

Agile Supply Chain Management in Agricultural Business

Denis Syromyatnikov^{#1}, Alexandr Geiko^{*2}, Sattar Kuashbay^{‡3}, Aizharkyn Sadikbekova^{‡4}

[#]*Department for Economics and Foreign Economic Activity, North-Caucasus Federal University, Stavropol, Russian Federation*

^{*}*Department of International Finance, Taras Shevchenko National University of Kyiv, Kyiv, Ukraine*

[‡]*Department of Economy and Account, Shymkentskiy university, Shymkent, Kazakhstan*

¹s_d_com@rambler.ru

²alex.g.e200@gmail.com

³sbaeu@mail.ru

⁴saijarkyn@mail.ru

Abstract— The modern development of the agricultural business in the world is focused on a system of flexible network management, innovations, information, and intellectual property. Large companies are of great significance in this process; agricultural holdings are very important in Russian agricultural business. Unfortunately, the Russian agribusiness sector is dominated by small and medium-sized enterprises, namely, concurrent enterprises, farms, small businesses in rural areas. They produce and market agricultural products. Therefore, supply chain management in agricultural business requires digitalization and the use of flexible management methods. The purpose of the research is to study agile supply chain management methods in agricultural business. We have considered such flexible methods as a digital platform and a blockchain technology, which contribute to the partnership between small and medium-sized agrifood enterprises by creating a digital network platform for all parties interested in the agricultural product. These methods are more productive compared to the traditional approaches; they provide more efficient interaction between manufacturers, consumers and intermediaries in the flow of goods and services through the supply chain. Unfortunately, agile supply chain management in the agricultural business of Russia has not been widely introduced yet, which makes it difficult to collect analytical information. We believe that this may be explained by the predominance of small and medium-sized enterprises in the country, the lack of digital platforms that act as intermediaries in the supply chain to connect crop producers and consumers.

Keywords— *management, supply chain, blockchain, digital platform, agricultural business*

1. Introduction

There are more than 570 million small farms in the world, and 28% of the global labor force is employed in the agri-food sector [1]. Agricultural

holdings are of great importance in this sector as they produce, process and sell products. They are also interested in completing the production cycle and expanding the scope of company activities. In addition, all agricultural businesses are interested in increasing profits and reducing costs by maximally satisfying the demand for the goods produced. Therefore, the improvement of the supply system of goods from the producer of agricultural products to consumers is an urgent issue. This is facilitated by supply chain management, which is a complex system that ensures the turnover of agricultural products on the market [2]. Supply chain management is a set of management approaches and information tools that contribute to the effective integration of suppliers, manufacturers, intermediaries and sellers [3]. A supply chain is characterized by limited time, high flexibility and mobility of all resources. This approach has been successfully implemented in industrialized countries since the 1990s [4]. The approach is used by such companies as Amazon, Zara, and Seven-Eleven. Supply chain management helps them deliver the right product to the right place at the right time with minimum costs [5]. As the value generated by the life cycle becomes more important for manufacturing enterprises than the value generated by sales, customer relationships and the entire value chain are being changed [6]. Supply chain management methods in agricultural business are being gradually improved with the focus on agile supply chain management.

2. Literature review

The emergence and the development of the supply chain management concept were stimulated by the desire to reduce risks and uncertainties on the basis of cooperation models, being intensively developed in the mid-twentieth century, and echelon inventory management [3]. In addition, agribusiness is characterized by the risks associated with seasonality, increased supplies, long delivery times and flexibility

[7], which can affect supply efficiency. Globalization has also made its contribution; it has made supply chains longer and more complex. Therefore, supply chains are now at greater risk and more vulnerable. Thus, business effectiveness is determined not only by the costs and revenues of the enterprise, but also by a holistic consideration of all elements of consumer value creation. The holistic structure includes suppliers, consumers, intermediaries (firms that provide services to the central (focal) supply chain company: forwarding clerks, transport operators, warehouses, terminals, customs brokers, insurance companies, etc.) Supply chain management is a business strategy, which provides effective management of material, financial, service and information flows. Today there is a competition between individual companies, as well as the groups of independent suppliers, manufacturers, and distributors in terms of their supply chains [8].

Supply chains are traditionally linear. The processes are sequential and feedback-based [9]. A supply chain consists of planning, search, production, distribution, and delivery of products or services from the manufacturer to the consumer. Supply chain management affects all stages: “design - supply - production - storage - distribution - transportation - demand - consumption - service – disposal” [4]. The traditional approach is becoming obsolete; it is being replaced by the network approach, which allows the transition from supply chains to supply networks [10], [11]. The transition is characterized by a non-linear, more flexible and adaptable supply chain, which allows supply networks to compete.

Supply chain flexibility has a positive effect on performance, which allows companies to meet delivery times and ensure reliable and accurate service [12], [13]. The traditional supply chain is being transformed into a dynamic smart supply chain. It should work as an adaptive system; on a real time basis, it should take into account individual requirements of customers, changes in the volume of supplies or, if necessary, quickly update orders that have already been launched; a smart supply chain should also operate well even in case of technological or informational failures and deviations, cushion the negative effects of demand fluctuations [5], [9]. The development of a smart supply chain was possible due to digitalization. It allows covering three production dimensions: vertical and horizontal integration of intra-group chains, as well as the integration of product life cycles and digital engineering activities throughout the entire value chain of a product and the related production system. A set of integrated, coordinated, and interdependent supply chains are involved in the movement of a product from the producer to the end-user. This approach allows considering and managing risks [7]. Flexible information

management is based on the principles of cooperation, coordination, and synchronization of the main business processes, as well as planning and management models based on common information channels connecting suppliers and customers throughout the supply chain. These concepts use Internet technologies to quickly coordinate the supply chain. This provides a flexible response to changing market conditions by constructing organizational and functional schemes of business interaction.

The studies conducted by the international consulting company BCG confirm that the response to market demand of digital supply chain leaders is quicker by more than 25%; they can reduce working capital by 30%, increase operating margins by 40-110%, and decrease days working capital by 17-64% [14]. In addition, the effective application flexible methods is based on the creative thinking technique, which in recent decades has been in demand contributing to the involvement of personnel in the company business processes [15].

2.2 Problem Statement

Agricultural business is a sector of strategic importance. It provides food security of the state and regions. At the same time, agricultural business is interested in profitable activities and the reduction of costs associated with the production and sale of manufactured goods. Therefore, the issue of agile supply chain management methods in agricultural business is of interest. This approach helps to better respond to changing market conditions and improve customer relations ensuring increased market share, the growth of turnover and, at the same time, profit. Flexible supply chain management methods integrate all supply chain participants and allow them to adapt and easily respond to changing market conditions by constructing organizational and functional schemes of business interaction and integrating. At the same time, the gradual integration of information and material flows throughout the supply chain serves as an effective tool for competition, and the introduction of modern information and communication technologies ensures uninterrupted and end-to-end information flow throughout the supply chain.

Given the information given above, the purpose of the research is to study agile supply chain management methods that can be successfully implemented in the agricultural sector of the country contributing to the integration of information, financial, service and material flows throughout the supply chain as an effective tool for ensuring profit and meeting the demand. Accordingly, the research objectives are:

- to demonstrate the advantages of agile supply chain management in agricultural business by comparing flexible methods of supply chain management with the traditional ones;
- to analyze the possibility of using any flexible

method of supply chain management in the country's agricultural sector.

3. Methods and materials

The methodological basis of supply chain management (material, financial, service, and information flows) is a systematic approach. The approach is a direction of the scientific knowledge methodology, which is based on the consideration of objects as systems, which allows us to study hardly visible object properties and relationships [8], [10]. A systematic approach allows us to see the integrity of the object, to reveal its properties, the internal and external relationships of flexible methods to manage supply chains in agricultural business, as well as to show their advantages and disadvantages. Flexible methods are effective for a business that is represented by various management forms. These methods include digital platforms and blockchain technologies. In the agricultural sector, blockchain technology can record supply chain information [16]; however it is still in the early stage of its development representing various difficulties related to behavioral, organizational, technological or political aspects [17], [18]. A digital application platform is primarily used in agriculture business. The platform is based on a business model for enabling the algorithm-driven exchange of certain values between a significant number of independent market participants by conducting transactions in a single information environment, which reduces transaction costs due to the use of digital technologies and changes in the labor division system [19].

Flexible methods of supply chain management in Russian agricultural business have not been extensively used. Therefore, the studies are of empirical nature. This allows us to identify the evolution of ongoing processes, that is, the introduction of flexible methods in agribusiness, based on the chronological sequence of the empirical factors of historical reality and information sources. Today, there are sources of information on the use of these methods that need to be accumulated and analyzed in order to describe the application of flexible methods to manage supply chains in agricultural business.

In addition, the study of the use of digital technologies in Russian agribusiness involved the development of questionnaires to conduct an online survey. A total of 1,100 supply chain participants, both manufacturers and wholesale consumers of agricultural products of the central part of Russia (Ryazan, Vladimir, Tula, Ivanov, Kostroma, Yaroslavl regions) took part in the survey. The questions consisted of blocks; they were related to production, the awareness and readiness of

manufacturers and wholesale buyers to use flexible methods to manage supply chains in agribusiness, as well as the barriers to the introduction of agile supply chain management in Russia. The data obtained were analyzed in the MS Excel information processing program.

4. Results

Today, traditional agri-food supply chains coexist with smart supply chains. Traditional supply chains track and store orders and deliveries; they do not provide such features as transparency, traceability, and auditability [20]. One of the reasons may be the fact that most modern Internet of Things (IoT) solutions still rely on highly centralized serverless technologies. These technologies usually lack transparency, including accessibility, data blocking, confidentiality, and audit capability.

At the same time, a digital supply chain based on a blockchain technology and digital platforms is gaining popularity in many industries. Blockchain technology differs from most available information systems in terms of the following key characteristics: non-localization (decentralization), security, audit capability, and smart execution [21]. The advantage of flexible methods is that despite competition, manufacturers have to work together to integrate the entire supply chain. Intermediate products must be quickly integrated; logistics partners should make deliveries using tracking and visibility features, as well as information and communication technologies at all stages. Thus, blockchain is considered the safest and cheapest alternative to the Internet network of any company [11]. Supply chain digitization can significantly reduce costs, increase product availability and even create new markets that used to be unknown or inaccessible before the introduction of the key technologies [22]. But there are intra-organizational, inter-organizational, systemic, and external barriers [21].

In addition, Russian agribusiness is characterized by production fragmentation, which necessitates the integration and coordination of flows at all levels of supply chain management. In Russia, agricultural products are mainly produced by agricultural organizations (business partnerships, communities, production cooperatives, unitary enterprises, subsidiary farms of non-agricultural organizations and institutions); the second place is occupied by households; vegetables, fruit and berries are grown by agricultural farms. Thus, 55.1% of all agricultural products are produced by agricultural organizations, 32.5% - by households and 12.4% - by farms [23].

As it can be seen, different producers supply agricultural products to the domestic market. Unstructured nature of the goods sold or lack of real-time information about each supply chain element makes the process poorly controlled and poorly planned. Flexible methods can help to eliminate this problem by reducing transaction costs and increasing

producer's surplus.

The spread of information technologies in agricultural business is expanding the access of small farmers to information, production resources, the market, finance, and training. Digital platforms create new opportunities for the integration of farms into the agri-food systems of the country. However, the introduction of flexible methods in agricultural business requires the study of the issues urgent for all supply chain participants, as well as the assessment of their knowledge of flexible methods (digital platforms and blockchain technology).

Thus, a survey of supply chain participants, both manufacturers and wholesale consumers of agricultural products of the central part of Russia, shows that the most problematic issues associated with the application of flexible methods to manage supply chains in agricultural business include (Fig. 1): (1) the lack of digital platforms in the agricultural business market (69%); (2) weak partnership of manufacturers and prevailing competition (48%); (3) insufficient technical support for manufacturers and consumers (42%); (4) poor awareness and commitment of agribusiness management to use flexible supply chain management methods (39%); (5) insufficient legislative regulation of the agricultural business market in the field of agricultural production and supply chain management (61%); (6) lack of staff training sessions (35%).

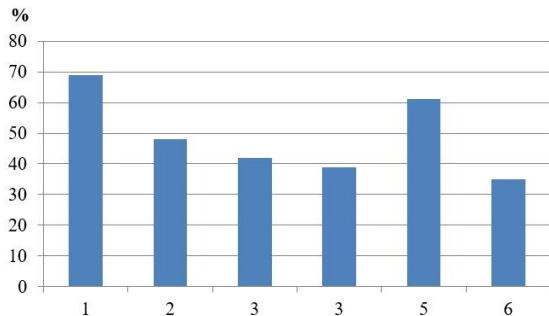


Figure 1. Problems associated with the application of flexible methods to manage supply chains in agricultural business.

To improve the situation, we suggest the development of courses in “Flexible methods of supply chain management in agricultural business” along with the development of digital supply chain management servers in the agricultural business of the country. It is also necessary to legislatively regulate the partnership between agribusinesses participating in digital platforms and blockchain technologies, as well as to establish clear rules for the information exchange between supply chain partners.

5. Discussion

The penetration of digital technologies is cardinaly transforming traditional industries and markets by reformatting them and personifying their internal processes. Digital platforms that lie at the heart of these business processes accumulate information about consumers and manufacturers, encourage cooperative relationships between participants, and are open and safe for their interaction [24]. They contribute to the reduction of transaction costs in the supply chain of agricultural products from the producer to the consumer, as well as to the development of partnerships between agricultural producers. Therefore, they are gradually being introduced in the agricultural business of the country. In 2019, the country started the implementation of the “Digital Agriculture” department project [25] in the agri-food industry; the project is aimed at the digital transformation of agriculture through the introduction of digital technologies and platform solutions to ensure a technological breakthrough in the agricultural sector and stimulate productivity growth in digital agricultural enterprises. The digital platform will be integrated with other sub-platforms at the regional and municipal levels. Thus, in Tatarstan, an e-commerce system for the sale of meat and culinary products through the Kazan Agro-Industrial park is successfully operating as part of the program [26]. In the Agro-Industrial park, the products of local farmers are directly presented to the customer in the ID Farmer application. To make a purchase, the consumer has to install the “Personal Account” program, developed on the basis of the distributed blockchain registry technology. The technology is a new framework of computational and information flows that has wide implications for the future development of supply chain and logistics management [21], [27]. The platform involves all project participants and assets, food token exchanges and electronic identification of animals. The Milk Token, Seed Token, Ebergo Token projects are being developed.

There is also a portal for the selection of technologies and suppliers - TAdviser. This is a Russian analytical company and a portal of the same name (www.tadviser.ru) [28]. The system consists of the following modules: financial accounting and planning; MRP II and industry support; human resource management, procurement management, logistics management, as well as sales management and business analytics. It facilitates information analysis in the “single web-page” mode regardless of its physical location. The system also allows combining data from the databases of various manufacturers; it dynamically changes the content and format of the user data and

allows individual settings of dashboards, notifications and reporting, etc.

Digital platforms are successfully implemented by Alibaba Group and Amazon [29]. Thus, the capitalization of Alibaba Group exceeded \$ 500 billion, which made it the leader in terms of this indicator in Asia. The ET Agricultural Brain system developed by Alibaba allows determining the health condition of each animal based on the appearance, temperature, and voice. According to the developer, in hog breeding AI technologies will allow farmers to reduce labor costs by 30% –50%; they will also decrease the dietary requirements of hogs and reduce sagination period by 5-8 days. The introduction of the system in all Chinese hog farms would save the country 50 billion yuan (\$ 7.5 billion) [30]. But, unfortunately, digital platforms have not been widely used in the agribusiness sector yet.

Modern methods allow integrating different forms of management on a single digital platform, especially if these enterprises produce the same products or are located in the same region. First, it is necessary to create a digital platform that will consolidate manufacturers. Secondly, manufacturers should realize the advantages that they will get. Thirdly, the cost of digital platform services should be acceptable to both manufacturers and consumers. In addition, agile supply chain management in agribusiness combines economic, social and environmental aspects at all stages of the product life cycle and the supply chain management. Agricultural business supplies domestic and foreign markets with agricultural products and services, increasingly focusing on consumers and environmentally friendly goods. Today, all additional aspects, such as improving customer service, reducing risks in the supply chain, reducing waste, improving product design and maintenance service, are considered as integral parts of supply chain management. This emphasizes the importance of considering economic, social and environmental components of supply chains. Today, supply chains should be characterized by high economic efficiency and sustainability. A sustainable supply chain is a chain that is “capable of responding and adapting to external changes, while keeping the assessment indicators at certain acceptable intervals, or returning to its initial parameters during a given transition period” [31].

6. Conclusions

The world community is rapidly entering the era of the platform economy, which is based on online tools and mechanisms that are fundamental to the economic and social life. Flexible methods are gaining popularity and becoming more common, as a growing number of organizations and business structures realize their effectiveness, especially in the businesses that are represented by different management forms. These methods are more productive compared to the traditional approaches; they provide more efficient interaction between manufacturers, consumers and intermediaries in the flow of goods and services through the supply chain. Unfortunately, agile supply chain management has not been widely implemented in the agricultural business of Russia due to the lack of a sufficient number of digital platforms in the agricultural business market; weak partnerships between manufacturers; insufficient technical support for producers and consumers; legislative regulation of the agricultural business market in the process of supply chain management. In addition, the application of flexible methods is hampered by the predominance of small and medium-sized enterprises in the country. However, there is a gradual development: the “Digital Agriculture” project, regional projects and digital platforms are being implemented. A digital platform can directly provide high-quality and low-cost standardization services through virtual aggregation and planning of decentralized agricultural business resources. Thus, it easily adapts to the changing conditions of the external and internal environment of agricultural business, and is characterized by reliability and safety. The platform performs virtual integration of various decentralized agricultural business resources based on various cloud technologies; it encapsulates these resources and creates a standardized service for the centralized management of a decentralized agricultural business.

Blockchain technology is one of the modern developing technologies. The technology is expected to ease some of the supply chain management problems in agribusiness and the food industry; it is transparent, traceable and safe. However, the transformation of agribusiness and blockchain-based supply chain management is at the implementation stage. There are many issues that require further research, namely, overcoming barriers and implementing blockchain technologies to manage supply chains; encouraging partnership between various agricultural businesses, the confidence of producers and consumers in the blockchain security system.

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