Brief Analysis of Green Supply Chain Management Based on PEST

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Abstract. Powered by the increasing demand for environmental protection, GSCM (Green Supply Chain Management) has received mushrooming amount of attention. In this dissertation, GSCM is clustered based on PEST, and thereafter analyzed by bibliometric and literature research. This dissertation reviews literature from eight perspectives such as carbon tax, carbon cap, circular economy, economic model, environmental awareness, green cooperation, green packaging, and green transportation. Eventually, the dissertation puts forward the analysis of the prospect of GSCM based on the conclusion after the review.

Keywords: Green Supply Chain Management, PEST, Environmental Protection, Low-carbon.

1. Introduction

Currently, the public is paying increasing attention to protecting the environment and saving resources due to the soaring oil price and the environmental injustice brought by COVID-19 [1]. Meanwhile, global warming and the shortage of oil resources have brought a grand challenge to sustainable development. Industries' unplanned and irresponsible action is one of the primary responsibilities. For the sake of lessening the impact on the environment, organizations bring the environmental concept into supply chains. GSCM stands for the convergence of environmental concerns and supply chain management strategies. [2].

The concept of GSCM originally emerged during the 1960s and was mentioned again in the early 1990s. After 2000, it began to have a rapid evolution and was highly valued by researchers throughout the world. Since GSCM was put forward, an immense number of academics have optimized the process and structure with a mathematical model and other methods. Simultaneously, quite a few relevant reviews highlighted the optimization method and practical application of GSCM which provides practical experience for the public. Nevertheless, in the context of a specific period, the papers related to the development stage and future direction of the green supply chain are scarcely adequate.

Based on the above background, this study hopes to summarize and compare the current GSCM research findings by reviewing recent literature, identifying the limitations in the current research and suggesting possible future research directions.

2. Method

Literature studied in this dissertation comes from WOS (Web of Science). According to the current hot spots, the search keywords are determined as: GSCM+ carbon tax, GSCM+ carbon cap, GSCM+ green cooperation, GSCM+ economic model, GSCM+ environmental awareness, GSCM+ energy crisis, GSCM+ green packaging, and GSCM+ green transportation. This dissertation makes a cluster analysis of eight keywords, which is divided into four parts such as carbon reduction policy, low carbon economy, environmental protection and green process on the base of PEST, which

respectively corresponds to P(Politics), E(Economy), S(Society), and T(Technology). The clustering relationship is shown in Figure 1.

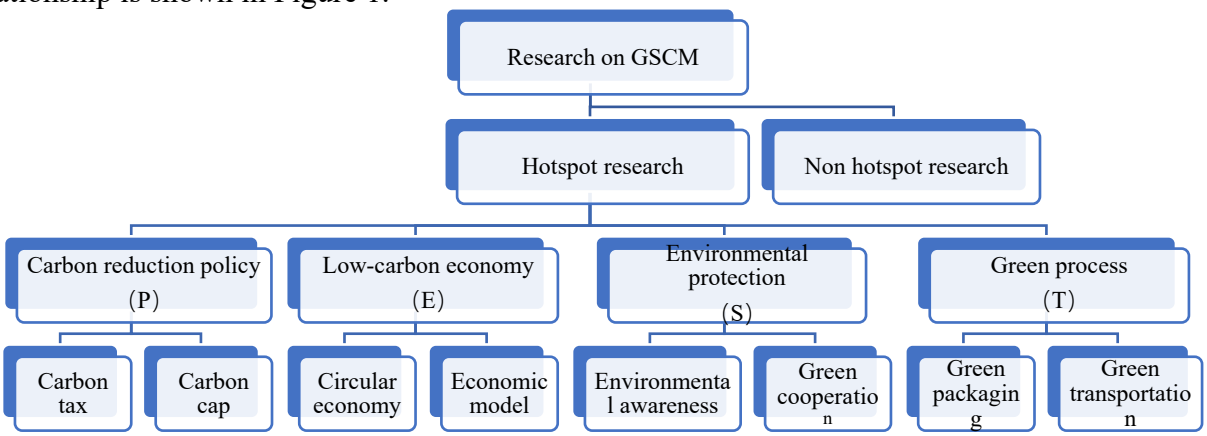

Figure 1 Clustering Diagram

3. Research

Before specific research, this dissertation uses the bibliometric based on WOS first. A total of 1491 dissertations were tallied, and Figure 2 depicts the tendency from 2005. It illustrates that the number of dissertations is growing year by year, from four in 2005 to four hundred and thirty-one in 2020. With a yearly frequency in the average citations growth rate of 45.51 percent, the average annual volume of publications climbed by 58.83 percent. The graph depicts that the total volume of research literature on the subject of GSCM has soared by leaps and bounds. After 2016, the amount of literature related to GSCM further accelerated, which means that the research related to GSCM is prone to be mature. Therefore, the relevant literature after 2016 has more significant value in research.

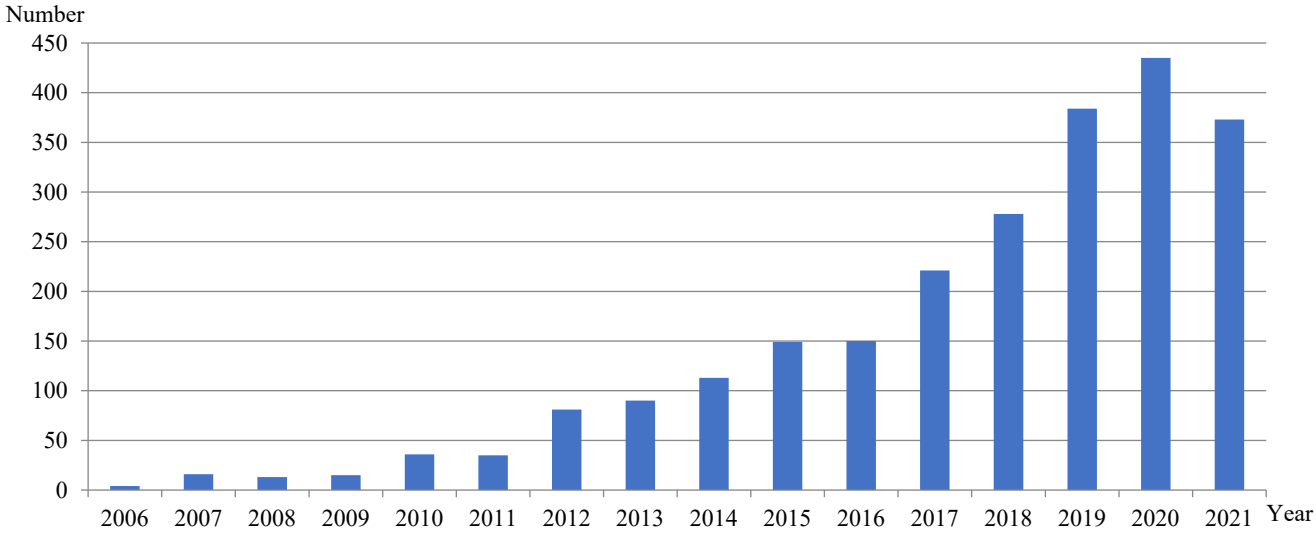

Figure 2 Amount of WOS-based research literature on GSCM

3.1 GSCM and carbon reduction policy

3.1.1 Carbon tax

The majority of the papers on carbon policy are concerned with the issue of carbon taxation. Furthermore, all of these papers have a linear relationship between the carbon cost and overall emissions. A large proportion of these studies are concerned with the taxation of transportation emissions, which is frequently bundled with other sources of emissions such as industry, raw materials, and storage.

Carbon prices are frequently determined to use marginal emission reduction cost curves. It can be used to describe the relationship between business expenses and lowering emissions. Using a marginal emission reduction cost curve, Mart et al. determine the classification of tax that demanded accomplishing carbon reduction targets. The scholars point out that various tax rates are required for assorted product kinds (functional versus inventive) in order to achieve similar carbon reduction objectives. This demonstrates that a certain tax can disproportionately affect one group [3].

Several studies solely account for emissions from transportation operations [4]. Transportation carbon output is proportional to the quantity of items carried along an arc, meaning that the model charges depending on the intensity of emission [5]. In their objective function, they use a 'carbon emission cost' rather than a type of explicit tax. The total emission costs are affected by energy use, traffic conditions, carrying weight and friction between surface and air [6]. Power generation accounts for 29% of worldwide greenhouse gases, with coal, natural gas, and other fossil fuels accounting for around 67% of those emissions [7]. As a consequence, emissions from industries that are primarily powered by electricity can hardly be ignored.

3.1.2 Carbon cap

The key challenge, similar to the carbon tax, is determining the appropriate carbon cap to ensure that economic progress is not hampered. As a consequence, the strategy is not widely used in practice, notwithstanding its appearance in scientific publications. It is evident that the carbon cap is the second most discussed issue among the publications in our review on carbon policy. [8]. Due to the unpredictability of the future, selecting a carbon cap might be complicated; yet, it is most usually chosen based on existing or previous emission levels.

Most carbon caps are approximated by placing an upper bound on emissions. Transportation and shipping emissions are taken into consideration in almost every dissertation. Merely transportation emissions are measured [9]. Furthermore, there are several publications compute emissions per unit of journey miles and establish upper limits per period. [10]. In any circumstance, there is a limit on how much contamination may be produced in a given time period. Furthermore, Soleimani et al. established a restriction on transportation-related carbon dioxide emissions for each production or regeneration unit, essentially limiting the carbon footprint of transportation. [11].

3.2 GSCM and low-carbon economy

3.2.1 Circular economy

CE (Circular economy) and SCM (Supply Chain Management) studies should be linked, according to previous experts [12]. In recent years, the notion of a circular supply chain has been included in CE. It combines supply chain management with the surrounding industrial and natural surroundings using a thought of circular. From product design and service design to reaching the life limit and waste management, it enables systematic innovation through business operation mode and supply chain operation process. Meanwhile, the GSCM was defined as "To efficiently and effectively manage materials, information, and capital flows related to the procurement, production, and distribution of products or services, so as to cater to various requirements of the stakeholders and to improve the profitability, competitiveness, and resilience of the organization, fully integrate economic, environmental, and social considerations with key inter organizational vocational work systems as well." [13]. It demonstrates that the concept of CE is well aligned with the effect that GSCM wishes to create.

3.2.2 Economic model

Brandenburg et al. examine the economic impact of GSSC quantitative models and divide them into five categories: simulation methods, mathematical programming methods, heuristic methods, analytic models, and hybrid approaches. An examination of mathematical programming models and simulations is carried out in this dissertation [14].

Mathematical multi-objective programming models stand out in the field of mathematical programming for they strive to reduce overall costs and carbon emissions, including linear models,

non-linear, fractional, and routing [15, 16]. For the sake of better comprehending reality, we introduce a series of modeling of fuzzy and random variables [17]. The model which optimizes the number of employees evaluates suppliers, minimizes the loss of working days due to industrial accidents, and maximizes food safety, making it relevant to social roles and objectives [18]. This contributes to the progress of sustainable supply chain practice and has an impact on competitive advantage [19].

Van Der Vorst et al. compare two scenarios in accordance with product quality, logistic costs, energy consumption, and carbon dioxide emission using computer models [20]. Sahay also employed agent-based modeling to reduce logistic expenses while reducing overall costs and carbon emissions [21]. Orji and Wei assess the selection of sustainable suppliers using SD with the aim of guaranteeing that suppliers keep their position for quite a long period of time [22].

3.3 GSCM and environmental protection

3.3.1 Environmental awareness

In the backdrop of environmental production, the green supply chain has made great strides. Its contribution is to solve environmental contamination and energy crisis issues. The evolution of GSCM is boosted by the awakening of global environment protection consciousness. When confronting increasingly severe environmental issues, governments develop relevant policies such as contamination tax and carbon emission standards. These policies oblige the core enterprise of the supply chain to transform the chain relationship into GSC relationship to control carbon emissions.

3.3.2 Green cooperation

Walmart has been committed to selecting green suppliers in recent years. Walmart purchases organic cotton from environment-friendly suppliers who have obtained relevant environmental certifications. Coca-Cola, the biggest beverage producer in the world, establishes a greener supply chain by improving the process of reverse logistics. In India, Coca-Cola cooperates with several third-party recyclers for the sake of recycling PET bottle waste [23]. The strategies which innovate the green supply chain made by enterprises under various pressures make green supply chains more efficient and more eco-friendly. On account of this, enterprises in the supply chain have developed a trusting relationship. Additionally, the progress of GSCM provides solutions for alleviating environmental issues. GSCM can reduce the consumption of natural resources, increase the utilization rate of resources and protect the global ecology. It can similarly enhance the corporate social responsibility that will make enterprises obey environmental policies spontaneously.

3.4 GSCM and green process

3.4.1 Green packaging

SF achieves the goal of low-carbon-logistics emission by researching and developing the technology of green packaging. The green package laboratory of SF was founded in 2013 and aimed at applying different categories of technology in green packaging to a variety of merchandise. For instance, EPP (Efficient Power Plant) cycle-insulation boxes are used to transport fresh food in order to control transportation temperature and reduce energy consumption as well. As for the unavoidable scotch tape, SF uses recyclable BOPP (Biaxial Oriented Polypropylene Film) material to manufacture [24].

3.4.2 Green transportation

GSC has obtained tremendous progress in freightage during the past few years. For the sake of low carbon emission of trucks, new-energy automobile is applied by logistics business enterprises. Nevertheless, due to virtual battery power and freight volume shortage, new-energy trucks have not been popularized yet. The invention of extended-range electric vehicles makes it feasible to realize zero-emission transportation [25]. The definition of extended-range electric vehicles is as follows: An electric vehicle can achieve all its performance in pure electric mode, and when the on-board rechargeable energy storage system cannot meet the range requirements, turn on the on-board

auxiliary power unit to provide electrical energy for the powertrain system to extend the range of the electric vehicle, and the on-board auxiliary power unit has no connection with the drive system. In brief, low carbon emission and long battery life are realized at the same time by its range extender. Extended-range electric vehicle is the optimum vehicle for city green logistics.

4. Conclusion

In this dissertation, GSCM is clustered based on PEST, and then analyzed by bibliometric and literature research. This dissertation reviews literature from eight perspectives such as carbon tax, carbon cap, circular economy, economic model, environmental awareness, green cooperation, green packaging and green transportation as well.

By analyzing the existing literature, it can be clearly found that the evolution of GSCM has four currents such as standardization, scientization, autonomy and practicality. The standardization of GSCM is reflected in that a mounting number of policies and regulations put forward requirements for GSCM, which makes the implementation of GSCM reliable. The scientization of GSCM is reflected in the gradual change of relevant research from theoretical qualitative research to quantitative modeling research. The autonomy of GSCM is reflected in that with the general improvement of national quality and an increasing proportion of the public is eager to protect the environment from the bottom of their hearts. They can reach consensus in society, form alliances and achieve twice the result with half the effort. The practicality of GSCM is reflected in that research on it is no longer limited to theoretical analysis, but ever-increasing emphasis on practical application value. It can be foreseen that GSCM will further develop in depth from the above directions in the future.

As for the further optimization of GSCM, the research team results that the bottleneck of GSCM should be taken seriously during practical application. By analyzing the reasons why GSCM cannot be used under certain conditions, this dissertation puts forward targeted suggestions for the model improvement, so as to broaden the application scope of GSCM and realize the optimization of GSCM. It is difficult and significant to further promote the application of GSCM. However, as technology and the improvement of average education levels gather momentum constantly, the prospect of GSCM is still promising.

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