

## Chapter 3

# Artificial and Natural Intelligence Techniques as IoP- and IoT-Based Technologies for Sustainable Farming and Smart Agriculture

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### ABSTRACT

*In this chapter, the author describes the main new challenges and opportunities of blockchain technology for digital economy in Russia. The study in Russia showed that the Russian research community has not addressed a majority of these challenges, and he notes that blockchain developer communities actively discuss some of these challenges and suggest myriad potential solutions. Some of them can be addressed by using private or consortium blockchain instead of a fully open network. In general, the technological challenges are limited at this point, in terms of both developer support (lack of adequate tooling) and end-user support (hard to use and understand). The recent advances on developer support include efforts by of the towards model-driven development of blockchain applications sliding mode in intellectual control and communication and help the technological challenges and created tools. The chapter shows how avatars may communicate with each other by utilizing a variety of communications methods for sustainable farming and smart agriculture.*

### INTRODUCTION

The degree of development of industrialization and the widespread introduction of new technologies unquestionably lead to the transition of the world into a new digital era. This period is characterized by the rapid development of high technologies that penetrate into all spheres of our life. The widespread use of cloud technology, the Internet of Things (IoT), virtual and augmented reality, 3D printing, and

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the development of quantum technologies, robotics and other technologies as a result has become the driving force of the Fourth Industrial Revolution, also known under the term “Industry 4.0”.

If at the turn of the century not a single farm around the world used sensor technologies, then by 2025 their use is expected to increase to more than 500 million sensors, and by 2050 - more than 2 billion smart agro sensors. Moreover, it is expected that for the period 2017–2022. The aggregate average annual growth rate of the Internet of things market in the agro-industrial complex (agriculture IoT, AIIoT) will be 16-17%. According to the PwC (Price water house Coopers) forecast, the minimum economic effect of introducing IoT technologies into the agro-industrial complex by optimizing personnel costs and reducing crop losses and fuels and lubricants by 2025 could amount to 469 billion rubles.

If we talk about the long-term effect of the introduction of IoT technologies in agriculture, then it will be primarily associated with significant savings in materials and resources and, as a result, optimization of the costs of agricultural enterprises. In addition, new technologies will increase yield and, as a result, increase revenue. All this in the future will have a direct impact on the marginality and competitiveness of enterprises. According to forecasts of the development of the world food market by 2050, in connection with an increase in the population of the Earth (by about 2.3 billion people (about 33%) and an increase in its well-being, consumption will naturally occur, moreover, in favor of agricultural products. The country in terms of potential for increasing the arable land necessary for food production is, of course, the Russian Federation. Thus, against the backdrop of ongoing changes and taking into account the main trends of world development, the search and implementation of new methods, methods and technologies in the agro-industrial complex is one of the paramount tasks. At the state level, this issue is being actively discussed and worked out. As part of the National Technology Initiative (STI), the concept of a FoodNet market roadmap is currently being developed. The FoodNet market is a market for the production and sale of nutrients and final types of food products (personalized and general, based on traditional raw materials and their substitutes), as well as related IT solutions (for example, providing logistics and selection services individual nutrition). The key market segments will be “smart” agriculture, accelerated selection, new sources of raw materials, affordable organics, personalized nutrition. Ultimately, according to NTI, it is planned to create such services and products that will occupy from 5 to 15% of the global market (depending on the segment). The basis for the development of the above segments of the FoodNet market is the use of Internet of things technology.

As part of the execution of the order of the Deputy Prime Minister of the Russian Federation A.V. Dvorkovich dated October 21, 2016 in accordance with the Decree of the President of Russia Vladimir Putin dated July 21, 2016 “On measures to implement the state scientific and technological policy in the interests of agricultural development” “In order to implement the” Strategy for improving the quality of food products until 2030 ” A draft roadmap was developed for the development of the Internet of Things (IoT) in the Russian agro-industrial complex (AIC). The development of this document was carried out by experts of the Internet Initiatives Development Fund (IIDF) with the participation of the Open Government, the Internet of Things Association (IoTA), the Department of Information Technology (DIT) and the Russian Ministry of Agriculture. According to the draft roadmap, by 2020 the share of developments in the domestic component base for creating equipment in the field of the Internet of Things should be 14% (today it is 7%), the share of agricultural enterprises using IoT solutions should reach 30%. In addition, by the same time, it is planned to implement at least 20 pilot projects for the implementation of IoT technologies in the agricultural sector.

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