NATIONAL RESEARCH UNIVERSITY

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AGRICULTURE 4.0. RUSSIA IN A GLOBAL CONTEXT AND THE MOST PROMISING INNOVATIVE SEGMENTS

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Introduction

«AGRICULTURE 4.0» – is fundamentally new stage of technological development based on the introduction of «smart» solutions (robotics, «precision» agriculture, IoT («Internet of things»)), biotechnologies, alternative technologies and raw materials sources

The scientific potential development and the introduction of innovative solutions are becoming critical in ensuring the competitiveness and further development of the Russian agriculture and food processing industry. Otherwise, the gap with developed countries could increase significantly in the coming decade and entire markets would simply cease to exist for Russian products.

Global Challenges 2025 – 2030

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The threat of resource scarcity and the crisis of the AIC 3.0 model

2030
Demand growth

+ 35 % food
+ 40 % freshwater
+ 50 % energy

- Reduction of agro-climatic potential
- Exhaustion of the effect of the «green revolution»
- Increasing threats to biosafety
- Food waste problem

Industrial Revolution 4.0

Implementation of cross-industry technologies

- IT and cognitive technologies
- Biotechnologies
- Robots and new technology
- Nanotechnologies

New values orientations

Personalization and customization
Crowdsourcing
Safety!
Sustainability and ethics
healthy lifestyle
Shared economy

- Urbanization and income growth
- Millennium values

2025 I 75%
percentage of the economically active population

Political, economic and structural challenges

- Increasing food price volatility
- Growing influence of large integrator companies
- Trends towards autarchy and rising protectionism
- Trend towards implementation of «sustainability» principles
- Transition to a «knowledge economy»

World Agriculture Trends 2025 – 2030

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In the future, food production should depend more than ever on technologies for sustained productivity improvements, preventing losses, but less than ever on the impact of climatic and biological externalities.

Changes in value chains	Concentration of value added in knowledge-intensive sectors (genetics and breeding, IT and geo-information technologies, industrial design and engineering)
Growing influence of large integrator companies	Integrators are taking control of large portions of the food system. The formation of global value chains.
Mixing value orientations and choice factors	New production and distribution models. Personalization and customization. Increasing popularity of «food design», healthy food, products with improved and predetermined properties
Strengthening the role of security and «sustainable» development factors	The information component becomes the most important feature of the product. More complex architecture of standards that increasingly integrate the entire product life cycle
Transition to a «knowledge economy»	Fundamental changes in the structure of employment, the need for a new education model and the labour market

Agriculture 3.0 ⟶ Agriculture 4.0. Investment in transition

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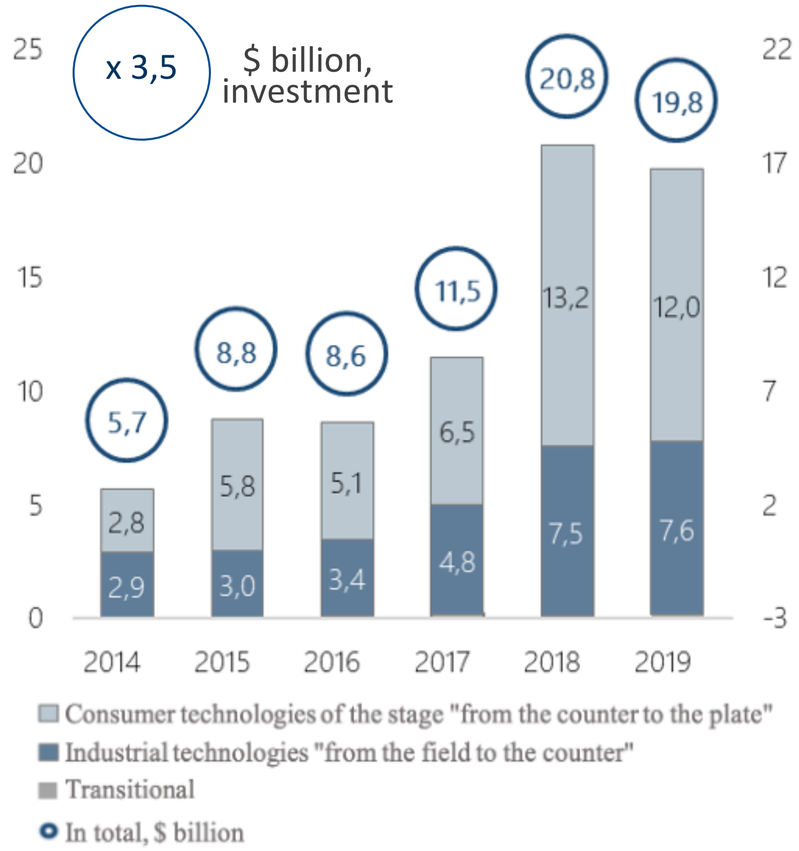
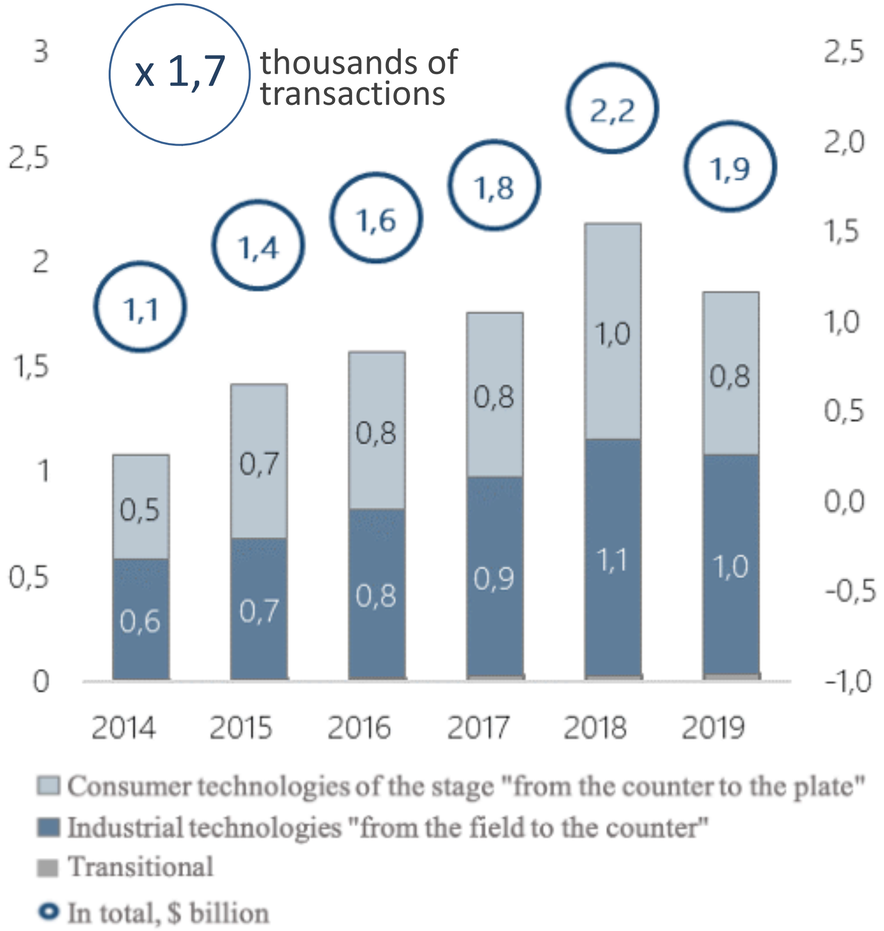
Key factors

2019 I $20 billion, investment; 1,9 thousands of transactions

2014 I 2019 $75,2 billion, investment; 9,9 thousands of transactions





AgFUNDER

Agriculture 4.0 World Market

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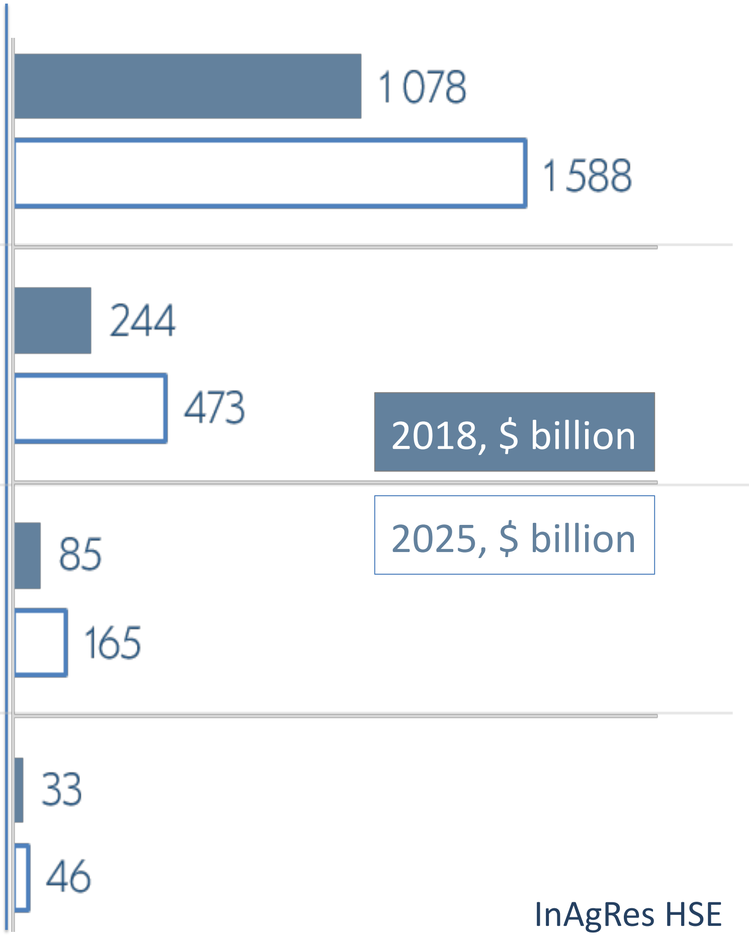
Key factors | 2018 | 2025 | + $ 832 billion | 6,7 % CAGR | 2020 | $ 2,3 trillion

Final product of Agriculture 4.0	Growth points: healthy and therapeutic food (organic, personalized food, products with improved characteristics)
Technologies and means of production	Growth points: biotechnology, robotics, closed farming, food processing equipment
Marketing technology	Growth points: online ordering and delivery platforms, new restaurant formats, unmanned delivery technologies
Food waste treatment	Growth points: processing technologies for new high value added products



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Russia in the World Context

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Change of the technological structures

new windows of opportunities

KEY PERIOD FOR CONTINUED GROWTH

New drivers of competitiveness are emerging

PREREQUISITES FOR TRANSITION

Exhaustion of growth factors of the past period

Reduced effects from increased domestic purchasing power, increased investment, improved management, food embargo.

Updating barriers to global competitiveness

Critical dependence on foreign technologies and means of production
Crop volatility and technological backwardness

Pollution of the environment by illiquid raw materials. Food losses

ADVANTAGES

Good starting position of the Agriculture 4.0

AIC: One of the leading sectors in the economy (4.5% of GDP), strong position in export markets, industry consolidation

Enabling socio-demographic environment

Russia: High level of urbanization and proportion of educated population, PPP income comparable to most Eastern European countries

High biocapacity reserve

Russia: 10% of the world's arable land fund, freshwater leader

Russia. Growth Vectors 2030

Agriculture 3.0 → Agriculture 4.0.

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KEY VECTORS

- **Strengthening sovereignty by factor of production**
  Genetic potential and technologies for its best realization
- **Digital and cross-platform technologies**
  Increased productivity, efficiency and loss reduction
- **Diversification of commodity structure**
  Healthy therapeutic food, organic matter, highly-processed foods
- **Reducing dependence of production on external agro-climatic and biological factors**
  Closed farming, city farms
- **Addressing the recycling of the agriculture waste**
  Introduction of closed-loop economy principles and solutions

Key technologies in Russian agricultural sector*

EXPERTS' OPINIONS

	2025	2030
IT and cognitive technology	91%	73%
Biotechnology	64%	82%
Robots and new technology	45%	64%
Innovative food	18%	55%
New farming systems	9%	27%

*According to the results of the expert survey

Russian Innovation Prospects Today

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Program

development of breeding and seed breeding

FSTP 2019 25 FEDERAL SCIENCE AND TECHNOLOGY PROGRAMME

Strengthening sovereignty by factor of production

Products of the FSTP

- Seeds
- Agrochemicals
- Feed additives
- Breeds/Crosses
- Database (indexes)

Industry 3.0

Industry 4.0

how? when? ?

- IT- and cognitive technologies
- New farming systems
- Robots and new equipment
- Food processing technologies
- Waste management technologies

Russian Innovation Prospects Today

State of Agricultural Science

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R&D expenditures

Domestic research and development costs

2018 | **₽** billion

17,3 in current prices

9,4 in 2010 prices

20 | 10 +90%

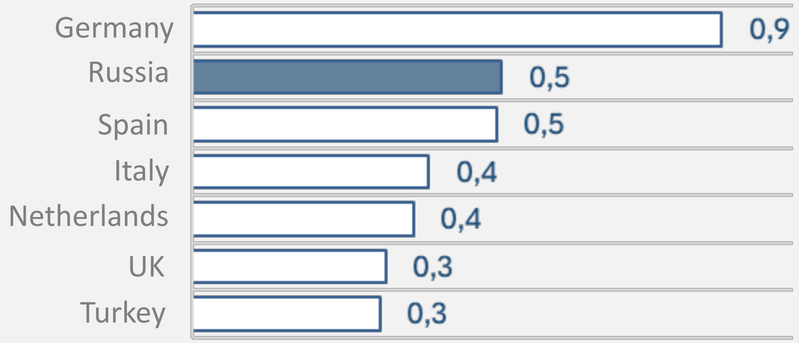
18 +3%

RUSSIA: AMONG COUNTRIES

Leading in state financing of agricultural science

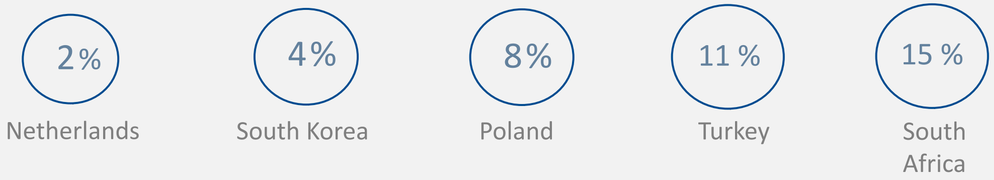
№2 in Europe

by PPP $ billion



Outsiders in R&D private investment

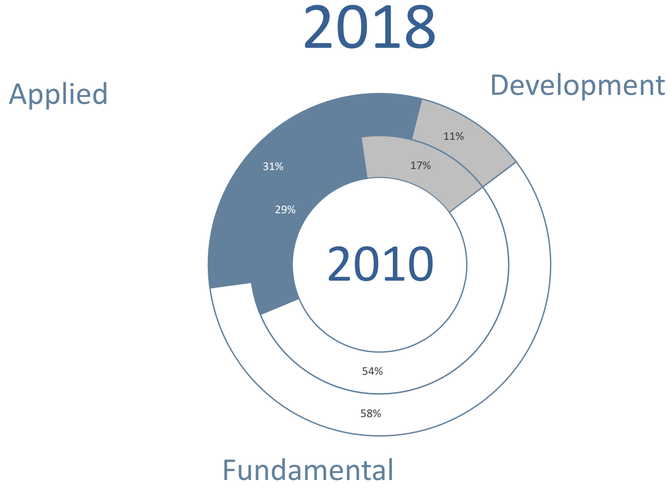
in % of similar indicators



Dominance of the public sector

Budget resources > 60%

Public research institutes > 80%



Russian Innovation Prospects Today

State of Agricultural Science

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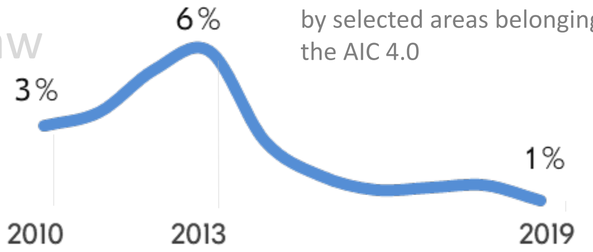
! The quality of the scientific product is not adequate to the expenditures

Contribution of Russian authors to the global volume of publications in the field of agricultural sciences

	WoS	Scopus
Agriculture, forestry, fisheries	< 1 %	< 2 %
Animal husbandry, dairy farming	< 0,3 %	< 1,5 %
Veterinary Science	< 0,2 %	< 0,5 %

Share of Russian patent applications in the global indicator

№217 Federal Law



by selected areas belonging to the AIC 4.0

! Transfer system ineffective

A significant part of the rights holders are universities and public research institutes, whose patent portfolios are mostly unbalanced (contain a high proportion of inactive patents)

Shortage of qualified personnel is a systemic problem of the Russian AIC

- Low prestige of the agricultural profession
- Outdated educational approaches
- Weak connection with practice
- Generational gap

QS University Ranking «Agriculture» 2018

None of the Russian Federation's agrarian universities have joined the TOP 200

Russian State Agrarian University - Moscow Timiryazev Agricultural Academy is in the group of universities ranking 201-250

BARRIERS TO INNOVATION TRANSFORMATION OF THE AIC*

The average planning horizon is currently 3-5 years even for large companies in agribusiness. In such conditions investment in science and human resources become highly risky

EXPERTS' OPINION

91% Imperfect legal framework with an emphasis on the bureaucratic nature of the problems

Largely outdated and contradictory, but rapidly changing and insufficiently developed legislation; conservative and apathetic of officials, their unwillingness to understand new issues, lagging in decision-making

82% Lack of dialogue between business and science

The set of factors: both objective-low level of equipment of research institutes, lack of personnel and competencies, and subjective - different vision of goals and results.

Business often cannot formulate a task understandable to the science, scientists presents their developments by the language that is not clear to business

73% Inefficiency of the technology transfer support system

Existing support measures target the conventional path of the AIC development and do not focus on breakthrough and truly innovative directions

*Based on expert survey

Proposals
For Improving The Effectiveness Of State Support Of The AIC

UPGRADE THE INSTITUTIONAL ENVIRONMENT

Build a flexible regulatory system capable of adapting to new conditions in a timely manner

LOOK AND THINK ONE STEP AHEAD

Overcome the perception of the agriculture as an archaic sector

Limit the dominance of the isolationist paradigm in the scientific and technological development of the AIC

DEVELOP A TRANSFER SUPPORT SYSTEM

Establishment of an Innovation Fund in the Agriculture to complement the existing format for supporting science, technology and innovation projects

REORGANIZE THE AGRICULTURAL EDUCATION SYSTEM

Division of Agrarian Higher Education into two levels

Updating and expansion the range of programs

Modernization of the system of agrarian secondary vocational education

TO ENSURE THE TRANSPARENCY OF MINISTRIES COORDINATION

Creation of a single coordination center for scientific and technological development of the agriculture and food processing industry

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