

Tamara Stanković<sup>1</sup>

Goran Milovanović<sup>2</sup>

Aleksandra Anđelković<sup>3</sup>

University of Niš, Faculty of Economics

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## PERFORMANCES OF KEY PROCESSES IN GREEN SUPPLY CHAINS

### Abstract

*There is an obvious negative influence of business activities of supply chains on the environment, which represents one of the most significant problems at the global level. Due to their activities, industries have disrupted the environmental balance greatly. The concept of green supply chain arose from the successful execution of production activities while taking care of the environment. The subject of this paper refers to describing activities within chains in specific segments in order to examine the ways in which satisfactory financial performances can still be achieved in combination with environmental (green) performances. The goal of this article is to identify supply chain components that can adopt environmental activities, demonstrate environmental responsibility and improve green performance. The focus is mostly on identifying measures inside core processes, such as defining environmental activities and restructuring supply chains, in order to meet the expectations of environmental preservation and environmentally conscious consumers (buyers) as green supply chain members.*

**Key words:** green supply chains, ecology, sustainable development, green performances

**JEL classification:** Q5

## ПЕРФОРМАНСЕ КЉУЧНИХ ПРОЦЕСА У ЗЕЛЕНИМ ЛАНЦИМА СНАБДЕВАЊА

### Апстракт

*Евидентан негативан утицај пословних активности ланаца снабдевања на животну средину, један је од најизраженијих глобалних проблема. Индустије су својим активностима у великој мери нарушиле природну равнотежу. Успешно извршење производних активности уз бригу о природи, допринело је настанку концепта зеленог ланца снабдевања. Предмет овог рада односи се на описивање активности ланца у одређеним сегментима, како би се испитали начини помоћу којих се могу постићи задовољавајући*

<sup>1</sup> tamara.stankovic.995@gmail.com, ORCID ID 0000-0003-2719-3765

<sup>2</sup> goran.milovanovic@eknfak.ni.ac.rs, ORCID ID 0000-0002-9758-3606

<sup>3</sup> aleksandra.andjelkovic@eknfak.ni.ac.rs, ORCID ID 0000-0002-7053-1830

*финансијски резултати у комбинацији са еколошким перформансама. Циљ рада је указати на сегменте ланаца снабдевања у којима је могуће имплементирати еколошке активности, еколошку одговорност и унапредити еколошке перформансе. Акцент је, пре свега, на идентификовању мера унутар главних процеса, односно дефинисању еколошких активности и редизајнирању ланаца снабдевања како би се одговорило на захтеве очувања животне средине и еколошки свесних потрошача (купаца) као чланова зелених ланаца снабдевања.*

**Кључне речи:** зелени ланци снабдевања, екологија, одрживи развој, зелене перформансе

## Introduction

Business activities in supply chains are focused towards satisfying the aims of different stakeholders. In order to accomplish superior business performances, it is necessary to implement different concepts, which, from a holistic perspective, create new roles for the members of supply chains. In order to achieve competitiveness, it is important to fulfil more and more sophisticated demands of consumers. Due to this fact, there is a separate segment of activities which represent the efforts of companies focused on sustainability or sustainable development. Green innovations represent one of the demands of consumers, especially of those who are environmentally oriented. On the one hand, there is a large positive association between green innovation and environmental performance, and on the other hand, there is a significant positive relationship between environmental performance and competitive advantage (Khaksar et al., 2016). Sustainable development is currently a source of distinction and of a competitive advantage (Zimon et al., 2019). A very significant segment of this concept refers to the environmental aspect of business activities.

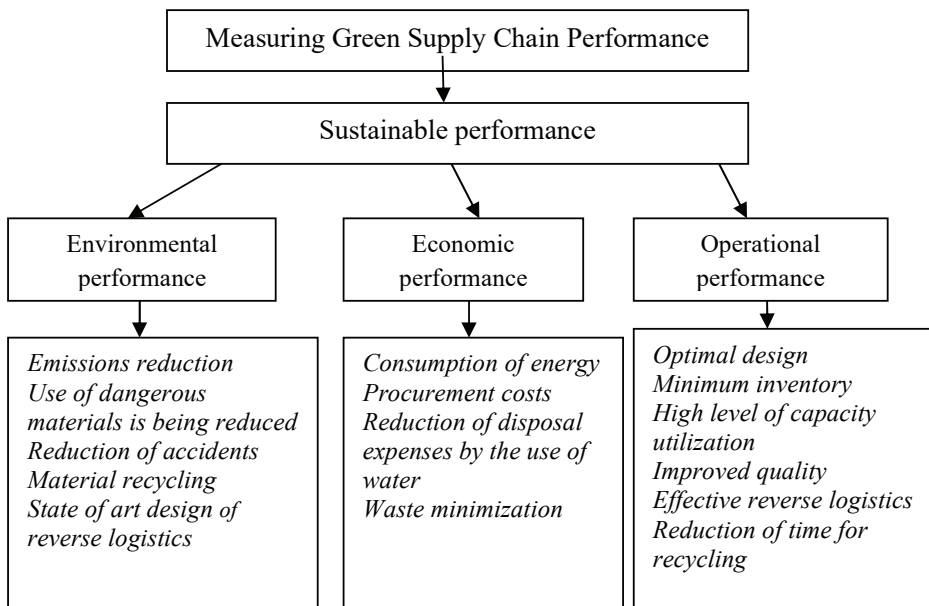
Green supply chains are becoming increasingly important as the environment continues to deteriorate, as evidenced by limited raw material resources, overflowing waste sites and rising pollution levels (Srivastava, 2007). All of the above-mentioned represent problems that managers encounter during the realisation of business activities; therefore, it is necessary to proactively consider the alternatives which will be appropriately implemented within the strategy of the supply chain. This field of research is very appealing because the environmental question is crucial for improving the quality of life. The environmental issues emphasize the importance of incorporating environmental considerations into supply chain design. On the one hand, this is a realistic need for preserving the environment, while on the other, it is a potential opportunity for numerous savings and creating partner relationships with consumers, but also with other members of the supply chains.

## Measuring green supply chain performance

In the late 1990s, academic interest in sustainability began to grow significantly. This increased interest inspired a slew of new research projects focusing on various supply chain activities with significant environmental consequences (Min & Kim, 2012). There

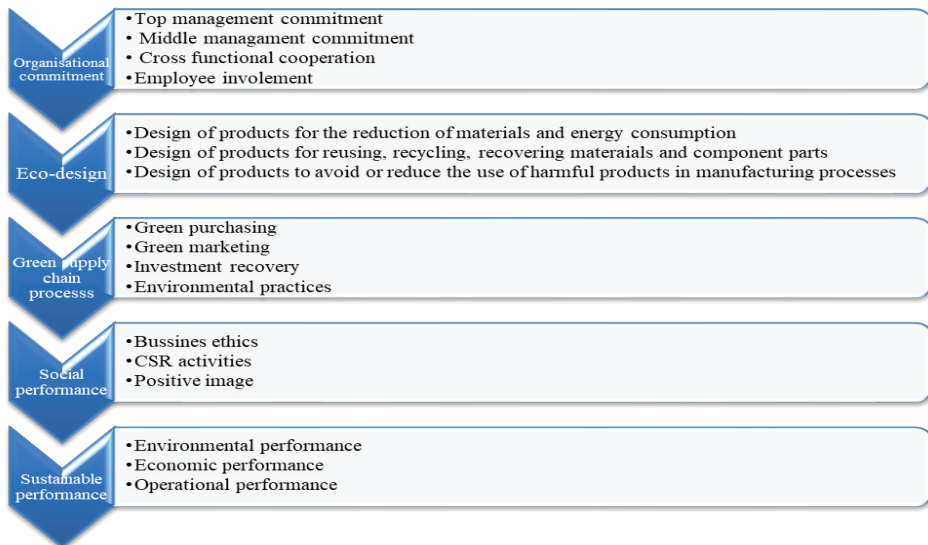
is no universally accepted concept of green and sustainable supply chains (Fahimnia et al., 2015). By using a life cycle approach to product design, material selection, production, sales and recovery, GSCM attempts to maximize overall environmental profit, assisting the firm in realizing its long-term development and improvement goals (Shi Guang et al., 2012). Green chains are characterised by the fact that they implement within them the activities of reverse logistics, which make consumers active participants. Different frameworks for assessing performance have been established, with the goal of first identifying the segments of chains where environmental principles are used, and then, defining quantitative and qualitative indicators to describe these effects. Figure 1 depicts Dey and Cheffi’s proposed framework for measuring environmental performance, which is based on the AHP technique.

Figure 1: AHP method-based framework for monitoring environmental performance



Source: Adapted according to Dey & Cheffi (2012)

In their paper, the authors Dey and Cheffi segmented the performances of green chains by observing them through the perspectives of consumers, the focus company and suppliers. This model provides a wider image of not only environmental performances, but also the application of the sustainability system. With the aim of comparing, the model, proposed by Bhattacharya and his associates and based on the Balanced Scorecard scheme, is shown below.

*Figure 2: Measuring green supply chain performances*

*Source: Adapted according to Bhattacharya et al. (2014)*

The second model, as well, overviews from a wider perspective the significance of environmental principles within the context of sustainable development. The focus of the following section will be directed towards the segments which accomplish environmental business effects. By comparing the aforementioned models, the authors point to the chain segments which contain environmental effects that will be described further in a more detailed analysis.

## Green procurement

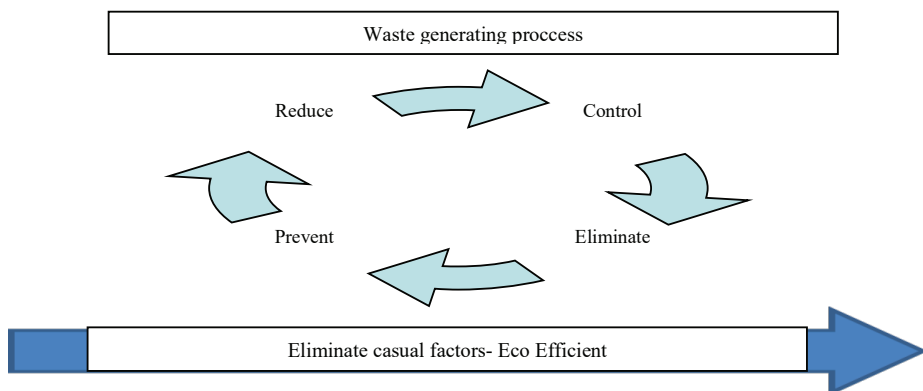
Cost, quality and delivery are the three main considerations in traditional purchasing (Ghosh, 2019). Along with traditional purchasing elements, like product pricing and supplier location, green purchasing methods cover all environmental issues in supply management decisions (Yook et al., 2018). By using these activities, companies tend to apply in the beginning green standards in the *upstream* segment of the chains, while these standards will be used in other segments of the business for the formation of superior performances. Environmental considerations are integrated into purchasing policies, programs and actions (Fang et al., 2020). The activities which the company most often performs in order to make this segment green are related to the use of environmental materials, primarily those whose implementation in the production process creates a smaller amount of waste. The company needs to pay special attention to toxic gases and hazardous materials which come as a consequence of the procurement process. Green purchasing strategies limit waste generation and stimulate recycling and reuse activities while having no negative impact on the company's performance (Khan

et al., 2017). The model of used transportation should be taken into account, as well as other segments which will be further analysed in detail.

## Green production and eco-packaging

Production and its activities play an important part in designing green supply chains. Paul, Bhole and Chaudhari believe that the term *green* is used too often today, thus its role has lost its meaning. What environmental production is or is not should be carefully analysed, as well as the way in which these activities are performed. While e-waste is the most pressing issue in today's world, green technology is the use of one or more environmental sciences, green chemistry, environmental monitoring, and electronic devices to monitor, model, and conserve the natural environment and resources, as well as to mitigate the negative effects of human activity (Paul, Bhole, & Chaudhari, 2014). Environmental activities of supply chains are reflected in such production processes which lead to the least possible amount of different types of waste, which refers to the *outbound* systems of logistics in chains. Figure 3 shows which activities are involved in achieving environmental effects in production.

Figure 3: Green production and waste



Source: Adapted according to Deif (2011)

Green production should be observed as an opportunity to achieve a bigger competitive advantage, because it can help producers to differentiate themselves from the competition. The accomplished savings through reduction, control, elimination and prevention of waste, will create the space for differentiating at the chain level. The use of renewable energy sources, the reduction of dangerous materials, the management of poisonous gases, and, above all, the application of green technology are the major tasks carried out within the corporate operation. The aforementioned activities refer to the inbound segment in the supply chains. The design of the inbound segment of business activities is closely related to the lean systems whose application leads to optimal environmental effects. According to a study conducted by Diaz-Elsayed et al. (2013), the deployment of tailored lean and green techniques resulted in a decrease of roughly 10.8% of part production costs in an automotive industry (Gandhi et al., 2018).

Packaging can have a very active role in the achievement of a competitive advantage. Furthermore, packaging can significantly contribute to environmental preservation and the development of long-term relationships with customers. While analysing the role of packaging, there are different aspects of observation that need to be pointed out. Logistics concerns include packaging unit size and ease of handling, whereas marketing concerns include package color and labeling (Madhani, 2017). By introducing the concept of green supply chains, packaging also receives a completely new role. Besides its logistics and market related role, packaging becomes the means of the implementation of environmental principles. The term eco-packaging has been coined for this purpose. The attitudes of consumers are analysed through one research, and the conclusions are as follows. The environment-friendly container option (recyclable-labeled carton package) was clearly chosen by the respondents, but non-recyclable plastic packages had negative utility estimations (Magnier & Crie, 2015). Such preferences by consumers are significant because the participants of chains, and thus the creators of business practices have to take into account the demands of their clients. The comparison of traditional and eco-packaging indicates the occurrence of additional participants who are in charge of collecting packages and reusing them within the activities of managing eco-packaging. The two main functions are achieved by the principles of 4R1D, which stands for reduce, reuse, reclaim, recycle and degradable (Zhanga & Zhao, 2012). The main goals of such a positioned chain are connected with the previously mentioned activities. It is necessary to reduce the amount of waste which occur as the result of processes within chains. It is important to implement the policies of reusing certain resources, and also within these activities, returning flows which would make potential resources return to producers. All the activities serve the function of constructing recycling systems and using degradable materials. The application of the aforementioned principles enables the creation of coherent systems which could be used for the implementation of the apparently conflicting goals.

## **Green transportation and warehousing**

Transportation services are an integral part of almost every segment of a supply chain, referring to transportation among its members or to the one within a single company. Using any type of transportation leads to negative environmental consequences; however, due to its necessity, it represents an inevitable business activity. The negative consequences refer primarily to the emission of CO<sub>2</sub> and the negative effects have taken a global scale. The term "green transportation" refers to the use of a low-polluting fuel as the source of energy in order to create a multi-transportation and allocation method (Jumadi & Zailani, 2010). Besides the choice of appropriate fuel, it is necessary to take care of the appropriate model of transportation, as well as the routes, thus saving on both time and financial aspects. The type of transportation also plays a significant part. The vehicle routing and scheduling problem (VRSP) was developed by Dantzig and Ramser and it has been well studied and many different solution algorithms, which include exact, heuristic and metaheuristic approaches that have been developed (Salimifard et al., 2012). The Emissions Vehicle Routing Problem (EVRP) is defined as follows: "The main goal or portion of the generalized cost function is to reduce pollutants and fuel consumption" (Toro et al., 2016).

One of the most important aspects of in-house and outbound logistics and distribution is warehousing (Agyabeng-Mensah et al., 2020). Besides the fact that a warehouse represents the place for storing products and semi-products, its role is also reflected in adding value. Special functions of warehouses enable adding value to products. The products which leave a warehouse are more valuable to consumers due to the special storing conditions in the warehouse. In a warehouse, there are numerous elements that can be implemented, but in general, any feature that decreases energy consumption or material usage/waste is a greening element (Đukić et al., 2010). The following are some of the elements that are frequently cited in literature and also applied in practical examples: (Đukić et al., 2010):

- utilizing a paperless warehouse management system,
- utilizing energy efficient lighting,
- utilizing sensor doors,
- utilizing wind turbines or solar energy,
- utilizing ventilators to suppress hot air,
- utilizing lighting sensors,
- utilizing better insulation,
- utilizing the equipment which emits lower levels of carbon,
- utilizing returnable equipment, using improved equipment intended for warehouses.

Eliminating paper documents in warehouses refers to the implementation of automated systems for tracking the merchandise within a warehouse. The eco-packages which can be reused and efficiently recycled should also be applied here. The use of materials which are less polluting for the environment is crucial for, primarily, raising awareness about ecology. The use of adequate lighting in a warehouse is very significant. Lighting is often used in the processes of adding value, and the expenses which are generated during this occasion are high. That is why the use of lighting is recommended only when it is necessary. The sensors which recognise the need for lighting are used for this purpose, and when there is no need, the lighting is turned off. The use of adequate construction materials certainly improves insulation, which prevents unnecessary energy consumption. A significant role is given to the use of adequate operating equipment depending on the type of the warehouse. Workers in fully automated warehouses utilize forklifts and cranes that follow a predetermined route, saving fuel and time and, as a result, improving supply chain performance.

## Conclusion

Green supply chains enable the implementation of environmental activities. In order for supply chains to achieve their performances, both financial and environmental, it is necessary to find new ways of performing basic functions such as procurement, production, transportation and warehousing. The domain of greening refers mostly to logistical activities which create a balance between the demands of consumers, on the one hand, and the fulfilment of environmental standards, on the other. Waste and harmful chemicals can be reduced by making better use of inputs and operating with them in



different spatial and transport units. There is a constant need in science to find new methods which would make it possible for supply chains to operate in accordance with the environmental requirements to a large extent.

The application of environmental activities in chains is a necessity facing every company, because simultaneously with the excessive and uncontrolled consumption of resources they become scarcer. This imposes the need for questioning the existing strategies in search of already scarce and depleted resources. Moreover, science is focused on the creation of new materials which will replace the existing conventional ones, and in that sense, provide a priori the application of environmental standards.

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