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THE RISK OF DISRUPTIONS IN SUPPLY CHAINS AFFECTING THE STRATEGIC SECURITY OF THE ORGANIZATION (STATE)



ABSTRACT: The article is devoted to the problem of safe supplies in crisis situations in selected organizations of the health care sector. An attempt was made to answer the question to what extent, for example, the implementation of the ISO 28000-based model can assist organizations in managing the security of the supply chain, especially in crisis situations. What actions should be taken to maintain the supply chain security management system or what solutions can be introduced to the identified processes affecting the functioning of the supply chain? The essence is to emphasize the role of the supply chain management system, based on specific requirements, in maintaining an appropriate level of security, especially during a crisis. To what extent can requirements focusing on the flow of process control activities ensure supply chain security?

KEYWORDS: supply chain, risk, crisis, security, green deal

INTRODUCTION

The article discusses the issues related to the possibility of assessing individual processes operating within an exemplary supply chain. Specific attributes, indicators and measures needed to carry out such an assessment in the perspective of the supply chain, on three levels, incl. using the SCOR model. Research focused on the security of supply chains under normal and emergency conditions. By analyzing the attributes, we searched for those that would be related to the goals and assumptions of the organization (state) security and would not

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introduce the risk of disruptions in the management of supply chains. The analysis of the issues raised shows that economic, not ecological, aspects are taken into account in the first place when assessing the effectiveness of supply chains. Of course, the specifics of the research sample should be taken into account. As a helpful solution for analyzing and assessing the effective and safe functioning of the supply chain, e.g. for medical facilities, a systemic approach based on the requirements of ISO 28000 was proposed.

The implementation of such a system would allow managing the security of the supply chain in an organization (state) under normal conditions and in crisis situations. The article uses theoretical and empirical research methods adapted to the problems posed and the purpose of the article. It is a combination of quantitative and qualitative methods that allows data to be collected, analyzed and assessed.

They include: analysis of normative documents and system documentation of the assessed organizations, system modeling, audit method using direct interview, observation of processes and activities of the organization, methods of risk and opportunities assessment.

SUPPLY CHAIN ATTRIBUTES IN NORMAL AND EXTRAORDINARY CONDITIONS

We must be aware that currently the security of supply chains is based mainly on normative and legal regulations regarding environmental protection. According to the principles of the Green Deal, the reduction of greenhouse gas emissions was assumed by 2050, e.g. in transport by 90%. The transport sector is crucial to the safe and reliable operation of supply chains. Therefore, it becomes important to introduce cleaner, more efficient and ecological forms of transport, including by implementing new digital technologies, enabling rational use of low-emission public transport in cities, more efficient fleet management and control systems.

Many programs are focused on investments increasing traffic flow, enabling the replacement of the fleet with a more modern one, and the integration of various means of transport, for the transport of goods, which can directly reduce the negative impact on the environment. The next perspective will be a continuation of activities to promote low and zero-emission means of transport, as well as the implementation of modern transport solutions¹.

¹ The European Green Deal. Collective work 92021, POiŚ 2014-2020. Warsaw.

The European Green Deal, 2021; Matczak M. (2011), Wpływ rozwoju koncepcji łańcuchów dostaw na strukturę współczesnego rynku transportowego. Zeszyty Naukowe SGH. Kolegium Gospodarki Światowej. no 31, pp. 223–238. The meaning and ways of the Green Deal. Instytut Badań nad Gospodarką Rynkową. Pomorski Thinkletter 3(6) 2021: 16-25.

With this in mind, it is necessary to analyze the actions taken so far to adapt the supply chains to the new conditions resulting from the Green Deal.

From the analysis of the current research in the field of supply chain management, it should be emphasized that the authors², e.g. in the selection of indicators for assessment, did not take into account environmental aspects relevant to the Green Deal. A clear example is the study by the Supply Chain Council (SCC) on improving the functioning of logistics chains³.

The Supply Chain Council has developed a Supply Chain Reference Model (SCOR) that incorporates relevant indicators and metrics to measure supply chain performance.

In the case of process analysis, the role of tools is taken over by measures and indicators. In the SCOR model⁴ measures and indicators are assigned to one of the five attributes of supply chains. The attributes are listed in Table 1.

Table 1

Attributes of the supply chain in the SCOR model

Attribute	Characteristics of the attribute	Recommended strategies
External perspective of the supply chain (customer)		
Reliability	Ensuring a high level of customer service, indicates the fulfillment of customer orders through the supply chain, deliveries should take place at the right time, in the right quantity, quality, cost, in the right packaging, with the right documents, this attribute focuses on the results of the processes	correct execution of orders, products that meet the quality requirements of customers
Reactivity	The time necessary to respond to the customer's request, How quickly orders are processed - from customer request to order fulfillment	Improving the speed of delivering products / services to customers
Agility Flexibility	Ability of the chain to handle changing demand The speed of reaction and the ability to adapt the supply chain to changes in the environment, these changes should be characterized by the inability to forecast them, e.g. natural disasters, instability on financial markets, etc.	Increasing the ability to respond to changes taking place in the external environment
The internal perspective of the supply chain		

² Domański R., Adamczak M., Cyplik P. (2012) Identyfikacja wielowariantowości współpracy pomiędzy ogniwami w łańcuchach dostaw w kontekście modelu SCOR. *Management*. vol. 16, no. 1, pp. 838–851; Poirier Ch.C., Quinn F.J. (2004) How Are You Doing? A Survey of Supply Chain Progress, *Supply Chain Management Review*. 11/12. Rutkowski K. (2000) Teoria i praktyka zarządzania zintegrowanym łańcuchem dostaw [in:] *Zintegrowany łańcuch dostaw. Doświadczenia globalne i polskie*. SGH. Warszawa.

³ Supply Chain Council, SCOR. *The Supply Chain Reference Model – Version 10.0*, 2010, pp. 127-137.

⁴ Rutkowski K. (2000). *Teoria i praktyka zarządzania zintegrowanym łańcuchem dostaw [in:] Zintegrowany łańcuch dostaw. Doświadczenia globalne i polskie*. SGH. Warszawa.

Costs	Total costs related to operations in the supply chain.	Cost rationalization related to management and operations in the supply chain.
Resources	Effectiveness of resource and asset management in the supply chain in the process of meeting customer needs.	Improving the efficiency of asset management in the supply chain to achieve its goals, by reducing the resources needed to implement the processes, e.g. reducing the level of inventories in the supply chain.

Source: Supply Chain Council, SCOR Framework 2.1, 2008.

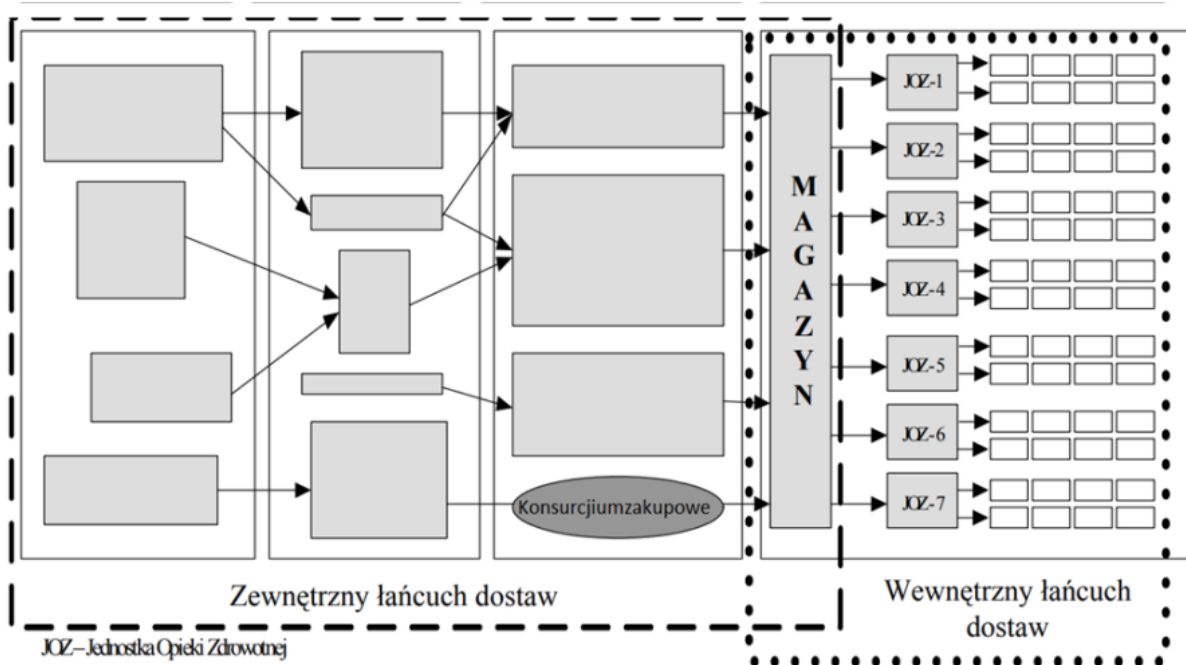
The attributes reflect two supply chain perspectives:

- External (Client) - attributes: reliability, reactivity, flexibility;
- Internal - attributes: costs and resources.

Figure 1 shows the ideological arrangement of the external and internal supply chains on the example of a medical facility, along with the sequence of connections between individual links.

Figure 1

An example of extended supply chains



Regardless of these perspectives, the measures and indicators for assessing the efficiency of supply chains functioning, indicated in the SCOR model, are assigned to 3 levels. They are helpful in monitoring the supply chain and controlling the fulfillment of the set goals. Measures and indicators in the SCOR model are assigned to 3 levels⁵. Environmental attributes are not taken into account at any level or perspective. Table 2 shows the arrangement of these levels.

Table 2
 An example of supply chain attributes in the SCOR model

Level	Type of level	Characteristics of measurements at a given level
1	strategic	They measure the effectiveness of the entire supply chain - "health of the supply chain", Define the goals of the supply chain, Translate a business problem or strategy into a measurable quantifier, Help to define priorities in running a business.
2	diagnosis of the current state	They focus on measuring a part of the supply chain and a part of the business strategy, They allow you to find the source of a problem in the supply chain, Measures and indicators from this level do not have to translate directly into measures and indicators from level 1.
3	specific	Measures functioning in the supply chain, adapted to its characteristics, can be used. Measures and indicators at this level can be used to more accurately identify the problem that has arisen.

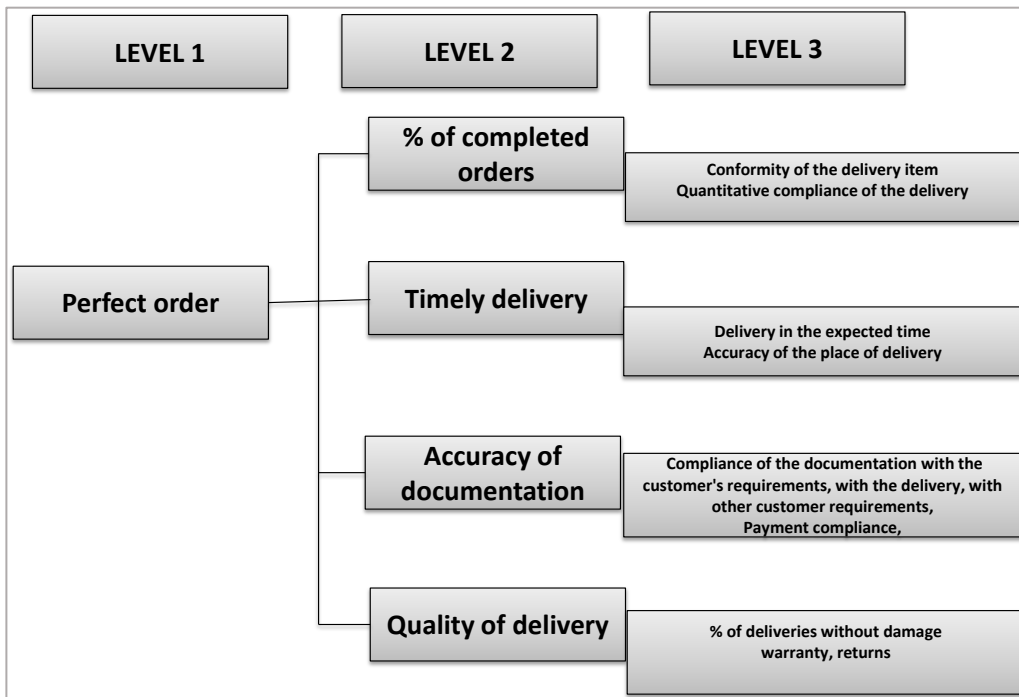
Source: Supply Chain Operations. Reference Model – Revision 11.0, 2012.

Strategic level indicators and measures are essential to assess and monitor the supply chain. It is important to measure every part of the supply chain, at every stage of the life cycle. Figure 2 shows the arrangement of these levels on the example of the reliability attribute.

⁵ Supply Chain Operations. Reference Model – Revision 11.0, 2012.

Figure 2

Layout of levels of indicators for the reliability attribute



Source: own study based on Hentschel and others, 2015.

Following the layout shown in Figure 2, we note that the processes, including logistics, that make up the supply chain, according to the SCOR model, are composed of three levels⁶:

- top level - at this level, the scope of the SCOR model is defined, goals for building the company's competitive advantage are set;
- configuration level - on the second level, the methods of fulfilling customer orders are compiled;
- process element level - the third level determines the company's ability to compete on the market, determines process elements, process inputs and outputs, process measures and good practices for its implementation.

The most important role of the SCOR model is played by the meters. They cover all levels and are concentrated around 5 areas. Table 3 presents examples of measures assigned to the strategic level.

⁶ Hentschel B., Cyplik P., Hadaś Ł., Domański R., Adamczak R., Kupczyk M., Pruska Ż. (2015) Wieloaspektowe uwarunkowania integracji łańcucha dostaw typu forward i backward. Modelowanie i ocena stopnia integracji. Wyższa Szkoła Logistyki. Poznań.

Table 3.

Examples of measures at the strategic level of the SCOR model to assess the supply chain

	An external perspective			Internal perspective	
	reliability	reactivity	flexibility	costs	resource
Perfect order	x				
Order fulfillment time		x			
Supply chain flexibility			x		
Supply Chain Adaptability			x		
The total value of the risk in the supply chain			x		
Supply chain management costs				x	x

Source: Hentschel B., Cyplik P., Hadaś Ł., Domański R., Adamczak R., Kupczyk M., Pruska Ż. (2015) Wieloaspektowe uwarunkowania integracji łańcucha dostaw typu forward i backward. Modelowanie i ocena stopnia integracji. Wyższa Szkoła Logistyki. Poznań.

The SCOR model indicates a comprehensive set of measures and indicators for the monitoring and evaluation of the efficiency of the supply chain functioning. The attributes presented above highlight the structuring of supply chain assessment tools. On the other hand, Table 4 presents selected measures from the 3rd level of the SCOR model.

Table 4

Selected measures for various attributes from the SCOR model proposal

Attribute	ID miernik	Measure
reliability	RL 3.5	Percentage of deliveries without errors in the reverse flow
	RL 3.47	Percentage of on-time deliveries in the reverse flow
reactivity	RS 3.104	Average time to return a damaged product from the customer
	RS 3.105	Average time to return excess inventory from a customer
	RS 3.106	Average time to return defective products from the customer
	RS 3.127	Mean time of backflow supply
	RS 3.131	The time it takes to return to the time of fulfilling customer orders after unexpected changes
	RS 3.137	Average time it takes to pass a link in the supply chain of excess inventory
	RS 3.138	Average time it takes for defective products to pass through the supply chain
flexibility	AG 3.2	Additional flow volume resulting from reverse flows
	AG 3.3	Number of reverse flow distribution orders
	AG 3.75	Time needed to obtain additional equipment
Costs	CO 3.1	Percentage of the cost of scheduling a sourcing of damaged products to the total cost of sourcing damaged products
	CO 3.2	Percentage of the cost of scheduling the over-inventory provisioning in relation to the total cost of the over-inventory provisioning

Source: Supply Chain Council, SCOR, 2010.

Regardless of what plane, level, attributes, measures or indicators we look at the issue of the efficiency of the functioning of supply chains, we will not see any orientation towards the goals of the Green Deal. As can be seen, these are indicators related to the basic parameters of the assessment of logistics processes, which are more economic than ecological.

However, when analyzing the goals and assumptions of the Green Deal, we also explicitly and explicitly refer to environmental aspects. They are simply based on strategic elements related to environmental protection, for example, such as⁷:

- energy efficiency,
- renewable energy sources for total energy decarbonisation,
- pure mobility,
- competitive industry and circular economy,
- development of infrastructure and interconnections between countries,
- development of bioeconomy and CO₂ absorbers.

In order for the Green Deal to meet its goals, at least in industries that are links in the supply chains, e.g. transport, must take a holistic approach.

According to the calculations of the European Commission, transport is responsible for 25% of greenhouse gas emissions in the EU⁸.

Ask yourself: what benefits can be expected from the implementation of the Green Deal? Will the market and industries cope with the resulting transformation? Will the introduction of innovative, cleaner forms, e.g. in transport, negatively affect the effective functioning of supply chains? Among the many assumptions adopted for the Green Deal, sustainable transport should be emphasized. We know that the work on the European Climate Law is essential in relation to the strategy for sustainable smart mobility, as well as alternative fuels and TEN-T infrastructure.

FINDING SOLUTIONS IN THE EVENT OF DISRUPTIONS IN SUPPLY CHAINS

We are not able to answer all doubts right away. In order to try to tackle these issues, we need to revisit the mechanism for evaluating and monitoring processes using indicators and

⁷ Clean Planet message COM 2018 (773) final, (12 February 2021). European Green Deal Communication COM(2019) 640, (12 February 2021) https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_pl.; Supply Chain Council, SCOR, 2010.

⁸ Grendys A. (2021) Sposoby na neutralność klimatyczną, czyli o co chodzi w Zielonym Ładzie. Platforma przemysłu Przyszłości. Warszawa.

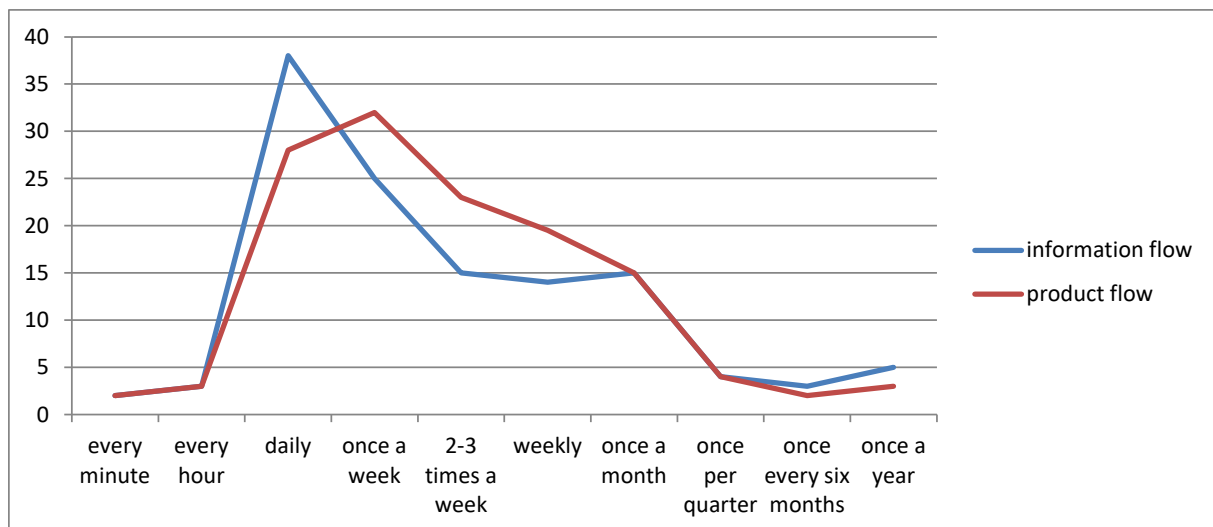
measures related to essential attributes. Many authors, e.g., while conducting research on the risk of disruptions in supply chain management, show that the factors causing an increase in the sensitivity of supply chains are⁹:

- globalization - indicated by 52% of respondents,
- reducing the level of inventories in supply chains as a result of breaking links in emergency situations - indicated by 51% of respondents,
- reduced supplier base indicated by 38% of respondents,
- outsourcing - indicated by 30% of the respondents.

Where to find a way to overcome the vulnerability of supply chains and make them more flexible (resilience). Figure 3 Shows the results of research on the frequency of disruptions in the supply chain.

Figure 3.

The frequency of disruptions in the flow of goods and information



Source: Konecka S. (2015). Ryzko zakłóceń w zarządzaniu łańcuchów dostaw. UE. Poznań.

What factors can disrupt the flow of flows of goods and information? Chart 3 shows that the flow of information is slightly more disrupted than the flow of goods. It was most often indicated that disruptions in the flow of goods occur every day - 28.7% and 2-3 times a week - 34.9%, every week the disruption occurred in 19.5% of the respondents. In the flow of

⁹ Erkan T.E. (2011). Supply chain performance measurement: a case study about applicability of SCOR model in a manufacturing industry firm, *International Journal of Business and Management Studies*, vol. 3, no 1, pp. 381–390. Finch, P., (2004). Supply chain risk management. *Supply Chain Management: An International Journal*. vol. 9, iss. 2. pp. 183-196. Fechner I. (2007). Zarządzanie łańcuchem dostaw. Wyższa Szkoła Logistyki. Poznań.

information, it was declared that there were disruptions every day - 32.3%, 2-3 times a week - 26.7% and once a week for 12.8% of the respondents. Disruptions may arise from the size and complexity of the organization, - number of suppliers and customers, geographic coverage of the supply and distribution network, customer relationships, customer service and other supply chain processes¹⁰.

Each of these processes generates specific types of risks. Table 5 presents examples of risk groups influencing possible disruptions to supply chains.

Table 5.
Examples of risk groups in the links of supply chains

PROCESS / SITUATION	RISK GROUPS WITHIN THE SUPPLY CHAIN
Customer relationship management	Problem with identifying key customers or groups of buyers, inaccurate prediction of customer needs, inadequate level of services provided, error in estimating customer profitability, error in choosing a distribution channel management strategy.
Customer service management	An insufficiently customer-oriented service process, insufficient ability of partners to react to unexpected orders (low flexibility, too slow meeting of requirements), problems with the flow of information, too high maintenance costs.
Demand management	Imbalance between customer expectations and the capabilities of all links in the supply chain, lack or insufficient flow of information on demand from points of sale and key customers, inadequate methods of forecasting demand, misunderstanding of the market needs, no integration with clients, volatility of demand competitive forces in the market, market potential, volatility of legal regulations, the power of promotion and advertising structure of products
Order fulfillment	Failure to meet the order fulfillment time, decrease in the number of orders lack of integration between production, distribution and transport processes, breach of contract terms by carriers, logistic operators, etc. failure of suppliers to meet technical standards, material quality control system, timely deliveries, hidden defects of materials, having unnecessary stocks,

¹⁰ Kulińska E. (2007). Zarządzanie ryzykiem w łańcuchu dostaw. Logistyka 1 (2007): 18-21.

	material price volatility, changes in delivery conditions, inadequate supplies of materials in terms of quantity, quality, time, place and costs, problems with the flow of information
Breaking supply chains	Natural phenomena, e.g. natural disasters, e.g. earthquakes, floods, volcanic eruptions, etc. biological, e.g. epidemics and pandemics, political, e.g. decisions of governments and international institutions have a direct impact on the functioning of the supply chain, technological, e.g. server room failures, data leaks, cyber attacks, etc.

Source: own study based on Kulińska E. (2007) Zarządzanie ryzykiem w łańcuchu dostaw. Logistyka 1 (2007): 18-21.

Being aware of the risk of disruptions in supply chain management is critical to taking action properly. It is important to build a strategy of supply chain resilience. Examples of strategy proposals to increase the resilience of the chain in relation to supply disruptions are presented in Table 6.

Table 6
Examples of risk group strategies in the links of supply chains

Strategy	Characteristics of activities	Objective	Benefits of implementing the strategy
Strategic stock	Opening additional small warehouses, which retailers in nearby regions can use	Increasing product availability	Quick response (QR) on demand
Economic supply incentives	Financial support of your suppliers and sharing the risk of lack of demand with them, in order to avoid their exclusion from the market and the formation of monopolistic suppliers	Increasing product availability	It allows you to quickly adjust the size of orders to the size of the demand
Postponement	Delaying the moment of product differentiation according to the current needs of customers	Increasing the flexibility of deliveries	It allows you to quickly change the configuration of the product depending on the changing demand
Flexible supply base	Procurement of raw material / component from several suppliers with the possibility of flexible adjustment of the size of orders depending on the existing demand	Increasing the flexibility of deliveries	It enables quick transfer of production between suppliers / plants

Make-and-buy	Using not only outsourcing, but also developing your own production capabilities	Increasing the flexibility of deliveries	It allows you to quickly switch from in-house production to outsourcing production and vice versa
Flexible transportation	- the use by carriers of various means of transport, - introducing new transport routes that can be used in emergency situations	Increasing the flexibility of transportation	If necessary, it allows you to quickly change the mode of transport between nodes
Dynamic assortment planning	Appropriate placement of products on displays and store shelves in order to increase the sale of some products in relation to others, the continuity of which has been disturbed	Increasing control over the demand for a specific product	More efficient management of the demand side of the supply chain Allows you to quickly influence the demand for a product
Silent product rollover	Introducing a product to the market without prior advertising, so that the customer does not feel that the current product perceives the new product as equivalent to the previous one	Increasing control over supply and demand	More efficient management of both the supply and demand side of the supply chain. Quick and smooth change of demand for various products

Source: own study based on Konecka S. (2015) Ryzyko zakłóceń w zarządzaniu łańcuchów dostaw. UE. Poznań.

The proposed strategies and related activities are aimed at achieving the security of supply chains, including by assessing the functioning processes in the chain and constant control of individual links in the supply chain. Table 7 presents an example of the use of selected measures to evaluate the processes included in the supply chain for a medical facility. For the functioning of a medical facility in the supply chain, an external (customer) perspective was taken into account.

Table 7
Example of safety assessment of processes related to the supply chain for selected indicators

Indicators	Result
the degree of supply reliability	$h_{nd} = 87\%$
delivery flexibility	$e = 92\%$
rhythmicity of deliveries	$r_{ad} = 1,15$
the degree of readiness for deliveries	$h_{grd} = 94\%$

number of suppliers	$n_d = 25$
timely deliveries	$t_d = 68\%$
security factor	$J_b = 24\%$
warehouse seizure degree	$h_{wm} = 47\%$
environmental aspect indicators	lack

Source: own study.

Processes need to be improved. The implementation of a safe supply chain supporting the logistics sphere of the facility may allow for a significant improvement in the supervision of the consumption of drugs and medical materials, and thus provide the management of the facility with knowledge about the actual picture of the distribution of costs and purchasing needs. The secure chain system was tested during the project implementation in a medical facility.

The main function of the "Integrator" module should be the collection of data from hospital systems supporting the movement of patients, laboratories, warehouses, pharmacies, wards, etc. This module, based on the collected data from the above-mentioned systems, should enable the preparation of summaries supporting decisions on the demand. The analysis of the economic effectiveness of the integration system implemented according to the described assumptions showed the high profitability of this type of investment. After the implementation of the proposed solutions for supply chain management, a decrease in the inventory of drugs in the Central Pharmacy by over 60% and in the branches by over 40% was observed. The coverage index, which informs about the average time a drug remains in the Central Pharmacy, fell from 19 days to just 5.78 days.

An additional improvement solution should be the implementation of a system aimed at effective security management in the supply chain in accordance with the requirements of ISO 28000: 2007. This system approach has been developed specifically for companies and organizations participating in the supply chain. It enables the identification of threats and reduction of risks in the supply chain by analyzing activities related to all stages of the supply chain. The ISO 28000 standard requires the company to¹¹:

- defining a supply chain security policy,
- performing a risk assessment,

¹¹Szymonik A., Bielecki M. (2015). *Bezpieczeństwo systemu logistycznego w nowoczesnym zarządzaniu*. Difin. Warszawa.

- designing a management plan and reducing the detected threats,
- implementation of the supply chain security management plan, system observation and control, and making the required corrections,
- continuous improvement of procedures through training and simulations.

Figure 5 covers all requirements to be implemented in an organization to ensure efficient and secure supply chain management with support.

Figure 5.

Supply chain security management system



Figure 5. own study ISO 28000 (2007). Supply chain security management system. PKN. Warszawa.

The system approach in safe supply chain management allows for the following activities¹²

- identification and assessment of the probability of possible disruptions to supply chains,
- developing various paths of action in the event of the emergence of these threats,
- preparing adequate resources to deal quickly and effectively with supply chain disruptions,
- taking action on the basis of the prepared plan when the risk of disruption occurs.

¹²ISO 28000 (2007). Supply chain security management system. PKN. Warszawa.

CONCLUSIONS

Current, global problems with maintaining safe supply chains have highlighted the ways of their management. Many participants of particular cells ask themselves questions: how to maintain the continuity of supplies in the conditions of so many variables, also in line with the assumptions of the Green Deal. These are challenges that raise the bar of environmental requirements for the economy and society. It is important that supply chains can run smoothly. This is the challenge for which the Supply Chain Council has developed the Supply Chain Reference Model (SCOR), taking into account relevant indicators and measures to measure the efficiency of supply chains. In the SCOR model, measures and indicators are assigned to one of the five attributes of supply chains: reliability, reactivity, agility (flexibility), time and costs. Environmental aspects were not taken into account when selecting the attributes for the evaluation of the processes operating within the supply chains. In the face of the challenges of the Green Deal, it is important to focus on methods for assessing the effectiveness of the functioning of supply chains in terms of the selection of appropriate indicators and measures. The security of supply chains in the conditions of sustainable development is not only focusing on the customer and his requirements in terms of the flow of products and information, but also on the safety of the natural environment. The essence is the speed of reaction and the ability to adapt the supply chain to changes in the environment, including those resulting from the Green Deal. The effectiveness of supply chain resource management in the process of meeting customer needs must take into account both economic aspects, including environmental aspects. Many authors, while conducting research on the risk of disruptions in supply chain management, have shown that globalization is the factor causing an increase in the sensitivity of supply chains (this was the opinion of 52% of respondents). Being aware of the risk of disruptions in supply chain management is critical to taking action properly. Building a supply chain resilience strategy is important. The safe chain system has been tested during the project implementation in a medical facility. An additional improvement solution should be the implementation of a system aimed at effective security management in the supply chain in accordance with the requirements of ISO 28000. System approach based on the implementation of a supply chain security management plan, observation and control system would be intentional.

The developed model of the supply chain management system may, assuming a literal adaptation to the requirements, increase the level of security, especially in crisis situations, through: systematic activities and practices in the organization, identifying the weakest links and limiting the negative effects of the functioning of processes, as well as increasing awareness and responsibility employees.

REFERENCES LIST

- Clean Planet message COM 2018 (773) final, (12 February 2021). Domański R., Adamczak M., Cyplik P. (2012) Identyfikacja wielowariantowości współpracy pomiędzy ogniwami w łańcuchach dostaw w kontekście modelu SCOR. *Management*. vol. 16, no. 1, pp. 838–851.
ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_pl.
- Erkan T.E. (2011). Supply chain performance measurement: a case study about applicability of SCOR model in a manufacturing industry firm, *International Journal of Business and Management Studies*, vol. 3, no 1, pp. 381–390.
- Finch, P., (2004). Supply chain risk management. *Supply Chain Management: An International Journal*. vol. 9, iss. 2. pp. 183-196.
- Fechner I. (2007). Zarządzanie łańcuchem dostaw. Wyższa Szkoła Logistyki. Poznań.
- Grendys A. (2021) Sposoby na neutralność klimatyczną, czyli o co chodzi w Zielonym Ładzie. Platforma przemysłu Przyszłości. Warszawa.
- Hentschel B., Cyplik P., Hadaś Ł., Domański R., Adamczak R., Kupczyk M., Pruska Ż. (2015) Wieloaspektowe uwarunkowania integracji łańcucha dostaw typu forward i backward. Modelowanie i ocena stopnia integracji. Wyższa Szkoła Logistyki. Poznań.
- ISO 28000 (2007). Supply chain security management system. PKN. Warszawa.
- European Green Deal Communication COM(2019) 640, (12 February 2021).
- Konecka S. (2015) Ryzyko zakłóceń w zarządzaniu łańcuchów dostaw. UE. Poznań.
- Kulińska E. (2007) Zarządzanie ryzykiem w łańcuchu dostaw. *Logistyka* 1 (2007): 18-21. Matczak M. (2011), Wpływ rozwoju koncepcji łańcuchów dostaw na strukturę współczesnego rynku transportowego. *Zeszyty Naukowe SGH. Kolegium Gospodarki Światowej*. no 31, pp. 223–238.
- Poirier Ch.C., Quinn F.J. (2004) How Are You Doing? A Survey of Supply Chain Progress, *Supply Chain Management Review*. 11/12.
- Rutkowski K. (2000) Teoria i praktyka zarządzania zintegrowanym łańcuchem dostaw [in:] *Zintegrowany łańcuch dostaw. Doświadczenia globalne i polskie*. SGH. Warszawa.
- Supply Chain Operations. Reference Model – Revision 11.0, 2012.
- Supply Chain Council, SCOR Framework 2.1, 2008.
- Supply Chain Council, SCOR. The Supply Chain Reference Model – Version 10.0, 2010, pp. 127-137.
- The meaning and ways of the Green Deal. Instytut Badań nad Gospodarką Rynkową. *Pomorski Thinkletter* 3(6) 2021: 16-25.
- The European Green Deal. Collective work 92021) POiŚ 2014-2020. Warsaw.
- Szymonik A., Bielecki M. (2015) *Bezpieczeństwo systemu logistycznego w nowoczesnym zarządzaniu*. Difin. Warszawa.





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