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Identification and assessment of risk components of enterprise cooperation in the supply chains

Identyfikacja i ocena elementów ryzyka współpracy przedsiębiorstw w łańcuchach dostaw

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Abstract. In the changing conditions of functioning of economic entities, an important role is played, on the one hand, by identifying resources and areas with the potential to increase competitiveness, and on the other hand, by ensuring the stability as well as safety of processes and reducing uncertainty and risk. Building links between business partners is essential in this respect. The basis for such partnerships in supply chains is cooperation based on trust and risk-sharing. At the same time, it should be emphasized that creating such relationships is not only a challenge, but also an additional source of risk. The purpose of this paper is to identify and assess risk elements occurring in the connections of enterprises in supply chains. Knowledge of risk and potential threats is the basis for creating relationships with partners and building security of enterprises and supply chains. The paper presents the results of research on key elements of risk in the relations of metal industry enterprises operating in supply chains. The research was conducted using a proprietary questionnaire and covered businesses operating in the metal industry in Poland. The issues examined included such elements as: assessment of the perceived role of monitoring and reducing risk in enterprises, identification of competences in the area of risk analysis and assessment as well as preparation for irregularities and disruptions in supply chains characterized by the studied enterprises, identification of the impact of risk elements in relations with suppliers and recipients on the company's operations, the used risk mitigation methods and factors influencing the implementation of risk management in supply chains. The obtained results allowed to identify the role of the risk of cooperation of enterprises in supply chains and significant factors impacting its reduction. The role of managing relations with business partners as an important element influencing the security of supply chains was also emphasized.

Keywords: supply chain, risk, relations, supply chain security, metal industry

Abstrakt. W zmieniających się warunkach funkcjonowania podmiotów gospodarczych istotną rolę odgrywa z jednej strony identyfikacja zasobów oraz obszarów o potencjale pozwalającym na wzrost konkurencyjności, a z drugiej zapewnienie stabilności i bezpieczeństwa procesów oraz ograniczenie niepewności i ryzyka. Szczególne znaczenie w tym zakresie ma budowanie więzi między partnerami gospodarczymi. Podstawą takich partnerskich relacji w łańcuchach dostaw jest współpraca polegająca na zaufaniu i podziale ryzyka. Należy jednocześnie podkreślić, że tworzenie takich relacji stanowi nie tylko wyzwanie, ale także dodatkowe źródło ryzyka. Celem pracy jest identyfikacja i ocena elementów ryzyka występujących w powiązaniach przedsiębiorstw w łańcuchach dostaw. Wiedza z zakresu ryzyka i potencjalnych zagrożeń stanowi podstawę tworzenia relacji z partnerami oraz budowania bezpieczeństwa przedsiębiorstw oraz łańcuchów dostaw. W pracy przedstawiono wyniki badań dotyczące kluczowych elementów ryzyka w relacjach przedsiębiorstw branży metalowej funkcjonujących w łańcuchach dostaw. Badania zostały przeprowadzone za pomocą autorskiego kwestionariusza ankietowego i obejmowały przedsiębiorstwa branży metalowej prowadzące swoją działalność na terenie Polski. Badane zagadnienia obejmowały takie elementy jak: ocena postrzegana roli monitorowania i ograniczania ryzyka w przedsiębiorstwach, identyfikacja kompetencji w obszarze analizy i oceny ryzyka oraz przygotowania na nieprawidłowości i zakłócenia w łańcuchach dostaw jakimi odznaczają się badane przedsiębiorstwa, identyfikacja wpływu elementów ryzyka w powiązaniach z dostawcami i odbiorcami na działalność przedsiębiorstwa, wykorzystywane metody ograniczania ryzyka oraz czynniki wpływające na wdrożenie zarządzania ryzykiem w łańcuchach dostaw. Uzyskane wyniki pozwoliły na identyfikację roli ryzyka współpracy przedsiębiorstw w łańcuchach dostaw oraz istotnych czynników wpływających na jego redukcję. Podkreślono również rolę zarządzania relacjami z partnerami gospodarczymi jako istotnego elementu wpływającego na zapewnienie bezpieczeństwa funkcjonowania łańcuchów dostaw.

Słowa kluczowe: łańcuch dostaw, ryzyko, relacje, bezpieczeństwo łańcuchów dostaw, branża metalowa

Introduction

Important conditions shaping the sustainable competitive advantage of modern enterprises undoubtedly include such elements as [5]: key competences, continuous improvement based on knowledge management, time compression regarding the product development cycle, completed operations, but above all the quality of cooperation between business partners. At the same time, contemporary economic conditions and striving to ensure an appropriate level of safety of the processes and meeting expectations encourage companies to look for opportunities to improve the efficiency of operations. One of them is to create relationships with partners within integrated supply chains. Such a cooperation requires to form relationships both within the company and throughout the entire supply chain, which on the one hand can be an opportunity for the development and success of enterprises, and on the other hand, a challenge and a source of risk. An important factor that constitutes a motivation in the creation of bonds with partners within integrated supply chains is the desire to ensure an appropriate level of security of the processes [22], meeting expectations and ensuring a high level of quality of activities undertaken in order to strengthen competitiveness.

The purpose of the paper is to identify the key elements of risk in the relations of enterprises operating in supply chains. Achieving the aim of the work required the formulation of a research problem in the form of: What are the key risk areas and the nature of relations between enterprises in supply chains?

Achievement of the research goal was related to the following research questions:

- What is the perceived role of monitoring and mitigating risk in enterprises?
- What are the competences of companies in the area of risk analysis and assessment as well as preparation for irregularities and disruptions in supply chains?
- What are the risks involved in relationships with suppliers and customers and what is their impact on the enterprises?
- What methods of risk mitigation in supply chains are used in enterprises?
- What factors influence the implementation of risk management in supply chains?

Obtaining answers to the indicated questions allows for the verification of the research thesis: The identification of significant risk factors for cooperation between enterprises in supply chains affects its reduction and ensures security.

Corporate relations in the supply chain

Among the basic types of resources constituting an enterprise's competitiveness, Hunt and Morgan (1996) distinguish human, material, financial, technological, organizational, IT, legal and relational resources, which regard the cooperation of enterprises with suppliers and recipients. This ability to cooperate is the basis of creating relationships that result from a sense of belonging, and which can consequently result in the division and sharing of resources and an increase in entrepreneurial behaviour [24]. These relationships may regard the associations of entities with stakeholders and may be based on the exchange of information and knowledge, which, when used in accordance with the goals and needs of the organization, becomes a resource of value in itself. This value can be unique and difficult to copy [6]. Due to the significant impact on the functioning of enterprises, acquiring knowledge and building a competitive advantage [10], this intangible resource of enterprises is referred to as relational capital [4], [21]. Establishing a cooperation that is characterized by trust, good communication, effective flow of information/knowledge and willingness to contribute key competences to relationships, is the basis for increasing added value as a result of more efficient use of resources and achieving the effect of synergy by partners.

At the same time, it should be emphasized that the activity of each enterprise constituting a link in the supply chain is associated with making decisions burdened with risk. However, the consequences in the event of failure can also be severe for all partners and can pose a significant threat to the entire chain and its goals.

The basic elements determining the success of relationships in supply chains [25] include:

- quality of cooperation – satisfaction with cooperation,

- credibility of cooperation – reducing the level of costs and risks and building trust,
- invention in cooperation – promoting quality, innovation and long-term sustainability aimed at encouraging productivity growth,
- durability of cooperation – synchronization of goals and deepening trust,
- communication in cooperation – frequent dialogue and information sharing.

The subject of consideration in this paper will be mainly elements of risk and uncertainty in relations with supply chain partners, which can significantly affect the security of the entire network.

Enterprise and supply chain risk management

Hazard and risk issues are considered in many areas and scientific research e.g. [1], [2], [7-9], [11], [12], [16], [18]. Risk is not an unambiguous concept and is therefore difficult to define. At the same time, it is an integral part of every enterprise's functioning and entire supply chains and its sources can be diverse. It is the result of uncertainty and the impact of various types of adverse events, i.e. threats. Depending on the research area, it may be associated with undesirable and negative consequences, but also with desirable consequences constituting an opportunity to achieve business goals.

According to Ho, Tian, Zheng and Talluri [11], risk related to the supply chain can be defined as the probability and impact of unexpected events or conditions at macro and/or micro levels that adversely affect any part of the supply chain, leading to operational, tactical disruptions or irregularities at the strategic level. On the other hand, risk management in the supply chain is defined by these authors as an inter-organizational joint venture using quantitative and qualitative risk management methodologies to identify, assess, mitigate and monitor unexpected events or conditions at the macro and micro level, which may adversely affect any part of the supply chain.

The comprehensive approach to risk management in the supply chain was reflected in the developed concept of SCRM (Supply Chain Risk Management) – risk management in the supply chain. It is a management process, involving all the links that cooperate within the supply chain, consisting in the implementation of a risk management strategy (covering both standard and exceptional risks) implemented through the coordination/cooperation of chain partners in order to ensure continuity of operations and adaptation to changing conditions [19], [14].

The risk depending on the location of its sources is most often defined and classified as [20]:

- external, which most often refers to the impact of elements of the environment (political system, market, competition, etc.) or random events,
- internal, the source of which are events and processes carried out in the enterprise (resources, information system, activities).

In the case of the supply chain, which is a complex system, there are risk elements resulting from the activities of individual enterprises, but also with interdependencies, connections, impact and the entire structure of the relationship network, which may generate additional risk categories. According to such an approach, external risk in the supply chain comes from the environment of the supply chain, while internal risk refers to the entire supply chain, and its source may be the activities of its individual links, the connections between them, or the structure itself [15], [23].

In addition, Borkowski [3] points out that one can distinguish general risk, industry-specific risk (raw materials and sales markets, competition risks), company-specific risk (e.g. operation research and development, behavioural risks, etc.).

Among the basic categories of risk in the supply chain functioning, Machowiak [17] specified the following:

- risks arising from external threats which are independent of the activities of economic operators,
- risk resulting from the conditions of internal and external processes carried out in the supply chain,
- supply chain specific risks arising from interconnections and interdependencies between supply chain partners.

It is important that the latter two risk categories are susceptible (to varying degrees) to management, so that the causes and effects of the risk can be influenced to a certain extent. From the point of view of this paper, particular attention will be paid to the last group of risks related to activities that go beyond a single enterprise, which result from the dependencies and relationships between the participants in the supply chain.

A risk specific for the supply chain may be the one arising from the lack of a single owner regarding problems with decision-making, the risk of disturbances, limited possibilities of coordinating activities leading to chaos, the risk of passivity/inertia, problems occurring in relations with partners, lack of loyalty, etc. These new and specific forms of risk, force the supply chain partners to cooperate and coordinate in an advanced way, but above all to define common objectives and actions.

To sum up, it can be stated that risk is an integral element of the functioning of enterprises, and also of supply chains resulting from the impact of various types of events and their effects. Risk in the supply chain most often refers to events that negatively affect its functioning as a whole. Most frequently they result from uncertainty of environmental conditions, implemented processes and occurring dependencies and relationships. At the same time, the cooperation and creation of partnerships can constitute the basis for achieving tangible benefits.

Research methods

The study is based on direct research carried out using a proprietary questionnaire, which consisted of questions concerning the characteristics of the studied businesses and the undertaken research issues. The survey contained closed questions with the possibility of extending or supplementing some answers. The survey questionnaires were completed by target respondents, people in managerial positions, mainly from areas related to logistics, supply chain management, or other related fields (e.g. procurement, production, distribution). The obtained results, subject to quantitative and qualitative analysis, formed a basis for formulating conclusions.

The choice of the research sample was deliberate (not probabilistic) and focused on businesses operating in the metal trade, covering the broadly understood metal industry, i.e. production and processing of steel and steel products. Completing the research within a specific industry sector results from the fact that, as Iwaszczuk [13] states, factors related to a specific business profile or industry have a significant impact on the risk level. The research was conducted among 50 Polish enterprises (micro-enterprises were not included). Table 1 presents a detailed structure of the analysed enterprises in terms of size (according to EKD), type, scope of operations, ownership of the capital involved, and the duration of their existence on the market.

Table 1. Characteristics of the surveyed businesses

Classification criteria	Characteristics	Share, %
Size of operations	small	22
	medium	36
	large	42
Type of operations	production	88
	trade	8
	service	4
Ownership	Polish capital	60
	with a share of foreign capital	26
	foreign capital	14
Range of operations	international	66
	domestic	26
	regional	8
Period of operation in the market	1-5 years	10
	6-20 years	50
	over 20 years	40

Source: Own study

Among the surveyed businesses, the main role, in terms of the type of activity, was played by production enterprises (88%), with the dominant being mature enterprises operating on the market for 6-20 years (50%) and longer (40%). Taking into account the scope of activity, 66% were businesses operating on the international market, while the basis for financing in 60% of the surveyed businesses was Polish capital.

Research results

The first of the issues considered was the identification of the approach of business practitioners in the analysed enterprises to the relationship between the cooperation of partners in the supply chain and preparation for disruptions, risk reduction and the perception of the role of a partnership cooperation based on trust and risk sharing when managing the supply chain. The results are presented in Figure 1.

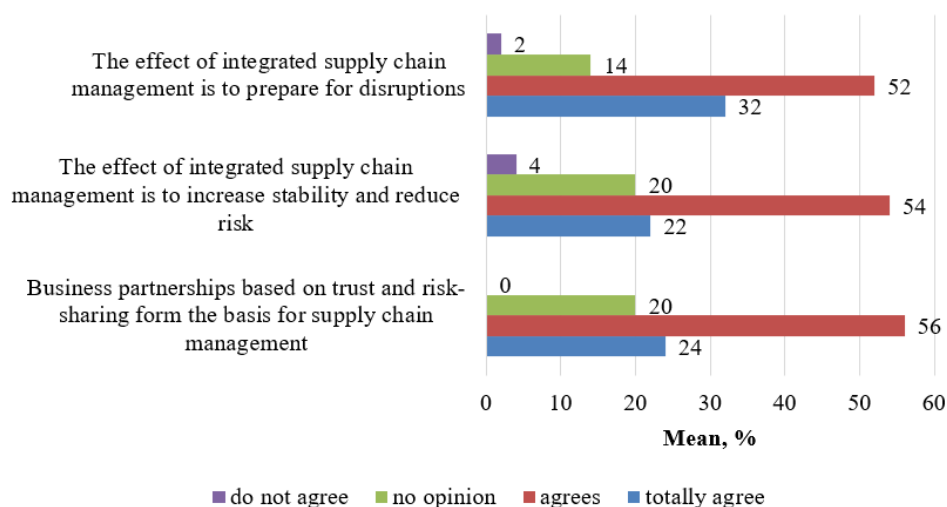
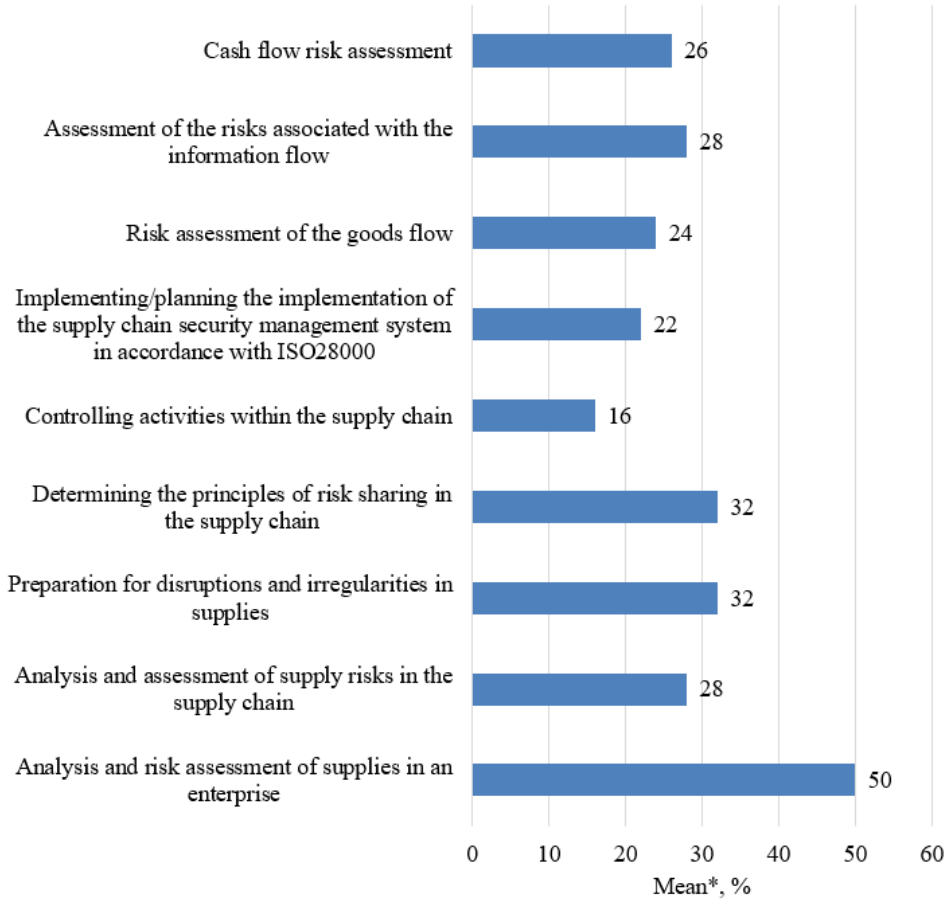


Fig. 1. Supply chain management vs. risk
Source: Own study

The respondents' indications makes it possible to state that enterprises notice a relationship between effective supply chain management and preparation for disruption and risk reduction. More than 80% of respondents agree with the statement that the effect of management within the supply chain is to prepare for disruptions, while 76% notice the possibility of risk reduction. At the same time, 80% of respondents agree that partnerships based on trust and risk-sharing constitute the basis for supply chain management.

The question of what competences of supply chain management are characterized by the analysed enterprises was another issue. The results of indications are presented in Figure 2.



* it was possible to choose more than one answer

Fig. 2. Competences of enterprises in supply chain management
Source: Own study

The studied enterprises mainly analyse and assess the supply risk in the enterprise (50% of indications), while less frequently within the supply chain (28%). The lowest number (16%) of indications applies to control of activities within the supply chain, which indicates a limited possibility of impact on risk due to the important role of control in risk reduction.

It is also worth noting that 32% of the surveyed enterprises indicate that as part of the cooperation in the supply chain, the principles of risk sharing have been defined.

Another studied area was the identification of risk elements in relations with suppliers and recipients, and their importance for enterprises. The obtained results are shown in Figures 3 and 4.

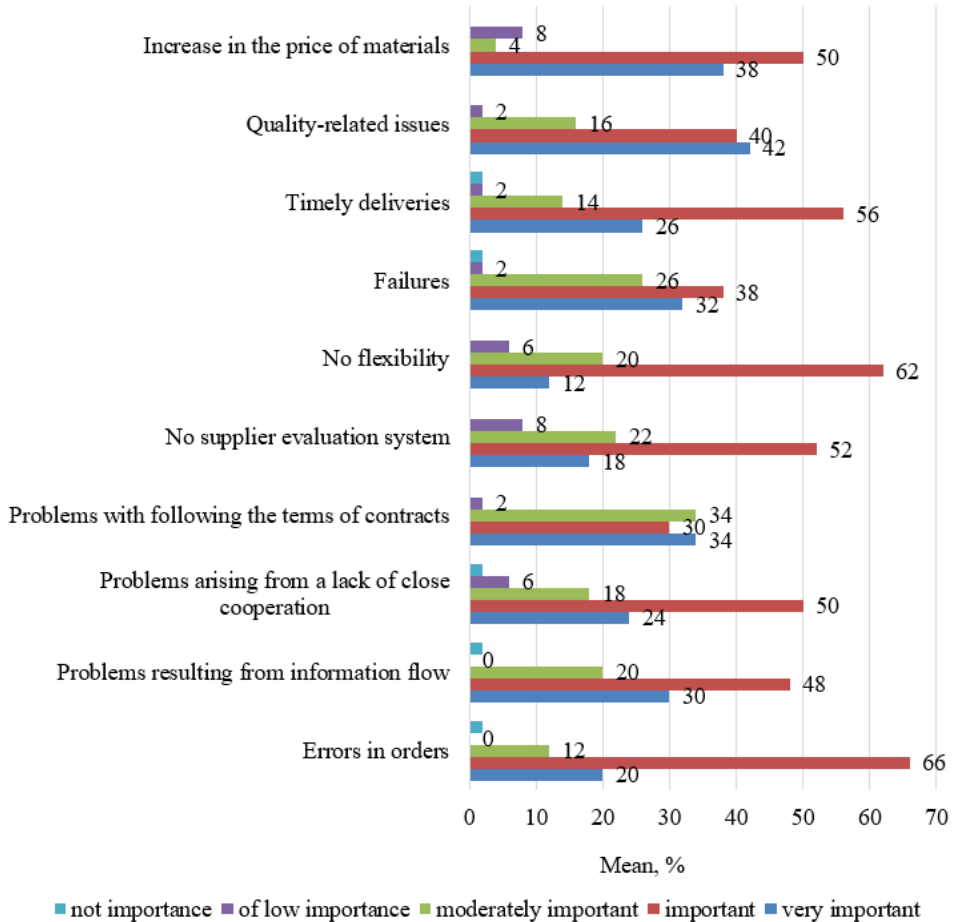


Fig. 3. Risk elements in relation to suppliers and their importance
Source: Own study

Risk elements, assessed as important and very important related to cooperation with suppliers, regard the areas relevant to operational activities such as price (88% of indications), quality and raw materials and materials (82%) and timeliness of deliveries (82%). According to the respondents, another important element in the risk assessment are also errors in orders (86% of indications).

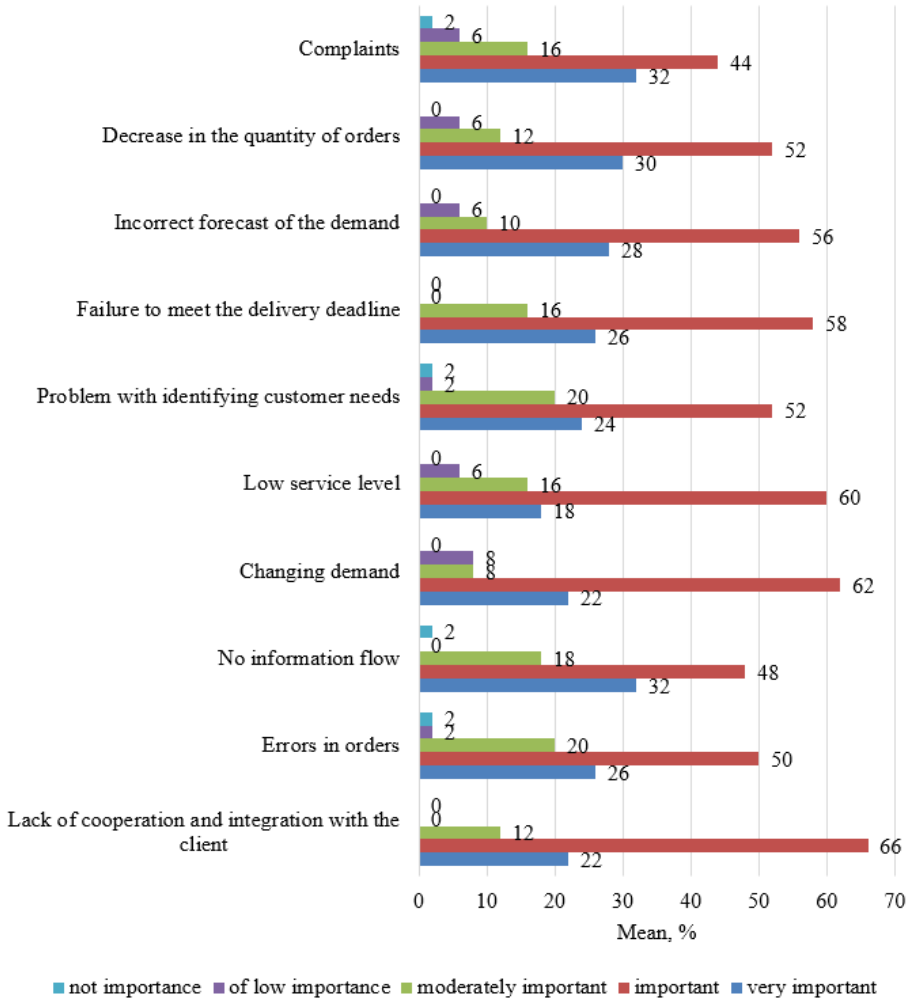


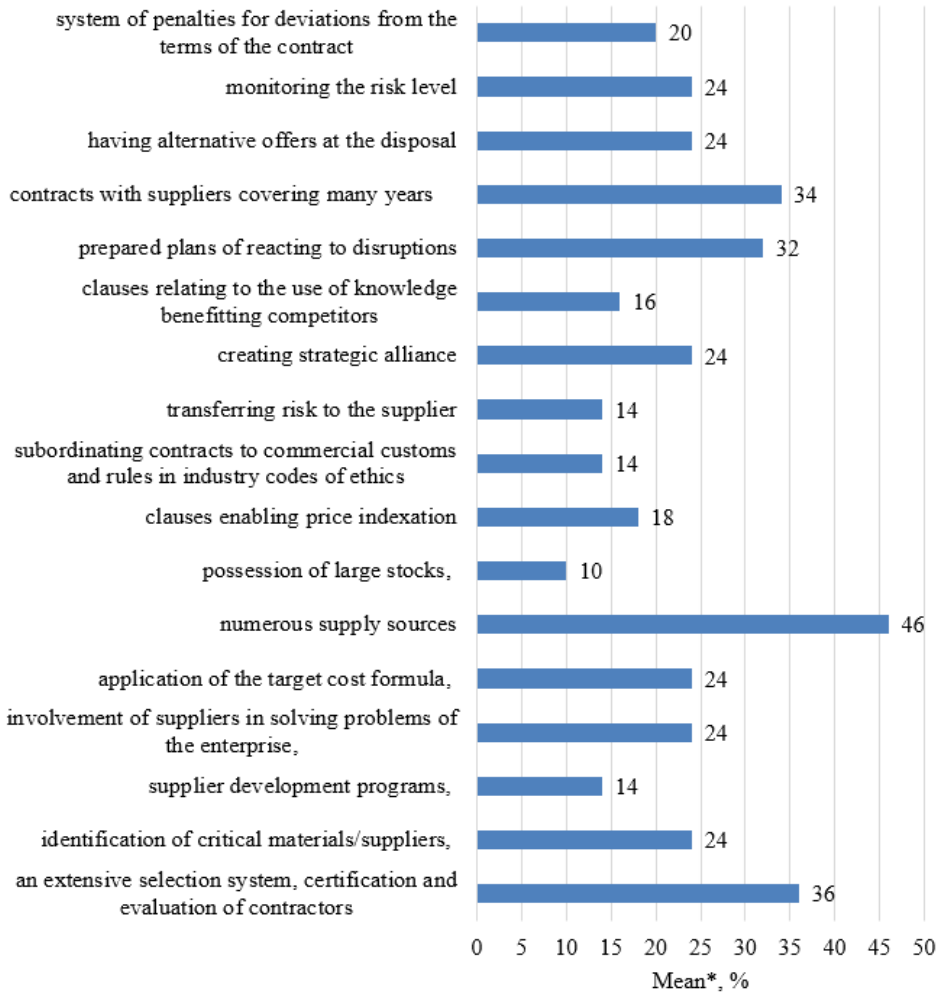
Fig. 4. Risk elements in relation to recipients and their importance
Source: Own study

The largest number of indications related to the risk associated with the lack of cooperation and integration with customers (88% of indications). The other elements of the risk assessment are at a similar high level.

Another area analysed is the application of methods of reducing supply risk in enterprises. The results of the respondents' indications are shown in Figure 5.

Based on the obtained results, it can be concluded that in order to reduce the supply risk, enterprises most often have numerous supply sources (46%), an extensive system of classification of suppliers (36), multi-annual contracts with suppliers (34%) and emergency plans (32%).

Another studied area covered the activities undertaken in risk management, and the results are presented in Figure 6.



* it was possible to choose more than one answer

Fig. 5. Methods of mitigating risk in undermining with suppliers

Source: Own study

Based on the obtained results, it can be concluded that in order to reduce the supply risk, enterprises most often have numerous supply sources (46%), an extensive system of classification of suppliers (36), multi-annual contracts with suppliers (34%) and emergency plans (32%).

Another studied area covered the activities undertaken in risk management, and the results are presented in Figure 6.

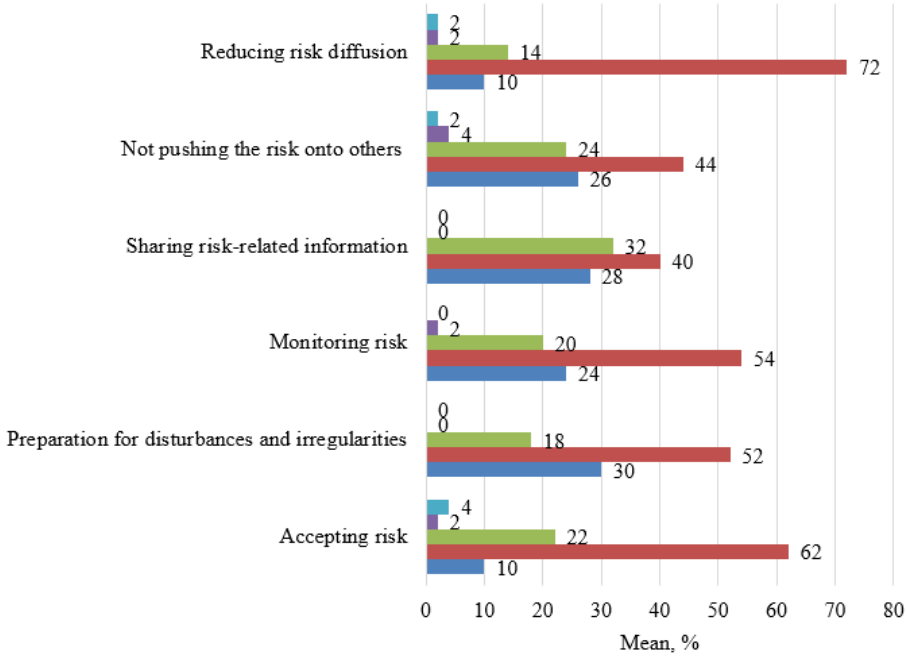


Fig.6. Risk management activities
Source: Own study

Among the results received, attention should be put on the lowest of the listed level of assessment in the area of sharing information about risk. This may indicate a lack of trust in cooperation with partners.

Summing up the results obtained, it can be stated that the analysed enterprises largely limit risk management to the enterprise’s own area, and the integration of activities in this area within the supply chain is limited.

Summary and conclusions

Integration with supply chain partners, under market economy conditions, becomes necessary as it provides the basis for effective competition in the market and reduces uncertainty and risk.

The idea of supply chains is to create relationship networks between entrepreneurs, which requires to manage the physical flow of material goods, financial means, and also data and information. A high level of efficiency and reliability requires

information sharing and joint planning as well as coordination, monitoring and risk sharing. Uncertainty and risk are an integral part of the activities carried out within individual enterprises, interactions and couplings in individual links of the supply chain and, in particular, the functioning of the supply chain as a whole. Particular importance should be attached in this context to understanding the conditions, dependencies and interactions between partners in supply chains.

Understanding the preconditions of the activity of individual links in the chain and the relationships between them is a basic element of managing risk in the supply chain. The strength or weakness of the entire chain depends on its individual links and the associations between them. This, in turn, requires constant monitoring of changes in the environment and the structure of the chain. It is also a key element of risk management in supply chains, while another element is the undertaking of inter-organizational activities, in which the use of risk management methodologies consisting in the identification, assessment, mitigation and monitoring of risk elements at various levels allows to determine activities with a significant impact on the supply chain. Measures to structure such an approach are an essential element and challenge for theoreticians and practitioners of risk management in the supply chain.

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