the strategy for designing for effective reverse logistics, these findings contribute to understand the use of information system and technology for reverse logistics to enhance the customer's business process and provide value-added process for customer retention.

1. Introduction

The increasing concern about environmental and energy conservation leads enterprises to rethink about their market position; reformulate the strategy and reengineer the business process. A recent survey showed that around 82% of respondents are willing to increase spending on green marketing (Environmental Leader LLC & MediaBuyerPlanner LLC, 2009) because the enterprises realize the opportunity to sell the product at a higher price due to the green image and social responsibility. In the past decade, most enterprises found that it is not economic to remanufacture, recycle or refurbish and enterprises struggle and strike for the balance between economic and ecology. As there is a high price related to climate change or global warming, legislation has been enforced to request manufacturers to take back the sold product and reduce carbon footprint. Enterprises realize the need of developing green competence to have effective and efficient reverse logistics. As remanufacturing can reduce the waste and landfill space and save energy, in certain cases, it may be more cost effective for remanufacturing rather than producing the product from raw material. Sharma, Iyer, Mehrotra, and Krishnan (2010) devised the strategy of reducing surplus supply and reducing reverse supply to achieve sustainable environment. From an operational point of view, to manage the value of reverse logistics system, plant manager may base on volume and use plant managed and process control approach for managing ferrous scrap reverse networks. The barrier for enterprises to implement green movement is due to the complexity in interrelated issues in ecology, incomplete information, lack of expertise and commitment, and lack of disparities between regions and industry (Peattie & Ratnayaka, 1992). Enterprises mainly concern about the marketing and promotion before sales and they may usually ignore the roles and responsibility of green marketing after sales which can further improve a company's reputation and the loyalty of green customers. From the strategic point of view, it is important to explore the value proposition of customers and operational benefit of companies. However, the top management usually faces the dilemma of advocating green movement as the cost and benefit is difficult to be evaluated and correlation among various factors for sustainable industrial marketing is unclear.

The objective of this research includes strategic and operational aspects. For strategic aspect, the objective is to analyze the main contributors for sustainability of industrial operational management. The operational goals of this study are to identify the daily problem faced by industry and analyze the cause of the problems. Through comprehensive literature review and case study, a sustainable industrial marketing framework is proposed and eight propositions are derived from the discussion. In order to solve the problem, corresponding solution is suggested to enhance the performance and efficiency of reverse logistics. The managerial implications are discussed and a direction for future research is listed in the Conclusion.

The significance of the paper is to develop a framework that explores how green marketing affects sustainable operations management which mainly focuses on the domain of business-to-business

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marketing. Based on the comprehensive study of recent work of researchers in sustainability development, several propositions are derived. The propositions developed in the framework can be used as a guide for further empirical research. The case study can also provide potential contribution to the body of knowledge in sustainable supply chain operations. The study about how company detects the problem by identifying symptoms to formulate the strategy and develop solutions to the problems and finally to measure the effectiveness of the implemented solution can provide insight for industrial practitioners and researchers for the financial, policy and operational aspects in reverse logistics programs. The managerial implications are discussed and the future work is listed for researcher's further study.

2. Literature review

2.1. Sustainability strategy

One of the earliest ideas on sustainability spun off from the World Commission on Environment and Development (WCED) Report (1987), also known as the Brundtland Report. The report attempted to articulate how sustainability needs to be regarded as the combination of environmental, economic and social factors. Elkington (1997) provided a comprehensive definition of the concept by defining it in terms of the triple bottom line (3BL): economic prosperity, environmental quality and social justice. In relation to corporate performance, Savitz and Weber (2006) noted that sustainability means operating a business in a way that causes minimal harm to living creatures. Sustainability is regarded as the integration of environmental, social and economic criteria and keeping an equitable balance among the three aspects that supports an organization for long-term competitiveness (Carter & Rogers, 2008; Goncz, Skirke, Kleizen, & Barber, 2007; Sikdar, 2003). The holistic view of sustainable development is seen as becoming increasingly strategic because it affects the core business of the firm and its growth, profitability and even survival (Corbett & Klassen, 2006; Kolk & Pinkse, 2008).

The importance of sustainable development has been recognized over the years. Accordingly, the number of studies in terms of the strategies and practices leading to sustainable outcomes has increased. From a macro perspective, the first rubric of thoughts in sustainability strategy is managerial orientation. Elkington (1997) examined sustainability in relation to corporate governance and argued that the key to establishing the triple bottom line is stakeholder consultation. At the firm level, there is evidence that linking sustainability goals and measures to corporate strategy helps to integrate sustainability into what the organization does (Azzone & Noci, 1998). Corporate proactive stance and tangible commitment, often in the form of a written environmental policy is a significant contributor to sustainability (Ramus & Steger, 2000). There are a large number of papers in the domain of logistics, supply chain and operations management, and more attention has been paid on the environmental dimension. One group of literature focuses on remanufacturing as an effective way to maintain products in a closed-loop, reducing both environmental impacts and costs of the manufacturing processes. Guide, Jayaraman, Srivastava, and Benton (2000) discussed the complicating characteristics including uncertainty in the timing and volume of returned products. The main recommendation is to adopt planning and control techniques. Guide and Wassenhove (2001) demonstrated a framework for analyzing the profitability of used product activities. Souza, Ketzenberg, and Guide (2002) made a further effort to model the firm's decision to remanufacture an optimal product mix enabling profit maximization in the long run. Ketzenberg, Souza, and Guide (2003) focused specifically on the configurations of a mixed assembly–disassembly line for remanufacturing. They suggested having advanced yield information for the remanufacturing parts can generally improve flow times. Ijomah, McMahon, Hammond, and Newman (2007) devised remanufacturing guidelines with the focus on practicing design for environment, i.e. ecodesign. Also examining ecodesign, Pigosso, Zanette, Filho, Ometto, and Rozenfeld (2010) presented some 'end-of-life' remanufacturing methods, including using environmental design, industrial template and support tool. As a whole, the literature shows that sustainability strategies in remanufacturing require proper planning, efficiency and effectiveness in the process.

Recycling is another strategy for sustainable development. The main theme in this aspect is on product recovery management. Thierry, Salomon, Van Nunen, and Van Wassenhove (1995) considered investment recovery usually occurred at the back end of a closed-loop supply chain as a key strategic issue in product recovery management. Linton, Yeomans, and Yoogalingam (2002) focused on the uncertainty in the availability of waste as raw material for manufacturing. The modeling of the waste flow of durable goods was developed to tackle the challenges and requirements for forecasting. Andel (2004) discussed that repair and refurbish, rekitting and repackaging as well as parts retrieval and replacement are some of the returns models that can maximize the return on investment in reverse logistics with proper data management. Taking another perspective, Anderson and Brodin (2005) highlighted the importance of effective customer participation in recycling business. Jayaraman (2006) developed a mathematical programming model called Remanufacturing Aggregate Production Planning for aggregate production planning and control in product recovery and reuse. Purchasing and supply management has also received some interest with regards to sustainability. The so-called environmental purchasing stresses the collaboration with suppliers and customers. Min and Galle (1997) examined the role of green purchasing in reducing and eliminating wastes. They suggested proactive environmental audit programs and including environmental goals within the long-term corporate policy. Carter and Carter (1998) focused on inter-organizational factors and found that environmental purchasing activities will be facilitated through increased coordination with suppliers as well as downstream members of the supply chain, including retailers. Increased coordination within the firm would be important also. Carter and Jennings (2004) analyzed the role of purchasing in corporate social responsibility and claimed that external pressures from customers must be taken into account. To be sustainable in business, remanufacturing, recycling, environmental purchasing and other green supply chain management measures have to contribute to the commercial aspect in improving economic performance and competitiveness (Rao & Holt, 2005). Green marketing is another strategy which will be discussed in the sub-section below.

Though seemingly well researched, the approaches taken by these studies are largely driven by the individual technical streams and are not well connected to the sustainability literature. Also, the triple bottom line model shows that there are three aspects to be addressed simultaneously and the lack of any one of the three tenets would not be a total success in this area. While much interest has been generated on sustainability research, relatively scant literature can be found in terms of a holistic framework or model encompassing sustainable strategies and practices. Zhu and Sarkis (2004) presented a model consisting of the components of green Supply Chain Management (SCM), empirically validated by a survey on Chinese manufacturing firms. However, social responsibility has not been included in the study. Carter and Rogers (2008) developed a framework of sustainable SCM based on literature survey and conceptual theory building. They demonstrated the relationships among environmental, social and economic performance in the supply chain context. At the intersection of the three aspects, there are activities that organizations can engage in which not only positively affect the natural environment and society, but which also contribute to the long-term economic benefits of the firm. Also building on literature review, Seuring and Muller (2008) presented a conceptual framework addressing more on supplier management and product development. Pagell and Wu (2009) performed case studies of ten exemplar firms from various industry sectors for building a testable model of the elements necessary

to create a sustainable supply chain. Shang, Lu, and Li (2010) identified 6 green SCM dimensions, namely green manufacturing and packaging, environmental participation, green marketing, green suppliers, green stock and green ecodesign, and developed a cluster analysis for relative firm performance. The study was an empirical investigation in electronics-related manufacturing firms in Taiwan. Sharma et al.'s work (2010) is the only framework largely related to marketing. Based on literature review, their paper developed the framework of industrial marketing in the supply chain for achieving environmental sustainability objectives. In addition to literature, our framework is based on a case study which adds rigor to conceptual development. We propose some new elements, especially more exactly on what entails sustainable industrial marketing.

2.2. Green marketing

In recent years, there is a trend of rising ecological concerns that impact marketing activities, as identified in Chamorro, Rubio, and Miranda (2009). However, Polonsky (in press) noted that the concept of green marketing is certainly not new, and has been explored for more than three decades. At present time, green marketing is steadily gaining influence and has spread from the original consumer-centric to business-centric marketing. This is evident from increased research focus on green industrial and supply chain management concepts in the past 2 years (Eltayeb, Zailani, & Ramayah, 2010; Polonsky, in press; Shang et al., 2010; Sharma et al., 2010; and Sheu, in press). Much of the originally consumer-centric marketing strategies can be seamlessly applied to the B2B context, as certain concepts such as Marketing Mix (4Ps) are common. In fact, a few studies intimate the marrying of 4Ps with industrial marketing strategies. Lampe and Gazdat (1995) outlined the evolution of green marketing with discussion on 4Ps focusing on the US and European markets. Mathur and Mathur (2000) attempted to capture the fluctuations in general market sentiment, i.e. stock price reaction in response to green marketing strategies, namely the green announcement pertaining to the 4Ps of marketing. Polonsky and Rosenberger (2001) categorized green marketing tactics into three levels, namely tactical, quasi-strategic and strategic. Concepts in channel/supplier forces were included in the analysis. Scholars also introduced quantitative methods to evaluate the performance of the said strategies (Eltayeb et al., 2010; Mathur & Mathur, 2000). Some specific topics including modular design (Giutini & Gaudette, 2003), product returns (Andel, 2004) and remanufacturing (Ferrer & Clay Whybark, 2000) are also connected to green marketing, though not in a comprehensive manner. Much of the literature pertaining to green SCM (Linton, Klassen, & Jayaraman, 2007; Zhu, Sarkis, & Lai, 2007) merely alludes to green industrial management, but the two are usually disparate and not applied in tandem, with the exception of Sharma et al. (2010). Most of the literature available does not focus on the financial and other quantitative implications (with the exception of Sheu, Chou, and Hu (2005), but only to a small extent) of green industrial marketing, and bears no reference to actual analyses of green industrial marketing integration.

2.3. Reverse logistics operation

Enterprises nowadays put more emphasis on reverse logistics due to social responsibility and customer expectation. Green image and green branding act as the main marketing devices (Srivastava & Srivastava, 2006). As the volume of returned goods is increasing due to liberal return policy adopted by retailers as standard practice, the accommodation for the returned goods, product recall, maintenance and repair make companies to give a higher priority to effective returns operations (Autry, Daugherty, & Richey, 2001). An effective reverse logistics allows the company to take the advantage of inventory reduction and distribution cost salvage so as to improve customer satisfaction (Giuntini & Andel, 1995; Sarkis and Talluri, 2004; Mollenkopf et al., 2007). In fact, effective reverse logistics can significantly affect a company's bottom line in a positive direction by recapturing value remained in the returned product (Andel, 1997, Clendenin, 1997; Giuntini & Andel, 1995; Stock, 1998). Andel (1997) reported that accurate forecast of returned product helps control the business process. It is important to make the decision of recondition or deposition with cost and benefit analysis. Recondition and selling the used item in second market can bring potential profit for the company but Andel (1997) also emphasized that those reconditioned item should not canalize new product line. Clendenin (1997) analyzed Xerox's return channel process and suggested Quality Function Deployment (QFD) to reinforce the importance of the voice of customers. Apart from QFD, Kano model, which can let company realize the basic performance, competitive performance and innovative performance, can also be adopted to further improve the quality of the return process. Return to available is one metric used by Xerox to measure the cycle time from return to usable inventory. Corporate competitive advantage can be developed from recovery of products using remanufacturing, repair, reconfiguration, and recycling (Giuntini & Andel, 1995). Olorunniwo and Li (2010) have conducted a survey with 600 US companies and it is found that IT operational attributes, information sharing and collaboration can positively affect the performance of reverse logistics. Computational intelligence such as genetic algorithm has been used to determine the optimal collection point so as to have a good reverse logistics network. Lee and Chan (2009) proposed to use RFID for tracking the returned product and adopt genetic algorithm to determine the optimal collection point. In addition, Lee and Chen (2008) realized that adopting RFID into reverse logistics helps keep track of the returned products and recover the value from the products more effectively. As time required for the whole process reduces; it will result in reducing costs and increasing profits for the firms.

After the literature review, it is realized that sustainable development, green marketing and reverse logistics have drawn significant attention from researchers and the interest keeps increasing especially over the last decade. However, the interrelationship among the three topics remains unclear. More theoretical explorations are required. This study is an original and rigorous attempt to propose a conceptual framework of sustainable industrial marketing in considering all three dimensions of environmental, social and economic performance with suggestions on the know-how particularly on reverse logistics in achieving long term sustainability.

3. Research methodology

This study is based on extensive literature review and an in-depth case study. Yin (2002) claimed that case studies can contribute to improved validity and reliability by providing qualitative evidence for understanding the underlying rationale or theory. In general, case study is most appropriate in the early stages of research on a topic. It is ideal for exploring a study area (Eisenhardt, 2002). The case study method is thus preferred due to the limited initial understanding and existing knowledge of sustainable industrial marketing in the literature. As explained previously, there are only a few prior studies presenting a holistic framework or model encompassing sustainable strategies and practices, and virtually one is on marketing, yet it focuses on environmental sustainability. Case study is adopted as research methodology for this paper because the inherent flexibility of the method fits the nature of the complex, dynamic relationships and interactions in industrial markets (Dubois & Araujo, 2007). The research process of this study particularly drew reference from Beverland and Lindgreen (2010) who reviewed 105 qualitative case studies published in Industrial Marketing Management between 1971 and 2006 and examined how authors addressed issues of case quality. Specifically, case background will be described to allow judgments on the boundary conditions of findings. Details about the

analysis especially on the reverse logistics process of the case company will also be presented in order to demonstrate research validity.

The case company is an Original Equipment Manufacturer (OEM). Data and information collection for the case study was conducted in 2010 at Singapore through various methods, namely on-site participation, interviews, field visits and searching library and internet sources. The case study involved a team of nine researchers, including one professional from the case company. Among nine researchers, two instructors are involved. Five of them are PhD candidates, the other two come from industries. The researchers are selected based on their knowledge domain in logistics or supply chain management. As suggested by Carter and Rogers (2008), a profound understanding of the motivations of case company's practices and strategies can be obtained through ethnographic inquiry. This approach enables an experimental investigation into organizational phenomena, including management philosophy, logistics functions and processes, company performance and shortcomings. The case greatly strengthens the industrial inputs for the research. In addition to previous studies, the conceptual framework and propositions are based on the analysis of the case, enhancing the research relevancy to the industry.

4. Case study

4.1. Background of case company

Case study is conducted at an internationally recognized, full service OEM specializing in medical and cosmetic devices with the alias names as KK. KK Company offers product testing, engineering and design services, regulatory support, manufacturing, inventory management, warehousing and transportation logistics. From small volume, hand-assembled products to highly automated computer-controlled fabrication, the clients are assured quality, consistency and on-time delivery.

4.2. Reverse logistics of case company

Increasing attention has been given to reverse logistics in KK Company. Due to the recognition of the importance of customer services after sale, high rates and high cost of products returned, the main reasons for reverse logistics in KK Company include:

(1) Failed products but repairable.
(2) Obsolete products or products at the end of leasing life but with recoverable value.
(3) Unwanted and unsold products from retailers.
(4) Products that have been recalled.

Reverse logistics cost constitutes the major cost in the business. New reverse logistics solutions are needed to be put forward in order to cut down the cost and expand the business development of KK.

The management of reverse logistics supply chains has come under increased scrutiny in many manufacturing industries. The medical device industry is no exception. However, efforts to improve the efficiency and productivity of the supply chain, particularly with respect to Aftermarket Service and regulatory compliance issues within the typical medical device manufacturer, have often taken a back seat to other strategic priorities. As a result of the current status quo, aftermarket service organizations within the medical device industry have experienced an environment characterized by excessive operational costs and inefficiencies.

The marketplace for medical devices grows rapidly because of the increased demands for more affordable and accessible healthcare. Medical device manufacturers are urged to explore opportunities to streamline processes and control costs in order to maintain operating margins and sustain high levels of quality and regulatory compliance. Business process outsourcing represents a viable strategy for achieving these goals. Manufacturers should explore outsourcing their supply chains to maintain high levels of quality; realize efficiencies; control costs and improve the overall customer experience (Linder, 2004).

4.3. Deficiencies and solutions of current reverse logistics process

The field study has been conducted in KK Company to identify the symptoms and causes of the problems. In accordance with each problem, solution is suggested and the details are shown in Table 1. In general, KK faces the following problems:

(1) Low efficiency of aftermarket service
(2) Inability to control and manage financial aspects of aftermarket logistics
(3) Inadequate freight, re-stocking and carrying cost policies
(4) Inability to manage daily inventory data

KK Company realizes the importance of reverse logistics and the detail solution is proposed in Sections 4.3.1–4.3.4.

Table 1
Problems, symptoms, causes and possible solution of the case company.

Problems	Symptoms	Causes	Possible solutions
Low efficiency of aftermarket service	(1) Low profitability and/or customer satisfaction associated with aftermarket service (2) Low levels of efficiency and productivity	(1) Lack of proper systems to automate processes streamline operation (2) Logistics workforce not available on properly trained on aftermarket issues	(1) On-line real time control of logistics pipeline down to field level. (2) Streamline operations to increase competitiveness
Inability to control and manage financial aspects of aftermarket logistics	(1) Delays in issuing credits (2) Delays in cash flow or billing (3) Frequent budgetary discrepancies	(1) Inflexibility of systems and procedures (2) Logistics systems not able to capture financial data (3) Systems not accessible to all users	(1) Expand system functionality — improved programming modules and better trained staff. (2) Improved interface between finance and logistics (3) Users (staff) need to be educated in all aspects of aftermarket logistics
Inadequate freight, re-stocking and carrying cost policies	(1) Unnecessary freight and carrying costs. (2) Low cost items result in a net loss to the company. (3) Excessive inventory for spares and components	(1) Every week, on average, four parts returned are unwanted or un-needed. (2) The company's policy includes a 20% flat re-stocking fee for all items (3) An inadequate inventory monitoring system and procedure is in place.	(1) Establish a method of automatic quarterly communication that predetermines a "Do not return" list. (2) Inbound Freight Savings Program — reducing freight costs, with a potential savings of 20%. (3) Adequate inventory monitoring system and procedure to identify excessive inventory.
Inability to manage daily inventory data	(1) Little or no accuracy on timely data (2) Limited visibility to the status of components	Information systems do not track critical data related to the components and aftermarket logistics	(1) Add the components' data into information system timely in manual (2) Use some technological methods to improve the efficiency of saving data, like RFID

4.3.1. Enhance the efficiency of aftermarket service

In order to streamline the operations, integrating front- and back-office functions to strengthen customer relationships and increased profitability is critical, which can deliver several benefits as following:

- Stronger competitive advantage
- Higher productivity
- Higher revenues and lower operational costs
- Better information flow and data accuracy

However, the solution considered should meet several criteria. First, KK Company should conduct green market analysis and then devise green market development for catered aftermarket service. The idea is to understand customers' demand. Also, the network solution must guarantee privacy and confidentiality. In addition, the processes and systems must be coordinated to ensure that customer data is consistent and comprehensive for company decision makers. KK Company sometimes finds it difficult to coordinate with partners and units within the company. Technically, managing the need for dynamic and real time coordination and control of the full logistics pipeline of parts, sub-assemblies, and items of supply not only significantly increases the efficiency of the field service organization, but also can result in a more significant real bottom line dollar savings in the overall costs of operations, than activity in any other areas of service industry. Full automation and the concept of logistic pipeline can lead to a reduction in total inventory costs in the range of 25%–35% (Blumberg, 2011), together with the benefit of maintaining or increasing the trunk stock, fill rate, or ability to meet service requirements and demands in the field.

4.3.2. Control and manage financial aspects of aftermarket logistics

In the case study, when logistics practitioners and staff of the financial department coordinate well, they can increase efficiency in estimating budgets and issuances of financial invoices by at least 25% (Improvements can be seen in terms of better response time and lesser budgetary discrepancies). The data come from financial department and the detail calculation is obtained from financial personnel through sale increase and comparing the budget from previous and current financial year. There are several ways to improve budget discrepancy. The main issue is closely monitoring the delivery expense and inventory of returned products. As the company puts more emphasis on clear breakdown of budget, the priority and the important items are identified. It is easier for enterprise to minimize the budgetary discrepancy. Enhancing the knowledge and skill proficiency of the staff through training contributes to better process management. Although the education of staff and upgrading of systems may entail rather high costs, this can be done in phases over a longer time horizon. The more pressing issue lies in improving the interface between Finance and Logistics, which can be mitigated by clearer communication of requirements and needs between the Finance and Logistics department staff, so that the financial aspects are adequately understood by the Logistics staff and vice versa.

4.3.3. Adequate freight, re-stocking and carrying cost policies

The Inbound Freight Savings Program, that also incorporates an inventory management protocol, can have a potential savings of up to 20% if implemented in tandem with better internal communication. This saving can be observed in the unnecessary returns figures, as well as a reduction in general losses from reverse freight handling. For infrequent returned item, the product can be shipped by 3rd party logistic companies to reduce the cost. For regular returned item, returned products should be consolidated effectively so as to ship in full truck load (Blumberg, 2004). Reducing the unnecessary high safety stock can have potential saving for the company. Effective reverse logistics allows the company to take the advantage of inventory reduction and distribution cost salvage so as to improve customer satisfaction (Giuntini & Andel, 1995; Mollenkopf et al., 2007; Sarkis & Talluri, 2004).

However, this program may entail a long period of integration, high costs in implementation and also additional labor education costs. Therefore, it has to be done stage by stage. However, the benefits of this program can be lasting and will far outweigh the initial costs. The immediate solution to control the return quantity is to establish the "Do Not Return" list that states which parts should not be shipped back. This novel concept can be simply implemented by sending the notification to the correspondence via email and the cost of implementation is small.

4.3.4. Manage inventory on day-to-day basis

Although data could be input into information system manually, there are some problems that could not be avoided easily. Manual error may affect the accuracy and integrity of the data. Computer has higher efficiency than human being to process data. If there is large amount of data to be processed every day, it will take a lot of man hours to collect those data. In that case, data could not be processed timely and it is challenging to have real-time data. Using latest data capturing technology can solve this problem because those devices could be efficient and accurate. It is suggested to use bar-code or RFID and information system to improve information management and inventory management. The cost of implementing barcode/RFID of information system includes the cost of hardware, software, consultancy service and training. However, long term cost savings would be beneficial for implementation throughout the whole company. This allows KK Company to track the movement of goods for the whole supply chain, ranging from suppliers to goods delivered to distribution centers. RFID/barcode information system can provide high visibility of goods/parts and it can help to reduce bullwhip effect; reduce excess inventory and holding cost and provide better service level for the customers.

4.4. Analysis of new reverse logistics performance

Quantitatively, performance can be measured by yardsticks for measuring corporate performance (Hervani, Helms, & Sarkis, 2005) which are crucial to the purpose of reverse logistics, namely:

(1) Time saved in the reverse logistics cycle such as returns lead time.
(2) Cost savings in the returns process
(3) Contributions to revenue, if applicable.
(4) Decrease in inventory holding costs

Qualitative metrics can be observed, that may exert a bearing on the overall performance of a company after the new reverse logistics solutions are implemented, and they are listed as follows:

(1) Reduction in uncertainty, leading to better inventory management
(2) Better customer service
(3) Decreased occurrence of stock outs and other undesirable situations

The metrics identified above are precursors to the analysis of results. Company performance, after the new reverse logistics processes are introduced, is benchmarked against the quantitative yardsticks with the aid of graphs. The graphs can be plotted for savings/revenues over time, with the periods of analysis falling under 2 categories which are (1) Updated Quarter-by-Quarter and (2) Compared Year to Date/Yearly Comparison. The qualitative enhancements from the new reverse logistics solutions can be manifested in the form of

employee and customer feedback or surveys, which may either be an ongoing activity or conducted on a quarterly/yearly basis.

Results analysis is an important process in a reverse logistics reform, as it is essentially a continuous feedback mechanism for the ever-changing reverse logistics situation. Proper results analysis at adequate time intervals enables:

(1) Effective monitoring about the efficiency of the solution implementation
(2) Control the costs of the existing projects
(3) Identify the processes or tasks that are not value added for the reverse logistics operation
(4) Appropriate adjustments and modifications to be made — whenever there is a change in business landscape, and/or in response to external/internal feedback

The implementation schedule of KK Company is outlined in Table 2 below. The task list has been set based on the implementation schedule which includes immediate, short term, mid-term and long term.

5. Proposed framework and propositions

Green market analysis, green market development, sustainable operation management and customer acquisition are the four research constructs in the proposed framework shown in Fig. 1. The items under each construct are proposed according to literature review and case analysis.

5.1. Green market analysis

Identifying the customers' requirement is the first step to design the product and process. Apart from the functional requirement, the implicit requirement of customer such as social and ecology responsibility is one of the concerns of green customers. With the advent of latest computational intelligence for market basket analysis, market analyst can realize the associated green products and services required by green customers so as to carry out cross-selling and upselling.

5.2. Green market development

Having understood the customers' requirements, enterprises are required to define the market segment based on environmental consciousness of the customers. Realizing the competitor's competency and examining the strength of company can devise the appropriate tactics for segment target. With suitable marketing campaign, products can be promoted and green culture can further facilitate the green market development.

5.3. Sustainable operation management

Seamless integration of information and material flow leads to the effectiveness of logistics operations. With effective logistics operation, the cost of delivering supplies to patients can be reduced and, the responsiveness of customer's need can be achieved. In addition, the environmental impact of supply delivery can be minimized. ISO14000 provides the guideline for organization to address the environmental management. Recently, carbon footprint is also one of the indicators to measure the organization's emission of carbon dioxide which is one of the greenhouse gasses leading to global warming.

5.4. Customer acquisition

Climate change, greenhouse effect, and ozone depletion have increased customer's awareness about energy saving, resource and environment conservation. Green customers are not only concerned on the basic functional requirement of the products, but also interested in whether the manufacturing or distribution process is environmental friendly or not. Once the corporate has set up the green image, customer loyalty can be built up and customer retention can be maintained.

Understanding customer demand is a fundamental step in marketing. In the sustainability area, conducting market analysis to identify the green driving forces such as green product demand and willingness to pay a premium. Competitors' green initiatives need to be considered for devising green marketing strategies (Peattie & Ratnayaka, 1992). Green marketing involves response to the design, production, packaging, used and disposal of products based on the rising trend in that consumers place more environmental considerations (Lampe & Gazda, 1995; Sharma et al., 2010). Tactics of green marketing will lead to the development of green logistics, waste marketing and green alliances (Polonsky & Rosenberger, 2001). In relation to our case study, medical equipment firms began using recyclable materials targeting environmentally conscious business customers (Armstrong, 2005). KK Company should conduct green market analysis before implementing any new reverse logistics process. Hence, the first proposition is to test the relationship between green market analysis and green market development.

Proposition 1. *Proper green market analysis has a positive effect on green market development.*

Sustainability requires a greater focus on integrating marketing and other corporate functions, including reverse logistics and eco-design for modularity and disassembly (Sharma et al., 2010; Sroufe, Curkovic, Montabon, & Melnyk, 2000). Marketing and operations within a firm should be more integrated, whereas key decision areas can include strategic planning, forecasting, product and process development and

Table 2
Implementation schedule of KK Company.

Stage	Duration	Task
Immediate	Immediate	1. Recognize importance of data capture and information systems 2. Implement a new policy for restocking fee 3. Establish method of automatic quarterly communication
Short-term	1–6 months	1. Proactive and accurate reporting, tracking, and follow-up 2. Improve interface between finance and logistics 3. Reduce the number of FedEx account numbers (better transportation strategy)
Mid-term	Within 1 year	1. Investment in test equipment and quality processes 2. Expand system functionality 3. Education of users (staff) in all aspects of aftermarket logistics
Long-term	1–2 years	1. Full closed loop logistics management system 2. On-line real time control of logistics pipeline down to field level 3. Integration and use of the Inbound Freight Savings Program in the company

Fig. 1. Sustainable industrial marketing framework.

demand management (Malhotra & Sharma, 2002). Also, based on external marketing efforts, demand-driven manufacturing adopting build-to-order (BTO) processes create remarkable savings in the operations areas of reduced raw material inventories, reduced finished goods inventories, and reduced space requirements (Sharma & LaPlaca, 2005). As a whole, green marketing consisting of green market analysis and green market development should contribute to sustainable outcomes on operations management. This is also recommended for the case company. Hence, propositions 2 and 3 are hypothesized as below.

Proposition 2. *Proper green market analysis has a positive effect on sustainable operations management.*

Proposition 3. *Green market development has a positive effect on sustainable operations management.*

It was empirically proven that firms engaged in a strategy based on product innovation, integrating product development decisions between manufacturing and marketing/sales improved firm performance (O'Leary-Kelly & Flores, 2002). Adopting lean and market-oriented processes allows firms to effectively and efficiently customize their products, which provides for a more precise matching of product to customer needs, resulting in enhanced customer satisfaction and loyalty (Berman, 2002; Holweg & Pil, 2001; Sharma & Laplaca, 2005). Green product strategies, including proper environmental positioning in the market, can gain better customer endorsements; build corporate reputation and improve long-term profits (Kotler, Keller, Brady, Goodman, & Hansen, 2003; Menon, 1997). Furthermore, empirical evidence suggests that ecologically-conscious policies lead to better customer retention which leads to better organizational performance including profitability (Sisodia, Wolfe, & Sheth, 2007). Green marketing is a green supply chain capability and strategic asset for electronics-related manufacturing firms to obtain a competitive edge (Shang et al., 2010). Commercial, ecological and social objectives can be compatible. A truly sustainable corporation is one that creates shareholder value while protecting the environment and improving the lives of those with whom it interacts (Savitz & Weber, 2006). Therefore, efforts in environmentally-friendly and socially-responsible market development and operations management would enhance customer acquisition and firm performance, leading to sustainable success in all three aspects. Propositions 4 and 5 are envisaged accordingly.

Proposition 4. *Green market development will lead to sustainable outcomes on customer acquisition having high economic, environmental and social performance.*

Proposition 5. *Sustainable operations management will lead to sustainable outcomes on customer acquisition having high economic, environmental and social performance.*

As effective reverse logistics can reduce reverse logistics cycle such as returns lead time, cost savings in the returns process and decrease in inventory holding costs, those benefits provide value for the customer which may lead to customer satisfaction and in turn retain the customers. Xerox has ISO14000 as environmental management system in 1990 and puts emphasis on environmental issue and asset recovery operations related to recovery, reuse, recycling and remanufacturing. Xerox differentiates herself by setting up the environmental friendly image from design for environment to green supply chain. Xerox realizes the logistics performance together with greening supply chain has an inextricable part of customer requirements and satisfaction (McIntyre, Smith, Henham, & Pretlove, 1998). Based on the performance indicator set by case company and Xerox, it is proposed that:

Proposition 6. *Effective reverse logistics will lead to sustainable outcome of customer retention.*

Information system is one of the importance resources of the company, Daugherty, Richey, Genchev, and Chen (2005) have conducted a survey to validate the hypothesis that Resource Commitment has a direct positive impact on Reverse Logistics IT Capabilities. Reverse Logistics IT Capabilities were found to have a direct and positive impact on Economic Performance and Service quality. From the case study, it can further validate with logistics practitioners of KK Company as they also believe that information system can provide updated data for inventory monitoring and those data can improve the visibility of the status of the components. Based on the above discussion, it is proposed that:

Proposition 7. *Information system and technology applied on reverse logistics will have a positive effect on service quality and economic performance.*

Eltayeb et al. (2010) have conducted a survey related to green supply chain initiatives in Malaysia and it is found that reverse logistics positively affects operational outcome and positively affect the cost reduction. Based on the past experience of KK Company, KK was unable to control and manage financial aspects of aftermarket logistics and manage daily inventory data which caused the delays in issuing credits and cash flow or billing, which in turn lead to revenue reduction. KK Company starts to build up the green competence and implement the Inbound Freight Savings Program, with a potential savings of up to 20% if implemented in tandem with better internal

email communication. This savings can be regarded as a reduction in general losses from reverse freight handling. Without Inbound Freight saving program, the cost will not be reduced and it finally will affect the revenue. Proposition 8 is suggested based on the observation of the case company.

Proposition 8. *Low green capability of enterprise can lead to low efficiency of sustainable operation management and reduce the revenue.*

6. Practical and research implications

The sustainable industrial marketing framework has given specific guidelines in green market analysis and green market development, which are both important for effective reverse logistics. Businesses can refer to the green market analysis and green market development guidelines to improve their reverse logistics in achieving customer acquisition and long term sustainability. For example, environmentally conscious customers having higher willingness to pay a premium are targeted. More resources in greener solutions, e.g. improving information systems and technology for reverse logistics can be deployed for these customers. This would lead to a more sustainable outcome of environmental protection, social responsibility and economic performance simultaneously. The case study and sustainable industrial marketing framework would provide managers and logisticians with some practical guidelines and insights as they try to adopt a greener approach in their business. The paper has highlighted the importance of green market analysis and green market development. They should be thoroughly conducted and entail specificity in order to allow market segmentation and development. For example, analysis should be at the level of product line, geographic market and customer account. As discussed previously, reverse logistics can constitute a high cost in an organization. To effectively reduce costs and achieve better customer service, green marketing efforts and reverse logistics should go hand in hand. The firm can devise an appropriate green branding strategy and be differentiated from its competitors and thus possess competitive advantage. This point is unique and has not been discussed in the literature, including the existing green market framework proposed by Sharma et al. (2010). Hence, this also draws implications for academics to conduct more future research.

Effective reverse logistics can support after sales market and explore new business opportunities to improve the productivity of the existing logistics operation. Similar to KK Company in the case study, most organizations have mature information system and technology to support the forward logistics while reverse logistics still need further improvement. Although forward and reverse logistics have similar logistics activities such as inventory management, delivery scheduling, storage and distribution network design, reverse logistics cannot be regarded as the opposite flow of material in forward logistics. Reverse logistics can be different from forward logistics in terms of forecasting method, distribution structure, product quality and packaging as well as product value. Forecasting the erratic return pattern increases the difficulty to design the after sales service. This is the main reason why most companies cannot optimize reverse logistic operation or has low efficiency in managing the inventory. The service parts usually are regarded as lumpy demand which is characteristics by large demands interrupted by periods with no demand. As the quality of the returned product is not uniform, it is difficult to estimate the product value which leads to the problem of control and managing financial aspects of aftermarket logistics. Frequent communication, co-operation and collaboration between logistics and financial department can resolve the problem mentioned above. Policy setup and standardized procedure can help to reduce conflict and confusion for handing aftermarket logistics.

As the culmination of new reverse logistics solutions proposed in the case study entails a high cost for the company, as well as considerable inconvenience, the enhancements should be implemented in stages. The stages across the planning horizon may be classified under immediate solutions; short-term solutions (from 1 to 6 months); mid-term solutions (within the 1st year); and long-term solutions (after the 1st year). This is a more realistic approach which can guarantee smoother implementation. Importantly, organizations are recommended to conduct a cost and benefit analysis for a long time horizon. Normally, some of the costs are sunk costs at the beginning stage of implementation. However, the benefits brought by the new solutions can only be realized at a later stage. This means that even the organizations can achieve desirable outcomes such as cost savings and customer acquisition in the long run, they may have to bear losses in the short run. Because of this, some firms may wish to stay stagnant instead of taking the risk. In order to alter the sluggish situation, the firms have to recognize and focus on the long term performance and profitability, which is truly defined as sustainable. For such strategic decisions, it is essential to have top management's support.

7. Conclusion

A framework of green and sustainable marketing has been proposed. The proposed framework mainly constitutes of four constructs which are green market analysis, green market development, sustainable operations management and customer acquisition. Based on the case study, challenges and difficulties faced by the OEM have been identified and the potential solution and performance measurement of reverse logistics have been suggested. The paper is limited in its extent of addressing the detail issues of KK company as it is a business entity with strict disclosure practices (hence it is unlikely to analyze some internal problems of their operations). However, the research team has attempted to circumvent this limitation by appraising the general reverse logistics problems that all companies in KK companies are exposed to. Given more information and a longer planning horizon, the issues could be analyzed in a more sophisticated and dynamic manner, possibly delving into modification heuristics to fit the evolving business conditions.

In future research, a confirmatory factor analysis can be performed to analyze the measurement properties of the four constructs to determine how well the items represent the latent factors. The next step would be performing examination of the propositions put forth. More case studies of other industry sectors can be conducted. Also other methods can be employed for empirical investigation in the future. For instance, empirical test can be done in a larger scale facilitated by surveys so as to enhance research validity. The literature contributed much more to the understanding of the situations in the United States and Europe. Emerging economies in Asia and other regions deserve more research in sustainable development as they go through rapid industrialization while addressing environmental and social concerns.

This paper is one of the few theoretical explorations in the research area, and opens up opportunities for further research. Unlike most case studies which concentrate on high-growth companies or single factor, the case study of this paper attempts to look into the in-depth operational problems, as well as symptoms and causes of the problems. A novel framework which contains the major elements of sustainable industrial marketing is proposed and eight propositions are derived from case observation and discussion. They suggested a solution that facilitates the creation of a lean reverse logistic operation through strategic coordination of marketing, production and logistics.

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