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## THE CONTRIBUTION OF GREEN LOGISTICS AND SUSTAINABLE PURCHASING FOR GREEN SUPPLY CHAIN MANAGEMENT

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### ABSTRACT

The search for new technologies that can mitigate the negative impacts caused by the processes of production and the excessive consumption of raw material has gained more and more relevance in the business world. In this scenario, the present research aims to identify the contributions that green logistics and green procurement bring to the management of the green supply chain. The present research is justified by the increase in the adoption of ecological practices by the companies, which implies in the continuous search for improvement of the techniques that involve all the practices within the Chain of Green Supply, aiming at greater efficiency of the whole chain. Once ISO 20400 was implemented, which came into force in 2017, it aims to increase the efficiency of green purchasing practices.



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The method used was the qualitative exploratory bibliographic research carried out in the secondary databases ACM, EBSCO, Emerald, Academic OneFile (GALE), Scielo, Science Direct, Springer, Web of Science, and Wiley. A bibliometric analysis of the information obtained was also performed. The research concluded that Green Supply Chain Management aims to reduce waste, negative impacts on the environment and maximize profitability. It increases competitiveness through innovative strategies aligned with the organization's strategic objectives: green logistics and green procurement in particular. It also contributes to reducing carbon dioxide emissions by replacing fossil fuels with alternative fuels, reducing operating costs, adapting transport modes, improving internal communication technologies, investing in personnel training to achieve sustainability.

**Keywords:** Management; Sustainable; Green Logistics.

## 1. INTRODUCTION

The emergence of Green supply chain management (*Green Supply Chain Management*) has brought the concept of eco-efficiency within the supply chain involving more effective environmental issues throughout the production chain.

The issue has gained prominence due to many polluting agents which not only seek improvement in their processes, but also having an awareness of the importance of preserving the ecosystem along the entire production chain, without losing the ability to grow and generate profits.

The processes must be committed to eco-efficiency from its conception to the final product-recall for its reuse or final destination.

Within the production process, we emphasize the importance of logistics, because it consists of activities associated with the transportation of inputs for production, disposal and storage of products throughout the production chain. These logistical activities are responsible for much of the emission of carbon dioxide in the atmosphere due to the burning of fossil fuels, since in Brazil the most used modal is the road.

To contribute to the improvement of the management of green supply chains, the International Organization for Standardization (ISO) published the standard ISO 20400 in 2017, which presents guidelines for sustainable procurement practice.

Within this context, this research has as its overall objective identifying the contribution that the green logistics brings to the green supply chain management. To realize the present paper, the sustainability concepts, supply chain management, logistics, green sustainable purchasing are investigated on bibliography to understand the relationship between the practices of green purchasing and the effective green supply chain management follow.

## 2. GREEN SUPPLY CHAIN MANAGEMENT

The expression supply chain was established in 1990 by setting the *Supply Chain Council*, which corresponds to the understanding of every effort involved for the production and release of a final product, since the first supplier to the end customer, where efforts turn to planning, supply and deliver. The term Supply Chain can be translated in several different ways, such as: production, supply or value chain, everybody follows the definitions laid down by *Supply Chain Council* (MENTZER *et al.*, 2001; CAGLIO; DITILLO, 2012; SHIBAO *et al.*, 2013).

Companies aiming to achieve efficiency have adopted this system looking forward to reducing the life-cycle of products. Customers have become more demanding looking for better quality of products, services and technologies in communications and transport; the use of the concept of the supply chain has been usual in modern organizations (CAGLIO; DITILLO, 2010).

Currently, companies are large sources of emissions of pollutants and toxic waste, throughout the production chain both upstream and downstream, causing negative impacts to the environment. For this reason, they are frequent targets of legislative constraints, pressures from consumers who are increasingly aware and demanding, or even because of a highly competitive market.

Nowadays, companies seeks innovative alternatives to the continuous improvement of the performance and preservation of the environment, therefore, sustainable development is seen as a strategy to win new markets, strengthen their brand and get tax breaks. What once seemed only a burden has turned into competitive strategy.

The adoption of green practices in the supply chain management, according to Porter and Van Der Linde (1995a; 1995b), underlie the green supply management

as a competitive practice, where he seeks the finite natural resources economy, through the elimination of waste and improvement in productivity.

According to Bowen *et al.* (2001) and Hall (2001), actions are inserted into the practical activities of the Green supply chain (GSCM) aiming at reducing losses, such as: reuse of materials, adoption of non-polluting technologies, inputs, production processes more efficient and less polluting given current legislation, works of environmental awareness among participants of the entire production chain.

To Sarkis (2003), the Green supply chain management is concerned with the development of partners along the chain and as a mode to stimulate the adoption of green practices throughout the chain. The preference is for the services of companies that have certification ISO 14000, or type of companies that somehow demonstrate concern for the reduction of environmental impacts. The same author even notes that the reverse logistics is present in this process since the creation of the product through the product's future disposal, recycling and all transportation of waste.

According to Sarkis and Dhavale (2015), the definition of the Green supply chain management is not consensual. The concepts presented in incorporating dimensions of social and environmental sustainability in the supply chain management are wide. The author considers that the approach Triple Bottom Line is one part incorporated into the concept of green supply chain management.

The authors Large and Thomsen (2011) claim that the practice of green supply chain management comprises a set of activities, such as the design, selection of raw material purchases, green manufacturing, green distribution, monitoring of environmental impacts during the life cycle of the product, and the reverse logistics.

The green supply chain management features as its main objective to transform the eco efficient chain, by meeting the needs of environmental and economic issues, maximizing profits and market participation, as well as showing a constant improvement of green practices to achieve environmental objectives of the entire chain, which can be measured through the environmental indicators (SELLITTO *et al.*, 2012).

Kopicki; Berg and Legg (1993) understand the green supply chain management on three distinct business visions. The first reactive character is when

the companies concern about the environmental management resources only when a problem or environmental disaster already happened and these resources are exclusively for repairing the harm caused.

The second vision would be proactive companies, where they take some initiatives to anticipate the negative environmental externalities or the prohibitive legislation; in this vision, we can exemplify the recycling and the design of green products. The third is the aggregation of value, where the company seeks to maintain an integration of environmental activities, environmental certifications on your environmental strategy.

According Akili (2009), the level of interaction that gets inside the green supply chain will be the determining factor for improving the performance of the environmental management, in this sense, the higher the level of interrelation, the better the quality of the results achieved. Then, the organization can choose to become reactive or proactive.

The author points out that, in positioning reactive, companies go back to its inner workings, while companies that adopt a proactive posture is more focused on innovation practices.

At the implementation of green supply chain, we can observe that there are barriers and motivations. Barriers, such as operational costs and conflicts with operational targets, hinder the implementation of SCM (SHI *et al.*, 2012).

The sources of motivation for implementing green practices are operational support for adoption of green practices, social capital support, internal pressures and Government involvement (WU; DING; CHEN, 2012).

The adoption of green supply chain management by a large number of organizations, both manufacturing and services, acquires relevance due to globalization and considering several factors in response to environmental laws and regulations, brand image, innovation at work, changes on reduction of waste, water conservation, global warming and reduction of pollution such as water, noise, air etc. (KUMA; VASHISTHA, 2013).

Despite the need for green supply chain management practices, some companies find it difficult to do this, due to factors such as technology, response time, cost of investment, numerous reports, communication, a lack of skilled

workforce, and understanding of environmental issues (CHUN; HWANG; HWANBYUN, 2015).

## **2.1. Practice of green supply chain management**

Green supply chain practices include: material management, green purchasing, green manufacturing, reverse logistics, green design, investment recovery, internal environmental management, green distribution/marketing that refer to the environmental involvement, and the integration of supply chain management with consumer's end-of-life management (CHOWDHURY *et al.*, 2016)

According Luthra, Garg and Haleem (2016), practices of green supply chain management include:

### **2.1.1. Green Design**

It includes the perception that covers the design for remanufacturing, disassembly and recycling of products, adding the fundamentals of cleaner production and eco-efficient production efforts (TSENG.; TAN; SINIBAN-MANALANG, 2013).

### **2.1.2. Green Purchasing**

According to Appolloni *et al.* (2014), green purchases include environmental aspects in all processes and units of the company. It brings the following contributions to the organization:

- a) Environmental impact Mitigation;
- b) Improvement of financial performance through improved competitiveness;
- c) Meeting the criteria established by the regulatory agencies;
- d) Meeting the requirements of the community that is more demanding each day.

The Green purchasing management has been defined as the implementation of “an environmentally-conscious purchasing practice that reduces sources of waste and promotes recycling and reclamation of purchased materials, without adversely affecting performance requirements of such materials” (CHUN; HWANG; HWANBYUN, 2015). This implies applying environmental criteria in the selection of suppliers, requiring active suppliers to comply with certain minimums in their

environmental management and performance, and thereby forming a panel of suppliers that are committed to their natural environmental practices of green supply chain management (GSCM), having increased under the condition of new regulations for greening the business operation.

The authors Gonzales-Benito *et al.* (2016) conduct an empirical study on a sample of 100 Portuguese firms, aiming to analyze the relationship between the environmental management of purchases and firm performance. The authors examine the moderating role played by two variables: the establishment of long-term relationships with suppliers and the strategic integration of the purchasing function.

Evidence reveals that green purchasing management improves the performance of the purchasing function, although the impact is greater when the organization forges lasting alliances with its suppliers. This study contributes to the analysis of the consequences of introducing environmental practices into the purchasing function, especially regarding the formation of a panel of sustainable suppliers.

Specifically, this research provides evidence to show that the implementation of those practices has positive impacts on the operating performance of the purchasing function and that the said effect is greater when a firm establishes long-term relationships with its suppliers.

#### *2.1.2.1. Green purchasing strategies*

The formulation of a green purchasing strategy is not a simple matter. Green purchasing may result in increased material cost and qualified suppliers may be limited because of the need for non-traditional materials and parts. In light of these challenges, this research addresses the following questions about green purchasing strategies:

- a) How knowledgeable are purchasing professionals about environmental advances in products, parts, materials, and packaging?
- b) What are the most prevalent green purchasing strategies among source reduction and waste management programs?
- c) Do state and federal environmental regulations significantly influence green purchasing efforts?

- d) What kinds of green packaging materials are available?
- e) How do purchasing professionals work with suppliers to reduce upstream waste?
- f) How do environmental partnerships affect supplier evaluation and selection?

Based on those, Min and Galle (1997) presents the findings of an empirical survey in firms with a high level of awareness and frequent applications of “green” purchasing. Environmental factors were identified and may reshape supplier selection decisions.

The role of “green” purchasing in reducing and eliminating waste has been discussed lately. In addition, effects of “green” purchasing on packaging decisions have been explored too. Finally, some important practical guidelines were suggested and may enhance the effectiveness of regulatory compliance, pollution prevention, and reestablish recovery.

These studies observed the influence of environmental factors on supplier selection strategies. The most important influences on supplier selection are potential liability, followed by cost associated with the disposal of hazardous material, and compliance with state and federal environmental regulations. The importance of the factors may stem from fear of liability litigation and fines and subsequent negative publicity.

Improving the environmental performance of suppliers is critical in developing green supply chains. Suppliers being the first and the foremost critical link in any organization exercise a great control in developing green supply chain performance by furnishing essential raw materials.

More and more organizations are investing in many green initiatives such as green purchasing design for environment, reverse logistics, and ISO 14001 certification to enhance their business performance and competitiveness. Several studies now confirm that organizations involved in greening the suppliers, green operations, and green innovation rank superior on environmental performance and competitive advantage (JOSHIA; RAHMANB, 2015).

#### 2.1.1.2.2. *Sustainable Purchases and the ISO 20400*



In addition to the own organization, the purchasing decisions cause impacts on economy, environment and society. Therefore, organizations need to act more committedly to sustainability. Observing practices of suppliers and how goods and services are produced and how all of this influences the well-being of the workers consumers involved become a key player in the competitive strategies of the present day.

ISO 20400 emerged from a global initiative involving 52 countries that contributed to the development of ISO 20400 through its National Standardization Organizations, with the support of the International Organization for Standardization (ISO). These countries account for 65% of the world's population, 85% of world GDP, and 73% of CO2 emissions. Other major international organizations have participated in the project, including the UN, OECD, UN Global Compact, European Commission, as well as other standards such as ISO 26000 and ISO 31000 (ISO,, 2017).

In this sense, it was published at the beginning of 2017 an international technical standard ISO 20400, that is a set of guidelines for sustainable purchasing. According to ISO (2017), ISO 20400 provides a guidance for organizations that wish to integrate sustainability into their purchasing processes. This is a more specific application of ISO 26000, guidance on social responsibility, which discusses more broadly to all practices of the organization. ISO 20400 is focused specifically on the purchase.

According to ISO (2017), sustainable purchasing is the process of making purchasing decisions that meet the needs of an organization for goods and services in a way that benefits not only the Organization, but society as a whole, minimizing your impact on the environment. According to ISO (2017), by adopting sustainable procurement practices, the organization can also ensure that "the working conditions of employees and its suppliers are decent, the products or services acquired that are sustainable, whenever possible, and socioeconomic issues, such as inequality and poverty, are treated".

The guidelines provided by ISO 20400 guide the integration of sustainability purchasing processes of an organization. Despite a focus on production function, it is intended that the adoption of this standard is their strategic decision because it

incorporates political and strategic aspects of the purchasing process, seeking to align the shopping function with the organizational objectives and goals, promoting the culture of sustainability. ISO 20400 establishes the principles of sustainable procurement, including accountability, transparency, respect for human rights and ethical behavior. In addition, the ISO 20400 discusses risk management and priority setting.

According to ISO (2017), when implementing ISO 20400, the organization will contribute to society and to the economy, because taking sustainable purchasing decisions will stimulate their suppliers and ultimately the entire supply chain to develop sustainable practices. According to ISO (2017), still the adoption of ISO 20400 can assist the organization to reduce its impact on the environment, addressing issues of human rights and manage relations with suppliers, while at the same time it harmonizes long-term costs and improves the performance of its purchase, thus giving to the organization a competitive advantage.

According to ISO (2017) "the use of the standard will help to improve communication between contractors and all interested parties and promote mutually beneficial relations". According to ISO (2017), the implementation of the standard "also harmonizes the function of purchase by improving relations with the suppliers and reducing risk in the supply chain, such as interruptions due to the withdrawal of the product or the supplier's failure". The adoption of ISO 20400 can lead the organization to increase productivity, to optimization of costs and to stimulate innovation in the market.

ISO 20400 can be adopted by any organization, public or private, regardless of its size and branch of activity. In addition, the standard provides guidelines and requirements that cannot be used for certification purposes.

### 2.1.2.3. *Structure of ISO 20400*

The way an organization buys, whom it buys from, and how purchased goods and services are used can affect the performance and well-being of employees to reputation and relationships with stakeholders. For this reason, the purchasing function of an organization can play a key role in social responsibility and help integrate it at the governance level.

According to ISO 20400 Sustainable Purchases ABNT (2017), “purchases usually make up a considerable part of an organization's budget”. Only in the Brazilian public sector does it account for about 12% of GDP and 29% of public expenditures in the member countries of the Organization for Economic Cooperation and Development – OECD (ABNT, 2017).

ISO 20400 has seven sections in addition to the section with the attachments. The first section introduces the scope of the standard, where it claims that it can be adopted by any organization that has sustainable motivations. Even in this section, the limitations of standard and alignment with other standards geared to sustainability are presented.

Section 2 presents the normative references used for its preparation, namely, the foundations and essential concepts that were considered as premises for the development of the standard.

In section 3 are described the terms and definitions adopted by the standard, to equalize its understanding by different users. Section 4 presents its fundamentals, justifying its existence and relevance, showing the benefits that can be obtained by the organization when it adopts the standard.

In section 5 are described the policies and strategies, focusing on the senior management of the organization. In section 6, more targeted to purchase managers of organizations, the guidelines with more managerial approaches are presented, such as training of team members, management and performance indicators for the measurement of this process.

Section 7, more aimed at the operational level of the shopping process, containing guidelines for the planning, implementation and evaluation of this process. The annexes are some managerial tools that can be adopted for the implementation of the standard.

### **2.1.3. Green Management**

According to Zuluski *et al.*, (2016), integrating the practices of GSCM waste reduction and the reduction of toxic or dangerous inputs throughout the production cycle is essential.

Garza-Reyes (2015) notes that standards such as ISO 14001, while seen by organizations as environmental costs, provides a reduction in the use of resources and reduce the generation of residues, thus assisting the Organization to offer more quality to the final consumer.

#### **2.1.4. Green Logistics**

Green logistics consists of integrating all the activities that involve the movement of products through the supply chain. It ranges from the raw material source, for a specific product, to the production and distribution system for the final consumer, also associating reverse logistics. Logistics activities include "freight, warehousing, inventory management, material handling, and all related information processing." Its primary objective is to achieve a more sustainable balance between economic, environmental and social objectives through coordinated order to meet customer requirements with minimal cost. Companies should consider the external logistics costs associated mainly with climate change, air pollution, noise, vibration and accidents (GREEN LOGISTIC ORG., 2010).

After a brief presentation on logistics, a deeper analysis brings to the this scenario the environmental difficulties the current society presents in its communities, such as: the incorrect disposition of solid waste, air pollution, inadequate product transportation, causing climate change due to environmental degradation, among others. Pollution prevention and recycling practices should become essential practices for industrial and social activities (FAHIMNIA *et al.*, 2015).

Green logistics can be defined as the integrated management of all the activities necessary to mobilize products through the supply chain considering environmental and sustainable issues. The product of a supply chain starts from a source of supply of raw material, goes through the process of manufacturing, storage and physical distribution to the final consumer, associating with the reverse logistics of this product (GREEN LOGITICS ORG., 2010).

According to Fahimnia *et al.* (2015), due to the increased incidence of environmental pollution through transport activities, organizations, transportation providers and governments have taken many initiatives to reduce the environmental

impact of activities related to transportation and product logistics and the concept of green logistics is a part of reducing the environmental impact on organizations.

The pollution caused by different activities has increased in recent years and transport and logistics activities are the main contributors for it. Different means were adopted to mitigate this negative effect, one of them adopted by the Ministry of the Environment was the creation of 12305/10 Law, which establishes the National Solid Waste Policy (PNRS) in Brazil.

The concept of green logistics development originated in the importance of environmental issues and logistics sector; the emission rate of carbon dioxide in industries and switching to green logistics is part of reducing the environmental impact caused by these organizations. Green logistics refers to "attempts to measure and minimize the ecological impact of logistics activities on transport, handling, storage and distribution of products and services" (GREEN LOGISTICS ORG., 2010).

According to Mckinnon, Browne and Whiteing. (2015), with increasing of environmental awareness on the part of society, international standards are increasingly stringent, especially under government in actively promoting energy saving and reducing carbon emissions, reducing operating costs and Environmental issues to the attention of all parties in the economy and society. Another important approach is the use of alternative sources of energy, trying to deploy or use alternative fuels to totally or partially replace the use of fossil fuels. Other practices also include choosing the most appropriate transport modes, using current technologies to communicate with in-house personnel, and providing the education and training needed to achieve sustainable results, with the mission of practicing the concept of green logistics in its essence.

Zuluski *et al.*, (2016) affirm that this practice is concerned with sustainability; this concern involves not only economic issues, but also environmental concerns that affect the whole society, such as pollution, garbage collection, and customer relationships.

### **2.1.5. Green Production**

The practices of green supply chain management cover the entire organization including internal and external parties, thus allowing a broad control over the entire chain of production (ZULUSKI *et al.*, 2016).



## 2.2. Adoption of Green Practices

Mauricio; Frascareli and Jabbour (2013) state that, in general, the results obtained with the adoption of the practices of the green supply chain management tend to affect positively the operating performance and environmental performance. Many indicators are used to measure it. It was clear to the authors that each practice tends to be more or less affected by some indicators; environmental indicators show the practices adopted in green supply chain management contributed to the reduction of waste, reduction of emission of pollutants, and reduce energy consumption.

In the case of interaction with customers, the indicator that tends to change is the quality.

## 2.3. Suppliers environmental performance

Awasthi and Kannan (2016) cite environmental performance of suppliers is critical for green supply chain management. Organizations are nowadays investing in many green supplier development programs to enhance their supplier performances. The decision to select the right program for green supplier development is often a challenging decision due to lack of prior experience, limited quantitative information, specific context of the organization, and varying supplier backgrounds.

This paper addresses the problem of evaluating green supplier development programs and proposes a fuzzy NGT (Nominal Group Technique). NGT is used to identify criteria for evaluating green supplier development programs. Fuzzy theory is used to address qualitative (linguistic) ratings for the alternatives and the selected criteria used under lack of quantitative information.

Those authors used NGT to generate green supplier development program rankings and recommend the best program(s) for implementation. Sensitivity analysis is performed to determine the influence of modeling parameters on ranking results of alternatives and a numerical application is provided.

Van Den Berg; Labuschagne and Van Den Berg (2013) conducted a research in companies in South Africa and noted such an important influence of green practices and innovation so their suppliers could achieve environmental goals

and competitive advantages. The research found that green innovative process had a significant effect on environmental performance.

Green managerial innovation further had a significant correlation with competitive advantage. The primary result of the study indicated that all the constructs positively related to each other, meaning that greening suppliers, by means of green innovation, leads to an enhanced environmental performance and to competitive advantages.

Considering Yan; Chien and Yang (2016), today's manufacturing companies are not striving for individual capacities but for the effective working with green supply chains. However, in addition to environmental and social objectives, cost and economic feasibility has become one of the most critical success factors for improving supply chain management with green component procurement collaboration, especially for the electronics OEM (original equipment manufacturing) companies whose procurement costs often make up a very high proportion of final product prices.

The authors present a case study from the systems perspective by using System Dynamics simulation analysis and statistical validations with empirical data. Although the price negotiation of upstream raw materials for the collaborative suppliers has no statistically significant benefit to the shipping time efficiency, the shared cost reduction of component procurement is significantly positive for supply chain collaboration among green manufacturers. Managerial implications toward sustainable supply chain management were also discussed.

### **3. METHOD**

Vergara (2011), in relation to the purposes, sorts the research as "exploratory, descriptive, explanatory and methodological, applied and interventionist".

Cervo, Bervian and Silva (2007) claim that the exploratory research does not require the formulation of hypotheses, since it aims to meet a phenomenon little studied or get a new perception, as well as contemplate new ideas about the object of study.

In relation to data collection, we can understand from primary and secondary sources.



For Prodanov and Freitas (2013, p. 127), the "exploratory" research is one that "aims to provide greater familiarity with the problem, making it explicit or constructing hypotheses about it."

This paper used qualitative research as a method using secondary data. The data were obtained from a systematic search in the literature; the searched articles discuss the sustainable logistical operations.

The search was carried out by using the following key words: supply chain management, green supply chain management, green logistics, sustainable purchasing and ISO 20400. The following scientific databases were used as sources: ACM, EBSCO, Emerald, Academic OneFile (GALE), Scielo, Science Direct, Springer, Web of Science, and Wiley.

The selection of the terms was carried out considering the following situations: cases about organizations that practice green SCM, the use of Green-SCM, the requirements for the practice of this, norms for its use with sustainable purchases, tools for its use, sustainable purchases, and strategies for its use. After the initial research, it was classified by type of documents. The research delimited the period of publications from 2013 to 2017, as it was the moment when the theme began to be more widespread by the creation of ISO 20400.

Regarding the "document type" filter, we searched for articles published according to the standard procedures and articles published in scientific journals (magazines). The language used to search was Portuguese and English. EndNote X7 software was used to organize the material.

The titles were read to eliminate references that were not consistent with the research objective. Of the 197 articles that remained, the keywords and abstract were read and only 25 were related to the theme. Afterwards, a bibliometric analysis and descriptive content analysis were performed, aiming to present the main results achieved by the studies, followed by discussion related to the results and integration of the studies.

#### **4. RESULTS AND DISCUSSION**

In this topic, the publications found on the topic of interest of this article were categorized and counted, and an analysis was performed on the results found. Bibliometric shows that there are twenty-five academic publications on the subject



Green supply chain management, whose focus is on sustainable logistical operations. Table 1 below presents a classification of the publications found during the period considered.

Table 1: Publication type, year and origin.

<b>Classification</b>	<b>Number</b>
Total Articles	25
Journal	17
Proceedings	03
Book	01
<b>Search Type</b>	
Case study	03
Literature Review	03
Business Survey	14
Theoretical	05
<b>Year</b>	
Prior to 2013	05
2013	04
2014	01
2015	06
2016	07
2017	02
<b>Country</b>	
EUA	20
Korea	02
China	05
Bangladesh	02
Brazil	02

Fonte: Authors

The table 2 presents where the articles were published.

Table 2: Published journal

<b>Journals</b>	<b>Total</b>
Computers & Industrial Engineering	1
Management & Production	1
Greener Management International	1
Greening of Industry Networks Studies	1
Harvard Business Review	1
International Journal of Engineering and Management Research	1
International Journal of Production Economics	2
International Strategic Management Review	1
Journal of Business & Industrial Marketing	1
Journal of Business Logistics	1
Journal of Cleaner Production	5
Journal of Economic Perspectives	1
Journal of Management & Governance	1
Journal of Purchasing and Supply Management	1
Journal of Supply Chain Management	1
Journal of Transport and Supply Chain Management	1
Management Accounting Research	1

Production and Operations Management	1
Magazine of Management, Innovation and Business	1
Social and Behavioral Sciences	1
Supply Chain Management: An International Journal	1
Theoretical Foundations of Chemical Engineering	1
<b>Congresses and Seminars</b>	
<b>Total</b>	
EurOMA Conference 2016	1
Procedia – Social and Behavioral Sciences	1
16th SEMEAD - Administration Seminar	1
20th Production Engineering Symposium	1

Fonte: Authors

By means of the results presented in Table 2, we verified that 4 are congress articles, indicating that they are practical works. It was also observed that 3 are case studies and 14 surveys and mainly 19 published in academic journals.

This means that the number of studies that seek to assess whether existing literature on green logistics is actually applicable to business practice is still reduced.

As for the year of publication, we verified that the first studies were published before 2013. As of this year, the annual production of articles has increased, mainly in the last two years, due to the development of ISO 20400.

The country with the largest number of publications on the subject was the United States, with 20 of them. In the studies based on primary data that had authors from different countries, it was considered only the country where the data were collected. Next were Korea, China, Bangladesh and Brazil.

Regarding the number of published studies, the US also appears as the country with the highest number of studies published in scientific journals.

Regarding the type of publication, the newspaper that most published on the subject was Journal of Cleaner Production, with 6 publications. Thus, showing a recent theme but of great impact since the referred magazine presents an impact factor 6, 121 and in the Qualis A1.

From the bibliometric study and analyzing the content of the articles, it can be observed that it is possible to cluster the results into 5 groups: Green Purchasing Management, Environmental management of purchases and the performance of the company, Strategy applied to Green Purchases, Improving Competitiveness and ISO 20400.

After surveying the integration of the publications with the central theme that is the green purchasing, the following five articles dealing with this integration were

considered. They are presented in Table 3 below, citing the authors, the practices used and the results of their respective studies.

**Table 3: Cluster of practices and results obtained with green purchases**

	<b>Authors</b>	<b>Practices</b>	<b>Results</b>
<b>Green Purchasing Management</b>	Chun, Hwang & Hwanbyun (2015)	<ul style="list-style-type: none"> <li>Green Supply Chain Management (GSCM)</li> <li>Application of environmental criteria in the selection of suppliers, requiring:</li> <li>Minimum environmental management requirements</li> </ul>	<ul style="list-style-type: none"> <li>It has increased with new regulations for green practices in business operations.</li> </ul>
<b>The environmental management of purchases and the performance of the company</b>	Gonzales-Benito <i>et al.</i> (2016)	<ul style="list-style-type: none"> <li>Long-lasting alliances with your suppliers.</li> </ul>	<ul style="list-style-type: none"> <li>Improves the performance of the purchasing function.</li> </ul>
<b>Strategy applied to Green Purchases</b>	Min & Galle 1997)	<ul style="list-style-type: none"> <li>Packaging Decisions.</li> <li>Increase the effectiveness of regulatory compliance-Prevention of pollution.</li> <li>Supplier selection strategies.</li> <li>Cost analysis associated with the disposal of hazardous material and compliance with state and federal environmental standards.</li> <li>Improve supplier environmental performance.</li> </ul>	<ul style="list-style-type: none"> <li>Reduction and elimination of waste.</li> <li>Increased potential liability.</li> <li>Development of the green supply chain.</li> </ul>
<b>Improving Competitiveness</b>	Joshia & Rahmanb (2015)	<ul style="list-style-type: none"> <li>Purchases green.</li> <li>The reverse logistics.</li> <li>The ISO 14001 certification.</li> <li>Green operations.</li> <li>Green innovation.</li> </ul>	<ul style="list-style-type: none"> <li>They present higher environmental performance and competitive advantage.</li> </ul>
<b>ISO 20400</b>	ISO (2017)	<ul style="list-style-type: none"> <li>It guides the integration of sustainability.</li> <li>Has a focus on the production It incorporates political and strategic aspects.</li> <li>Establishes green purchasing principles.</li> <li>Accountability,</li> <li>Transparency, respect for human rights and ethical behavior.</li> <li>Risk management.</li> </ul>	<ul style="list-style-type: none"> <li>Contributes to society and the economy.</li> <li>Develops and encourages suppliers throughout the chain for sustainable practice.</li> <li>Helps the organization reduce its impact on the environment.</li> <li>Harmonizes overall long-term costs.</li> <li>Improves purchase performance.</li> </ul>

			<ul style="list-style-type: none"> <li>• Improves the competitiveness of the company.</li> <li>• Improves communication throughout the supply chain.</li> <li>• Reduces risk along the production chain</li> </ul>
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Fonte: Authors

From the analysis of the five clusters observed, it was possible to develop a diagram to represent this interaction, according to Figure 1.

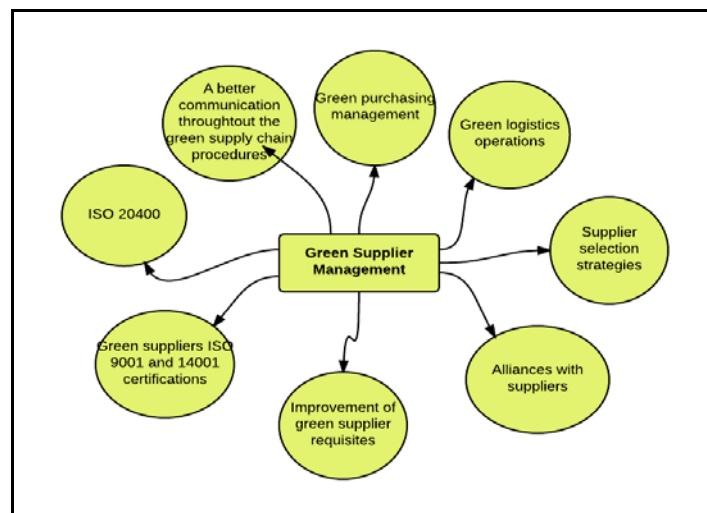


Figure 1: Integration of factors preponderant to the study of green supplier obtained by the bibliometric analysis in the analyzed period.

Fonte: Authors

The representation of figure 1 shows the main factors of collaboration required between the links of the Green Supply Chain, factors that contribute to make the companies more efficient and competitive in the market.

Considering the themes that were used and their integrations, sustainable supplier performance is the link that becomes preponderant.

According to Appoloni *et al.* (2014), green purchasing includes aspect of the campaign as a whole and leads to mitigation of environmental impacts.

According to Garza-Reyes (2015), for an organization to achieve waste reduction, the partnership with suppliers with higher performance certainly indicates certifications in ISO 9001 and 14001.

Corroborating with Awasthi and Kannan (2016) and Van den Berg (2013), organizations must solve adequate and specialized programs, seeking to improve

their selection and development, thus improving competitiveness (according to a study of a correlation between sustainable practices and innovation in suppliers to reach the strategy for competitiveness) (FERREIRA; GEROLAMO, 2016).

Another factor observed is the alliance with sustainable suppliers, Yan; Chien and Yang (2016) and Chun; Hwang and Hwanbyun (2015) in a study with manufacturing companies, demonstrated that "procurement" was what led to cost reduction – a greater collaboration in the sustainable chain - compared to the green logistics operations.

According to Zuluski, *et al* (2016) and Joshia Rahmanb (2015), not only economic but also environmental issues, and the one that has the ability to carry this practice through the chain is the supplier.

However, ISO 20400 (2017) stands out with the tool that will have the guidelines for the participation of society and the economic environment; a structuring of the requirements and procedures to be adopted, being principles transparency and risk management. This ISO 20,400.00 theme is still little explored, due to its recent creation, thus, it becomes something with great potential to analyze its effectiveness in green purchasing and green supplier performance.

## 5. CONCLUSION

Green supply chain management provides companies with a better use of resources by reducing waste. The green purchases have economic, environmental and social consequences, due to the importance of this process, ISO 20400 comes with guidelines and integrated practices that make it possible to gather sustainability in this process.

The adoption of green logistics makes it possible to reduce costs and reduce the use of fossil fuels by looking for more efficient modes and using clean energy forms. Green purchases and green logistics working in tune allow the company to gain more competitiveness in the market.

The research found that for an enterprise to reach sustainability is necessary to deal with the problems in a comprehensive manner taking into consideration the tripod of the concept *triple bottom line* (social, economic and environmental dimensions).

The governments concerned with environmental issues create increasingly strict standards to mitigate the negative externalities caused by the organizations. The latter must readjust quickly the new demands, because they are inserted into a dynamic and competitive market environment, where it is necessary to pick up new strategies, and innovate always, so that they can persist over the years.

In constant search of efficiency, organizations began to incorporate environmental issues in your strategy, causing the adoption of green supply chain management aimed at eco-efficiency. The Green supply chain management seeks to eliminate waste, reduce costs and maximize profits mitigating environmental damage caused throughout the production chain.

The logistics of supply chain management is a very important part as it is used within the entire production chain both inside of organizations, outside and are a source of emission of carbon dioxide.

Focusing on eco-efficiency, we inserted green logistics in the context of green supply chain management. It is important to stress that the contribution portion of the Green logistics throughout the Green supply chain management consists in reducing carbon dioxide emissions by replacing fossil fuel use by less polluting alternative fuels, reducing operational costs through the optimization of processes and improvement of internal communication systems, investment in staff training to the adoption of sustainable practices.

Complementing the Green logistics practices, ISO 20400 presents a set of guidelines for sustainable purchasing, which contributes more to the Green supply chain management. In this sense, we observe that the aim of this work was reached, since it was possible to show the contributions of green logistics and sustainable shopping for green supply chain management.

It is recommended that for future work the investigation of cases of organizations that have adopted the ISO 20400, since this document has been drawn up recently and there are no cases for study in the literature. Still, it is recommended to explore in more details how each activity of the Green logistics (storage, transport, distribution, information systems etc.) can be optimized for the contribution to the Green supply chain management.

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