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CONDITIONS OF INFORMATION FLOW IN SUPPLY CHAINS OF MANUFACTURING ENTERPRISES

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Purpose: The aim of the work is to identify and assess the basic conditions and the role of information flow in the aspect of creating relationships between manufacturing enterprises within supply chains.
Design/Methodology/Approach: The paper presents the results of a pilot study examining key aspects of information flow and exchange within the framework of collaboration between manufacturing companies in supply chains. The study was conducted using a proprietary survey questionnaire and included companies operating in Poland. The research covered topics such as identifying the role and scope of information exchange in supply chains, actions taken to improve information flow, issues of trust, risk, ensuring confidentiality, and barriers in relationships between business partners in the supply chain.
Findings: The obtained results allowed us to identify the role of information exchange among the surveyed enterprises and the activities undertaken in the field of information exchange as a fundamental element of integration and cooperation within the supply chain.
Research Limitations/Implications: The article is of an exploratory nature and provides a basis for further research in the field of building effective information exchange between enterprises in supply chains.
Practical Implications: Understanding the role of information exchange within inter-organizational relationships is a fundamental element of supply chain management and, at the same time, a significant challenge for many enterprises.
Social Implications: Building relationships based on information exchange within the supply chain is an important aspect of business operations and creating value for customers.
Originality/Value: The research niche presented in the article concerns the application of opinion and judgment research, based on the author's survey questionnaire, in the environment of manufacturing enterprises.
Keywords: information flow, supply chain, manufacturing companies, information security.
Category of the Paper: Research paper.

1. Introduction

In the current operating environment of businesses, identifying resources that ensure competitiveness plays a crucial role. Among these key resources is building relationships between business partners within the supply chain. The foundation for creating relational resources is collaboration in information exchange, which allows for the integration of the customer value stream and also provides opportunities for development and increased competitiveness.

Creating value currently requires focusing on activities such as speed of product or service introduction, shortened order lead times, and flexibility. This, in turn, requires the integration of resources, both physical and information, across all supply chain participants. Achieving benefits requires not only process optimization but, above all, close collaboration based on information exchange and trust between partners (Daneshvar Kakhki, Gargeya, 2019).

Collaboration, information exchange, and the use of information technology that ensures access to relevant and up-to-date information form the foundation of relationships in supply chains. It is worth emphasizing, however, that the basis for these activities is internal integration in the area of information flow, which is then extended to all supply chain participants. Collaboration within such an "extended enterprise" requires overcoming numerous barriers to information flow between supply chain links.

The aim of this study is to identify the determinants and role of information flow in establishing relationships between manufacturing companies and to assess the fundamental barriers and constraints in creating information resources in supply chains.

The research method used was a proprietary survey addressed to manufacturing companies operating in Poland.

The research objective was related to the following research questions:

- What competencies in the areas of internal integration and information flow in supply chains do the studied manufacturing companies demonstrate?
- What level of cooperation in the area of information exchange with contractors in the supply chain does the studied companies operate at?
- What actions are being taken and what information exchange tools are being used for integration in supply chains?
- How were the risk elements assessed and what security measures related to information exchange in supply chains were implemented?
- What actions are being taken to improve information flow and build trust within supply chain integration?

Obtaining answers to these questions allowed to assess the role of information flow in manufacturing companies and identify areas that influence effective cooperation in information exchange within supply chains.

2. Information flow in supply chains

Enterprises are a system of interacting material variables and information, and the efficient flow of information streams is a fundamental requirement for the effective functioning of their information system. Its efficient operation requires the involvement of IT services, the use of IT tools, and their adaptation to individual needs to collect, store, process, and use information in decision-making.

Currently, information technologies supporting Industry 4.0 play a special role within the information system (Fatorachian, Kazemi, 2021; Ghadge, Er Kara, Moradlou Goswami, 2020). New technologies can facilitate information exchange and reduce disinformation (Zissis, 2023), influence the decision-making process, streamline information flow in supply chains, and increase their resilience to disruptions (Huang, Wang, 2023). Information sharing in supply chain processes also has a significant impact on costs, financial results, and overall business performance (Şahin, Topal, 2019).

The concept of supply chain management is based on integration activities within individual organizations, which are then extended to other links. The essence of modern supply chain management (SCM) is the decision-making process related to the synchronization of physical, informational, and financial flows of demand and supply between its participants (Witkowski, 2016). In turn, functioning within a supply chain requires the development of new information channels that encompass all supply chain partners and address both internal and external information sources. This requires collaboration and commitment to integrate and coordinate material and information flows (Raweewan, Ferrell, 2018), particularly in areas such as inventory management (Dominguez et al., 2018).

Information exchange is a fundamental prerequisite for integration and coordination in modern supply chains (Huang, Phan, Do, 2023) between supply chain partners, which affects the level of cooperation and operational efficiency, reduces uncertainty and costs, and enables the fulfillment of demand-related (Wang, Zhuo, 2020) and pro-environmental (Zhang, Wang 2022) functions. Effective information flow combined with the use of modern technologies provides an opportunity to improve SCM efficiency (Gouiferda, Mounir, 2020), both in terms of integration, information exchange, and transparency (Dominguez et al., 2018), reducing forecasting errors, and improving the resilience of supply chain systems (Tang, Yang, Tu, Ma, 2021). However, it requires taking into account many factors that determine the effective flow of information (c.f. Kalaiarasan et al., 2022).

Supply chain efficiency is therefore the result of many factors: from personal relationships (Van der Walt, Niemann, Meyer, 2021), trust (Kim, 2025), digitization and access to information (Tiwari et al., 2024), to real-time visibility (Swink et al., 2023, Agrawal et al., 2024), which is currently a key issue. 2024), to real-time visibility (Swink et al., 2023, Agrawal et al., 2024), which is currently a key issue for organizations (AlMahri, Xu, Brintrup, 2025).

It is worth emphasizing that, apart from the use of modern technologies that support the flow of information and reduce uncertainty (Khamaiseh et al., 2024), reducing the bullwhip effect, increasing resilience and balancing the supply chain, organizational and relational conditions for information sharing are also important (Kembro, Näslund, Olhager, 2025). These include trust, culture, information asymmetry, risk, and organizational and relational factors that may limit the flow of information about threats in supply chains (Can Saglam, Sezen, Çankaya, 2020).

Reluctance to share information, incompatibility of IT systems, and lack of commitment to cooperation are just some of the factors hindering cooperation within the supply chain. Other important issues include information exchange (Wang, Zhuo, 2020), contractual arrangements between business partners regarding the use of information (Parry et al., 2016), and information sharing (Lotfi et al., 2013). The basic barriers (Hannibal et al., 2022) and limitations found in information systems in supply chains also include organizational standards, concerns related to trust (Collier, Sarkis, 2021), privacy and data security management in supply chains (Daneshvar Kakhki, Gargeya, 2019), and cybercrime (Herburger, Wieland, Hochstrasser, 2024).

However, it is worth pointing out a number of solutions (cf. Yin et al., 2025) currently recognized as tools supporting information sharing (Xue, Dou, Shang, 2021) or the dissemination of risk information in supply chains (Zhou et al., 2025; Fernando et al., 2022). One of them may be blockchain technology, which allows for reducing opportunism and lack of transparency through better information flow in chains and building trust (Dubey et al., 2020), increasing transparency, better planning, and supporting cyber resilience (Hajian et al., 2025).

3. Research Methodology

The research forming the basis of the study was pilot in nature. It was conducted using a proprietary survey questionnaire consisting of questions concerning the characteristics of the surveyed companies and the research issues addressed. The survey contained closed questions with the option to expand or supplement some of the answers. The questionnaires were completed by the target respondents, i.e., people in managerial positions, mainly in the area of supply chain management or other related areas (e.g., procurement, production). The results obtained in this way were subjected to quantitative and qualitative analysis and formed the basis for the conclusions.

The research sample was selected deliberately and focused on manufacturing companies. The research was conducted in 79 companies located in southern and central Poland (micro-enterprises were not included in the research). The characteristics of the companies surveyed are presented in Table 1.

Table 1.
Characteristics of the surveyed businesses

Classification criteria	Characteristics	Share, %
Size of operations	small	14
	medium	37
	large	49
Ownership	Polish capital	52
	with a share of foreign capital	34
	foreign capital	14
Range of operations	international	77
	domestic	18
	regional	5
Period of operation in the market	1-5 years	10
	6-20 years	47
	over 20 years	43

Source: Own study.

4. Research Results

The first issue examined was the assessment of the role of such elements as: internal integration of activities and functions, improvement of information flow, implementation of modern IT systems, and value creation in supply chains. The assessment was carried out using a 5-point Likert scale. The detailed results of the respondents' assessments are presented in Figure 1.

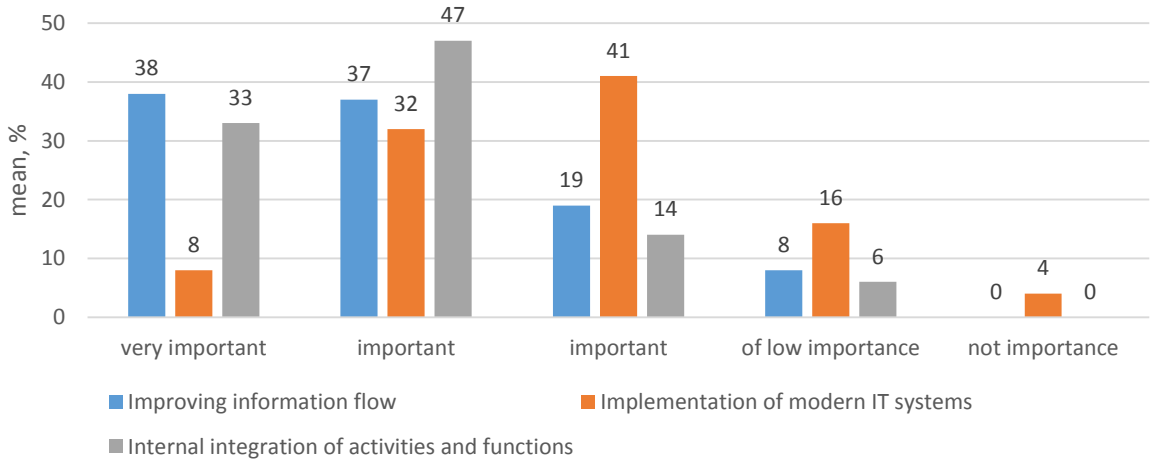


Figure 1. Assessment of the role of internal integration, improving information flow and implementing modern IT systems.

Source: Own study.

The results of the assessment in companies indicate the particular importance of integrating activities (as many as 80% of respondents rated this factor as important or very important). The role of improving the flow of information was also rated as important or very important by 74% of respondents. Surprising in the era of Industry 4.0 is the assessment of the factor concerning the implementation of modern IT systems (rated as important or very important by only 40% of respondents).

Another issue addressed in the survey concerned the assessment of the effects (achieved or expected) that may be associated with cooperation within an integrated supply chain in the area of information flow. Areas such as improving the flow of information, increasing the possibilities for fuller use of information and knowledge, increasing the accuracy of customer needs identification, and improving accuracy in planning and forecasting were taken into account. The results of the respondents' assessment are presented in Figure 2.

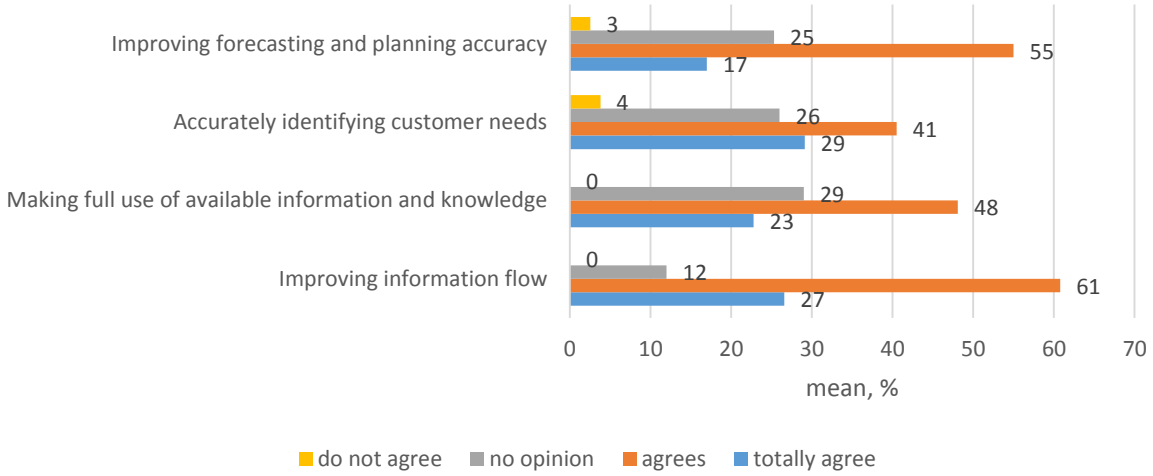


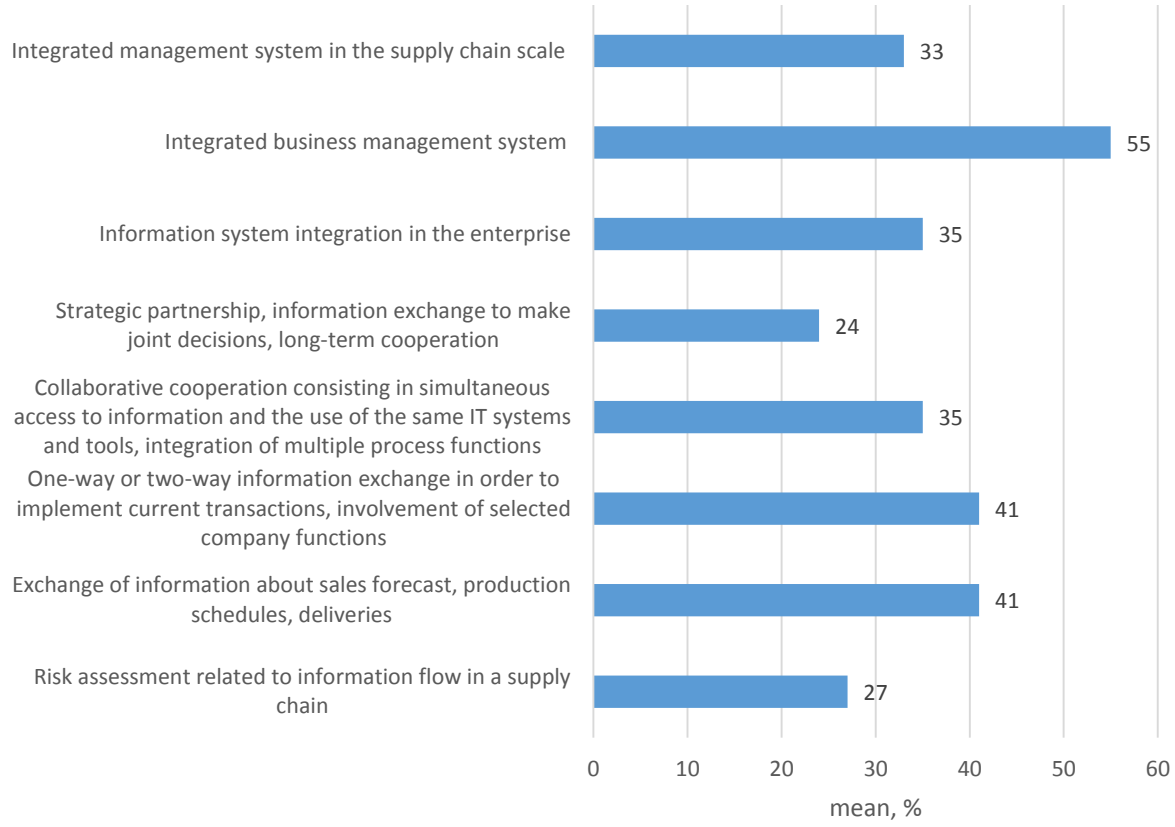
Figure 2. Effects (achieved or expected) in the area of information flow in integrated supply chain management.

Source: Own study.

The results obtained from the respondents' opinions indicate a significant correlation between supply chain integration and the positive effects achieved in the areas surveyed. For the vast majority of the surveyed companies, the positive effects of integrated supply chain management include improved information flow (88%), more complete use of information and knowledge (71%), improved forecasting accuracy (72%), and increased ability to identify customer needs (70%). The level of respondents' responses indicates a significant impact of the integration of companies within the supply chain on the improvement of the flow of information and knowledge, increased accuracy in forecasting, and identification of customer needs.

However, reaping the benefits of cooperation within integrated supply chain management requires a number of actions, from establishing rules for cooperation with partners, through the use of available tools, to building a common value system. Therefore, the next aspect examined concerned the identification of the competencies of the surveyed companies in the area of

integration, the nature of cooperation related to the exchange of information within companies and in supply chains. The results are presented in Figure 3.



* it was possible to choose more than one answer.

Figure 3. Competences of the enterprise in the area of information flow and integrated supply chain management.

Source: Own study.

Identifying the nature of cooperation between the surveyed companies in the supply chain allows for an assessment of the intensity and related scope of information exchange. Only 24% of respondents describe cooperation as a strategic partnership, characterized by long-term relationships and information exchange for the purpose of joint decision-making. As many as 40% of respondents describe their relationships with partners as cooperative collaboration involving simultaneous access to information and the use of the same IT systems and tools, as well as the integration of multiple process functions. Relationships involving the exchange of information on sales forecasts, production schedules, and deliveries, as well as those characterized by one- or two-way exchange of information for the purpose of carrying out current transactions, received 41% of responses each.

IT tools play a significant role in the integration process, both in terms of information flow and across the entire supply chain. Modern technologies enable not only the flow of information and communication, but also full time coordination and teamwork in a distributed environment, corresponding to modern supply chains. The basis for effective information exchange is the

integration of information systems, supported by modern tools in the form of integrated systems. In the first phase, information system integration most often takes place at the organizational level (35% of responses) and/or the implementation of an integrated management system (55% of responses), and can then be extended to the entire supply chain (33% of responses).

The results of the responses regarding the assessment of risks related to the flow of information in the supply chain (27%) can be described as low. At the same time, it should be emphasized that effective information exchange and trust are fundamental conditions for partnership in the supply chain. At the same time, lack of trust is most often indicated as a significant and very significant barrier to integrated supply chain management (74% of responses).

It was therefore reasonable to obtain information on which elements of information flow management influence trust building in the supply chain. The results are presented in Figure 4.

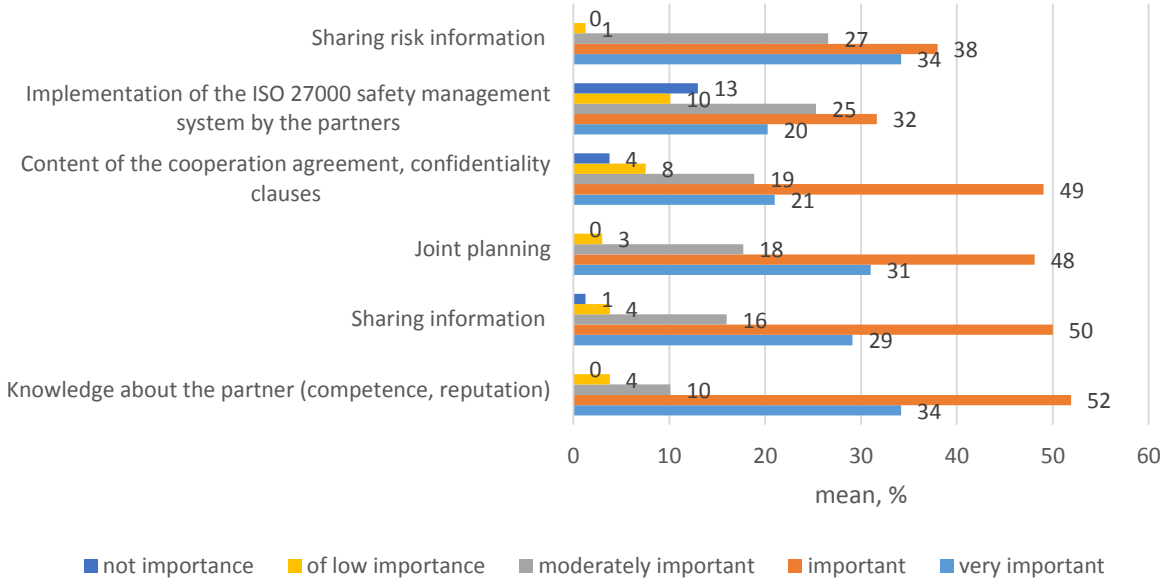
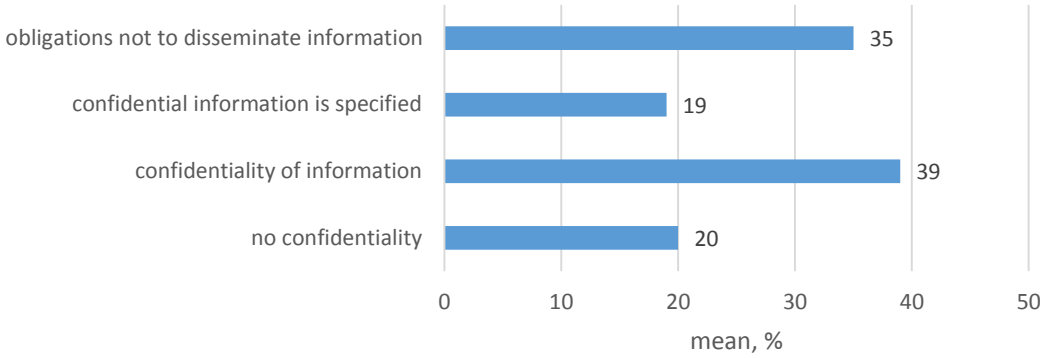


Figure 4. Information flow management elements influencing trust building in the supply chain.
Source: Own study.

According to respondents, the most frequently cited element of building trust in the supply chain is knowledge about the partner (86% indicated it as very important or important), followed by information sharing and joint planning (79% each), then 72% of respondents indicated that sharing information about risk and the content of the cooperation agreement and confidentiality clauses (70%) were important. Respondents considered the implementation of an ISO-based information security management system to be less important.

Another issue concerned measures taken to ensure the confidentiality of information in cooperation with partners in the supply chain, and the results are presented in Figure 5.



* it was possible to choose more than one answer.

Figure 5. Obligations towards partners in terms of confidentiality.

Source: Own study.

The regulations and activities concerning mutual obligations most frequently indicated by respondents concerned obligations regarding confidentiality of information (39%) and non-disclosure of information (35%), while 19% of respondents indicated obligations of confidentiality only in the case of classified information. At the same time, a significant proportion (20% of respondents) indicated a lack of regulations and obligations regarding confidentiality of information in cooperation with partners.

An important element of the functioning of the supply chain is the issue of risk and disruptions in the flow of information. The results of the assessment of the significance of individual disruptions and restrictions related to the flow of information on the functioning of the supply chain are presented in Figure 6.

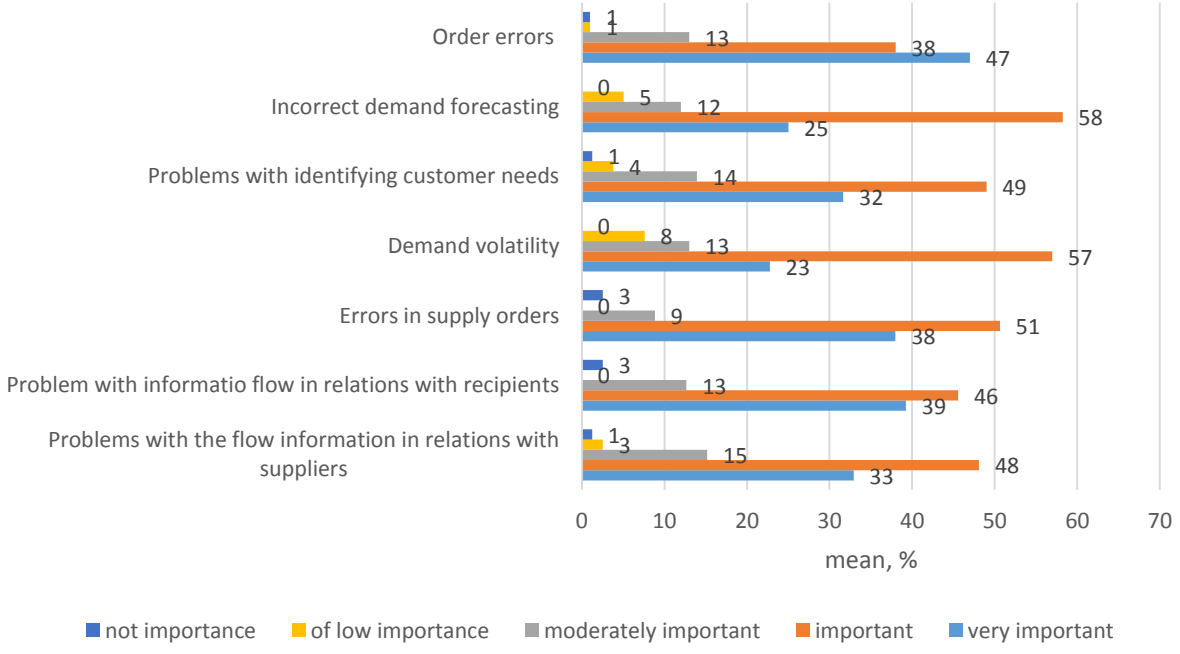


Figure 6. Information disruptions and their significance in connection with partners in the supply chain.

Source: Own study.

The results of the study indicate a significant impact of irregularities in the flow of information on the functioning of the supply chain. According to the respondents, the highest impact on supply chain disruptions is caused by errors in orders, both on the part of customers and in procurement orders. Respondents ranked problems in the flow of information in relations with customers and suppliers second. Problems related to identifying customer needs, forecasting demand, and its volatility received lower scores.

5. Summary

Gaining a market advantage requires close cooperation with business partners, which can be one of the greatest opportunities for stimulating business development. At the same time, effective information flow in supply chains remains a major challenge in business practice and an untapped area with significant potential for creating competitive supply chains.

Based on surveys conducted on the conditions for information flow in supply chain management in manufacturing companies, it can be concluded that they recognize the important role of information exchange between partners in the supply chain and elements such as integration of activities and improvement of information flow. The most frequently mentioned positive effects of integration in the supply chain are the streamlining of information flow, fuller use of available information and knowledge, and improved forecasting and planning accuracy. In terms of the scope of cooperation and information exchange in the surveyed companies, links can be identified mainly in the exchange of information on sales forecasts, production schedules, and deliveries. Cooperation defined as a strategic partnership is not very common, nor is the assessment of risks related to the flow of information across the entire supply chain.

The results indicate that the basis for building trust in relations with business partners is gaining knowledge about the partner, joint planning, and sharing information. At the same time, ensuring security in the flow of information through regulations such as confidentiality or non-disclosure agreements is an important aspect of information flow in business practice. However, it is worth noting that in the case of a significant proportion of the companies surveyed, there is a lack of regulations in this area.

The research results presented in this paper are limited to manufacturing companies, but a comprehensive analysis of cooperation involving partners throughout the supply chain seems justified. Similarly, in the case of risk analysis, in the area of such important resources as information and knowledge, it seems reasonable to extend the research to include issues related to the effective and efficient flow of information and its security. It should be emphasized that the flow of information is the basis for the formation of knowledge, which plays a special role in gaining a competitive advantage.

The article did not conduct a statistical test of correlation between the level of supply chain integration and the obtained results and the impact of limited strategic collaboration (24%) on supply chain resilience was also not examined. Moreover, the research results presented in the article are of a pilot nature, therefore further research requires the definition of a methodological framework.

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