DOI: 10.46541/978-86-7233-428-9_423

XXIX International Scientific Conference
Strategic Management
and Decision Support Systems
in Strategic Management
SM2024
Subotica (Serbia), 17-18 May, 2024

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THE GREEN FOOD SUPPLY CHAIN CONCEPT

Abstract: The traditional food supply chain is a complex network of interconnected entities whose function is to supply consumers with enough health-safe products, i.e. enough food with optimization of production and distribution. In the previous period, the traditional supply chain has faced numerous challenges and problems. Globalization, climate change, changes in living standards and consumer preferences, limited natural resources (agricultural land and water), growth in the amount of food and packaging waste, as well as food insecurity led to creation of numerous national and international regulations and agendas related to environmental protection. Those regulations and agendas influence various business philosophies, including the philosophy of food supply chain management. With its focus on optimizing production and distribution of food, the traditional supply chain cannot meet the international regulations' requirements. Because of that it was necessary to go in the direction of greening the activities of the traditional supply chain, i.e. in the direction of defining the concept of a green food supply chain. The concept of a green food supply chain represents an improved, wider concept of a traditional food supply chain that, apart from standard activities, agricultural production, processing and distribution of products, also includes additional activities such as green procurement, green product design and reverse logistics. Therefore, bearing in mind that in the future food should be produced and distributed in a way that pollutes the environment as little as possible, the aim of the research is an analysis of the importance of the green supply chain concept in food production and distribution. Considering the defined goal, the literature review method was used with a focus on the Scopus database. The results of the research indicated that due to the complexity and frequent changes of regulations in practice, the green supply chain concept is still not sufficiently applied.

Keywords: food, supply chain, green.

1. INTRODUCTION

The traditional food supply chain is a complex network of interconnected entities whose main function is to supply consumers with a sufficient amount of health-safe products, i.e. enough food, considering the optimization of food production and distribution. Ever since the second half of the 19th century, the food system has been exposed to the influence of globalization, which greatly contributed to the increase in the number of participants in the food supply chain who mediate between producers and consumers, thereby creating long, or global, food supply chains (Soria-Lopez et al., 2022). Apart from the numerous advantages that globalization has had on the food system, globalization has also brought a certain number of negative aspects. More precisely, the globalization of industrialization and trade activities has caused an increase in complications in the food supply chain (Qin et al., 2022), and one of the most significant is certainly the degradation of the environment (Soria-Lopez et al., 2022), due to the negative effects that the activities of each of the participants have on the environment (Petljak, 2019; Matani et al., 2015). The number of participants in the food supply chain is increasing, and the path that food travels from the place of production to the place of consumption is getting longer, which requires the use of enormous amounts of resources such as energy, water, land and others. Along the way, numerous environmental problems arise, such as adverse impacts on biodiversity, climate change and greenhouse gas emissions, soil and water pollution. As a result of such trends in the market, many so-called green regulations have been created, which impact all business concepts and the supply chain concept. In addition to the growing number of national, regional and international regulations related to environmental protection, changing consumer demands (Despoudi, 2020),

pressures from various interest groups (Miljušković, 2015), limited natural resources, food insecurity, population growth, climate change and increased amounts of food loss and waste generated along the food supply chain necessitates the need to redefine the concept of the traditional food supply chain (Despoudi, 2020).

When it comes to international regulations, the Kyoto Protocol signed in 1997 by the United Nations is the first international binding agreement in the fight against climate change. The basic requirement of this protocol, adopted by 38 countries, is to reduce or limit the emission of greenhouse gases by industrialized countries to stop climate change. The Kyoto Protocol did not show significant results, and 20 years later, i.e. in 2016, the Paris Agreement was signed, which aimed to reduce global warming (Zekić et al., 2023). Likewise, the United Nations has defined 17 sustainable development goals that refer to future social and economic development in accordance with the principles of sustainability. The realization of these goals is very important from the aspect of environmental protection. Among those goals, a certain number of goals, such as goals related to the problem of hunger in the world, protection of natural resources, climate change and responsible production and consumption (source) are very closely related to the agricultural sector. On the other hand, the European Union represents an entity that certainly has the most developed regulations related to environmental protection. In the case of the agricultural sector, the first significant milestones related to the integration of ecological goals and the promotion of sustainable agriculture were related to Agenda 2000 as well as to the reform of ZAP from 2013, which are related to the previously mentioned international regulations (Đokić et al., 2022). In the last reform of ZAP EU, the European Green Deal and the strategy “From farm to fork" which aims to ensure the sustainability of production within all segments of the food supply chain were of great importance.

Changing consumer demands, in terms of increasing demand for healthy products (Despoudi, 2020), as well as increasing pressures from various interest groups (Miljušković, 2015; Petljak, 2019) have also largely contributed to the need to redefine the concept of the traditional supply chain and integrate an ecological way of thinking in the activities of all chain participants. In addition to the previously mentioned, the traditional supply chain has faced challenges such as the limitation of the most important natural resources, climate change and population growth. According to the United Nations (2021), food production occupies 50% of the land area suitable for living, accounts for about 70% of freshwater consumption and contributes to the production of a quarter of global greenhouse gas emissions. In addition, food production is considered the biggest generator of biodiversity loss, air and water pollution, deforestation and soil degradation. Land and water are the most important natural resources of great importance for the agricultural sector, and their limitation indicates the need for conservation and rational use. According to the OECD (2024), agricultural production represents the largest consumer and major polluter of water, which is why improving the management of water use in the agricultural sector is essential for a sustainable food sector. On the other hand, according to Đokić et al. (2022) land is a non-renewable resource whose limits are finite, and which, in addition to the production of food, fiber, fodder and biofuel, also affects climate regulation, soil functionality, and cultural landscape and recreation. In the case of the agricultural sector, the negative impact on the soil is generated to the greatest extent through intensive agricultural production, which in the long term can have a very negative impact on food security. By 2050, the number of inhabitants is expected to increase to around 9 billion. The expected increase in population will put additional pressure on limited resources and the environment through increased food demand and supply. Apart from the increase in population, the increase in per capita income significantly changes the structure of consumption in terms of increasing demand for products of animal origin, and the production of these products requires a greater burden on the environment in terms of greenhouse gas emissions, water use, land use, energy and application of nitrogen and phosphorus. To ensure a healthy and safe future for both the population and the planet, the growing population must be fed in a way that is healthy, equitable and sustainable (United Nations, 2021). Also, one of the more important issues related to the food supply chain that has a major negative impact on the environment is the large amounts of food waste generated along the supply chain. Food loss and waste are characteristic of all participants in the food supply chain. In the world, on average, about 30% of the total amount of food produced is thrown away annually (FAO, 2011), and in addition to further exacerbating the problem of world hunger, food waste generated in the supply chain puts pressure on water, land resources and climate, and according to the United Nations (2021) accounts for 8 to 10% of greenhouse gas emissions. Therefore, bearing in mind that in the future food should be produced and distributed in a way that pollutes the environment as little as possible, it is necessary to redesign the traditional chain and harmonize it with market requirements.

In accordance with the previously said, the aim of the paper is to analyze the importance of the green supply chain concept in food production and distribution. After the introductory discussion and definition of the research methodology, the next segment of the research considers the problem of defining the concept of traditional and green food supply chain, as well as defining the key differences between these two concepts. In addition, this part of the paper also includes the problem of defining the term green supply chain with an overview of synonyms used in the literature to define the same concept, as well as the difficulties that complicate the application of this concept among individual participants.

2. RESEARCH METHODOLOGY

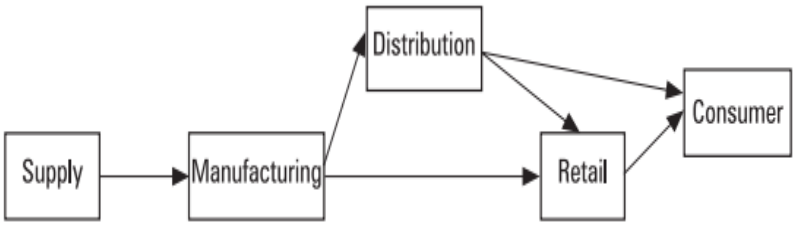
An extensive literature review on the green supply chain and the selection of references is mostly based on the Scopus database and the following keywords were used during the search: green, food and supply chain. Only papers in English were considered, i.e. articles, reviews and conference papers from the fields of Business, Management and Accounting, as well as from the fields of Agricultural and Biological Science and Economics, Econometrics and Finance. In addition, individual research listed in the bibliography of papers taken from the Scopus database were analyzed.
It is necessary to keep in mind the limitations of this research. Namely, it is very difficult to make a clear differentiation of the scope of the terms of traditional and green food supply chains based on a review of the previous literature, given that the definition of the term itself is quite diverse in the literature. Additionally, for the purposes of the review paper, it is quite difficult to find comparative analyzes between traditional and green food supply chains, and the literature is scarce when it comes to empirical data on the representation of certain chains in certain regions of the world.

3. TRADITIONAL VS GREEN FOOD SUPPLY CHAIN

3.1. Traditional food supply chain

The idea of supply chain management appeared in the early 80s of the 20th centuries, after which it was soon widely spread and accepted in various segments, including in agribusiness. The food supply chain represents the phenomenon of the movement of agricultural products from the agricultural sector to the final consumers (Jeremić, 2018). It is a network of organizations that, through mutual economic relations, ensure the production and distribution of food (Yakovleva, 2007). Bukeviciute et al. (2009) argue that the food supply chain consists of a wide range of products and companies that operate in different markets and sell a variety of products, and that the key sectors of the supply chain are the agricultural sector, the food industry and the distribution sector. According to El Ayoubi and Radmehr (2023) the food supply chain consists of related entities engaged in the production and sale of food produced from raw materials of agricultural origin. The authors also believe that effective supply chain management should increase sales while reducing costs along the entire supply chain. According to Beamon (1999), a traditional supply chain represents an integrated production process where raw materials are processed into final products and then delivered to customers through the distribution sector (Picture 1). The author believes the traditional supply chain focuses on optimizing the procurement of raw materials from suppliers and distribution from the manufacturer to the customer. According to Veljković, Milovanović and Talić (2022) the traditional supply chain focuses mostly on:

- Determining the most efficient production and distribution of products;
- Optimization of raw material stocks and the number of participants in the chain;
- Management of customer-supplier relationships.



Picture 1: Traditional supply chain
Source: Beamon, 1999, pp, 336

However, the increasing importance and problems related to environmental pollution caused by the activities of traditional supply chain participants have imposed the need to integrate an environmental component into the activities of chain participants as well as the need to redefine the concept of the traditional food supply chain.

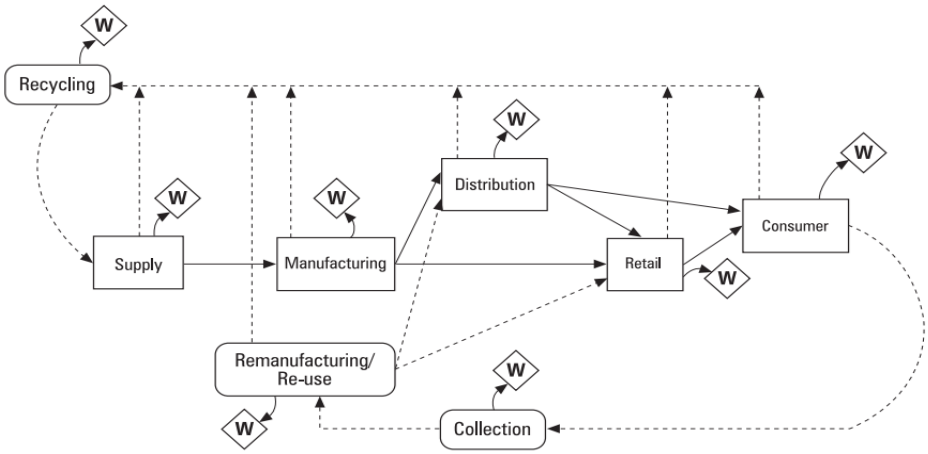
3.2. Green food supply chain

The green food supply chain implies the inclusion of an ecological way of thinking in the concept of a traditional food supply chain due to the impact that the activities of the participants have on the environment. The green supply chain concept represents an expanded version of the traditional supply chain that is gaining more and more importance among

both supply chain participants and researchers. The very name in the term indicates the fact that in the past period the focus in relation to environmental protection has shifted from individual participants to the entire supply chain. Apart from the broader scope of activities that the participants of the chain perform, the concept of a green supply chain differs from the concept of a traditional chain in certain segments. According to Matani et al. (2015) segments in which the concept of a traditional supply chain differs from the concept of a green supply chain include the following:

- While the traditional supply chain focuses on minimizing costs and improving the efficiency of the entire chain to maximize economic benefit, the green supply chain also seeks to maximize economic output while reducing energy and resource consumption to reduce pollutant emissions all to achieve a balance between economic and social benefits and environmental impact.
- In addition, in the case of these two concepts, the business model and business process are also different. That is, the business model of the green supply chain is more complete because it also includes an ecological component, unlike the traditional concept where that component was completely absent. In the case of a business process, in a traditional supply chain, the flow of activities moves in one direction from the procurement of inputs and raw materials to end consumers, while in the case of a green supply chain, activities move in both directions.

The concept of a green supply chain has been a subject of interest since the beginning of the 21st century, when it was first defined (Miljušković, 2015). However, when it comes to defining the term green food supply chain, there is still an inconsistency of definitions and a lack of uniformity in terminology (Petljak, 2019), which makes it somewhat difficult to compare different research related to this issue. Regardless of the absence of a single definition of the term green supply chain, the interest in researching this issue is increasing, and the environmental responsibility of the participants is becoming imperative in the business philosophies of many companies, especially in the case of companies engaged in production, as is the case with companies that produce and process raw materials of agricultural origin. In the literature, there are currently many synonyms used in parallel with the term green supply chain, and some of the most used synonyms are sustainable SCM (Ali et al., 2016; Seuring and Müller, 2008; Linton, Klassen and Jayaraman, 2007;) and environmental SCM (Jabbour et al., 2014). Apart from the disagreement on terminology, according to Perotti et al. (2012) among the authors who deal with this problem, there is a dilemma regarding the motivation of the participants for the application of this concept, as well as regarding the level of the chain at which the analysis needs to be performed. More precisely, the dilemma regarding the motivation of the participants implies the disagreement of individual authors regarding whether the application of this concept is a matter of coercion or the good will of the participants, while the disagreement regarding the level of analysis refers to the author's opinion as to whether the analysis is better to be performed at the level of individual participants, or there is still a need for analysis at the level of the entire supply chain. In her paper, Petljak (2019) states that most of the research that has been conducted focuses on only one segment of the green supply chain, and that there is still a lack of an integrative approach to green supply chain management research, which many researchers consider very important. Although many authors equate the term green supply chain with the previously mentioned synonyms, in his research Miljušković (2015) analyzes the transformation process of the food supply chain from a traditional to a green supply chain and clearly delineates the difference between the terms sustainable supply chain, closed-loop supply chain and green chain as the most comprehensive supply chain concept to date. Also, the author states that the concept of the traditional chain was followed by the development of the concept of a sustainable supply chain, which brought significant innovations and improvements in terms of the traditional chain. However, at the end of the 90s of the 20th centuries, because of increased legal regulation in Europe, the concept of a closed-loop supply chain was created, which, unlike the traditional and sustainable chain, also included return activities whose basic task is to return value while fulfilling environmental standards. In his paper, the author states that the previous concepts mostly lacked strategic breadth and that they therefore served as a basis for discrediting the most comprehensive concept, that is, the green supply chain concept. One of the most frequently cited definitions of the green supply chain is the definition of the author Srivastava (2007), who under the green supply chain means integrating an ecological way of thinking into the concept of supply chain management, including product design, procurement and selection of materials, production and distribution of products to end consumers, as well as product management after the expiration of his life span. Beamon (1999) believes that the concept of a green supply chain is an extended version of the concept of a traditional chain because, in addition to the basic activities of a traditional chain, it also contains additional activities (Picture 2). More precisely, in Figure 2, the solid lines represent the traditional supply chain, while the dotted lines show additional activities specific to the green supply chain concept. The W label means waste generated at all levels of the supply chain and that participants should take care of.



Picture 2: Extended supply chain
Source: Beamon, 1999, pp, 338

According to Lau (2011), the concept of a green supply chain is defined as the integration of environmentally conscious thinking into the supply chain, including product design, material procurement, production, distribution of the final product to consumers and end-of-life management of products. Likewise, according to Srivastava (2007) the green supply chain includes ecological production and ecological transport of products, as well as return logistics. The authors Davies and Hochman (2007) believe that the management of the green supply chain requires a holistic approach, that is, it requires the improvement of environmental results at all levels of the supply chain. Likewise, the authors Wang and Gupta (2011) also believe that for the supply chain to become completely green, the integration of green activities within all participants is necessary. In addition, the authors believe that some of the benefits that would be realized by applying this concept include reducing the use of energy, reduced consumption of natural resources as well as reduced problems related to pollution (Jaggernath, 2013). On the other hand, the author Jaggernath (2015) believes that adopting the green supply chain concept achieves the following environmental benefits:

- Improvement in energy use.
- Waste reduction.
- Reduction of greenhouse gas emissions.
- Water conservation.
- Increase in energy efficiency.
- Reducing the release of toxic chemicals into waterways.

Regardless of the fact that in the XXI century there has been a significant turn in the business philosophy of supply chain management in the direction of the green chain concept and regardless of the previously mentioned benefits of that concept, green business practices are still, due to a number of factors, not incorporated and applied by of all countries and business entities around the world. For example, apart from the lack of government initiatives related to the implementation of this concept, some are not familiar with the way of adopting and applying this concept, while some are slower to adopt this concept due to the misconceptions that are present in relation to the concept of green supply chain (Jaggernath 2015). Even today, the concept of green business is rather ambiguous, vague and broad, which proves the variety of definitions based in the literature. Poor understanding leads to confusion but also to disagreements and disputes between supply chain participants who should be working towards achieving a common goal. In addition, the implementation of the green supply chain concept is delayed due to the complexity and frequent changes in green regulations. In order to operate more successfully in the future, the participants of the food supply chain will have to understand how in the future climate changes will affect the functioning of the chain, and to align their business strategies with those changes, because by greening the activities of the participants of the supply chain, not only environmental protection is achieved but also reducing the costs of the participants as well as increasing the flexibility of the supply chain. Greening the supply chain requires strategic business transformation and collaboration along the entire supply chain that can only happen if participants integrate green initiatives into their core strategies (Despoudi, 2020). All participants in the supply chain should work together to ensure a positive impact on the environment.

4. CONCLUSION

Due to the observation of the negative effects of the activities of individual supply chain participants on the environment in the XXI century, there has been a significant change in the business philosophy of supply chain management. The concept of the traditional chain has so far undergone significant modifications in terms of greening the activities of the

supply chain participants. Participants in the food supply chain are also some of the biggest polluters of the environment. More precisely, the production of food products creates numerous environmental risks through the excessive use of limited resources, the emission of gases with the greenhouse effect, and through the generation of large amounts of waste. Today, when competition no longer exists between individual chain participants but between food supply chains, and when environmental protection requirements have become imperative, the integration of an ecological way of thinking into the activities of food supply chain participants is more important than ever. Greening the activities of participants in the food supply chain will be one of the most important goals in the future for those participants who will strive to protect the living environment by reducing pollution. That is, the rational use of limited resources and energy, the reduction of the amount of packaging and food waste generated along the food supply chain will represent one of the most important segments of food supply chain management in the future. In order to successfully realize the idea of greening the activities of chain participants in the coming period, it is imperative that all chain participants integrate ecological thinking into their activities.

Bearing in mind the fact that one of the most important factors contributing to the inadequate application of this concept among chain participants is the lack of understanding of the concept and the absence of a single definition, future research should be directed towards finding a single, homogeneous definition and methodology that will deal with analyzing this problem both at the level individual participants, as well as at the level of the food supply chain.

ACKNOWLEDGEMENTS

This paper has been supported by the Ministry of science, technological development and innovation, agreement number 08-803 (March 19th 2024).

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