

Literature Review on Green Supply Chain Management Concept and Problems During It's Implementation

Yeşil Tedarik Zinciri Yönetimi Kavramı ve Uygulanması Sırasında Karşılaşılan Problemler Üzerine Literatür Taraması

Abstract

Intensified competition, accelerated technological developments, growing volume and spectrum of international trade as well as ever-increasing environmental threats, all of which characterize a globalized world order, caused the need for an upgrade from conventional supply chain applications, one result being Green Supply Chain Management (GSCM). Customers' rising environmental awareness, governments' strict regulations and hikes in environmental threats have forced businesses to be more environmentally friendly, as they have become increasingly focused on environmental issues recently, resulting in a heightened interest in GSCM applications. Consequently, a myriad of studies has been conducted regarding GSCM. Nevertheless, businesses still have difficulties in identifying and taking actions to mitigate the obstacles confronted with during the management of green supply chains. The main objective of this study is to determine these barriers faced during the transition to and application of GSCM through extensive literature review and expert opinion. Even though non-negligible portions of those obstacles originate from internal dynamics of the business, some of those can also arise from customers, vendors and governments. Literature review conducted has revealed twenty-four different barriers. Therefore, it is being aimed that a roadmap will be structured for businesses planning to migrate to GSCM applications as well as academics pursuing studies on this issue.

Öz

Yoğun rekabet ortamı, hızlanan teknolojik gelişmeler, gittikçe artan çevresel tehlikeler ve uluslararası ticaret hacmi küreselleşen dünya düzeninin nitelikleridir. Bu durum geleneksel tedarik zinciri uygulamalarında bir gelişime ihtiyaç duyulmasına neden olur ve bunun bir sonucu Yeşil Tedarik Zinciri Yönetimi'dir (YTZY). Müşterilerin artan çevre bilinci, hükümetlerin sıkı düzenlemeleri ve çevresel tehlikelerdeki artışlar son yıllarda işletmeleri çevre konularına giderek daha fazla odaklanmaya ve çevre dostu olmaya zorlamıştır. Bunun sonucunda YTZY uygulamalarına olan ilgi artmıştır. Sonuç olarak YTZY hakkında çok sayıda çalışma yapılmıştır. Bununla birlikte işletmeler, yeşil tedarik zinciri yönetimi sırasında karşılaşılan engelleri ortadan kaldıracak eylemleri belirlemede ve uygulamada halen zorlanmaktadır. Bu çalışmanın temel amacı, kapsamlı bir literatür taraması ve uzman görüşleri ile YTZY'ne geçiş ve uygulama esnasında karşılaşılan engellerin belirlenmesidir. Bu engellerin ihmal edilemeyecek bir kısmı işletmenin iç dinamiklerinden kaynaklanmış olsa da, bir kısmı da müşteriler, satıcılar ve hükümetlerden kaynaklanmış olabilir. Yapılan literatür taramasında 24 farklı engel gözlenmiştir. Dolayısıyla, YTZY uygulamalarına geçmeyi planlayan işletmelerin yanı sıra bu konuyla ilgili çalışma yapmak isteyen akademisyenlere yönelik bir yol haritası oluşturulması hedeflenmiştir.

Introduction

Nowadays, companies are aware that environmental management is a strategic issue with a potential to make a permanent impact on organizational performance. The establishment of an environment-friendly approach in the supply chain is an issue of growing concern and a challenge for many businesses in the 21st century (Diabat and Govindan, 2011). GSCM is an important way for businesses to achieve their environmental goals.

GSCM may apply several precautions to meet numerous requirements that can arise in a complex supply chain (Kang and Hwang, 2017). GSCM, integrates the environmental concerns into product flow within organizational boundaries in order to capture the efficiency gains that reduce



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Article Type / Makale Türü

Research Article / Araştırma Makalesi

Keywords

Supply Chain, Supply Chain Management,
Green Supply Chain Management

Anahtar Kelimeler

Tedarik Zinciri, Tedarik Zinciri Yönetimi,
Yeşil Tedarik Zinciri Yönetimi

JEL: M11, Q20

Bilgilendirme

Bu çalışmanın özeti IBAD CONGRESS'te kabul edilmiş ve sanal olarak sunulmuştur.

Submitted: 03 / 03 / 2018

Revised: 12 / 04 / 2018

Accepted: 27 / 04 / 2018

environmental damage, has become a management approach which is accepted by manufacturers (Zhu et al., 2008).

Especially with the increase of environmental consciousness in recent years, a consensus has been reached that issues of supply chain management and environmental pollution should be taken together (Sheu et al., 2005). Reduction of packing and waste, assessment of suppliers based on their environmental performance, development of environment-friendly products and reduction of carbon emissions related with the transport of products can be shown as examples of GSCM applications (Walker et al., 2008).

In this study, the concept of GSCM, historical development of GSCM, advantages and disadvantages of GSCM are mentioned. Moreover, in consequence of the literature search, the obstacles that businesses encounter in GSCM applications are identified and classified. It is aimed that the identified obstacles help the researchers who work on the subject and the companies which want to adopt GSCM applications.

1. Green Supply Chain Management

The globalized age has seen intensified competition, rapid developments in technology and increased product complexity, all of which created the need for improvements to be made in businesses' ongoing supply chain policies. One of the many applications developed to cater for this necessity is the GSCM, which is the re-structuring and enrichment of conventional supply chain management through incorporating environmentally conscious methods into the links of this chain.

Academic literature contains an exhaustive span of studies regarding GSCM, resulting in a wide range of definitions. GSCM is the re-evaluation of the innovations in supply chain management and industrial procurement through an environmental perspective (Green et al., 1996). GSCM consists of substituting procurement activities with recycling, reusing and substituting materials (Narasimhan and Carter, 1998). GSCM is the monitoring and improving of a business's environmental performance. GSCM is the integration of certain transactions like product design, delivery, raw material selection, waste management with supply chain via taking into account environmental considerations (Srivastava, 2007). Even though plenty of definitions are presented in the literature, nearly all studies agree that the concept incorporates the unification of environmental awareness with effective supply chain management.

The main objective of GSCM is to make sure that businesses take into account environmental concerns while making progress in their supply chains. Through this environmental consciousness, it is being aimed that environmentally risky processes are eliminated from the supply chain, thus enhancing the businesses' environmental effectiveness and mitigate their environmental risks, while simultaneously helping increase their profitability and market share. The ever-increasing importance of GSCM mainly stems from diminished raw material sources, saturation of dump sites and rise in pollution.

2. Historical Development of Green Supply Chain Management

Rising trading/transaction volumes both domestically and internationally have forced businesses to acknowledge that self-management of operations is not sufficient for high performance. Therefore, they have started to strengthen the applications that integrate the backward processes comprising of businesses supplying the raw materials as well as the forward ones including processes that involve the delivery of the products to the end user and after-sales transactions (Handfield and Nicholas, 1993). Businesses prefer this method to effectively control pre- and post-production processes, therefore enhancing the maneuvering space for taking effective and systematic actions. Moreover, the recent ages have seen businesses comprise of many functions and evolve into multi-structured entities, contributing to their aim to unify and manage all these functions under one encompassing roof. Therefore, the notion of a supply chain has arisen from the need to form and transparently monitor a structure where all components are interconnected through a single network.

Supply chain management aiming to cater for rising consumer demand also boosts competitive advantage. Recently, businesses have taken up GSCM via integrating conventional supply chain methods with environmental consciousness to comply with legislations, to transform their businesses to be environmentally-friendly and ensure customer satisfaction. In contrast to the classical supply chain management, the GSCM method requires that actions such as procurement, shipping, production, etc. are taken through an environmental point of view.

Businesses should pay utmost attention to developing safe and reliable products, prefer more environmentally friendly production phases/lines, reduce toxic wastes, develop environmentally friendly packaging methods and act with a certain environmental awareness (Shrivastava, 1993).

While phases that require relatively more managerial scope than technical expertise like logistics and procurement are focused upon during the first few years following the emergence of GSCM, reverse logistics in through the environmental perspective has integrated with logistics and marketing in the later periods (Sarkis et al., 2011).

3. Advantages and Drawbacks of Green Supply Chain Management

Advantages of GSCM can be classified in three parts: legal, social and commercial. Businesses implementing GSCM can more easily comply with environmental laws, minimizing the potential compliance risks. On the social side, decreased energy consumption, waste production, emissions, environmental thread risks, raw material consumption, noise and radiation and risky material consumption contribute to improving employee and community health. In addition to all these, commercial benefits of GSCM include increased access to market, improved environmental performance, higher customer satisfaction and confidence, improved brand value and reputation, higher product and service quality, increased competitive advantage and market share, accelerated technological development and increased performance. Moreover, trading/transaction, energy, material, disposal and storage costs are reduced.

Despite all these advantages, GSCM requires significant capital expenditures to be undertaken and a highly-skilled R&D department to be formed, causing great economic difficulties for small and medium enterprises upon the decision to undertake GSCM. The drawback of GSCM is the hike in raw material costs, testing costs, investment expenditures as well as the time spent for conducting research and development.

4. Root Causes Influencing Green Supply Chain Management

GSCM is an integrated formation comprising of multi sub-systems. For its effective application these sub-systems and their components must be understood in depth and implemented successfully. Major root causes for a successful GSCM are green procurement, green manufacturing, green distribution, green packaging and reverse logistics.

Bearing a strategic importance in GSCM, green procurement consists of "purchasing involvement in activities that include the reduction, reuse and recycling of materials" (Carter and Ellram, 1998). Green procurement is the procurement of environmentally-friendly materials that are either recyclable or has already been recycled (Sarkis, 2003). Businesses implementing GSCM constantly conduct market research to pursue and improve green procurement strategies and aim to increase the maturity and competency of the business in selecting environmentally-friendly raw materials/inputs.

Green manufacturing is the conducting of manufacturing processes via taking into account environmental factors and re-designing and implementing those through ecological and environmental perspectives. This method of manufacturing also encompasses the recollection of used products and re-launching of those after being put through certain processes. Green manufacturing ensures that inputs/ raw materials utilization and damages/ threads incurred at the environment are minimized by making sure that products are recyclable and reusable.

Green distribution aims to identify and utilize shorter routes, reduce storage space/area and avoid holding unnecessary inventory. Main factors triggering risky gas emissions and carbon dioxide particles within the supply chain are distribution and transportation practices (Paksoy et al.,

2011). Moreover, as vehicles and types of combustibles utilized in distribution also bear critical importance, utilizing railways instead of highways could both incur economic benefits for businesses and create positive environmental externalities. Transportation / transmission of products in large bulks, utilization of noise inhibiting devices in vehicles, usage of environmentally friendly vehicles and effective vehicle routing are crucial in implementing and maintaining efficient green distribution.

Green packaging is an eco-friendly and environmentally-conscious type of packaging that ensures recyclability and reusability and supports sustainable development. It is a method of packaging that supports recyclability and reusability and does not create negative externalities such as pollution or threads on community health (Zhang and Zhao, 2012). Process and product re-designation to better enable recycling, cost reduction, enhanced utilization of environmentally-friendly materials and avoidance of petroleum-based plastics usage could all be put forward as the main objectives of undertaking green packaging.

Reverse logistics is the systematic acceptance process of products and parts that have previously been sent from consumption points for re-manufacturing or disposal (Dowlatshahi, 2000). Reverse logistics re-design supply chain to manage re-manufacturing, recycling / refurbishing and product/material flow. Reverse logistics management are examined within six parts: acceptance, reuptake, revision, renewal, transportation and re-engineering (Giuntinu and Andel, 1995).

5. Literature Review on the Barriers to the Implementation of Green Supply Chain Management

Despite incorporating a myriad of benefits, which were briefly outlined in the previous parts of this study, real-life practices of GSCM can create certain obstacles for businesses. The range and scope of these obstacles can vary depending on the scale of the business, from small to medium enterprises to multinational companies; yet most of them bear standardized characteristics.

Obstacles faced during the implementation of GSCM are classified in five main areas: outsource, technology, knowledge, financial, participating and supporting (Govindan et al., 2014). Even though a non-negligible portion of those obstacles originate from internal dynamics of the business, some of those can also arise from customers, vendors and governments. Literature review conducted has revealed twenty-four different barriers which are: non-availability of bank loans to finance green products, costliness of transition to green systems, costliness of disposal of risky materials, costliness of green/environmentally-friendly packaging, costliness of collecting used products, lack of training activities for green product applications, lack of awareness in adopting reverse logistics, lack of convincing parties on the environmental benefits, lack of knowledge on environmental issues, lack of awareness on environmental impacts on business, insufficient information technology applications, resistance against adopting advanced technologies, difficulty of designing processes that recycle used products, insufficient technical expertise, insufficient flexibility in transitioning to new systems, market competition and uncertainty, insufficient government support, insufficient tone at the top, insufficient customer awareness, fear of failure, restrictive company policies, reluctance of vendors/suppliers, insufficient environmental awareness of vendors/suppliers and complexity of assessing and monitoring vendors'/suppliers' environmental applications.

Table 1. Barriers faced in GSCM

No	Barriers	Resource
1	Non-availability of bank loans to finance green products	Govindan et al. (2014), Jayant and Azhar (2014)
2	Costliness of disposal of risky materials	Govindan et al. (2014), Jayant and Azhar (2014)
3	Costliness of transition to green systems	Mudgal et al. (2010)
4	Costliness of green/environmentally-friendly packaging	Walker et al. (2008)
5	Costliness of collecting used products	Govindan et al. (2014)
6	Lack of training activities for green product applications	Carter and Dresner (2001), Bowen et al. (2001)
7	Lack of awareness in adopting reverse logistics	Ravi and Shankar (2005), Meade et al. (2007) and Mudgal et al. (2010)

8	Lack of convincing parties on the environmental benefits	Revell and Rutherford (2003), Walker et al. (2008).
9	Lack of knowledge on environmental issues	Shen and Tam (2002)
10	Lack of awareness on environmental impacts on business	Mudgal et al. (2010)
11	Insufficient information technology applications	Rogers and Tibben-Lembke (1998), Wu and Hang (2009), Ravi and Shankar (2005), Al Khidir and Zailani (2009), McLaren et al. (2004).
12	Resistance against adopting advanced technologies	Hosseini (2007), Cooper (1994), Hsu and Hu (2008), Digalwar and Metri (2004), Gant (1996), Tsai and Ghoshal (1999), Al Khidir and Zailani (2009)
13	Difficulty of designing processes that recycle used products	Beamon (1999)
14	Insufficient technical expertise	Perron (2005), Revell and Rutherford (2003)
15	Insufficient flexibility in transitioning to new systems	Revell and Rutherford (2003)
16	Market competition and uncertainty	Hosseini (2007), Yu Lin and Hui Ho (2008), Mudgal et al. (2010)
17	Insufficient government support	Hosseini (2007), Yu Lin and Hui Ho (2008), Hsu and Hu (2008), Mudgal et al. (2009), Mudgal et al. (2010), Scupola (2003), Srivastva (2007), Al Khidir and Zailani (2009), Porter and Van de Linde (1995)
18	Lack of top management commitment	Digalwar and Metri (2004), Mudgal et al. (2009), Mudgal et al. (2010), Ravi and Shankar (2005), Zhu (2007), Yu Lin and Hui Ho (2008), Emiliani (2010)
19	Insufficient customer awareness	Lamming and Hamapson (1996), Mudgal et al. (2009), Ravi and Shankar (2005), Zhu et al. (2007), Zhu et al. (2008), Chen et al. (2006), Mudgal et al. (2010), Sharma et al. (2012)
20	Fear of failure	Gant (1996), Rao and Holt (2005), Perron (2005), Revell and Rutherford (2003)
21	Restrictive company policies	Beamon (1999), Revell and Rutherford (2003), Al Khidir and Zailani (2009)
22	Reluctance of vendors/suppliers	Hsu and Hu (2008), Lettice et al. (2010), Ravi and Shankar (2005), Srivastva (2007), Sarkar and Mohapatra (2006), Sarkis (2003), Hong et al. (2009)
23	Insufficient environmental awareness of vendors/suppliers	Ravi and Shankar (2005), Mudgal et al. (2010), Revell and Rutherford (2003)
24	Complexity of assessing and monitoring vendors'/suppliers' environmental applications	Faisal et al. 2000, Mudgal et al. (2010), Hervani et al. (2005), Björklund et al. (2012)

Non-availability of bank loans to finance green products: This is the effort that companies make in getting bank loans for environmental initiatives (Govindan et al., 2014). Even if companies have environmental awareness, financial institutions may not be as sensitive as them. Financial institutions that expecting high profit in short term may raise difficulties to companies in providing loans.

Costliness of disposal of risky materials: Eliminating dangerous substances in environmentally friendly ways is an extra cost for companies. Therefore, some companies may avoid this cost and prefer to release dangerous substances into the environment. This obstacle is determined as the most dominant low level obstacle. (Jayant and Azhar, 2014)

Costliness of transition to green systems: Transition of the company to a system that is compatible with the environment may require a high initial cost (Mudgal et al., 2010). Although in long-term, companies will benefit from this transition, especially small and medium-sized companies avoid high initial cost.

Costliness of green/environmentally-friendly packaging: Damage to the environment can be minimized by reducing shipping and packaging costs. (Walker et al., 2008). Transition to environmentally friendly packaging is one of the most important indicators of environmental sensitivities of companies.

Costliness of collecting used products: Collection of used products is a costly process for companies (Govindan et al., 2014). Collection and recycling of these products from end users and vendors is a complex problem.

Lack of training activities for green product applications: Education and innovation can ensure that the obstacles are overtaken and provide success in projects (Carter and Dresner, 2001). However, the lack of expert in the field of green procurement is the biggest problem faced by companies.

Lack of awareness in adopting reverse logistics: Although reverse logistics applications provide direct benefits to the environment, the fact that companies are not aware of these benefits is a major

obstacle to reverse logistics (Ravi and Shankar, 2005). Awareness of companies about reverse logistics practices will directly contribute to the understanding of green procurement.

Lack of convincing parties on the environmental benefits: If governments act as a persuasive party in ecological structuring, this will cause especially small firms to provide more contribution to the process. (Revell and Rutherford, 2003). The fact that governments are not trying to raise awareness about green procurement is one of the difficulties.

Lack of knowledge on environmental issues: Lack of trained staff and expert is considered as a critical obstacle in organizations (Shen and Tam, 2002). The lack of knowledge should be resolved through internal or external training.

Lack of awareness on environmental impacts on business: Being aware of the positive effects of environmental practices on companies in long term is a factor that will directly encourage companies. Therefore, if businesses are not aware of the effects of environmental practices, this will pose a serious obstacle to GSCM practices.

Insufficient information technology applications: Knowledge quality has significant positive effects on environmental management performance (Wu and Hang, 2009). Among producers, inadequacy in the application of information technologies, which are based on environmentally friendly requirements, is a critical obstacle for GSCM.

Resistance against adopting advanced technologies: Successful adoption and implementation of advanced technologies are important factors in improving environmental management performance (Hosseini, 2007). It is not surprising that businesses which are resistant to the adoption and implementation of advanced technologies experience difficulties in GSCM implementations.

Difficulty of designing processes that recycle used products: Recycling has a very important role in environmental practices. However, design of recycling operations is a complex and difficult process (Beamon, 1999).

Insufficient technical expertise: Insufficient technical expertise is a critical obstacle to strategic planning, especially when considering human resource and time constraints in small and medium-sized enterprises (Perron, 2005). Companies may have access to knowledge and professional expertise with the help of various programs.

Insufficient flexibility in transitioning to new systems: Switching to a new and environmentally-conscious system may not always be easy. Sometimes this process may cause technical, financial and managerial problems.

Market competition and uncertainty: Environmental uncertainty and market competition have a direct impact on the intention to adopt green innovations (Yu Lin and Hui Ho, 2008). The external environment in which a company operates also affects the intention of company to adopt innovations.

Insufficient government support: Government regulations are able to both encourage and discourage enterprises to the adoption of innovations (Scupola, 2003). Inadequate government support is a factor that discourages enterprises in GSCM implementations.

Lack of top management commitment: Top management commitment is the process of empowering, changing, formulating policies, progressing and monitoring strategies in order to ensure that basic production and business strategies are positioned, (Digalwar and Metri, 2004). It is difficult for GSCM applications to achieve success without support and effort of top management.

Insufficient customer awareness: The quality of the product returned at the end of its economic life, and uniformity of this quality are important factors to effect green logistics. (Ravi and Shankar, 2005). Thus, customers must be aware of product recycling at a certain level.

Fear of failure: GSCM requires high initial investment and may lead some difficulties at first, then brings success in long-term. Therefore, the fear of failure that may arise in enterprises and employees is a serious obstacle to the transition to the system.

Restrictive company policies: Policies and targets, defined and developed continuously at each organization level, for pollution prevention and waste minimization, are the primary requirements of environmental consciousness (Beamon, 1999). Therefore, restrictive company policies are barriers in the process.

Reluctance of vendors/suppliers: Cooperation of companies with vendors and suppliers for environmental purposes, and supply chain interactions for the improvement of environmental performance have significant impacts in the process (Theyel, 2006). Companies can improve their environmental performance with the help of vendors and suppliers by setting standards and sharing resources.

Insufficient environmental awareness of vendors/suppliers: The fact that GSCM practices are not known for their economic and environmental benefits may be an important cause of resistance to the process (Ravi and Shankar, 2005). Thus, especially vendors and suppliers must be informed about the process.

Complexity of assessing and monitoring vendors'/suppliers' environmental applications: The operation and implementation of GSCM applications compose a complex process, and this complexity is a major obstacle to the process (Hervani et al., 2005). However, once the system has been developed, the application can be more widespread and easier.

Conclusion

Businesses' are paying ever-increasing attention to GSCM practices that provide plenty of legal, social and commercial benefits. Nevertheless, business face a considerable amount of obstacles during the transition to and application of GSCM, and have difficulties in addressing and taking action against these barriers. This study encompasses a vast literature study and expert reviews that result in a list of twenty-four obstacles faced by businesses, while leaving out the interactions and hierarchies between and the prioritization of these identified barriers. For further research, it is strongly advised that these obstacles should be analyzed via Structural Modelling, Fuzzy Cognitive Map and Multi-Criteria Decision-Making techniques.

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