ON LOW-CARBON SUPPLY CHAIN MANAGEMENT

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Abstract: The concept of the low-carbon supply chain management is addressed in this paper. The benefits, the difficulties, and the key issues of low-carbon supply chain management are investigated based on the supply chain management theory. Finally, some public policies are proposed to support the implementation of low-carbon supply chain management.

1 INTRODUCTION

Global warming has already become a fact. Climate catastrophe caused by global warming, such as flood disaster, food production reduction, eco-system damage, etc, has seriously threatened human survival and development. According to IPCC report, human activities especially large burning of fossil fuel that produces excessive greenhouse gases is the principal cause of climate warming and consequently, the essential thing in slowing down global warming is reducing emission of greenhouse gases such as carbon dioxide. Developing low-carbon economy is an inevitable choice to fight against climate change, ensure global energy security and achieve sustainable social development. Developing low-carbon economy needs joint efforts of governments, enterprises, individuals and various social organizations around the world. A report titled The carbon emissions generated in all that we consume published by The Carbon Trust shows that ”Consumer purchasing decisions are the ultimate driver of carbon emissions in an economy. All carbon emissions can be attributed to the delivery of products and services to meet the needs of the consumer ” (CarbonTrust, 2006), so enterprises, the providers of products and services play a quite special role in the development of low-carbon economy.

Low-carbon is the only way for enterprises to develop in the future. There are several issues that drive enterprises to take actions to reduce carbon emissions, including increase in energy cost, existing and planned legislations which punish high energy consumption and reward emissions reductions and changing consumer attitudes to climate change. A report 2008 by the World Resources Institute(WRI) and A.T. Kearney, Inc. indicates that reduction of 13 to 31 percent in earnings before interest and taxes (EBIT) was projected by 2013, and 19 to 47 percent by 2018 for fast-moving consumer goods companies that do not develop strategies to mitigate the risk posed by environmental pressures (WRI and A.T.Kearney, 2008). At present, more and more enterprises have realized the limits of enterprise' inward-focused reduction strategies and are exploring to minimize the carbon emissions across the supply chain. As the extension of enterprise, supply chain management has been successfully used in practice for years and its benefits shown in weakening risk, reducing uncertainty, timely response, increasing efficiency, lowering cost and improving financial performance have greatly enhanced competitive advantages. Reducing carbon emissions across the entire supply chain and lunching ”carbon reduce race” between enterprises in the chain can increase reduction opportunities, lower capital investment and make more cost savings.

2 THE CONNOTATION OF LOW-CARBON SUPPLY CHAIN MANAGEMENT

2.1 The Definition of Low-carbon Supply Chain Management

Carbon footprint of a product is greenhouse gases

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emissions over the whole life of a product or service, from the extraction of raw materials and manufacturing right through to its use and final reuse, recycling or disposal. It can be seen that the carbon footprint of a product is throughout its entire supply chain. Therefore, Low-carbon Supply Chain Management (LCSCM) can be defined as: consider carbon emissions over the product lifecycle involving raw material suppliers, product manufacturers, distributors and retailers, users and recyclers and make the supply chain achieve economic benefits while reducing carbon footprint. Low-carbon supply chain management extends the ”carbon management” pattern that only for a single enterprise or a single plant, integrates multiple enterprises as a joined-up process and emphasizes the cooperation between upstream and downstream and the output of low-carbon products. The comparison of ”single enterprise carbon management” and ”low-carbon supply chain management” is shown in figure 1:

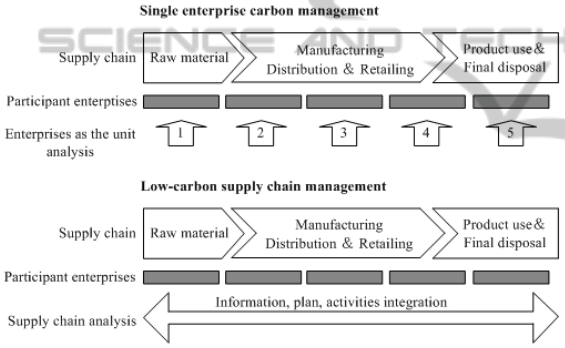

Figure 1: Single enterprise carbon management low-carbon supply chain management.

2.2 The Relationship between Low-carbon Supply Chain Management and Green Supply Chain Management

Low-carbon supply chain management is closely related to green supply chain management. In 1996, the Manufacture Research Consortium (MRC) in Michigan State University who had an ”Environmental Responsible Manufacture” research item then first put forward the definition of Green Supply Chain Management (GSCM). As a modern management pattern, the GSCM, based on the theory of green manufacturing and supply chain management technologies, considers environmental impact and resource efficiency in the chain, covers suppliers, manufacturers, sellers and customers and is to minimize the negative impact on environment and maximize the resource efficiency in the process of raw material sourcing, manufacturing, packaging, warehousing, transport, use and final disposal (Dan and Liu, 2000) . GSCM is an important means that can improve environmental efficiency and achieve a coordinated development of economy and environment. Nevertheless, LCSCM is to address the greenhouse gases which cause global warming, to reduce the carbon footprint of products and finally to mitigate the environmental impact of greenhouse gases by improving energy efficiency, developing alternative energy sources, new energy and emissions reduction technology. Low-carbon is a global problem and is to response to climate change, while the starting point of green concept is the industrial pollutants bring the damage to people’s health and our living conditions, until now, no country except US has regulated greenhouse gases as pollutants. LCSCM is not quite consistent with GSCM, although with similarity in energy saving, the former is to reduce greenhouse gases emission but the latter is to reduce pollutants emission including solid pollutants, liquid pollutants and gaseous pollutants, so it needs integrating greenhouse gases emission control into the air pollution prevention. Green supply chain management research has made a great development and the corresponding theories and methods for GSCM have a reference value to LCSCM.

3 THE IMPLEMENTATION OF LOW-CARBON SUPPLY CHAIN MANAGEMENT

Reducing carbon emissions from supply chain perspective and integrating ”carbon management” with supply chain management together can achieve more, faster, better, cheaper effect. Enterprises that plan to implement low-carbon supply chain management need to reintegrate their supply chain.

3.1 The Benefits of Low-carbon Supply Chain Management

A McKinsey study 2008 shows that about 40 to 60 percent total carbon footprints reside upstream in their supply chains-from raw materials, transport, packaging to energy consumed in manufacturing processes for high-tech companies and manufacturing industries,while reaching 80 percent in retailing (MckinseyCompany, 2008) , therefore, any significant carbon-abatement activities will require collaboration with supply chain partners. Considering all stages of supply chain and implementing low-carbon supply chain

management can avoid counter-productive trade-offs between supply chain stages and improve the overall carbon of the supply chain.

In terms of corporate citizenship or corporate social responsibility (CSR), many world leading businesses with global operations have been committed to reduce emissions on their supply chains and achieved great results. Wal-mart has been dedicating to create a more transparent supply chain, drive product innovation and ultimately provide his customers with information they need to assess products' sustainability by developing the sustainability index. The company's Sustainable Value Networks helped reduce carbon emissions through partnerships that extend beyond Wal-Mart's walls to include collaboration from nonprofits, suppliers, and other environmental stakeholders spanning from governmental officials to academics and finally produced up to 30 percent fewer greenhouse gas (GHG) emissions by 2009 globally (Wal-mart, 2010) . According to Business for Innovation climate & Energy Policy(BICEP, BICEP Members), World famous company Nike has been focused on reducing its environmental footprint for well over a decade, in addition to measuring the company's entire carbon dioxide footprint, it also measures its product footprint. It estimates the embedded carbon in its products to be equal to 2.5 times the carbon emitted by the footwear factories making the products, a conclusion which led the company to consider alternative materials in the design process. Given that the transport operations which move Nike product from the point of manufacturing to the distribution centers account for about 25 percent of Nike's CO2 emissions, the company has set a target to reduce the inbound logistics footprint by 30 percent from a 2003 baseline by 2020.

3.2 The Difficulties of Low-carbon Supply Chain Management Implementation

The implementation of low carbon supply chain management will face significant obstacles:

(1) Awareness side: Now many companies have not realized the impact of climate change on their future development. A Mckinsey survey of more than 2000 global executives finds that while nearly half of respondents say that climate change is a somewhat or very important issue to consider in purchasing and supply chain management, fewer than one-quarter report their companies always or frequently take climate change into consideration. In addition, some companies can not afford the upfront investment in emission reduction. Thus, it is not easy to reach a consensus on emission reduction issue for enterprises in supply chain.

(2) Action side: It will take a course to put low-carbon supply chain management into practice. On one hand, imperfect market and agent problem can be significant barriers to embody LCSCM. On the other hand, LCSCM that need a strategic reintegration on traditional supply chain will touch on the interests of some stakeholders. The partner selection and Logistics Network Configuration in the re-design of supply chain structure will undoubtedly affect the stable operation of current supply chain. Furthermore, it will become more complex in LCSCM globally optimization problem considering both economic and environmental factors. So to speak, it should be a big job to build low-carbon supply chain for most decision-makers.

(3) Legislation and policy: In the past two decades, global commerce has come to depend on an intricate web of supply chains. On the issue of climate change, Annex I countries commit themselves to a reduction of greenhouse gases, while Non-Annex I countries are not obligated by the limits of emissions in the Kyoto Protocol, moreover, national policies and standards made by different countries differing with each other will ultimately pose a challenge to the concept and objective integrating for global supply chains.

3.3 The Key Points of Low-carbon Supply Chain Management Implementation

By analyzing the difficulties of implementing low-carbon supply chain above, some proposals are provided with the theory of supply chain management as follows:

3.3.1 Playing the Leading Role of Core Enterprise and Adopting Low-carbon Concept

Most of the supply chains are built around core enterprises and core enterprises play a significant part in the process of reengineering low-carbon idea. Core enterprises should have a sight into what LCSCM could lead in the direction of future competition, establish low-carbon idea and vigorously promote low-carbon activities to make other partners understand the low-carbon connotation, the necessities and possibilities to implement low-carbon and the benefits offered by strengthening "carbon management" such as risk avoidance of public policies and cost saving, etc .

3.3.2 Emphasizing Cooperation between Enterprises in the Chain

LCSCM is based on cooperation, not only requiring all enterprises to take effective measures respectively such as staff training, energy efficiency and product process improvement, etc, but much more importantly, building on ”carbon management” across the supply chain. Strengthened cooperation between enterprises in the chain can attain greater abatement opportunities and create larger profit space.

(1) Sharing information and knowledge, developing strategies together. Enterprises should expand companies' borders, incorporate other partners in the chain and make joint efforts to explore means to minimizing emission by strengthening intercommunication and exchanging views on environmental issues and actions to be taken. For example, sharing the information of products carbon footprint that can be get by measuring carbon emitted by supply chain stages can help enterprises understand carbon emission condition of their own and the entire supply chain, can help identify the main emission source which can also be interpreted as emission reduction opportunities and then make carbon reduction strategies by weighing the costs and opportunities, and can help make a reasonable decision on the questions of product development, procurement, manufacturing and distribution.

(2) Developing emission trading between enterprises along the supply chains. According to emission trading, companies that exceed the emission cap allocated by a central authority can buy credits from companies who require fewer permits to meet their increases in emission permits. Due to the good long-term cooperation relations, emission trading between enterprises in the supply chain can help to reduce transaction cost and lower risk.

3.3.3 Considering the Cost of Carbon in Supply Chain Optimization

Price for carbon has become a reality, or through carbon taxes or carbon trading. As an important impact factor in the total cost of any product, it requires companies to consider the cost of carbon as a key performance indicator. Except for applying theories and methods of modern supply chain management such as inventory control, supply contracts, distribution strategies, the cost of carbon and the risk of volatile carbon price should be taken into account in supply chain integration and optimization.

3.3.4 Life Cycle Assessment Method

According to the ISO 14040 and 14044 standards, as one of the methods being developed, LCA (life cycle assessment) addresses environmental aspects and potential environmental impacts throughout a product's life cycle from raw material acquisition through production, use, end-of-life treatment, recycling and final disposal, i.e. cradle-to-grave. LCA Method can also be used to analyze carbon emission at various points in low-carbon supply chain which will help to construct the carbon footprint, identify emission reduction opportunities and support ongoing implementation steps.

4 THE EFFECT ON LOW-CARBON SUPPLY CHAIN MANAGEMENT OF GOVERNMENT POLICIES

Strengthening cooperation and making joint efforts between enterprises across the supply chain will be important, but government involvement must be more critical to put LCSCM into effect. Various countries in the world have already set reduction targets by participating in controlling emission with a positive stance and fulfilled it concretely to development strategies and policies, the EU, for example, who has set a target that 2020 emission level should be 20to do still, we make the following recommendations in order for LCSCM to be effective.

(1) Making carbon emission as one of the criteria in the government and public sector procurement which will guide companies' management idea.

(2) Making international worldwide carbon emission measurement standards to avoid divergence and emission reduction failure.

(3) Advancing product carbon footprint label and product carbon levels standards of different industries at different development stages to motivate companies to control carbon emission and meanwhile enable customers to identify low-carbon products.

(4) Providing consistent subsidies for low- or no-carbon alternatives and penalties for high consumption and high emission to encourage companies in emission reduction.

(5) Other incentives, for example, investing IT infrastructure and transportation networks.

5 CONCLUSIONS

Global warming has seriously threatened to human survival and development and mitigating global warming is a matter that admits of no delay for mankind. Low-carbon choices are the future developing tendency and enterprises can implement LCSCM to cost-effectively abate greenhouse gases emission through cooperation with other partners in the chain. It is worth noting that, the successful operation of LCSCM largely depends upon the common efforts of government sector and enterprises sector, therefore, in addition to the strategic and operational decisions enterprises can take with respect to their own supply chains, engaging in public policy frameworks is significant for both stabilizing the global climate and staying credible.

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