Chapter 6
Digital Transformation of Managing Business Entities Development in Agricultural Production

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Abstract The level of agricultural entrepreneurship development is one of the defining conditions for the sustainable economic growth, increasing GDP, providing employment, and reducing risks to food security. In the conditions of uncertainty and unpredictability, the digital transformation of planning and forecasting systems for managing the business entities' development in agricultural production becomes the objective necessity. The authors have analyzed the branches of the agricultural sector, which, in the pandemic context, received a strong momentum for the development (industrial biotechnology and Foodnet) and defined the main threats to the activities of agricultural enterprises: low digital maturity of business organizations, the lack of effective business models of digital transformation, the high level of resistance to changes on the part of personnel, and the low level of competence in implementing digitalization. The contributors have searched effective tools for implementing the development strategy of an agricultural enterprise, taking into account the change in the technological order, the active digital transformation of the competitive environment. The study substantiates the feasibility of forming a digital system for managing the business entities' development in agricultural production, based on the integrated use of machine learning, Big Data technology, blockchain technologies, virtualization of contractual relations, and transactions using smart contracts.

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6.1 Introduction

Nowadays, the business institute is going through a transformation stage in a completely new environment, which is primarily characterized by the emergence of opportunities for them to use digital tools in order to carry out their economic activities and to interact with other market participants.

The active development of information and communication technologies within the framework of the fourth scientific and technological revolution and the need to search the innovative ways for developing working relationships between economic entities create the preconditions for the business entities' virtualization and the digital transformation of their activities. For business organizations to adapt successfully, it is necessary that digital transformation encompasses the process of identifying consumer preferences; organizational and managerial sphere of activity of economic agents; transfer of material flows within the enterprise; and means of interaction and contracting between an economic agent and market participants. Among the basic problems of digital transformation of managing a business entity development, one can single out:

– the lack of the strategy for developing the stack of digital technologies necessary for business entities development;
– high level of resistance to digital transformation by the business entities personnel.

The fourth industrial revolution gave rise to opportunities to expand the market potential of business entities by forming new market segments which are subjected to a high degree of digital transformation. Agriculture is one of the most susceptible industries to digital transformations in the market economy. In this industry, both complex digital technologies for enterprise management are reflected, which allow the virtualization of the management system for end-to-end business processes, and a new market niche is being reproduced with the active involvement of the scientific and technological progress achievements and the results of implementing the national technological initiative.

The trend analysis of developing the digital transformation indicators of agricultural enterprises and biotechnological enterprises made it possible to identify the promising areas of business entities' digital development in these industries.

6.2 Methodology

Nowadays, many researchers [4–6, 8, 9, 11–13, etc.] recognize that the digital transformation of managing the business entities development in the field of agricultural production is necessary to increase the efficiency and effectiveness of their functioning through the fundamentally new change in the quality of managing the technological processes and decision-making processes at all levels of the hierarchy as well. This fact, in turn, predetermines the active introduction of modern production

methods and the further intensification of using the information data on the state and forecasting of controlled elements and subsystems possible transformations and also economic conditions in agriculture.

The experience of successful agricultural producers has proved that the use of modern digital technologies allows creating optimal soil-agrotechnical and organizational-territorial conditions that ensure the significant increase in productivity and labor efficiency; the decrease in material costs for fuels and lubricants, electricity, funds plant protection, wages, and other types of expenses, soil fertility preservation; and environmental protection during the entire life cycle of agricultural products. Therefore, in the territories' digital agenda, one of the priorities is the accelerated introduction of digital technologies in managing the agricultural enterprises' activities.

The industry evolution is only at the very beginning of the digital chain now. At the same time, according to the majority of researchers [1, 2, 10, 13, 14, 16–18], the fourth industrial revolution and scientific and technological progress make it possible to form the methodology for a digital system for managing business entities in the field of agricultural production. This methodology should be based on using the following information technologies: automation of business processes in the information flow transfer; work with big data; machine learning; blockchain technology. These digital transformation areas of agriculture predetermine implementing the projects of a complete innovative complex scientific and technical cycle of end-to-end digital systems based on modern competitive technologies, methods, and algorithms.

In this work, the authors have used general scientific research methods: analysis and synthesis, deduction and induction, methods of scientific abstraction and expert assessment, historical and logical analysis, as well as the methods of statistical, systemic, structural–functional, and comparative analysis. The trend analysis of developing the indicators of digital transformation of agricultural enterprises and biotechnological enterprises has made it possible to identify the promising areas of business entities' digital development in these industries.

6.3   Results

The driver for agricultural enterprises' digital transformation is the development of the following industries: foodnet, aeronet, and industrial biotechnology.

The market "Foodnet" is a dynamically developing market segment that includes many start-up projects of the corresponding direction, which propose various innovative ways of organizing economic activities. New efficient forms of management will substitute the traditional enterprises on the market, which will fail to restructure. Taking into account the forecast of developing the Foodnet market, the global consumption of products in this market will amount to 30 trillion dollars in the world market, and for the Russian geographic market, the projected capacity will be about 2.5 trillion dollars (Fig. 6.1).
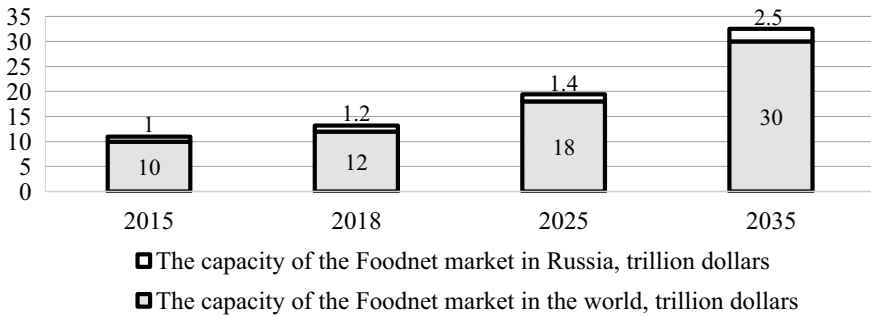
Fig. 6.1 The capacity of the Foodnet market in the world and in Russia. *Source* Compiled by the authors based on [7]

According to the forecast data of the analytical agency «J'son & Partners Consulting», the segmentation of the Foodnet market will be distributed as follows: «smart agriculture»—32%; available organic—28%; new sources of raw materials—15%; personalized nutrition—13%; accelerated selection—12% (Fig. 6.2). At the same time, biotechnology, innovative food products, and the Internet of Things (IoT) will become the fastest-growing food tech areas, and the leader among them will be innovative food products, including artificial meat and fish.

«Smart Agriculture» is one of the fastest-growing innovative segments of crop production. Five years ago, the technology market in it made up 2.3 billion euros, with the average market growth being about 12% per year in recent years—this is three times faster than the growth of the traditional equipment market.

The main directions of developing the projects for this segment of the Foodnet market are automation and robotization of production and technological processes in agriculture and the food industry; geolocation; and Big Data.

According to analytical data, the annual volume of investments in developing this market niche amounted to $21 billion in 2019; compared to the figures of 2016, it
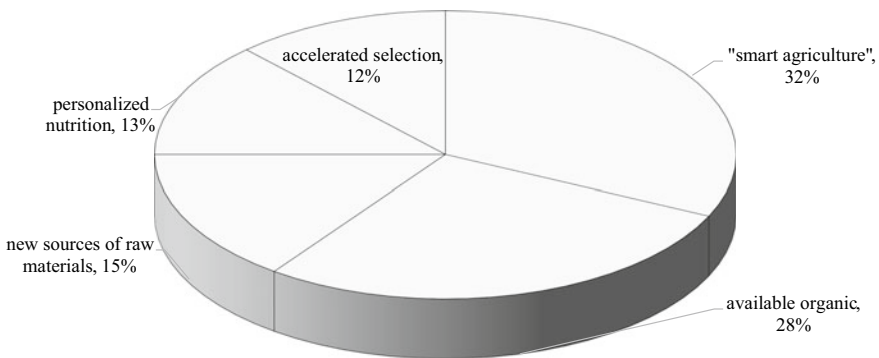

Fig. 6.2 The segmentation of the Foodnet market. *Source* Compiled by the authors based on [7]
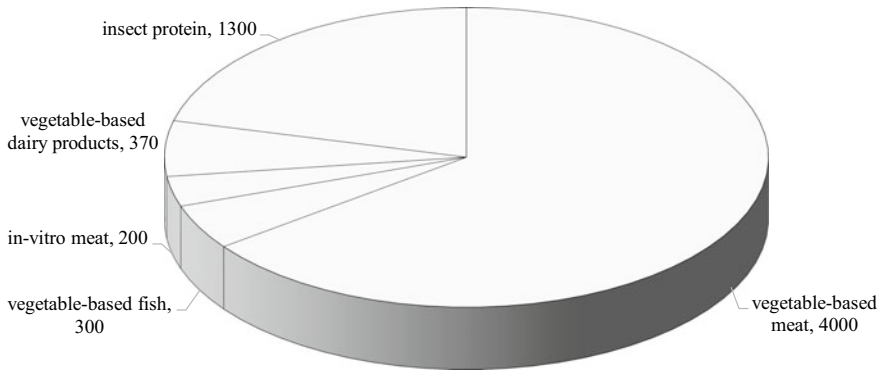
Fig. 6.3 The capacity of the market segment "new sources of raw materials", in billions of dollars. *Source* Compiled by the authors based on [7]

was $14 billion more. This fact also confirms the dynamic development of the "smart agriculture" market segment.

According to forecasts, by 2035, the market of solutions for "smart agriculture" will have been able to reach 15.8 billion dollars with the average annual growth of profitability being at the level of 10.4%. Besides, the market segment "new sources of raw materials" has significant market potential (Fig. 6.3).

The advanced demand for food products, especially for protein foods, forces people to look for new sources of raw materials. New sources of raw materials are designed to solve the problem of obtaining the artificial protein and the protein necessary for solving the food security problems of national economic systems.

Today these developments are reaching a new level. First of all, this is artificial meat, processing of algae, and pseudo-cereal structures. This also includes the recycling of production waste and "smart packaging" as they allow to reduce losses, which means that they can act as the equivalent of new sources of raw materials on the principle "saved resources = reproduced results".

It is difficult to single out the common leaders in this segment as the technologies differ too much, and, as a rule, each market participant specializes in its own direction. In general, we can say that by 2035 the volume of this segment will have been able to reach $218 billion with the average annual growth rate being 8.2%.

The capacity of the Russian market for developing and applying unmanned flying vehicle technology, including for agriculture, has the following growth dynamics (Fig. 6.4).

The growth dynamics of the market "Aeronet" capacity is provided by the following market segments: logistics operations and cargo transportation; support of technological operations in agriculture; remote sensing and farmland monitoring (Fig. 6.5). The use of unmanned flying vehicle technology significantly reduces transaction costs for technological operations and increases the cargo delivery efficiency, sown areas monitoring, control of germinating grain crops, and implementing chemical treatment of sown areas.
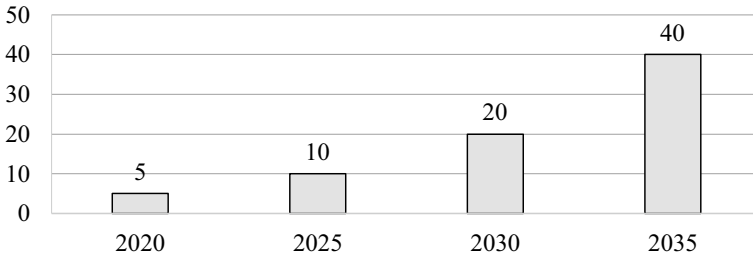
Fig. 6.4 The capacity of the market "Aeronet" in Russia, in billions of dollars. *Source* Compiled by the authors based on [3]
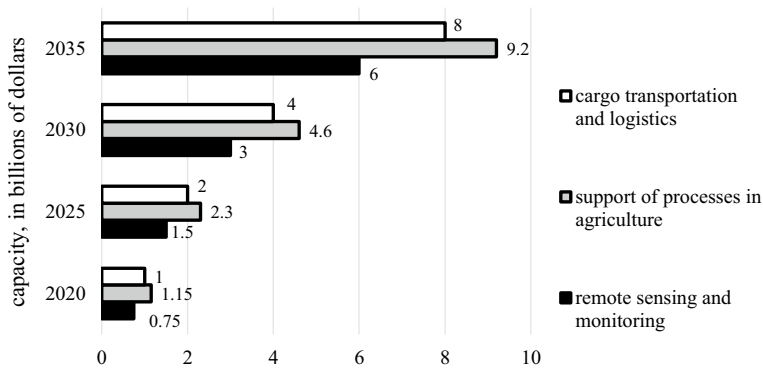

Fig. 6.5 The segments capacity of the market "Aeronet" in Russia, in billions of dollars. *Source* Compiled by the authors based on [3]

The biotechnology used by agricultural enterprises can significantly increase efficiency indicators, as well as it can reduce environmental damage from production. According to the estimates of the interdepartmental working group on the control over the biotechnology introduction under the Government of the Russian Federation, the total economic effect of using biological products in crop and livestock production in Russia may amount to more than 100 billion rubles per year at a cost of 10.5 billion rubles.

The capacity of the Russian market for developing and applying industrial biotechnologies in agriculture has the following growth dynamics (Fig. 6.6). The state program for developing agriculture for 2013–2020 assumes financing of biotechnology in 2015–2020 in the amount of 2 billion 226 million rubles from the federal budget and 780 million rubles from the budgets of the constituent entities of the Russian Federation.

The agrobiotechnology market is based on three segments:

– biotechnologies used in crop production (biological plant protection products, including plant growth stimulants and microbiological fertilizers);
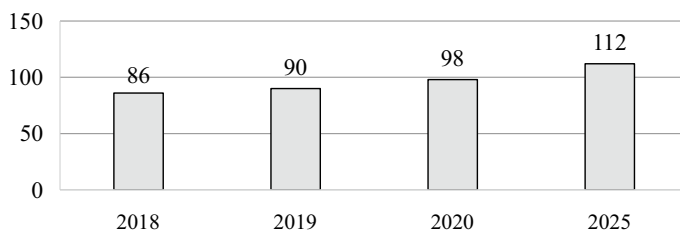
Fig. 6.6 The capacity of the market "industrial biotechnology in agriculture" in Russia, in billions of roubles. *Source* Compiled by the authors based on [15]

– creating new types and varieties of plants by the method of genetic engineering;
– biotechnologies used in animal husbandry (vaccines, therapeutic and feed antibiotics, diagnosticum, probiotics, and biological components of feed additives).

From the point of view of the potential for developing new technologies and projects, the following segments of this market are of greatest interest: biotechnology for crop production; production of enzymes and biopolymers; immunobiologicals; feed antibiotics.

The identified promising market sectors require reforming the management system of an economic agent and, above all, the inclusion of a preventive marketing analysis system in management.

For the successful integration of business entities in agriculture into new market niches, it is required to create a digital tool that allows people to form a prototype of the future market and to determine its development strategy by obtaining the reliable dynamic analysis of the indicators of the financial and economic activities of an economic agent with the possibility of predictive analytics.

Business processes automation during the information flow transfer within the digital management system of agricultural enterprises is designed to solve the following tasks:

– reception of primary documents required for implementing financial and management accounting of the business entities activities;
– sorting primary documents and checking the correctness of their filling;
– distribution of documents between necessary specialists and analytical modules of the digital management system of an economic agent;
– data distribution from primary documents between business transactions into the accounting system;
– forming financial records and sending them to government agencies;
– data distribution from the generated financial statements into special forms for analyzing financial and economic activities;
– creating the data array about the internal environment state of a business entity for the purpose of its further processing by Big Data technology for subsequent predictive analytics necessary to predict the financial and economic activities of business entities.

It is advisable to process the obtained data array, which characterizes the activities of business entities, with the help of Big Data technology tools in order to solve the following tasks of digital transforming the organization's management system:

– identifying the criterion parameters for comparative analysis of incoming data on the economic, financial, and marketing activities of a business entity;
– identifying the parameters of the business entity, which characterize its competitive advantages and weaknesses;
– forming the database of a business entity activity parameters, which allows using the theory of weak signals and elements of machine learning technology to determine the forecast for developing economic and financial activities;
– searching the optimal activity parameters of a business entity user for the subsequent formation of a hypothetical sectoral model of a reference economic agent necessary for benchmarking and determining the statistical data required by the government bodies in order to make effective decisions to support the economic sectors development.

Digital transformation of collecting and analyzing data on the business entities activities will allow cutting down the risks of obtaining inaccurate information and making ineffective strategic decisions, which will strengthen the business entities market positions significantly, increase the profitability of their activities, and also create the preconditions for the more transparent establishment of performance indicators of personnel activity in an organization. The establishment of these indicators supposes reducing the resistance of personnel to the process of digital transformation of a business entity management system.

The cause-and-effect relationships of establishing the indicators values identified with the help of big data tools become the basis for machine learning, which is necessary to solve the following problems of digital transformation of the business entity management system:

– creating a new market image based on the theory of weak signals, which consists in the need to detect and to rank the weak signals from current and potential consumers of services or products, to build their development forecast, and to highlight significant needs and qualitative assessment, which contributes to forming the potential forecast for the development of market niches corresponding the business entity potential;
– forming a preventive marketing system, consisting of the following stages: establishing constant monitoring of all trends in the external environment; forecasting the consumer preferences development using weak signals; describing the upcoming strategic and tactical implications for an enterprise; forecast results assessment and possible risks analysis; flexible change in the assortment of goods and services, taking into account the constructed forecast;
– developing the forecast of changes in economic and financial indicators of business entities, taking into account the peculiarities of the macro and microenvironment development;

– making forecasts of the financial and tax burden of business entities, taking into account the formed prototype of the market and changes in the macro environment, as well as taking into account the changes in the internal environment of an economic entity.

The use of digital transformation of the business entity management system also implies the inclusion of blockchain technologies necessary to create smart contracting between market participants and to build a transparent interaction system, taking into account reliable information about the financial and economic situation of business entities and market prospects for the business entities activities. The use of smart contracts will allow both to expand the geographical boundaries of the organizations' activities and to create a new digital format for the economic integration of entrepreneurial structures.

The comprehensive use of digital transformation of the business entities' management system in agriculture will increase the level of their digital maturity by including digital competencies and technologies in business processes, which will increase their competitiveness significantly and create the preconditions for adapting to the conditions of Industry 4.0.

As a result of forming the digital system for managing agricultural enterprises, it will be possible to achieve an increase in the economic efficiency of these economic agents' activities by reducing the cost of agricultural production and increasing the enterprises' profitability.

The digital system use for managing agricultural enterprises will simultaneously reduce both variable and fixed costs of economic agents. Reducing variable costs for agricultural enterprises using a digital control system occurs by means of: reducing the cost of fertilizing; selecting the placement of agricultural crops between the fields with different germination conditions; adjusting business processes when using agricultural machinery in the process of sowing and harvesting campaigns.

The basic tool for reducing the variable costs of a digital system for managing business entities in the field of agriculture is processing big data on production, technical and technological, financial, and economic components of economic activity.

The use of big data tools in the digital management system of a livestock business can reduce variable costs in such a «problem area» as the feeding process. Thanks to the data analysis, a schedule is drawn up for the acquisition, storage, and supply of feed to the livestock complex, which increases the efficiency of managing an economic agent significantly. The reduction in fixed costs in the livestock complex is due to the use of tools for processing big data and machine learning for controlling the temperature regime and supporting water supply and energy supply to the livestock complex. Blockchain technologies, as well as in the case of an agricultural enterprise, play a significant role in reducing the cost of the process of transactional interaction within the enterprise and with the external environment. The cumulative reduction in the total cost of the livestock complex using the tools of the digital control system can be 35–40%.

The share of variable costs of agricultural enterprises varies from 60 to 80% in the structure of the total cost, and the use of tools of the digital agricultural enterprise management system can reduce these costs by 20–30%.

A decrease in the fixed costs of agricultural enterprises takes place by means of increasing the transparency of interaction between the structural divisions of an economic agent and its counterparties and the formation of new effective contracting conditions by reducing transaction costs. Blockchain technologies will allow making effective smart contracts, both in the interaction of an agricultural enterprise with third-party organizations and within an economic agent, which will significantly affect the objectivity and transparency of business processes valuation and the efficiency of financial and material flows redistribution at the enterprise.

Reducing fixed costs by 10–15% due to the use of a digital system in managing an agricultural enterprise will allow an economic agent to reduce the total cost and increase the competitiveness of its activities.

With the simultaneous use of machine learning elements that contribute to the reliability of the crop yields forecast and the attractiveness of their implementation on the market, an agricultural enterprise receives a balanced picture of income and expenses and the ability to budget its activities effectively.

The digital system for managing agricultural enterprises by reducing costs and predicting the receipt of financial results of their activities allows increasing the economic viability of these economic agents.

6.4   Conclusion

The results obtained in this study allow us to make the following conclusions:

– the fourth industrial revolution has formed new perspective market niches, the development of which is largely predetermined by innovative technologies and digital services: foodnet, aeronet, and industrial biotechnology;
– developing a digital system for managing business entities in the field of agriculture should be based on an integrated approach to the digitalization of business processes for collecting and analyzing data and predictive analytics, which will allow adapting the activities of an agricultural enterprise effectively to new market niches and business conditions;
– the comprehensive digital transformation of the system for managing business entities in the field of agriculture will be carried out more effectively on the RPA technology stack (automation of business processes in data transfer), Big Data, and Machine Learning;
– the use of blockchain technologies for making smart contracts with business entities in the field of agriculture will increase the efficiency of interaction between economic actors and expand the possibilities of agglomeration in rural cooperation, which will lead to a decrease in transformation and transaction costs, and, as a result, will reduce the cost of manufactured products significantly.

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