M I S C E L L A N E A

DAGMARA K. ZUZEK*, BARTOSZ MICKIEWICZ**

Sustainable Development: A Challenge for Logistics Processes in Modern Enterprises[1]

Introduction

Adopting sustainable logistics solutions stems from the need to apply sustainable development concept not only in the enterprise but also in its environment. Taking into consideration economic, environmental, and social aspects of business activities may contribute to improving the competitiveness of enterprises.

Sustainable development requires a full understanding of the environment since the latter is the fundamental element as well as the setting in which we conduct economic activities. Without understanding the environment, it is impossible to achieve the primary goal of sustainable development (Zuzek 2007).

Sustainable development issues play an increasingly important role also in logistics, where it is assumed that individual links of the supply chain are involved in creating an added value, which is not limited to the value obtained by the participants in the process but also contributes to a common good for present and future generations. For the implementation of the concept principles, we should reflect on the actual method of influencing the individual logistical links so that the offered products and services meet certain social or environmental criteria (Rudnicka 2011).

The paper's objective is to identify the areas of logistics where the idea of sustainable development in enterprises can be applied, as well as compiling a list of such areas where it is used most frequently. The paper also presents general principles of the concept of sustainable development in logistics activities, with particular attention paid to environmental logistical aspects.

The paper presents a review of relevant concepts and confirms the opinions of other authors. The paper uses the methods of synthesis, analysis, deduction, and induction. Based on data gathered from the literature, the authors summarised the most important results of the analysed studies. The authors conducted their own empirical study in 2015, based on a sample of 150 enterprises. Statistical analysis used Kruskal–Wallis rank analysis and gamma coefficient rank correlation.

* Dr Dagmara K. Zuzek – Hugon Kołłątaj University of Agriculture in Kraków; e-mail: d.zuzek@ur.krakow.pl

** Prof. Dr hab. Bartosz Mickiewicz – West Pomeranian University of Technology Szczecin; e-mail: Bartosz.Mickiewicz@zut.edu.pl

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1. The concept of sustainable development

Sustainable economic development combines objectives related to environmental protection and economics. One of the basic principles which integrated development should be based on is the principle of sustainable development. The principle was borne from the need for economic processes to include the interests of present and future generations, especially with regard to preserving natural environment and its resources. The European Union, in the wake of the Earth Summit in Rio de Janeiro in 1992 and adopting Agenda 21, formally adopted this principle as binding in all areas of economic and social life. This was reflected in the Treaty on the European Union of 1992, the Strategy for Sustainable Development of 1994, the Cork Declaration (1997), the Treaty of Amsterdam (1997), and Agenda 2000 (Bryden, Shuckstnith 2000).

In 1987, the World Commission on Environment and Development (Brundtland Report) concluded that the key feature of the concept of sustainable development is "development which meets the needs of the present without compromising the ability of future generations to meet their own needs". This principle became the constitutional norm of Poland's economic development, which is binding for all areas of economy and all levels of strategic development planning. The implementation of this principle depends on specific conditions and developmental factors, the level of achieved development, and development objectives. Since it is multi-disciplinary, its interpretation is to some extent dependent on whether it is conducted by environmentalists, economists, or representatives of social sciences. It is often believed that the term 'sustainable development' was created as a mediating term designed to bridge the gap between developers and environmentalists (Bryden, Shuckstnith 2000). Initially, the environmentalist, ecocentric point of view developed the most dynamically; therefore frequently the concepts of ecodevelopment are treated as interchangeable with the concept of sustainable development. In this concept, economists emphasise mainly the sustainability and durability of development. An anthropocentric view reveals, along with economic aspects, the problem of 'sustainability of rural communities', maintaining traditions and cultural heritage. The anthropocentric approach, unlike the ethnocentric one, assumes that the environment is to some extent subordinate to human (social and economic) needs. Regardless of the point of focus, the two approaches emphasise the need for an integrated treatment of development issues.

The classical definition of the term from the Brundtland Report draws attention to 'human needs' and 'social equality' with regard to access to the benefits of the natural environment for present and future generations. Due to the great diversity of habitats, economic development levels, and organisation of societies, there are no uniform, repeatable conditions and forms of sustainable development. Sustainability and durability of human needs must therefore refer to specific environmental and economic conditions, in a longer timeframe. A more comprehensive approach to the concept of sustainable development draws attention to the need to consider (Adamowicz 2004):

1) the principle of intergenerational equity,
2) the principle of social justice (intragenerational equity),
3) the principle of transboundary responsibility.

The first two principles are included in the Brundtland definition, while the third refers both to international issues and to transboundary responsibility on different levels: global, regional, and local, and should be considered from different viewpoints: environmental, economic, social, political, ethical etc.

The principle of rational management in the natural environment should facilitate the implementation of economic and social objectives, while adhering to cultural, eth-

ical, and spatial values. Expanding the concept of sustainable development may be the basis for transforming a traditional, three-dimensional model of sustainable development (economic, environmental, social development) into a six-dimensional model, in which the previous three are joined by the new dimensions of technological, spatial, and ethical development.

The economic dimension of sustainable development must be based on the assumption that the other two elements will not slow down progress but will rather stimulate it through technological advancement, improving education, and increasing the society's participation in decision-making and responsibility for these decisions, creating new workplaces, improving activity and entrepreneurship, and increasing the effectiveness of using resources, materials, and human labour, as well as improving safety (Zuzek 2007).

The recent decades have shown that the private and microeconomic understanding of the rationality of economic activity is not aligned with the criteria of general social (global) rationality. Farming according to the narrowly defined principle of rationality, from the viewpoint of the economic interest of a single producer – i.e. maximising profit, has had many harmful consequences. As a result, there are more and more voices calling for embracing the concept of sustainable development in agriculture (Runowski 2002).

From a wider perspective, sustainable development also refers to conducting the development policy in such a manner as to ensure the durability of social, economic, and cultural structures in the long term. Sustainable development is connected with the concept of multi-functionality, shaping the conditions for varied economic activities conducted with respect for environmental aspects, development of social and cultural functions, and ensuring good standards of living for the population.

The three-dimensional model of sustainable development is widespread in the literature[2] (Figure 1). More and more frequently, the institutional dimension is also added, along with the spatial, moral, and awareness ones (Dresler 2006). The three-dimensional model is also analysed as a concept of sustainable development taking into account a set of objectives which can be treated as planes for specifying environmental, economic, and social objectives. The implementation of the idea of sustainable development depends on specific conditions and developmental factors, the level of development and developmental objectives.

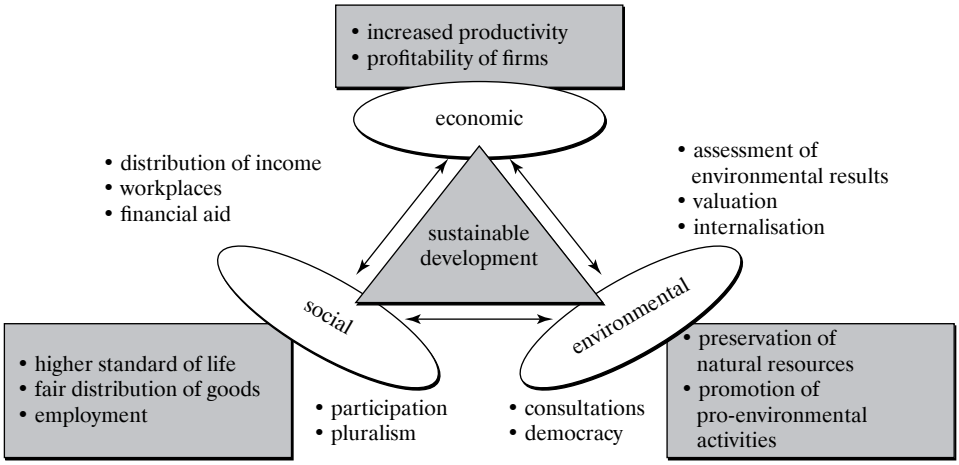
In the literature, the term sustainable development is used interchangeably with the term environmental development. However, sustainable development is a more complex term which includes such quantitative and qualitative changes in the socio-economic relations that take into account some systemic limitations. This concept, apart from the environmental component, is also society-oriented and reflects the problems and interests of a given community. This means that one of its main focuses, along with maintaining and ensuring the durability of natural resources, is the proper use of social and institutional resources (Paluch 2013b).

Balancing human needs must therefore consider not only specific environmental, economic, and social conditions, but also institutional and spatial systems in the long term. A more comprehensive approach to the concept of sustainable development (Maughton, Hunter 1994) pays attention to the need to consider the principles of:
– intergenerational equity,
– social justice,

[2] It can be found in the publications of authors such as: Borys (1999); Poskrobko (1998); Dresler (2006); Zegar (2003); Górka (2007); Paluch (2013a, 2013b, 2013c).

Figure 1

Traditional view of sustainable development



Source: Paluch (2013b).

– integrated approach to environmental protection and economic development,
– public participation.

Although the concept of sustainable development is a popular one, it does not have a single interpretation. Below are some examples of interpretations, which treat it as:

– socio-economic development which involves a process of integrating political, economic, and social activities while maintaining an environmental balance and durability of the basic environmental processes in order to guarantee that the basic needs of communities or citizens, both from present and future generations, can be satisfied (Płaczek, Szołtysek 2007);
– farming which is environmentally allowable, socially desirable, and economically viable (Hopfer 1992);
– conducting all economic activity in harmony with nature in a way that does not cause irreversible changes in living nature (Zaufal 1986);
– such manner of exploiting natural resources, executing investments, and creating techniques and technology which will build up the economic, environmental, and social bases for meeting the needs of present and future generations (Dubiel 1998);
– all activities which, while improving the human living conditions on Earth, do not lead to the degradation of the natural environment (Kozłowski 1985).

2. Sustainable development in logistics

Logistics activities enable enterprises to generate specific economic benefits, but they can also have a negative impact on the natural environment. Therefore, it is necessary to estimate the costs of the benefits, which are incurred during the process of making decisions with regard to logistics processes. Enterprises which want to stay competitive increasingly frequently introduce the idea of sustainable development into the area of logistics. They therefore search for innovative and modern solutions which would enable them to limit

the harmful impact on the environment and the setting in which they operate, as well as use resources more effectively, which would prevent the production of pollution. All these aspects force enterprises to use such logistics solutions that will be relatively less inconvenient for the environment in comparison to the enterprises they compete against. This means that entrepreneurs are becoming more aware of how to implement logistics processes without harming the natural environment.

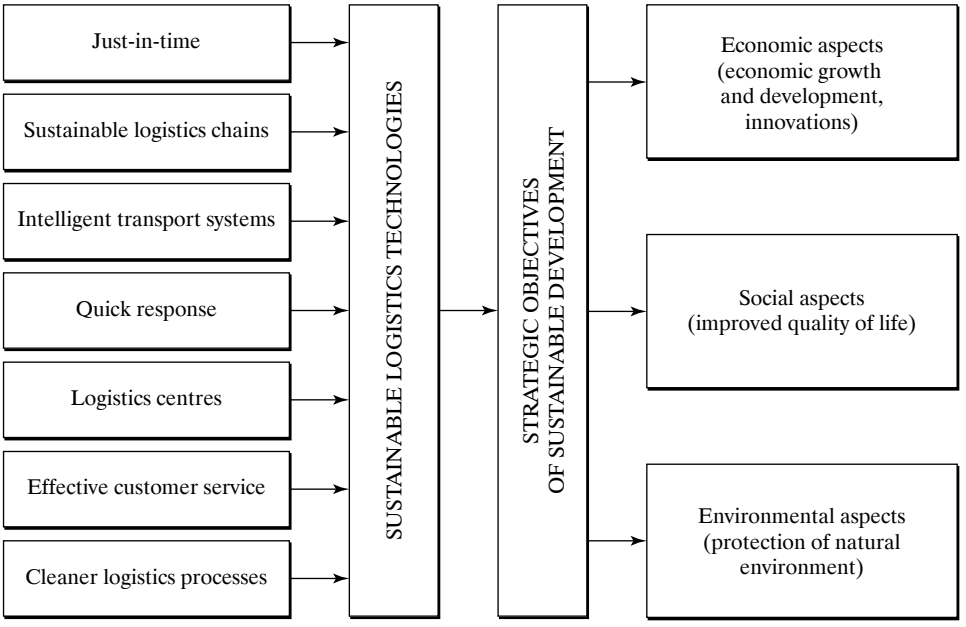
Environmentally-friendly technologies are not perceived as separate technologies, but as complex systems which include know-how, practices, procedures, goods, services, devices, and even techniques and standards of management organisation (Urbaniak 2007).

The scope of the term 'environmental technologies' is, therefore, broad. Including environmental media and stages of lifecycle of products, we can break down environmental technologies into the following thematic areas (Kurpanek, Skowrońska 2006):

– obtaining natural resources,
– protecting soil, water, and air,
– preventing global climate changes,
– sustainable logistics systems,
– sustainable production,
– sustainable waste management,
– sustainable consumption.

The areas of logistics technologies whose purpose is to popularise and support activities related to sustainable development are shown in Figure 2.

Figure 2
Sustainable logistics technologies



Source: author's analysis on the basis of Janikowski (2006).

Just-in-Time (JIT) is a method in which production is strictly adjusted to the available reserves and time. It is a system in which production planning begins at the final assembly line and goes backwards, including the individual production processes of the manufac-

turer and the processes implemented by sellers and subcontractors supplying materials and components (Lysons 2004).

Sustainable logistics chains are processes in which the used resources are environmentally friendly, and the manufactured products are utilised and recycled after exploitation. In this way, there is a balance in the chain, which ensures the possibility of utilising the manufactured product and consequently prolonging its lifecycle (Brdulak, Michniewska 2009).

Intelligent transport systems (ITS) are systems which comprise a wide array of technologies as well as management techniques used in transport in order to increase the safety of road users, improving the efficiency of the transport system, and protecting natural resources (GEFCO Polska 2008).

Quick response (QR) is a concept emphasising the quickest possible recognition and satisfaction of the real demand for so-called final products and integrating it with tools of the electronic economy; it helps to make decisions and undertake activities that enable a compressed duration of production and distribution processes (Rudnicka 2011).

Clean logistics processes consist in manufacturing environmentally friendly products so that logistics processes implemented during delivery chains are cheaper and the effects of these processes are more attractive for customers. For customers, this means a dual role: as shippers of the firm's goods and as providers of recycled resources. In the implementation of clean logistics processes, planning the 'lifetime' of a product or service takes on a new meaning and becomes a requirement of sustainable development (*Prawo ochrony* środowiska… 2001).

Enterprises also attach much importance to creating sustainable products manufactured as a result of sustainable production methods and more environmentally friendly and public-spirited in comparison to traditional production processes at every stage of the product lifecycle. Regardless of what motivates enterprises to adopt such initiatives, logistics activities are more and more often oriented towards conscious decision-making with regard to production or transport, which takes account of environmental and social aspects as well as making a profit.

Table 1 presents a concise characteristics of sustainable supply chains in small and medium-sized enterprises.

The starting point for a sustainable supply chain should be thorough knowledge about its potential and limitations. Mapping out the supply chain, we should consider (Sisco et al. 2010):

1) the main products and services, firms which have the biggest share in production, and factors critical for business operations;

2) the flow of materials and information, including a map of relations with suppliers and other participants in the chain, places where raw materials are extracted, etc.;

3) information about human rights, labour law, environmental protection, discrimination, and corruption; an analysis of social and environmental risks in each link of the supply chain.

The benefits resulting from adopting and applying the principle of sustainable development may vary depending on the decisions made by entrepreneurs, which enable them to gain a better competitive position. This follows from the fact that environmental awareness of entrepreneurs increases and protection of the natural environment and its resources is becoming an integral part of logistics strategies in enterprises.

The logistics activity of enterprises has many negative results for the environment, including air pollution, noise, waste production, accidents, and contribution to global warming. In the European Union, the transport of cargo is the source of almost 54% of

Table 1

Sustainable supply chains in small and medium-sized enterprises

Economic aspects	Environmental aspects	Social aspects
Financial condition of contractors	Product lifecycle control	Complying with legal norms and regulations
Dependence on other economic entities	Reduction of pollution emission	Supporting local communities
Pricing policy	Rational use of natural resources	Implementing social policy
Growth of local markets	Rational waste management	Safety at work
Gaining competitive advantage	Energy efficiency and rationality	Counteracting discrimination
Strengthening cooperation between suppliers	Information about origin, composition, and environmental impact	
	Use of more environmentally friendly raw materials	

Source: author's analysis on the basis of: *Unchaining Value Innovative Approaches…* (2008), *How to Manage…* (2009), GEFCO Polska (2008), Ćwik (2011).

the total emission of nitrogen oxide, 45% of carbon monoxide, and 23% of non-methane volatile organic compounds. It is also responsible for over 41% of the emission of precursors of tropospheric ozone, 23% of carbon dioxide, and almost 20% of other greenhouse gases (Badyda 2010).

The social consequences of the logistics activity of firms can be reflected in three main areas: production, transport, and storing. The social consequences of production may be related to employment policy, cooperation with suppliers, and pay policy. The social consequences of transport mainly include extending working time, low pay, and the social cost of accidents. The social consequences of storing may take the form of discriminating employees, a lack of training, or a lack of the necessary equipment for employees, etc. At the same time, firms which implement innovative logistics solutions should be aware that applying the principles of sustainable development may contribute to (Hopwood, Unerman, Fries 2010):

– keeping customers who are socially and environmentally aware;
– gaining a competitive advantage as a result of innovative products;
– attracting and retaining qualified employees who show concern about sustainable development;
– improving efficiency by reducing the use of energy;
– keeping the operating licence;
– encouraging investors to look for sustainable organisations;
– maintaining a good reputation and image of the enterprise's brand.

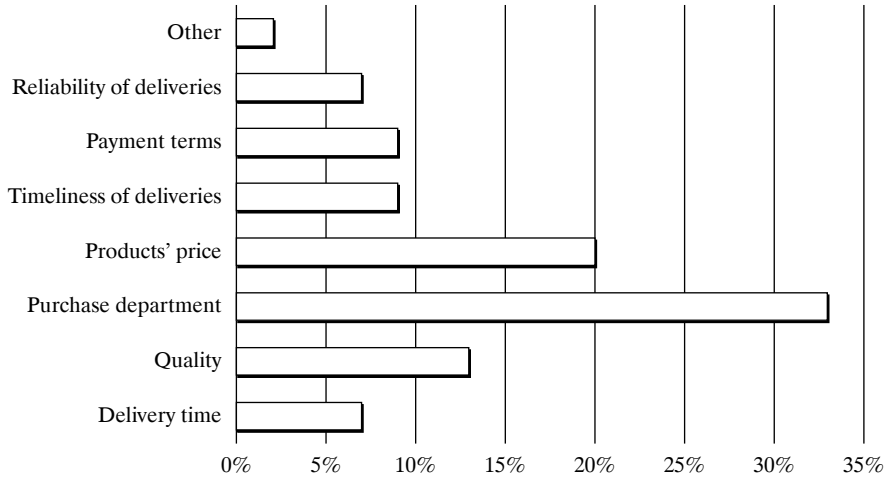
3. Sustainable logistics in the enterprise – research study results

The aim of the actions undertaken by enterprises within the framework of sustainable logistics is to create, protect and develop economic, social and environmental value for all participants involved in this process. Therefore, ultimately, evaluation criteria for the processes supporting sustainable logistics should fall into one of three categories – economic, environmental or social one.

In terms of economic aspects, the most significant role, according to respondents, is fulfilled by a purchasing department as it is involved in costs reduction, which makes the choice of a supplier by an entrepreneur a crucial element in the process of purchase management. Approximately 33% of the respondents indicated this factor. This was followed by product price (20%) and payment terms (9%). The criterion necessary to meet on the increasingly competitive market is supplying products and services with the required quality. Quality, similarly as price, is one of the criteria most frequently applied to evaluate a supplier (Figure 3).

Figure 3

Sustainable logistics in economic terms according to respondents



Source: Author's own study.

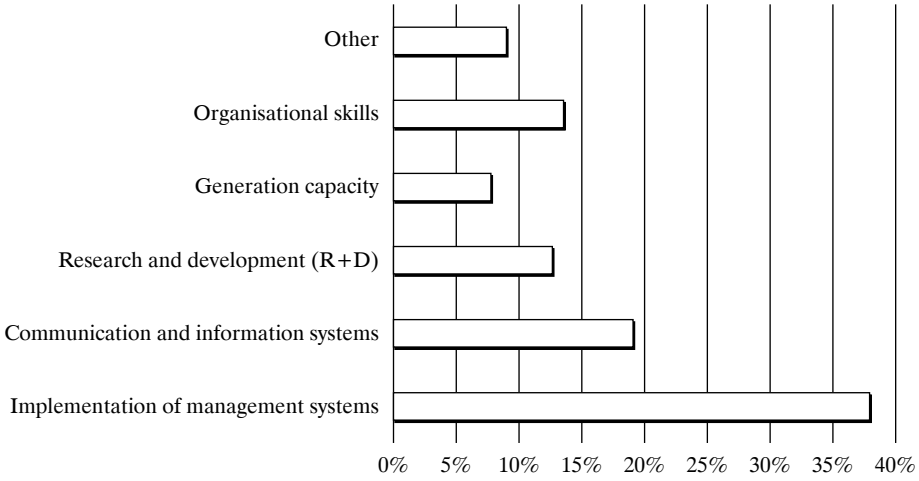
One of the essential aspects of the study is the evaluation of logistics functioning, including all significant actions from the moment of order placement to the moment of physical delivery of the product at the required place. In this category of actions undertaken by entrepreneurs there are such factors as delivery time, timeliness of deliveries or time of introducing new products to the market.

Enterprises, particularly from the sector of small and medium-sized enterprises (SMEs), have their own technological resources, whose strategic value is diversified and it contributes to the strategic potential value of those companies. In this respect, the entrepreneurs involved in the study most frequently indicated that the most significant

are: communication and information systems (19%), actions within the framework of research and development (R+D) – 13% or generation capacity – about 8%. One of the frequently applied criteria when evaluating logistics processes includes management and organizational skills as well as implemented management systems. These factors indicate the supplier's ability to ensure the required quality and delivery of the appropriate amount of materials in due time (Figure 4).

Figure 4

The evaluation of logistics functioning according to respondents



Source: Author's own study.

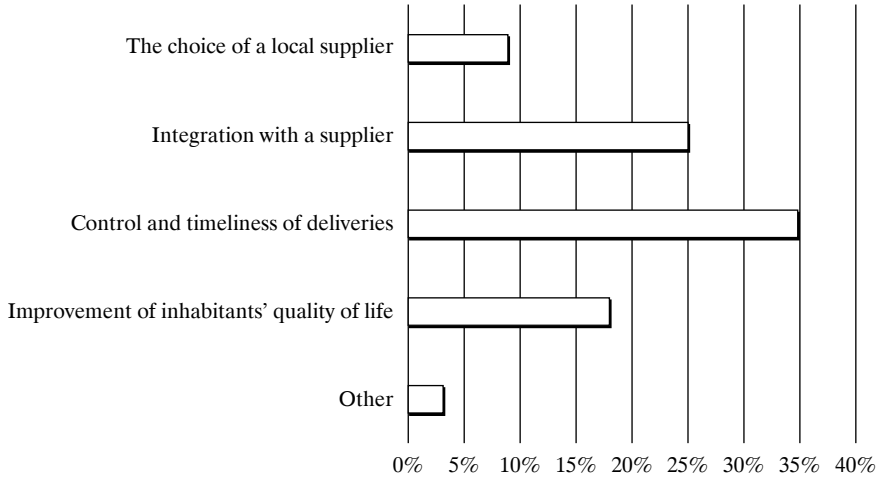
Financial situation constitutes another criterion essential for enterprises when evaluating logistics processes. It is particularly important for small and medium-sized enterprises, which are financed mainly from own funds. In the case of a supplier, whose financial situation is not stable, there is a threat of disruptions in a regular long-term service. The lack of financial liquidity of a supplier becomes the main problem and the source of disruptions in the supply chain functioning.

Social aspects are equally significant for sustainable logistics processes. The choice of a supplier, evaluation, choice, control and audit were much more important than integration with a supplier (Figure 5). On the integrated EU market international organisations are increasingly important as they have a substantial bargaining power in the supply chain due to supply and demand control, which significantly hinders small and medium enterprises to function on the EU market. However, on account of their role in the supply chain, they are obliged not only to control the date and term of delivery but also to influence the improvement of natural environment as well as the enhancement of social conditions in the remaining parts of the managed supply chain.

Entrepreneurs also indicated environmental criteria, which were divided into ecological aspects concerning products and those related to a supplier. Typical criteria related to products included limitations in the prohibited substances used in a product, recycling or packaging recycling (Figure 6).

Figure 5

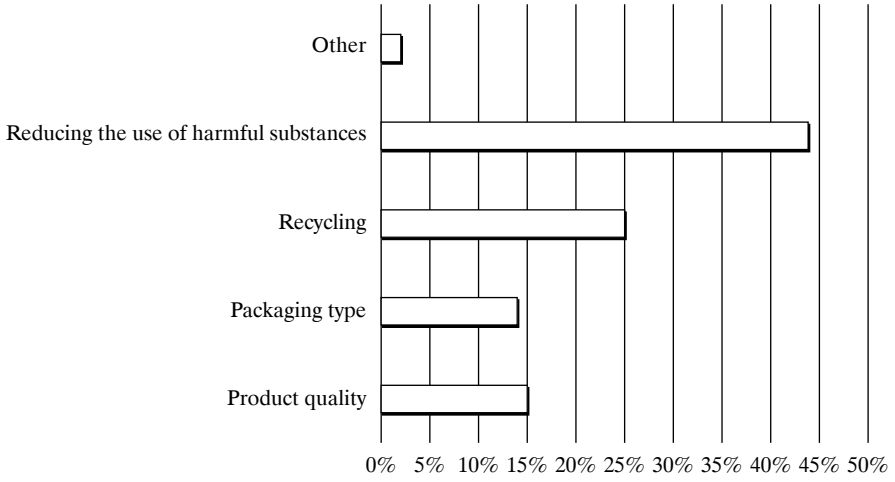
Social aspects of sustainable logistics processes



Source: Author's own study.

Figure 6

Ecological aspects related to a product

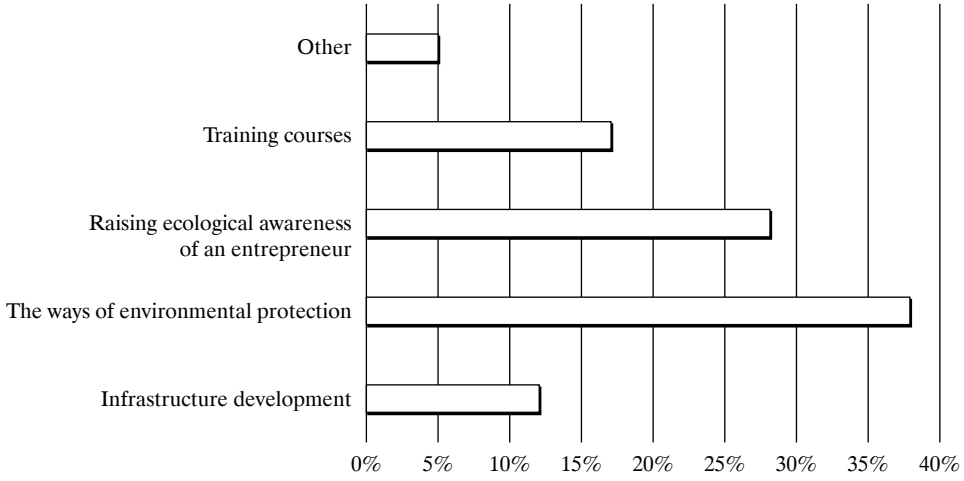


Source: Author's own study.

As regards environmental criteria analysed in the research study, and which are related to the enterprise, respondents indicated mainly training courses for employees that are supposed to raise the awareness of the need and ways of environmental protection. In turn, the use of ecological technologies and reduction of resources usage constitute the criteria, which are linked to a product (Figure 7).

Figure 7

Ecological logistics aspects related to the enterprise



Source: Author's own study.

Conclusions

Knowing the standards of logistics processes in enterprises contributes to increased competitiveness of these firms by way of improvements and innovations of such processes. In order to employ these processes, modern technological and organisational solutions are needed, which operate on the principles of sustainable development. Choosing such an approach requires reconciling economic, social, and environmental aspects.

To recap, we can conclude that sustainable logistics processes which are employed by enterprises are mainly activities which result from entrepreneurs' increasing environmental awareness and understanding of needs, which take these aspects into account. They should follow from objectives related to rational and effective resource management. The social aspects related to work safety or complying with legal norms and regulations are also important. Sustainable logistics means not only meeting the requirements imposed by regulations but, most importantly, the direction of development of each enterprise that wants to compete on the local or European market in a responsible way.

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ZRÓWNOWAŻONY ROZWÓJ – WYZWANIEM DLA PROCESÓW LOGISTYCZNYCH W NOWOCZESNYCH PRZEDSIĘBIORSTWACH

Streszczenie

Dążenie do zrównoważonego podejścia w rozwiązaniach logistycznych wymaga wielu wyzwań i współpracy pomiędzy wszystkimi elementami tego procesu, gdyż wymaga pogodzenia wielu ekonomicznych, społecznych i ekologicznych celów. W artykule przedstawiono ogólne założenia idei zrównoważonego rozwoju odniesionego do działalności logistycznej przedsiębiorstw. Wskazano także elementy technologii logistycznych sprzyjających szerzeniu tej koncepcji oraz czynniki zrównoważonych łańcuchów dostaw w przedsiębiorstwach z uwzględnieniem ekonomicznych, społecznych i środowiskowych aspektów.

Słowa kluczowe: logistyka, zrównoważony rozwój, małe i średnie przedsiębiorstwa

SUSTAINABLE DEVELOPMENT: A CHALLENGE FOR LOGISTICS PROCESSES IN MODERN ENTERPRISES

Summary

Choosing a sustainable approach to logistics solutions requires meeting many challenges and cooperation between all the elements of this process, since it necessitates reconciling many economic, social, and environmental objectives. The paper shows the general principles of the idea of sustainable development in relation to enterprises' logistics activities. It also points out the elements of logistics technologies which facilitate the popularisation of this concept and factors of sustainable chain supplies in enterprises which take account of economic, social, and environmental aspects.

Key words: logistics, sustainable development, small and medium-sized enterprises

СБАЛАНСИРОВАННОЕ РАЗВИТИЕ КАК ВЫЗОВ ДЛЯ ЛОГИСТИЧЕСКИХ ПРОЦЕССОВ В СОВРЕМЕННЫХ ПРЕДПРИЯТИЯХ

Резюме

Стремление к сбалансированному подходу при решении логистических задач требует многостороннего анализа и сотрудничества между всеми участниками этого процесса, т.к. должно учитывать множество экономических, социальных и экологических целей. В статье представлены общие положения идеи сбалансированного развития в отношении логистической деятельности предприятий. Перечислены также элементы логистической технологии, помогающие распространять эту концепцию и факторы сбалансированных цепей поставок на предприятиях с учетом экономических, общественных и экологических аспектов.

Ключевые слова: логистика, сбалансированное развитие, малые и средние предприятия