SUPPLY CHAIN SECURITY IN ENVIRONMENTAL PROTECTION

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Abstract: Market entities promoting ecological logistics adapt to legal changes taking place in Europe, seeing such action as an opportunity to build new and strengthen existing relationships with consumers. The basics of the concept of responsible business, which emphasizes reducing energy consumption in favor of clean production, limiting emissions of production pollutants, reducing CO2 emissions in transport activities, on the one hand, are to translate into lower costs, improved competitive position on the market and building relationships with customers, on the other hand, they cause challenges in which economic efficiency is a key factor. The aim of the article is to analyze the impact of the green business concept on the security of supply of logistic chains.

Keywords: economics, supply chain, ecology, electromobility

Introduction.

A strategic approach to organizational management in accordance with the green business concept is mainly the domain of large enterprises in Poland, but many activities are undertaken to popularize this concept also in the sector of small and medium-sized entities. Many studies and reports show that most consumers expect entrepreneurs to take pro-ecological actions. This has an impact on the costs of running a business. The implementation of social responsibility activities in business influences positive relations between the employer and employees, between the enterprise and society and understood here as the organization's environment. Because consumers would like to know more and expect reliable and honest communication from organizations about products and activities. Most respondents expect that companies will undertake CSR activities for society and the environment.

Entrepreneurs expect that their actions translate into improved reputation and purchase declarations of potential consumers.

The concepts of green management or pro-ecological management were introduced into common language. Such a trend may change the business profile of a company that has so far focused only on economic factors and economic growth, ignoring the damage it has generated for the environment and the local community. Green supply chain management considering the concepts of socially responsible business can increase the efficiency of resource use in the enterprise, which in principle leads to economic efficiency. Introducing new and ecological solutions at individual stages of the supply chain, while respecting the impact on the broadly understood environment, may be the key to success and a source of long-term benefits.

The aim of the article is to analyze the impact of pro-ecological attitudes, forced by changes in law, on the efficiency and security of supplies in logistic chains using secondary data based on expert forecasts and descriptive statistics analyses.

Market versus green management.

Green management is gaining interest and expanding to include new entities on the market, and sometimes becomes an important part of the organization's operating strategy. Entrepreneurs see the path proposed by the European Union, which forces restrictions on the use of fossil fuels in favor of green energy, both in production and transport processes. The entire economy faces a huge challenge to meet legal requirements without compromising its resources and the ability to maintain its offer (especially in terms of the price of the goods offered). Until recently, only two out of ten surveyed entrepreneurs had heard of the concept of green management [Millward]. Currently, there is no entrepreneur who has not wondered how to implement the above-mentioned solutions into the development strategy of his company. Colloquially, green management means that the company voluntarily considers social and ecological interests [Porada-Rachon, pp. 5]. Therefore, environmental protection issues in business activities must be considered in the company's activities. This is a concept thanks to which an organization, focused mainly on profit, considers social interests and maintaining environmental balance in its strategy [4, pp.16]. Currently, we should be sure that green management is perceived as a necessary factor in building the competitive advantage of enterprises. We can talk about the modern understanding of the concept of social responsibility in business since Howard Bowen argued that social responsibility is *the obligation of managers to pursue such policies, make such decisions and set such directions of business activities that will be consistent with the goals and values of our society* [8, pp. 11]. Like every theory, this one also has its opponents. Noteworthy here is the position of Milton Friedman, who was based on the belief that the most important goal of a company

should be to increase profits, especially in the perspective of shareholders' expectations in the realities of a free market based on consumer goods. Therefore, activities should be focused solely on the implementation of economic assumptions, and not on environmental and socially moral activities.

Although I have no doubts about the principle that every market entity should apply transparent business practices (respect for the law, ethics, etc.), opinions are divided regarding the use of practices based on respect for the environment. This is indicated by the differences in the views of Bowen and Friedman. Fortunately for the environment, the market does not like a vacuum, and the changing expectations of buyers will make it necessary to adapt the activities of enterprises to pro-ecological solutions. Therefore, in addition to carrying out tasks strictly related to profit-oriented business activities, market entities become responsible for their entire impact on people and the environment. Participants of the market game (employees, customers, business partners, investors, suppliers, retailers, etc.) will expect ecologically oriented actions. For the last decade, we have seen the boundaries between economies blur, and technological development has never progressed so quickly. Thus, the flow of information about the world and access to information about the strategies implemented by entities reach potential consumers almost in real time. That is why a responsible company development strategy is so important, as it will make the environment aware that the company's policy follows the generally accepted trend of climate protection. What sounds colloquially simple and innocent, in fact causes huge chaos in company management. Responsible business is being reduced to the classic principles of philanthropy, but rather to activities carried out in the spirit of sustainable development. Development (especially in the face of the fourth industrial revolution) raises concerns among employees. What is the only possible solution for consumers (environmental protection) may be a cause for concern for company employees. Changes in the structure of enterprises, new production processes, the implication of robotics and automation in production and distribution processes, changes in the acquisition of raw materials, packaging, energy systems based on renewable energy sources, etc., cause concerns about the future.

Ecology in supply chain.

Functioning according to the concept of socially responsible business can be specified, among others:

Table 1. Examples and benefits of applying the concept of sustainable development in the supply chain.

Elements	Action examples	Potencial benefits
Raw material acquisition	- reduction of raw material consumption, - recycled raw materials,	Social and environmental: - optimal use of resources.

	- choosing environmentally friendly materials, - appropriate selection of suppliers and location	Economic: - reducing the costs associated with obtaining raw materials.
Processing and production	- closing the water and energy cycle, - limiting packaging weight, - opening new plants proceeded by a through analysis, - production of low-cost/water-saving/Energy-saving products.	Social and environmental: - reducing the amount of waste, - new workplaces, - reducing water and energy consumption. Economic: - reducing distribution costs, - reducing energy and water costs .
Distibution and transport	- new mechanism to reduce exhaust emissions, - combined transport, - elimination of empty runs, - full use of the load capacity of the means of transport, - use of innovative products.	Social and environmental: - reducing air pollution and carbon dioxide emissions. Economic: - optimization of logistics processes, - reduction of transport costs.
Consumptions	- shopping optimization, - selection of ecological products, - waste segregation, - selection of recyclable packaging.	Social and environmental: - reducing waste, - reducing the amount of waste, - health benefits. Economic: - optimization of customer expenses.
Waste disposal	- at each stage of the supply chain, a system for collecting used products/packaging, containing information on the impact on the environmental	Social and environmental: - reducing pollution. Economic: - reduction of costs related to garbage collection, - lowering costs.

Source: M. Świetlińska, *Zrównoważony łańcuch dostaw żywności – studium przypadku.*, Warszawa 2014, s. 4.

Economic efficiency in enterprise management forces you to act aimed at reducing costs and profit, and activities based on green management and environmental protection force you to look for solutions in the field of so-called green solutions. Attempts to combine Bowen's and Friedman's theories require the coexistence of two directions of business:

Table 2. Dissonance in business directions

Differences	Traditional direction	Green management direction
Superior goal	– cost reduction, – Improving the quality of customer service, – Profit maximization.	– saving Energy and natural resources, – optimization of economic benefits in the long term.
Natural environment	– underestimating environmental aspects.	– Environmental impact in every process and at every stage of chain development.
Business model	– basic model of using traditional structure, product and technology to increase revenues and maximize profits	– extended and updated to include environmental aspects
Processes	– irreversible and one-way processes	– reversible processes and closed chain circulation
Consumption model	– initiated by the consumer	– legal regulations and the influence of the consumer and the other stakeholders

Source: Practices and Innovation of Green Supply Chain - Background and Research Objectives, Supply Chain Management, http://www.scribd.com [11.12.2023]

The effects of attempted implications of the theory of green management and the need to protect the environment with typically Friedman's business focused on profit maximization can be presented as follows:

Table 3. Common parts of the classic and green business models

A sustainablbe model				
Green orders	Green production	Green distribution	Green transport	Reeverse logistics
- optimal selection of suppliers, - purchase of materials and raw materials obtained in accordance with	- low emossion of harmful waste and pollution, - resource management, - green products,	- biodegradable or reusable packaging, - limiting or selecting intermediares in	- low carbon emission vehicles, - intermodal transport,	- increase in waste recovery, - environmental friendly forms of disposal.

environmental standards,		distribution channels,	- optimization of transport routes (calculated by AI),	

Source: own study based on J. Witkowski, A. Pisarek, *Istota zielonych łańcuchów dostaw – propozycja systematyzacji pojęć*., „Logistyka" 2017, nr 315, s. 18 - 22.

Analyzing the above proposals, it can be concluded that broadly understood business has been implementing the environmental protection agenda promoted by the EU for many years. Market economies and market entities adapt their activities to market requirements, thus implementing green business policy. However, what may cause concern around business security, and especially the delivery of goods and services in logistic chains, is the scale of changes proposed by European directives and policies. The most important of them is:

- by 2025, municipal waste is to be prepared for reuse and recycling, which will be added to a minimum of 55% by weight, by 2030 to a minimum of 60%, and by 2035 to a minimum of 65% [1],
- emission reduction is to be introduced in the EU ETS by 2030, which is to reach a level of approximately 43% compared to 2005, achieving this goal would result in a reduction in the annual available number of emission allowances [9],
- by 2030, nuclear energy is to be implemented, which could ensure an increase in energy efficiency by 23% compared to energy forecasts from 2007, between 21-23% of renewable energy in final gross energy consumption and no more than 56% of coal in energy production electricity in 2030 [9],
- in 2030, electrification of road transport in Poland is to be introduced, which would reduce the consumption of oil and liquid fuels by half or even by 90%. in 2050 [9],
- by 2050, The European Parliament resolution of 15 March 2012 on the transition to a competitive low-emission economy calls for actions to reduce greenhouse gas emissions by 80 to 95% by 2050 compared to 1990 [10].

Analyzing the proposed directions, one can concluded that these are drastic changes, deliberately forcing serious reorganizations of business activity. The imposed reductions in greenhouse gas emissions towards climate neutrality are a serious problem for logistics. Transport, especially road, air and sea, based on fossil fuels, the agricultural sector, waste management, where the main component is plastic, industrial emissions, the main component of which is CO2, and even the public transport sector in urban agglomerations are sectors of the economy that will face a real challenge. revolution. The first is the introduced fees, taxes and levies for exhaust emissions from road vehicles, on which

national logistics is based. Thanks to road transport, door-to-door deliveries are possible. The amount of tax imposed will depend on the level of fuel consumption used by a given vehicle, i.e., on the amount of CO2 emissions per 1 km. Based on the assumed trends until 2050, fees for the total content of carbon dioxide in plasma (tCO2) and current data on the emissions of fuels burned by vehicles, additional costs incurred by drivers were calculated. Fees will be imposed depending on the vehicle category, introduction of taxes on carbon dioxide emissions, which, for example, will contribute to an increase in operating costs in the passenger car sector by approximately 5% in 2030, and by 15-20% in 2050 [2].

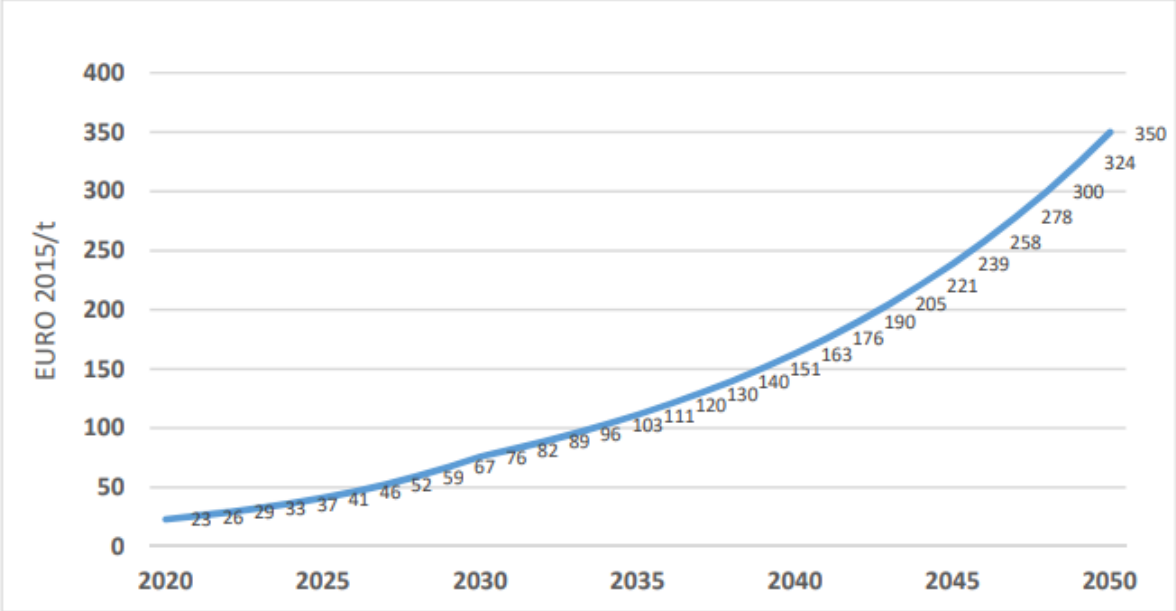

Figure. 1. Assumed path of increase in fee/tax rates for 1t CO2 emissions in the coming years.

Source: IOS-PIB/ KOBiZE, *Zmiana celów redukcyjnych oraz cen uprawnień do emisji wynikająca z komunikatu Europejski Zielony Ład*, 2020, s. 19.

According to the technology development scenario [Rabiega, Sikora, 2020, pp. 6], Over the years, as fuel prices and CO2 emissions increase, low-emission technologies will become more and more popular, so their price should gradually decrease. In addition, individual countries are providing subsidies for the purchase of low-emission vehicles, which will increase demand and at the same time discourage the use of combustion vehicles. According to this scenario, the number of cars in 2030 will be estimated at approx. 50% more, which gives approx. 1.5 million units, and in 2050 at approx. 120%, which gives approx. 10 million units. However, the possibilities of obtaining raw materials for the construction of batteries for low-emission vehicles are intriguing [Rabiega, Sikora, 2020, pp. 6].[1] The increase in the costs of fossil fuels together with the introduction of carbon dioxide emission fees will

[1] Today we hear about limited possibilities of extracting rare earth elements. Maybe an alternative will be vehicles with hydrogen engines or alternative methods of powering vehicles than batteries.

result in fees for light commercial vehicles increasing by approximately 10% in 2030, and by 2050 by up to approximately 30%, and in the case of heavy trucks, an increase in costs it will be around 18% in 2030, and in 2050 around 50% [Rabiega, Sikora, 2020, pp. 6].

It is very likely that the changes introduced will result in changes in the structure of vehicles in Poland - the share of traditional vehicles may drop to approximately 88% by 2030, and to approximately 35% by 2050, with an increase in low-emission (fleet) vehicles to approximately 50%. by 2050. It is worth mentioning the principle of the last link of economic activity, which states that ultimately, all costs of implementing changes will be passed on to customers and consumers.

The assumed reduction of carbon dioxide emissions, significant for diesel vehicles (mainly trucks), by 15% by 2030 and 25% by 2050 in domestic transport, in international transport, restrictions are to be 14% and 29%, respectively, will probably result in an increase in electric vehicles. The pragmatics of running a business in Poland suggest that it will be very likely that the transport of goods will be transferred to rail transport and that the importance of intermodal and combined transport in the supply chain will be strengthened.

Due to the introduction of low-emission vehicles, the demand for electricity may change. By 2030, the demand for electricity for low-emission cars may amount to approximately 3 TWh, and in 2050 to 22 TWh. This may result in an increase in the demand for electricity for low-emission vehicles to the level of 35 TWh, which will be a huge challenge for the already heavily exploited power grid (which, paradoxically, may contribute to increasing CO2 emissions in the energy sector).

Conclusions

Supply chain management, understood mainly as a way to effectively coordinate supply and distribution channels, will always be a topic of interest. The main reason is economic reasons. Currently, however, awareness of the impact on the natural environment requires the use of new solutions, focused on ecology and social changes, which will enable the reduction of environmental threats and sustainable development. Combining the pursuit of profit maximization with the need to protect the environment and reduce harmful waste emissions is a demanding challenge that will require entrepreneurs to plan, organize and control the flow of goods in the supply chain well and effectively. Supply chain management will require managing a network of entities in the field of supply, production, and distribution (especially in the face of the fourth industrial revolution). The aim of this management should be to provide the best possible customer service and relatively low but acceptable costs. A volatile market, changing customer expectations, exceptionally fast flow of market information and

frequent changes in law force entities and managers to implement complex solutions to act comprehensively.

To meet new and changing market requirements, supply chain management should enable its easy and quick transformation. The aim of such activities is to adapt the organization to the increasing complexity of activities combined with constant improvement of the effectiveness and implications of robots, automation and ICT systems. Waste generated in the supply chain and environmental pollution will be limited and planned in production and distribution processes before their actual production begins. Attempting to adapt to ecological solutions in supply chains will result in risk and danger of their interruption. In the era of global supply chains, minor flow blockages (e.g. blockage of the Panama Canal) may pose a threat to deliveries. In addition, the uncertainty in the functioning of the transmission and the efficiency of the energy system does not fill us with optimism.

Implementing effective green supply chain management should start with creating the business model in which the company wants to operate, establishing methods of communication, customer service, supplier management, etc. The selection of a supplier, the assessment of product quality, prices, places, customer service and other indicators requires great flexibility and considering environmental aspects in the assessment (such as giving priority to suppliers whose activities are ecological). But managing packaging waste, meeting the requirements for the final product, and finally overcoming difficulties in managing suppliers are only the beginning of the journey. The company, being aware of its impact on the environment, should implement clean production solutions. Therefore, it should focus on improving design, the use of energy and raw materials, the use of technologically advanced processes and infrastructure resources, and improving management. Reducing the amount of pollution, improving efficiency, and saving costs translates into the efficient use of available resources, avoiding overproduction and eliminating threats to health and the environment.

Clean energy, improving the quality of customer service, selecting suppliers are factors that effectively build socially responsible business strategies. The increasing importance attached to monitoring one's subcontractors and suppliers is reflected in many studies. This supply chain security risk is at the top of global business challenges. In the face of globalization of procurement, distribution and production, entities cannot afford to underestimate the issue of monitoring and checking the standards of work of their subcontractors and suppliers. Therefore, organizations must consider social and environmental aspects in their relationships with suppliers. In addition to the price and quality of products, other factors characteristic of the supplier should be taken into account, such as minimizing the negative impact on the environment, ethics or market reputation.

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