

# Impact of Supply Chain Management Strategies on the Performance Indicators of Small and Medium-Sized Businesses

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**Abstract**—The study considers the impact of supply chain management strategies on the performance of small and medium-sized businesses. It is shown that developed 4PL operators are economic integrators of countries dominated by small and medium-sized enterprises. The study deals with the data of the Federal Republic of Germany, China, the Republic of Kazakhstan, and the Russian Federation. The research hypothesis has been statistically confirmed: higher-level business models of supply chain management (for example, 4PL) are used in countries where there are significant investments in information and communication technologies. This positively affects the turnover of small and medium-sized enterprises. Logistics providers are supply chain integrators. It has been established that the higher the share of small and medium-sized businesses in the country's economy, the more developed the supply chain management system is. It has been shown that developed small and medium-sized businesses are integrated into a single management system with the help of 4PL operators; this makes it possible to increase the efficiency of both small and medium-sized enterprises and logistics operators. The scheme for increasing the efficiency of small and medium-sized businesses based on e-logistics has been presented.

**Keywords**— supply chain management system, logistics operator, small and medium enterprises, e-logistics.

## 1. Introduction

Modern trends in the global economy and market transformation processes observed in the domestic market dictate the need for changing the approaches to the structure and management of

the economic activity in general and supply chains in particular. The modern concept of supply chain management is a fundamentally new and creative approach to the regulation of economic processes in a market economy.

The concept of supply chain management (SCM) is part of the overall concept of sustainable development. Various economies have gained considerable experience in the application of this concept, which makes it possible to assess the impact of supply chain management strategies on business development, in particular on small and medium-sized enterprises. At the present stage of the development of society, the main factor affecting the effectiveness of supply chains is the introduction and use of digital technologies, for example, within Industry 4.0 [1].

Today, there are various business models of supply chain management [2]:

- 1PL (providers provide logistics services, such as freight transportation or warehousing);
  - 2PL (logistics providers perform all traditional functions of logistics related to transportation, processing and storage; this is a typical business model for freight forwarders, sea carriers, and parcel delivery services);
  - 3PL (logistics service providers offer cross-docking, inventory management and packaging design);
- 4PL and 5PL (providers have an opportunity to implement more alternative business models as joint economic solutions through the specific integration of consumer-oriented business processes to achieve a further positive effect of sustainability.

In the supply chain management industry, business models of shippers and carriers are classified according to the range of services and structure. Supply chain management has evolved from subcontracting (1PL) and globalization (2PL) to e-commerce and from cross-docking (3PL) to 5PL (4PL-5PL) [3].

In this regard, the potential of logistics service providers to promote sustainable practices in the supply chain comes to the fore; thus, coherent interaction between supply chain participants defines more sustainable and innovative business models.

In this context, various supply chain management strategies and the need to evaluate them to determine promising areas can be mentioned [4].

## 2. Literature review

The concept of sustainable development is dominant in supply chain management [5]. Within the framework of this concept, SCM is characterized by [2]:

- the availability of products and services focused on environmental, social and economic value;
- higher ecologization at all stages of the supply chain;

better interaction with customers and other interested parties to improve overall responsibility in production and consumption.

In scientific literature, research on sustainable supply chain management focuses on the economic and / or environmental aspects, namely on optimizing individual functions and reducing emissions from the transport sector. At the same time, less attention is paid to the social aspect of supply chain management [4].

Today, small and medium-sized businesses are increasingly focused on SCM as a means of reducing costs and improving work efficiency. The factors that make it possible to gain and maintain a stable dominant position in the face of the global environment uncertainty are the SCM strategies, collaboration practices and the integration of SCM and the overall business strategy. In particular, the quality, cost and flexibility of SCM and support policies, as well as problem solving and information exchange practices have the greatest impact on delivery and collaboration [6].

Modern supply chains are formed in a highly competitive and volatile environment that is characterized by significant regional differences, climate changes, different levels of urbanization of regions and countries, demography and dynamic demand changes [7]. Supply chain

management (SCM) is changed in accordance with the requirements of sustainable development; today, SCM is considered as part of the overall entrepreneurial strategy [2].

Efficiency criteria in SCM are different: reduced supply chain costs, increased total profits, synchronization of several intermediaries, higher customer satisfaction, increased territory coverage [3].

Basic supply chain business models include:

- Supply Chain Operations Reference Model (SCOR) that considers five main business processes (Plan, Source, Make, Deliver, Return); it is used for managing material flows excluding sales of goods and marketing, research, and after-sales service. The model combines the three modern management concepts of Business Process Reengineering, Benchmarking and Best Practice;

- Global Supply Chain Forum (GSCF) that considers the following business processes; Customer Relationship Management (CRM), Customer Service Management (CSM), Demand Management (DM), Order Fulfillment (FM), Manufacturing Flow Management (MFM), Supplier Relationship Management (SRM), Product Development and Commercialization (PDC), Returns Management (9RM).

The model provides for the information exchange within the supply chain, which makes it possible to increase the overall economic efficiency of the supply chain and improve commercial offers [8].

Enterprises face difficulties when trying to simultaneously improve logistics services and reduce logistics costs in order to achieve a long-term competitive advantage in supply chain management. Therefore, SCM is focused on the balance between the level of logistics services in accordance with customer requirements and the level of logistics costs [5].

It has been established that the main supply chain management indicators that affect business performance are [9]: strategic partnership with suppliers, the level and quality of information, customer service management, internal practices, and overall quality management. In general, researchers note that closer relationships with partners in the supply chain are associated with increased profitability of the company [10]. Moreover, company performance is affected by the relationship between the company and customers rather than its communication with suppliers [11]. Also, centralized planning within the supply chain contributes to operational efficiency; however, the main obstacle to the implementation of centralized supply chain management is the human factor, problems with the organization and implementation of software [12].

Planning is based on various statistical models,

methods of mathematical approximation and mathematical modeling, etc.; for example, route planning, location planning, network design or assortment planning [13]. In SCM, improved planning increases efficiency due to the introduction of information technologies, common management systems, synchronization of supply chain management processes, and reduced product launch time [14]; continuous monitoring and supply chain management, fixing and correcting changes and violations [15]; improvement of business processes, in particular related to procurement and warehousing [16].

Despite significant developments on the issue, there are still discussions related to a number of points. In particular, most studies focus on supply chain management of large companies, and problems of small and medium-sized businesses are not adequately discussed in scientific literature.

## 2.2 Setting Objectives

According to the Global Value Chains Development Report 2019 (a product of the WTO, IDE-JETRO, OECD, RCGVC-UIBE, World Bank Group and China Development Research Foundation), the main factors causing disruptions between regions and individuals in the supply chain are digital technologies, as well as the fact that today small and medium-sized enterprises are under-represented in global supply chains; however, digital technologies provide new opportunities for their active participation [17].

The purpose of the study is to justify the impact of the supply chain management strategy on the performance of small and medium-sized businesses, in particular the extent to which the development of information and logistics technologies affects the turnover of small and medium-sized enterprises in individual countries.

The research objectives are:

- to determine the role of small and medium-sized enterprises in the country's economy;
- to determine the impact of information and communication technologies used in supply chain management on the profitability of small and medium-sized enterprises;
- to compare the Russian Federation data with similar data from other countries;
- to analyze the results obtained in order to improve sustainable supply chain management.

## 3. Research Methods

### 3.2 Research context

The A prerequisite for modern supply chain management business models is coordinated and logistically integrated supply chains. Therefore, business growth strategies and mergers are at the core of the 6PL development strategy, which is impossible without generalized management based on information and communication technologies. An example of such systems is Amazon's supply chain management information system [18]. Despite the fact that the company is one of the largest companies in the USA, its supply chain management system coordinates the activities of a great number of suppliers that are small and medium-sized enterprises. The transition from 2PL to 4-5 PL makes it possible to create new solutions that include sustainability in traditional supply chain management systems and expand the capabilities of consumers to conduct logistics operations.

Sustainability of the existing system can be improved to a certain extent by business growth strategies and mergers. 4PL companies can increase sustainability by managing fast supply chain components. However, there is a limited number of 4PL companies that are capable of following such strategies.

### 3.3 Research hypothesis

The research hypothesis has been statistically confirmed: higher-level business models of supply chain management (for example, 4PL) are used in countries where there are significant investments in information and communication technologies. This positively affects the turnover of small and medium-sized enterprises. Logistics providers are supply chain integrators.

### 3.4 Research factors

The study discusses the dependence of the turnover of small and medium-sized enterprises on the investment in information and communication technologies (ICT) in the Russian Federation, China, the Republic of Kazakhstan, and Germany based on the materials for the period from 2011 to 2019 [19-22]. The availability of high-level logistics operators (4-5 PL) is determined depending on the share of small and medium-sized businesses in the economies of the selected countries.

### 3.5 Research Methods

A statistical relationship between the ICT investment indicators for the period from 2011 to 2019 and the turnover of Russian, Chinese, Kazakhstan, and German small and medium-sized enterprises was constructed.

Within the framework of the statistical hypothesis testing, a relationship between the above indicators will be built; based on the results obtained, a comparison of the dependencies will be made to develop business priorities for state regulation of investments in digital technologies.

The study involved:

- establishing correlation between the indicators based on the graphical method;
- assessment of the relationship between the x and

- y variables based on the empirical correlation relation;
- construction of a simple linear regression model of the relationship between x and y;
- determination of the adequacy and applicability of the constructed model.

Theoretical and practical developments in business process management and general scientific methods of system analysis were used to develop regression models and determine their efficiency.

## 4. Results

Table 1 provides statistical data on the investments in ICT and the turnover of small and medium-sized enterprises in the countries being discussed.

**Table 1.** Statistical data on the investments in ICT and the turnover of small and medium-sized enterprises in the countries being discussed (according to the data from national statistics services) [19-22]

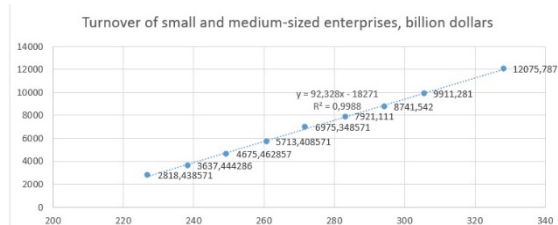
Year	Russian Federation		China		Germany		Kazakhstan	
	investments in ICT, million dollars	turnover of small and medium-sized enterprises, million dollars	investments in ICT, billion dollars	turnover of small and medium-sized enterprises, billion dollars	investments in ICT, million euros	turnover of small and medium-sized enterprises, billion euros	investments in ICT, billion tenge	turnover of small and medium-sized enterprises, billion tenge
2011	99	502.642457	227	2818.439	71.2	1.581	N/A	7.6
2012	112	503.876575	238.2	3637.444	73	1.589	N/A	8.22
2013	128	505.816922	249.4	4675.463	74.7	1.745	N/A	9.17
2014	126	417.322363	260.6	5713.409	77.6	2.116	122.95	15.57
2015	115	266.043969	271.8	6975.349	80.9	2.189	105.3	15.7
2016	123	266.043969	283	7921.111	82.8	2.294	57.739	19.6
2017	111	334.610931	294.2	8741.542	87.2	2.448	79.04	23.2
2018	123	288.280187	305.4	9911.281	90.3	2.581	99.24	26.47
2019	125	311.62954	328	12075.79	92.9	2.879	111.3	29.41

Based on the statistical data, graphical dependencies were built and regression dependencies were determined (Figure 1-3).

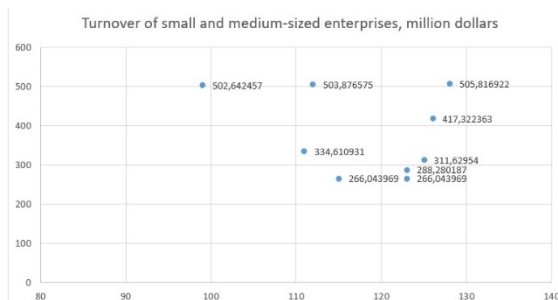
For the Russian Federation and the Republic of Kazakhstan: no adequate dependence was found.

For China:  $y = 92,328x - 18271$   $R^2 = 0,9988$ .

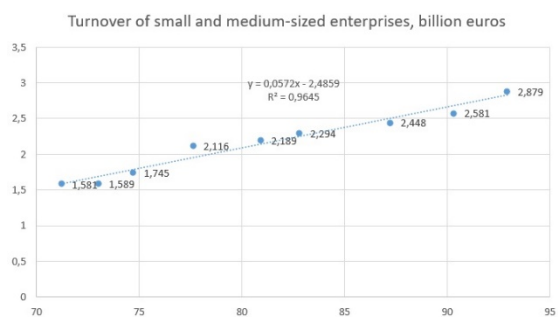
For Germany:  $y = 0,0572x - 2,4859$   $R^2 = 0,9645$ .



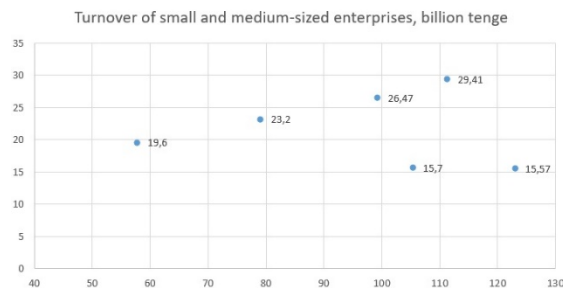
**Figure 1.** The relationship between the ICT investment and the turnover of small and medium-sized enterprises for the period from 2011 to 2019 (China).



**Figure 2.** The relationship between the ICT investment and the turnover of small and medium-sized enterprises for the period from 2011 to 2019 (Russia).



**Figure 3.** The relationship between the ICT investment and the turnover of small and medium-sized enterprises for the period from 2011 to 2019 (Germany).



**Figure 4.** The relationship between the ICT investment and the turnover of small and medium-sized enterprises for the period from 2011 to 2019 (Kazakhstan).

Linear dependencies with a high correlation coefficient were obtained for China and Germany. Thus, it can be stated that the research hypothesis has been statistically confirmed: higher-level business models of supply chain management (for example, 4PL) are used in countries where there are significant investments in information and communication technologies. This positively affects the turnover of small and medium-sized enterprises. For Russia and Kazakhstan, no adequate dependence that would describe the relationship between the analyzed parameters was found.

It also should be noted that the higher the share of small and medium-sized businesses in the country's economy, the more developed the supply chain management system is. In China, the share of small and medium-sized enterprises is about 90%; small and medium-sized businesses cater to the needs of 60% of the population and provide 75% of the working-age population with employment opportunities. The enterprises produce up to 90% of clothing, textiles, toys, and shoes that are exported. At the same time, 4 PL is observed (for example, Alibaba); the share of small and medium-sized enterprises in the economy of Germany is about 48%; 4 PL is also observed. It should be noted that in the Russian economy, the share of small and medium-sized enterprises does not exceed 15%; there is no need to create large logistics hubs and management systems. There is also no general trend toward the development of 4PL providers.

On the contrary, for the Republic of Kazakhstan, the need for hubs and their management systems is extremely high, for example, in the agricultural sector since it plays a significant role in the economic, social, and environmental life of the country. In 2017 the agri-food industry accounted for 4.4% of GDP and 18% of employment [23]. The Kazakhstan government, as well as the World Bank and the

European Bank for Reconstruction and Development, are implementing various programs in the field of agrology [24]. The national strategy Kazakhstan 2050 provides for the creation of logistics facilities outside of the Republic through joint investment projects [25]. Factors for the growth of the Kazakhstan logistics market include the interest of the state and other countries (China, Kyrgyzstan, Tajikistan, and Uzbekistan) in the development of land corridors through Kazakhstan, as well as the availability of free economic zones where efficient logistics should be developed [26]. At the same time, the central problems facing the Kazakhstan agricultural sector are as follows [27-29]:

- lack of a holistic concept of supply chain management and financial resources to create a large-scale network of logistics centers and terminals both in Kazakhstan and other countries;
- inadequate transport links between regions in the West-East direction, which increases logistics costs;
- low level of business interest in the improvement of public-private partnerships in logistics;
- lack of staff for marketing and logistics management;
- obsolete equipment of processing industry enterprises;
- insufficient volume of own seed stock;
- limited opportunities for obtaining loans in the field of logistics;
- ability to transport goods between China and the European Union, bypassing Kazakhstan;
- Russian attempts to develop its own logistics for export and import of goods engaging Russian logistics operators;
- low quality of logistics services.

Under these conditions, the development of logistics and the improvement of the supply chain management efficiency are of great concern to Kazakhstan.

Thus, it can be concluded that the development of ICT has become a driver for the development of small and medium-sized businesses, streamlined logistics, and allowed organizing various logistics hubs.

## 5. Discussion

The demand for 4PL providers stimulates the formation of logistics intermediaries.

The main difference between 4PL and 3PL is a

systematic approach to supply chain management, which provides for the general management, interaction and exchange of information about each business process within the supply chain.

It also ensures effective interaction and real-time data exchange on the basis of modern information systems and technologies in the framework of performing the following tasks:

- direct and reverse transportation of goods, warehouse and stock management, forwarding, coordination of suppliers and customers;
- packaging, repackaging, labeling, processing of payments;
- services of a customs broker;
- order processing that allows choosing carriers, including negotiations and consultations;
- provision of spare parts.

When entering a new market, logistic operators of any level act sequentially and gradually expanding their market share by providing a wider range of logistics services [18]. The speed of entering and tapping a new market depends on the financial capabilities of the logistics operator, the infrastructure used, as well as the market capacity. Therefore, to increase the effectiveness of this area, it is necessary to solve the following problems [17]:

- low level of trust in third-party organizations;
- inadequate number of competent logistics operators in the market;
- high cost of services;
- complex interaction between all supply chain participants due to the difference in existing standards.

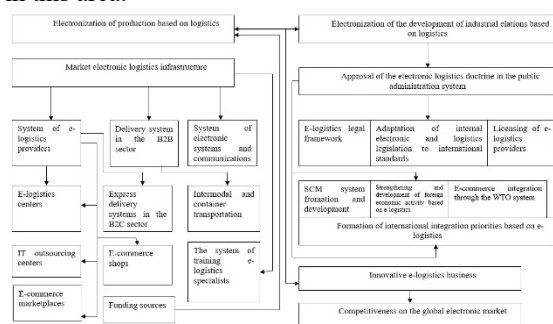
On the other hand, domestic logistics operators have less experience and fewer resources, which would make it possible to introduce the latest technologies in the industry. This problem is especially relevant in warehouse management, consulting, packaging, etc.

At the same time, developed small and medium-sized businesses are integrated into a single management system with the help of 4PL operators; this makes it possible to increase the efficiency of both small and medium-sized enterprises and logistics operators. Thus, Amazon, Alibaba, Metro and other companies coordinate the operation of a number of unrelated small and medium-sized enterprises by integrating them into a common system [18, 30, 31].

Today, domestic logistics companies have little prospect of survival among foreign operators operating on the local market [32]. They are large-scale businesses that exert price pressure on small competitors; in fact, they dump the price. We can only

hope that domestic logistics operators will learn to use their strengths to compete with foreign providers. On the other hand, low saturation of the logistics market can be considered optimistic; this allows local operators to occupy a significant market share.

Thus, the solution to these problems requires a comprehensive state approach which involves increasing the efficiency of the logistics sector and related areas, organizing a national logistics service system, creating transport and logistics clusters and / or hubs, and simplifying legislation in this area.



**Figure 5.** The scheme for increasing the efficiency of small and medium-sized businesses based on e-logistics

On the other hand, the entry of foreign operators into the domestic market of logistics services will make domestic providers improve the quality of services, increase their flexibility, develop integrated logistics services, etc.; this will help them become 4 PL operators. At the same time, the shortage of qualified personnel, logistics experts, regional expansion, and increased competition will stimulate companies to more actively transfer logistics operations to logistics providers.

Thus, there is a need for the development of small and medium-sized businesses and e-logistics. Based on the analysis of the logistics company performance in market conditions, a basic scheme demonstrating the company interaction with market actors was developed (Fig. 4); it is shown from the perspective of the information flow that goes through the entire logistics chain and the interaction between the tariff generator, logistics centers, and cargo shippers (customers).

Competition in supply chain management contributes to a more sustainable configuration. The available logistics business model (from 1PL to 3PL) impedes the transition to sustainable and stable systems.

Modern business models (of 4PL and higher levels) are part of modern socio-economic systems; they mainly adapt to environmental practices and provide the minimum social standards required by stakeholders. However, the data obtained indicate that business growth strategies and mergers can improve sustainability of the existing system to a certain extent. 4PL companies can increase sustainability by managing fast supply chain components. However, there is a limited number of 4PL companies that are capable of following such strategies. Technological innovations make it possible to strengthen the 3PL position in the supply chain.

Business digitalization based on logistics covers two structural areas: the development of production based on e-logistics technologies and the improvement of institutional and legal relations on the same basis. Approval of the electronic logistics doctrine in the public administration system is the institutional basis of business digitalization based on logistics; it aims to provide legal support for the formation and optimization of the movement and use of electronic resources at all levels of the country's economic development

## 6. Conclusions

Today, the economies of Russia and Kazakhstan are characterized by a limited amount of small and medium-sized enterprises (up to 15%). On the Russian and Kazakhstan logistics markets, logistics service providers are currently working according to 1PL and 2PL models. They are mainly multimodal freight forwarders using two or more modes of transport. There are no world-class 4PL and 5PL providers on these markets.

At the same time, in countries that have a significant share of small and medium-sized enterprises (for example, about 60% in China and 48% in Germany), there is a tendency to integrate their activities with the help of 4PL operators (for example, Alibaba, Metro). Supply chain management requires a systematic approach to managing information, materials and services throughout the supply chain.

Currently, there is a global tendency the sustainable and quality development of supply chain management.

The development of the Internet and e-business is affecting supply chain management; today, 5PL providers have already appeared while in our country, there are only 1PL, 2PL and 3PL operators.

The supply chain management system is the integrator

and the center of key logistics competencies as it is aimed at finding economic compromises and harmonizing economic interests through the end-to-end management of logistics flows. In this case, unlike traditional supply chains, it is possible to integrate internal business processes of the supply chain participants with the management system, to ensure partnership between suppliers and consumers, to synchronize internal and external logistics processes in a real-time mode through electronic document management, intelligent transport systems, "cloud" solutions, etc. Thus, the supply chain creates added value for all interested parties (the product, the staff, the enterprise, and the state) and becomes responsible for the final quality.

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