

The Influence of Coordination Mechanisms on the Procurement Performance Indicators of Supply Chains Participants

E.R. Abramova,¹ I.O. Protsenko², I.V. Terenina³

¹*Entrepreneurship and Logistics department Plekhanov Russian University of Economics, Russia, Moscow*

²*International commerce department the Corporate Governance High School Russian Presidential Academy of National Economy and Public Administration 119571, Russia, Vernadskogo avenue, 82, Moscow*

³*Marketing and engineering Economics department, Don State Technical University. Don State Technical University. (DSTU) 34400, Russia Gagarin Square 1, Rostov-on-Don*

¹eassman@list.ru

²290533@list.ru

³teririn@yandex.ru

Abstract—The proposed paper is an analysis of the impact of coordination mechanisms on the procurement performance indicators of participants in supply chains. Particular attention is paid to the study of mechanisms for joint planning, harmonization of guidance documentation in the field of process logistics management, coordination of operational procurement procedures, joint use of material, labour and information resources of partner enterprises in conjunction with the dynamics of stock status parameters, procurement volumes, percentage of completed orders, compliance with obligations for deliveries, etc. The dependence of logistic indicators on the level of use of joint activity instruments by companies in their relations with suppliers is shown; conclusions are drawn about the influence of coordination mechanisms on increasing the competitiveness of participants in integrated supply chains. When carrying out this study, methods of comparative and system analysis, expert evaluations, questionnaires, comparisons by analogy, and statistical analysis were used. The methodological basis of the study was the work of domestic and foreign scientists and practitioners in the field of logistic coordination, procurement management, and supply chain management.

Keywords— *Inventory management, completed order, price forecasting, procurement, supply volumes, logistic coordination mechanisms, joint planning, information transparency, supplier integration.*

1. Introduction

A study of the works developed by the classics of logistics management, and also modern theoretical and practical research in the field of procurement

coordination shows the urgency of developing inter-organizational relations of supply chain participants through the integrated use of various coordination mechanisms.

Cross-functional and inter-organizational logistics coordination types are identified in the concept of supply chain management (SCM). Inter-organizational coordination of partners in supply chains implies a higher level of coordination on the one hand, and on the other, the solution of joint problems, tasks of interaction between partners and contractors in order to increase the level of service, to optimize costs, quality of products and services, to use innovative technologies, to expand the market geography, etc.

Consider some of the points of view of Russian authors on the study of logistics coordination in a supply chain. In the opinion of a number of authors, for example, [1], etc., inter-organizational coordination is a partnership interaction aimed at the formation and continuous maintenance of the effectiveness of business processes in the supply chain by coordinating the risks, rewards, actions and goals of counterparties based on their segmentation [2-8].

Some authors highlight a number of important elements of inter-organizational logistic coordination: building relationships with contractors based on openness and trust; coordination of their goals with contractors / partners in the supply chain, as well as a system for sharing risks and rewards; the formation of project teams, the constant exchange of information to coordinate actions and management decisions. [9-13] Various conflicts of interest, situations requiring coordination and solutions are possible in the inter-organizational coordination of partners in the supply chain. Therefore, it is appropriate to talk about methods and approaches to their solution. For example, A.B. Vinogradov offers several measures to

prevent conflicts [9]: harmonization of goals and joint planning; establishment of a coordinating body; clear consolidation of duties and powers; development of a balanced scorecard; development of employee motivation system; use of mechanisms of interfunctional coordination; staff training related fields of activity; staff rotation; use of decision support systems, etc.

For example, M. Posternakova distinguishes in her studies on the problems of inter-organizational logistic coordination two groups of methods of logistic coordination: industry-wide and specific. [14] The author includes in an industry-wide group, for example, contracts and related evaluation parameters and standardization involving processes, norms, professional knowledge, and skills. The author gives a classification of the methods and tools of logistic coordination, which is important, and what we will talk about in this paper based on the results of the study.

Research studies have described various approaches to considering coordination mechanisms. In his work, G. Mintzberg considers five coordination mechanisms: mutual coordination, direct control or direct coordination, standardization of processes, standardization of graduation, and standardization of qualifications. As the author pointed out, the choice of coordination mechanisms may change as the organization develops and complicates its activities. [15-18]

An important aspect in the logistics coordination of partners in the supply chain is the harmonization and sharing of information technology. For example, they are the logistic coordination technologies, which are associated with an increase in the level of satisfaction of consumer demand. These include QR / Quick Response, ECR / Efficient Customer Response, VMI / Vendor-managed Inventory, CPFR / Collaborative Planning, Forecasting and Replenishment, SLA / Service level agreement, which are already known in the practice of companies.

The category of contract method of logistic coordination includes, for example, information technology SLA / Service level agreement: an agreement on the level of service between a client and a supplier. This agreement determines what goods and services should be provided, according to which standard, communication channels, interaction and document management, lead time, reporting, as well as ways to manage relations

between partners, and also rights and obligations of the parties [19].

It should also be noted that an important problem in the interaction of partners in the supply chain is an increase in inventory levels in the chain links, which was called the "bullwhip effect" [20, 21]. The desire to reduce inventory levels can be addressed in various ways and methods, for example, using VMI-technology of supply. But the optimal order size determined by the main company and the optimal delivery size from the supplier, which is called in foreign sources as "Economic Lot Size (ELS)", may differ. [22-26] Russian companies are characterized by a low level of trust with partners in the supply chain, which means their information gap in their coordination. Therefore, technologies such as VMI, SRM, etc., can be effective when participants are links in the same business and their activities are not competing against each other.

A number of authors, for example, [27] note the importance of the transition from vertical to horizontal supply chains, in which the synthesis of information technology, virtual integration and the responsiveness of suppliers is important to reduce the level of uncertainty in the external environment.

The formation of mutually beneficial relations between suppliers and consumers is considered by most scientists and practitioners from the point of view of implementing a systematic approach. So, according to foreign authors M. Linders and F. Johnson, the logistical coordination is determined from this position in their scientific work "Procurement and Supply Management". According to these authors, "the attractiveness of the logistic concept is explained by the fact that it analyses the process of material flow as a complete system, from the initial need for materials to the delivery of the finished goods or service to the consumers. Here an attempt is made to ensure the communications, coordination and control necessary to avoid possible conflicts between the functions of physical distribution and material flow management" [28].

Partnership formation also plays a special role in D. Gattorn's work "Supply Chain Management". However, at the same time, he draws attention to the likelihood of increased conflict among participants in partner unions: "Disagreements often arise about how to measure joint benefits and how these benefits should be shared among participants." [29]

In many respects, these views are similar to the positions of representatives of procurement management: Aryan van Willy, Robert Monzk, Peter Kraljic and some other scientists. In particular, the

model of [28] considers the so-called levers of the implementation of the procurement process, which are based on the use of separate coordination mechanisms, namely: integrated procurement planning, wide use of information technologies in the relations between suppliers and consumers, and joint management of labour resources. At the same time, aspects of the formation of mutually beneficial relations with suppliers depending on the integrated use of coordination mechanisms and the determination of their impact on the main indicators of the procurement activities of companies were not fully reflected in this concept. These issues are studied to a much greater extent in the work by Peter Kraljic; however, in his procurement concept, he considers the dependence of the financial performance of an enterprise only on specific categories of purchased products (for each of which he proposed his own procurement strategy). [30]

These ideas were further developed in the KPMG procurement maturity model, the authors of which believe that the interaction between companies based on the principles of partnership involves the use of the most diverse forms of joint activities in the relations between participants in supply chains. In particular, special attention is paid to the formation of effective organizational structures of enterprises participating in supply chains “having a significant impact on business” [29] D. Johnson and D. Wood, who believe that one of the most effective ways of coordination in an enterprise is to use a rational organizational structure, hold the same view [10].

According to M. Bowersox and D. Kloss, the development of a system for exchanging information between participants in the logistics process is of particular importance for building coordinated supply chains. “Coordination is the core of the entire system of information exchange between participants in a value chain. [7]

The relevance of the use of coordination mechanisms in procurement management is quite fully justified by modern Russian scientists. So, V.I. Sergeyev identifies logistics functions that are directly related to the “coordinating and integrating role of logistics, and then the supply chain management.” He includes such functions as managing an order fulfilment cycle. [19] A number of domestic experts such as [11], [6] [8] and others consider logistic coordination in conjunction with the use of the resource integration mechanism, in particular, the development of information

technologies, joint use of material and technical base by partner enterprises, etc. However, the relationship of coordination mechanisms with changing procurement parameters and their role in increasing the competitiveness of supply chains in the scientific literature is not sufficiently reflected. These circumstances determined the choice of the direction of this study.

2. Methods

The proposed work was carried out by the authors on the basis of a survey, comparative analysis and expert assessment of 34 domestic and foreign companies operating in the Russian market. In April-June 2020, production, trading, and transport enterprises, construction companies, warehouse operators took part in the study conducted by the authors. Assessment of the impact of joint activities performed by supply chain participants on key procurement indicators was carried out within the framework of several (most important, from the authors' point of view) coordination mechanisms: joint planning, harmonization of guidance documentation in the field of logistics management by procedures, coordination of operational procurement procedures, motivation of procurement and sales personnel for achieving uniform end results; resource integration, i.e. joint use of material, labour resources, the formation of a single information space of partner enterprises.

The result of the analysis was the determination of the dependence of stock status indicators, procurement volumes, compliance with supply obligations, and the share of the completed order on the level of development of coordination mechanisms in the procurement activities of enterprises in the supply chain.

3. Results

The analysis of the statistical data provided by the participating research enterprises for each of the coordination mechanisms confirms their direct influence on the key procurement performance indicators of supply chain companies. Most obviously, this trend (dependence) is manifested in relation to optimizing the value of stocks of partner companies. Survey results showed that over the past three years about 23% (of the companies surveyed) have achieved a reduction in inventory levels by an average of 16.6%. At the same time, the volume of purchases of such companies increased, on average, by 20%, and the number of supplier partners increased by about 30%. It seems that such an outcome is the result of effective interaction between partners. The diagram in Fig. 1 clearly shows the dependence of the average level of stocks of

companies on the share of the use of various coordination mechanisms.

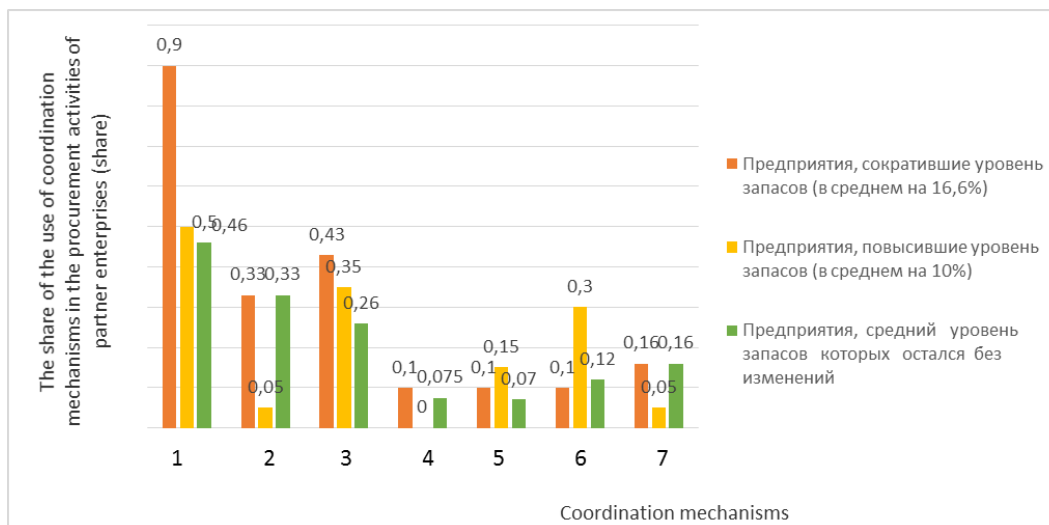


Fig. 1. The dependence of the average level of stocks on the share of the use of coordination mechanisms in the procurement activities of partner enterprises (Average values as of 01.06.2020)

Legend:

Used coordination mechanisms:

- 1- Joint planning;
- 2- Harmonization of procurement guidelines;
- 3- Coordination of operational procedures;
- 4- Sharing of material resources;
- 5- Application of a unified system of personnel motivation for the final results of joint activities;
- 6- Use of a single information space;
- 7- Involvement of supplier's personnel in the implementation of procurement procedures.

Obviously, the work with suppliers in the direction of planning had the greatest impact on optimizing the stocks of enterprises (gap 0.4). By joint planning activities, companies increase their degree of confidence in suppliers: they gain additional opportunities for accurate calculation of the optimal size of supply lots, time intervals between deliveries, determination of order points, and, as a result, ensuring uninterrupted supply of their customers. This allows them to achieve optimization of the value of stocks for each of the participants in the supply chain.

At the same time, as statistics showed, the joint use of material resources and a single information base did not significantly affect the analysed indicator. On the contrary, enterprises that actively use these coordination mechanisms in their procurement

activities have increased the average inventory level. In this regard, it is possible to assume that the identified trend is associated with a change in procurement volumes. In particular, at enterprises, the purchase volume of which grew by an average of 30%, there was an increase in the average level of inventories by about 10%, and it was these companies that most actively used common information systems and a common material and technical base (especially in the transport and storage household).

In general, 38% of companies noted their dynamics in terms of procurement volume. These are mainly enterprises that over the past three years have increased the number of partner suppliers (on average, by 16%) and increased both the volume of purchases (on average, by 26%) and the level of use of coordination mechanisms. The greatest dependence takes place here according to the mechanism of joint planning (gap 0.2) (Fig. 2). As mentioned above, the formation of joint plans both for short-term periods and for a strategic perspective, as well as subsequent coordination of the participants' operational activities based on staff motivation for the final result of the work (achieving maximum matching between purchases and sales) allows in the best way regulate counterparty relationships. As a result, conditions are created in which customers are not afraid of an increase in the volume of purchases (accepting ever-increasing volumes of products for their further sailing).

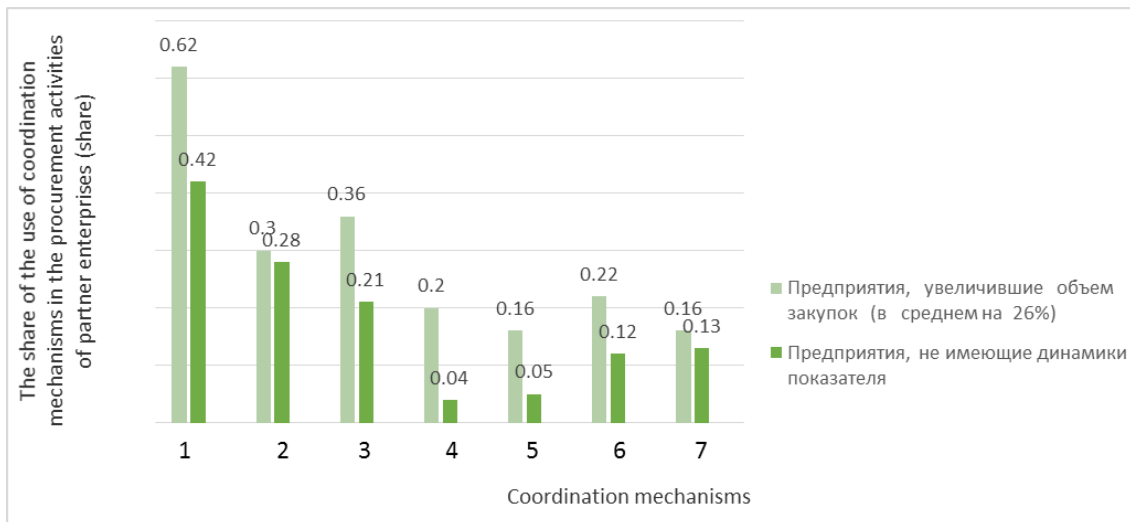


Fig.2. Dependence of changes in procurement volumes on the share of the use of coordination mechanisms in the procurement activities of companies (Average values as of 01.06.2020).

The majority of respondents called the share of the completed orders as the most important quality indicator of the effectiveness of procurement activities. More than half of the enterprises indicated a significant improvement in this indicator for 2019 and the first half of 2020 linking this fact with the active use of the mechanism for coordinating operational activities (the largest gap is 0.26 units for

the level of development of this mechanism between the enterprises showing an increase by 20-30% in the proportion of the completed orders for the last year and a half and the enterprises that do not have such dynamics), as well as the formation of a single information space with suppliers (a gap of 0.22 units).

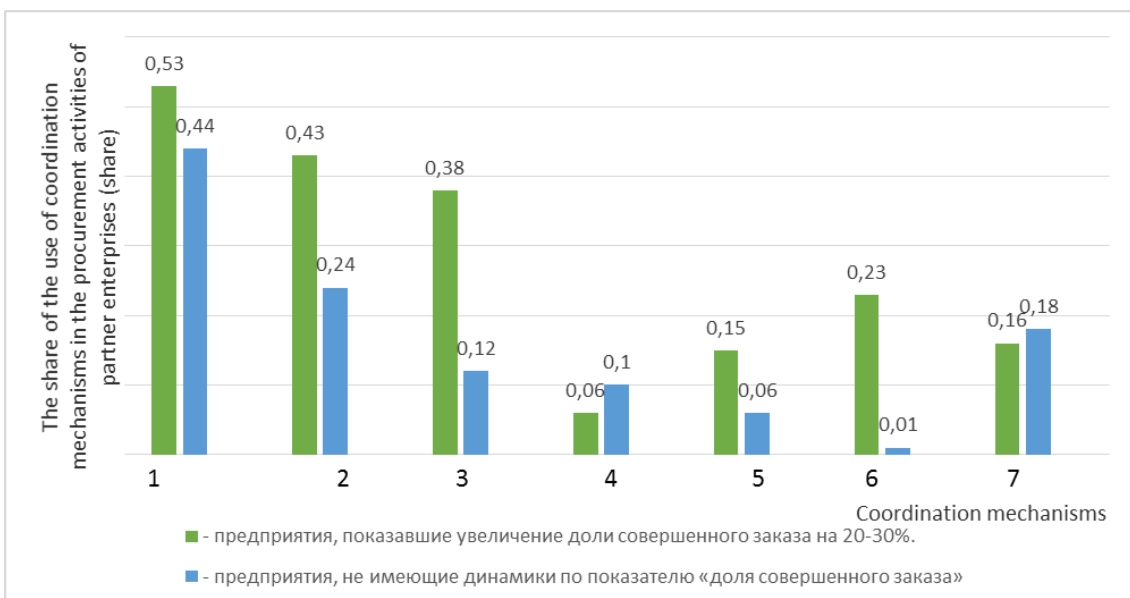


Fig. 3. Dependence of the share of the completed orders on the level of use of coordination mechanisms in the procurement activities of partner enterprises (Average values as of 01.06.2020)

The following trend can be traced as to attracting the personnel of suppliers to fulfil the procurement functions for customers: the share of completed orders at enterprises involving personnel of partners is by 0.02 units lower than in traditional management (Fig. 3). The aforementioned also confirms the assessment for the indicator showing the share of

violations of supply obligations, which is one of the most important components of completed orders. More than 32% of the companies participating in the study reduced the share of violations of supply obligations by an average of 22.5%. The utmost importance in achieving this result was played by the application of the joint planning mechanism (gap 0.54) (Fig. 4). However,

companies that actively use the services of supplier personnel were not able to achieve a reduction in the proportion of violations of supply obligations. This state of affairs for a number of indicators may be determined by the insufficient degree of motivation of suppliers to work for a common end result of

reducing costs for the logistics system as a whole. In this regard, as practice shows, despite sending their representatives to customers to mutually agree on the processes of procurement, supply, sales and inventory management, in reality such companies continue to work taking into account their own interests.

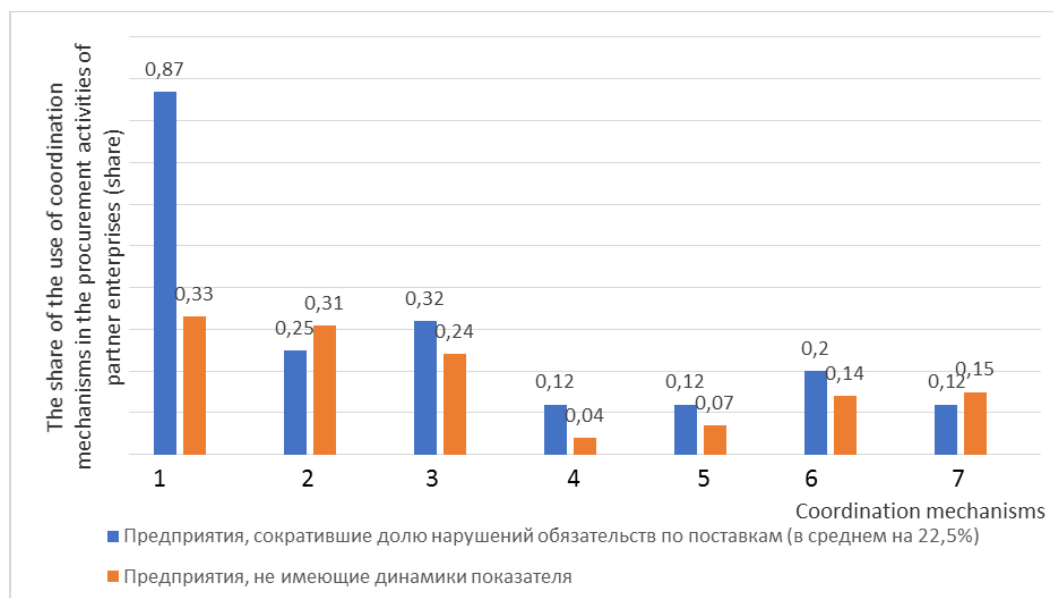


Fig. 4. Dependence of the share of violations of supply obligations on the level of use of coordination mechanisms in the procurement activities of partner enterprises (Average values as of 01.06.2020)

The use of coordination mechanisms in procurement has a significant impact on improving the accuracy of procurement price forecasting. (Fig. 5) Not all companies consider this indicator to be a priority (rating 7.5 points on a 10-point scale). However, over the past 1.5 years, more than 30% of enterprises noted its positive dynamics (on average, by 17.5%) due to close cooperation with partners. The maximum (up to 30%) increase in the accuracy of price forecasting occurred among companies actively developing mechanisms for joint planning and resource integration with suppliers. The survey participants noted the achievement of the highest performance in these areas (8-9 points). Moreover, as can be seen in Fig. 5, the maximum difference between enterprises that have increased the accuracy of forecasting procurement prices and those which parameters have remained unchanged takes place in the direction of sharing material resources (gap of 0.3). This situation is quite predictable in relation to various types of procurement (direct and indirect procurement, procurement of goods and services), since the mutual use of the assets of partner enterprises (transport, storage, investment in improving the economic development of partners, etc.) has a

direct impact on the joint formation of purchase prices allowing suppliers and consumers to reach a compromise with respect to price not only for a short period of time (in the process of selecting a supplier), but also in a strategic perspective.

In the process of direct procurement of raw materials, consumables, finished products, suppliers and consumer enterprises jointly using the logistics infrastructure are able to most accurately estimate the value of logistics costs in the total cost of purchased products, optimize them and thus predict compromise prices for acquired material resources in the course of joint work. In addition, in a situation where an (economically) stronger supply chain partner assists the counterparty in solving its economic problems (for example: invests in the most important supplier of material, financial, human resources, helping by joint efforts to solve problems in the economy, technology, personnel management, improving the quality of finished products, etc.), it becomes obvious that in the future the former will directly participate in the formation of prices for purchased material resources, in some cases (in the interests of the entire supply chain) restricting suppliers' purchase prices for products and services.

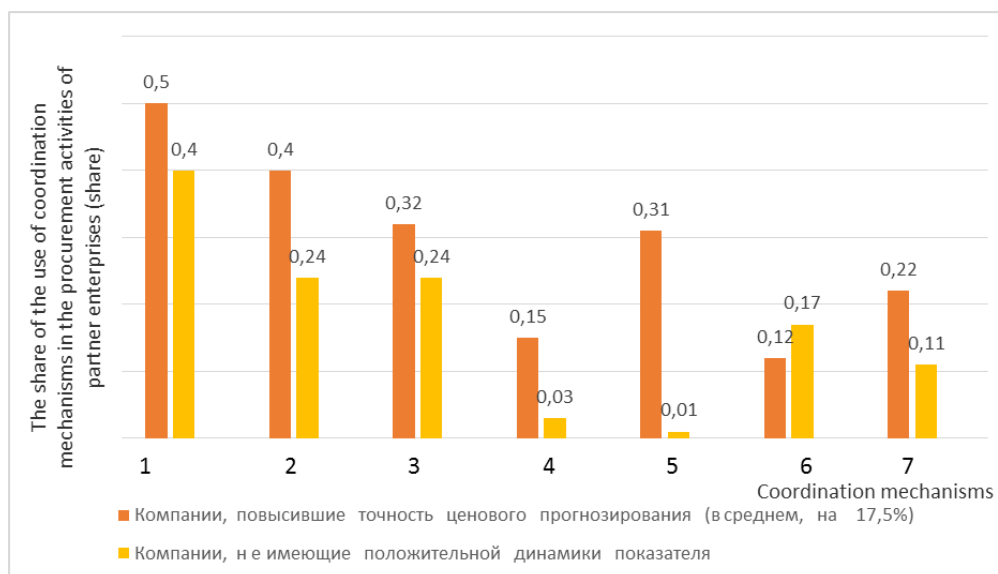


Fig. 5. The dependence of the accuracy of price forecasting on the level of development of coordination mechanisms in the procurement activities of partner enterprises (Average values as of June 1, 2020)

4. Discussion

An assessment of the most important areas of joint procurement activities has shown that in modern conditions, joint planning is becoming the most popular mechanism for inter-organizational coordination of supply chain participants. More than 85% of the companies surveyed use it in their procurement activities. Moreover, according to average estimates, the share of joint planning is 40-45% in the total volume of joint procurement activities of partner companies. The use of this mechanism has the greatest impact on optimizing the stocks of partner enterprises, increasing the share of completed orders, reducing the share of violations of supply obligations, increasing the consistency of procurement and sales plans. Most of the experts surveyed had rated the effectiveness of this coordination mechanism at 8–9 points on a 10-point scale.

The least impact on the dynamics of procurement indicators is provided by joint ventures in the direction of resource integration with partners, namely the joint use of logistics infrastructure and personnel of participating companies. These coordination mechanisms are quite risky due to the lack of regulated economic and legal relations in this area and, as a result, insignificant impact on the improvement of such indicators as the share of violations of supply obligations, the flexibility of procurement and supply, inventory levels, procurement volumes, etc.

Nevertheless, the use of resource integration mechanisms had a positive effect on improving the

accuracy of price forecasting of partner companies, which, in our opinion, should be associated with the effect of joint use of logistics infrastructure. Under these conditions, more opportunities arise for an objective assessment of logistics costs in the supply chain and price management.

The positive dynamics of the analysed indicators is also associated with the active use of harmonization mechanisms, coordination of operational activities and the formation of a single information space with suppliers, which affected the increase in the proportion of the completed orders.

5. Conclusion

The performed study allowed the authors to come to the following conclusions:

- The use in practice of companies of most of the coordination mechanisms considered allows supply chain participants to achieve maximum coordination of purchase and sales plans, which leads to an improvement in the most significant parameters of their procurement activities;
- In modern conditions, the relevant areas of integration in the supply chains in the procurement sphere are joint planning, coordination of operational procurement procedures, and the formation of a single information space. More than 90% of the participants in the study called these coordination mechanisms the most effective in terms of their positive impact on the procurement performance of most companies;
- The results of the study allow enterprises operating in various sectors of the economy to determine strategic directions for joint development, identify problem areas

in order to change procurement policies, and invest in the most relevant and priority areas of interaction in order to increase competitiveness in the market of goods and services.

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