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Report on Russia: technological capacities and key policy measures

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Section

Introduction

The objective of the international country reports is to explore the technology and policy landscape of selected non-European countries. Country performance in advanced technologies is presented based on patent, trade and investment data. The reports provide also a concise and informative review of policies relevant for advanced technology development and deployment.

The starting point of this analysis has been sixteen advanced technologies that are a priority for European industrial policy and that enable process, product and service innovation throughout the economy and hence foster industrial modernisation.

Advanced technologies are defined as recent or future technologies that are expected to substantially alter the business and social environment and include *Advanced Materials, Advanced Manufacturing, Artificial Intelligence, Augmented and Virtual Reality, Big Data, Blockchain, Cloud Technologies, Connectivity, Industrial Biotechnology, the Internet of Things, Micro and Nanoelectronics, Mobility, Nanotechnology, Photonics, Robotics and Security*. The full methodology behind the data calculations is available on the ATI website: https://ati.ec.europa.eu.

The report is structured as the following:

The first section outlines the capacities of Russia in terms of technology generation (patent applications), followed by an analysis of international competitiveness in technology-based products (export shares) and, eventually, entrepreneurial dynamism (venture capital activities and investments in tech firms).

The second section analyses the main Russian policy strategy in support of advanced technologies and provides an overview of some of the key policy initiatives and policy measures in the field.

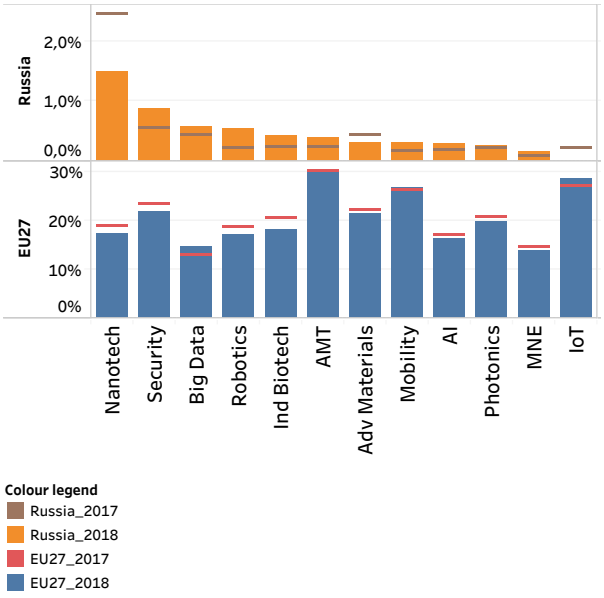
Section 1

1. Activities and capacities in advanced technologies

1.1 Patent applications

Technological trends and development have been captured based on patent data[1]. An analysis of Russia's current share of transnational patent applications helps to evaluate its current technological performance across different fields of advanced technologies. Figure 1 gives an overview of the Russian share of worldwide transnational patent applications related to advanced technologies in comparison with the EU27 Member States in 2017-2018.

Figure 1: Share in global transnational patent applications in advanced technologies (2017-2018)

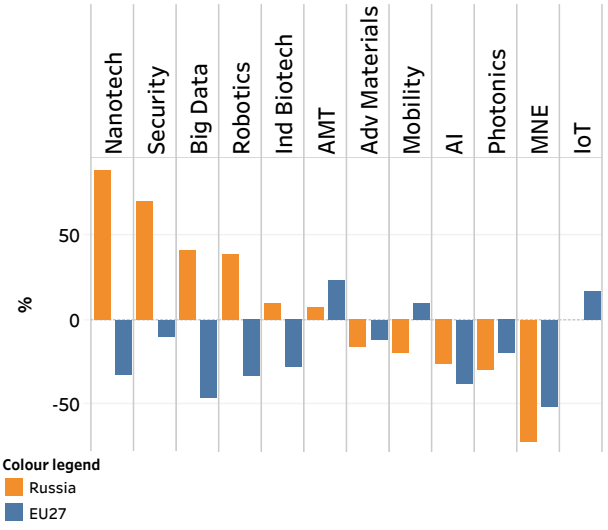


Source: Fraunhofer ISI, based on EPO PATSTAT
Note: AMT refers to advanced manufacturing technologies, AI to artificial intelligence. There is no data available for Russia in IoT=Internet of Things

As shown in Figure 1, the EU27 holds a considerably higher share of global patent applications than Russia in all advanced technology fields (please note that the scaling is different on the two diagrams above). In Russia the highest share of patent applications within the total number of transnational patent applications was recorded in the field of Nanotechnology in 2018. Further technologies that played a relatively more important role were Security, followed by Big Data and Robotics. In comparison with 2017, most of the shares of Russian patent applications in advanced technology fields indicated a slight growth in 2018, only shares of patent applications in Nanotechnology, Advanced Materials and Internet of Things revealed a slight drop down over one year period. On the contrary, the shares of European patent applications displayed a 1-3% decrease in most of the advanced technology fields during the same period.

The analysis of the RPA-index[2] as visualised in Figure 2 displays the relative technological specialisation of Russia in all twelve advanced technology fields in comparison with the EU27. In 2018, Russia was the most specialised in Nanotechnology and Security followed by Big Data and Robotics (similarly as in the case of its share of world patent applications). On the contrary, the EU27 displayed weak specialisation in all four of these areas. The results of the RPA analysis indicate that Russia has a rather weak specialisation in five of the advanced technologies.

Figure 2: Technological Specialisation RPA-Index of Russia and EU27 (2018)



Source: Fraunhofer ISI, based on EPO PATSTAT
Note: no data available for IoT

1.2 International competitiveness

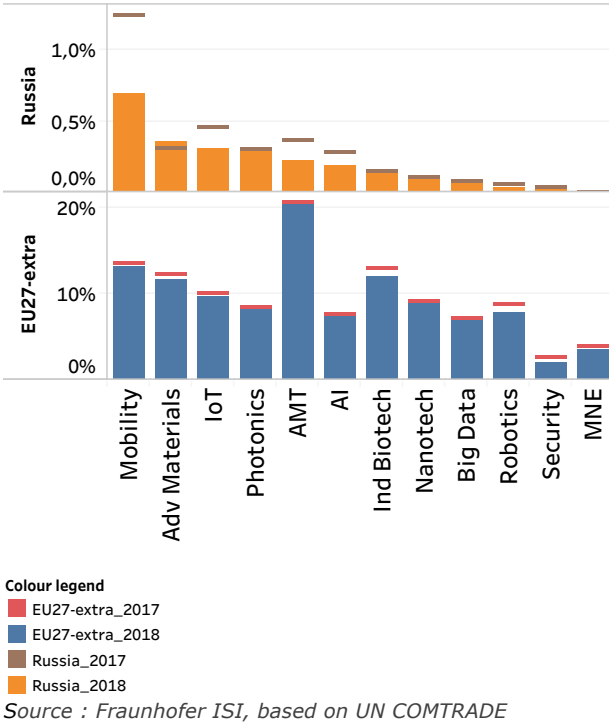
Trade measures are a common indicator of global competitiveness, as they document the attractiveness of a country's products beyond the home market. Total exports provide evidence about a country's role as a producer, and trade

[1] The patent analysis reflects the owner (applicant) of the technology, since patents have been localised based on the location of their legal owner.

[2] The RPA-Index illustrates the relative specialisation on a scale from -100 to +100, putting the share of a specific field in national applications in relation to the global average share.

balance captures its sovereignty in certain areas of production.

Figure 3: Export share in world total (2017-2018)

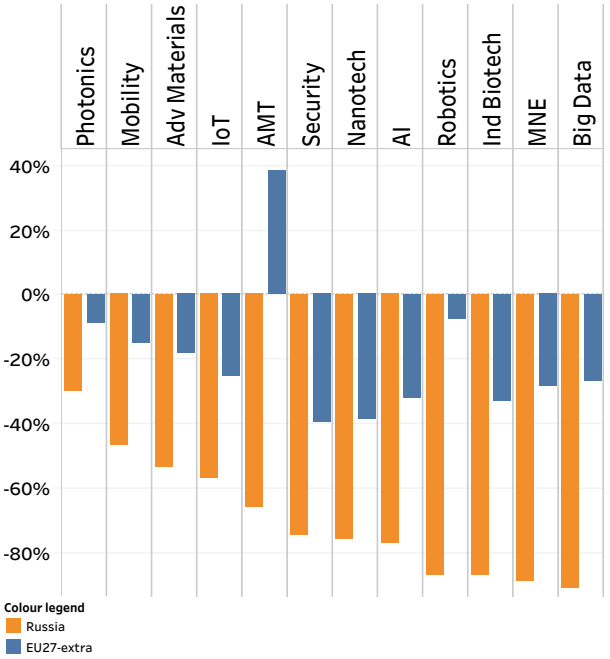


Source : Fraunhofer ISI, based on UN COMTRADE
Note: Russia and EU27 have different scale range

Figure 3 displays the Russian share of global exports related to advanced technologies in comparison with the EU27 for 2017-2018. The results clearly demonstrate that the EU27 exports more products that include any of the twelve types of advanced technologies than the Russian Federation. Russia displays a large relative trade advantage in Mobility, followed by Advanced materials and IoT compared to other fields of advanced technologies. In comparison with 2017, almost all Russian shares of global exports related to advanced technologies (except for Advanced Manufacturing technologies) slightly decreased. The shares of European global exports displayed a drop-down in half of the advanced technology fields during the same period.

Figure 4 visualises the trade balance[3] in relation to the total trade volume of Russia and the EU27 countries in 2018.

Figure 4: Trade balance in relation to overall trade volume (exp. - imp.) (2018)



Note: "EU27-extra" refers to exports to non-EU countries, i.e. competitiveness-based exports outside the single market
Source: Fraunhofer ISI, based on UN COMTRADE

The Russian Federation exhibits a strong trade deficit with regard to goods relevant for all twelve advanced technologies. However, the EU27 displays notable relative trade surplus in Advanced Manufacturing technologies. Overall, this situation is not surprising, since the main exporters of advanced technology related goods are located in East Asia.

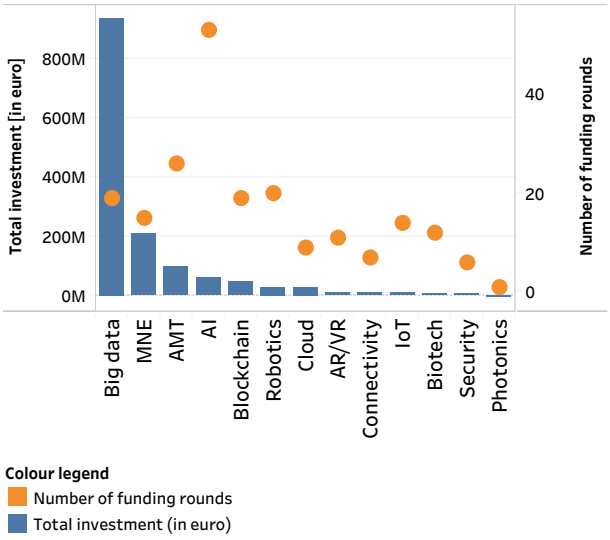
1.3 Investment activities

The following figures analyse private and venture capital (VC) investments in advanced technologies in Russia. Figure 5 illustrates the number of investment deals in advanced technologies and the share of investment-backed firms in Russia based on Crunchbase[4] data. The results have to be interpreted with caution since the data from Russian startups and scaleups are limited.

[3] Exports - Imports

[4] Private equity, venture capital investment and related innovative start-up creation have been explored based on the dataset available in Crunchbase. Crunchbase provides information on venture capital backed innovative companies.

Figure 5: The number of funding rounds and VC investment in Russia (2015-2021)



Source: Technopolis Group based on Crunchbase data

The analysis reveals that there are certain hotspots of VC activity in the area of Big Data and Micro and nano-electronics, followed by Advanced Manufacturing and Artificial Intelligence in terms of the total amount of investment. Although Artificial Intelligence technology only managed the fourth position regarding total investment, it ranks first in terms of the number of funding rounds.

The largest VC investments have been received by Yandex (€872 m) over the 2015-2021 period which is a multinational technology company that provides internet-related services and operates a search engine platform in Russia. The second largest VC investment has been received by M.Video (€197 m). This company is the largest Russian consumer electronic retail chain by revenue and the first and the only publicly-traded company in its market sector.

The most recent startups of 2020 are Ton Brains - Quanton & Quantchain[5] and CyberDrone Drone Shows[6] which are active in Blockchain and Robotics respectively.

[5] TON BRAINS is specialised in decentralised quantum computing solutions.

[6] CyberDrone provides spectacular drone light shows for all occasions.

Section 2

2. Key actors, policy and governance framework

2.1 Overview and policy context

Table 1: Overview of policy strategies and measures in support of advanced technologies

Policy strategy	**Year**	
Executive Order on National Goals and Strategic Objectives of the Russian Federation by 2024	2018-2024	
National Strategy for the Development of Artificial Intelligence for the period until 2030	2019-2030	
Policy measures	**Year**	**Budget**
The National Technological Initiative	2014-ongoing	6.2 bn rubles
The National Digital Economy Programme of the Russian Federation	2018-2025	annual budget of €162 m
Prospective standardisation programme for the priority area "Artificial Intelligence"	2021-2024	n.a.
Comprehensive Programme for the Development of Biotechnologies in the Russian Federation	2012-2020	€22.6 bn (1.2 tn rubles)
Federal S&T programme for the development of genetic technologies	2019-2027	€100 m-500 m (estimation)
Development of industrial production of fifth-generation networks and the Internet of Things in the Russian Federation in 2019-2024	2019-2024	€408 m (28 bn rubles)

Source: author

In the ranking of UNESCO[7], Russia is in the top ten in terms of investments in R&D, estimated at €35.6 bn at purchasing power parity. However, in terms of the ratio of investments to GDP, Russia is not even included in the top 15 countries, with the ratio of 1.03% of GDP (where the global average is 1.7%, and for North America and Western Europe is 2.5%) in 2019[8]. In 2017, R&D expenditures from the business sector in Russia represented about 66% of government spending on research and development, and only 4% of the government spending was invested in higher education institutions, private non-profit organisations (UNSCO Institute for Statistics).

The findings presented in section one illustrated Russia's positioning as a nation and economy catching up. The trade analysis confirmed that Russia has a strong deficit of advanced technology relevant goods. The patent and investment analyses found that own Russian capacities are limited in most of the fields and most prominently in digital technologies.

Russian policymakers recognise the nation's technological gaps and the difficulty in catching up with the US or the EU27. At the same time, they see the huge potential in digital technologies and invest in various areas.

In 2017 the Government of the Russian Federation officially announced an initiative towards a complete reformation of the state apparatus and a reorientation of the priority tasks of the country's development to the digital economy[9]. During 2011-2015 period, the digital economy showed a significant increase from €37.6 bn to 60.3 bn (2 tn to 3.2 tn rubles), or from 2.6% to 3.9% of GDP. However, in the USA, China and EU, this indicator is 2-3 times higher (10.9%, 10% and 8.2% respectively)[10]. The investments of private companies in digital technologies represent only 2.2% of GDP, while in the USA the investments reach 5% and in Western Europe 3.9%. By 2025 the potential effect of digitising the economy on GDP is

[7] http://uis.unesco.org/en/news/rd-data-release

[8] https://www.statista.com/statistics/461754/share-of-gdp-expenditure-on-research-and-development-russia/#:~:text=This%20statistic%20displays%20the%20share,decrease%20on%20the%20preceding%20years.

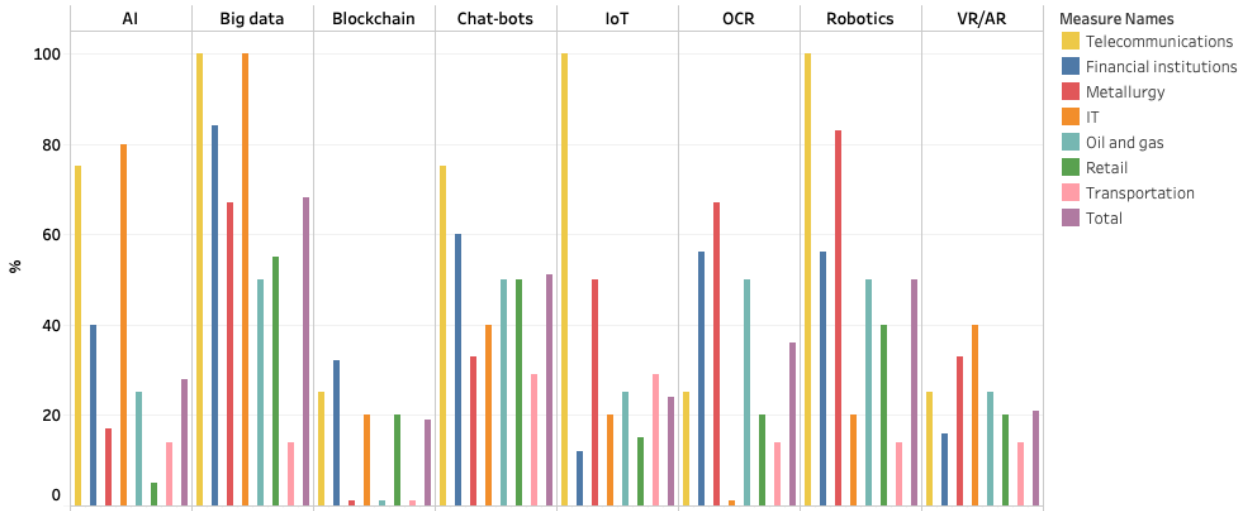
[9] http://static.government.ru/media/files/9gFM4FHj4PsB79I5v7yLVuPgu4bvR7M0.pdf

[10] http://corpshark.ru/wp-content/uploads/2017/07/Digital-Russia-report.pdf

estimated around €77-167.7 bn (4.1–8.9 tn rubles) in Russia, which will increase its GDP by 19–34% in total[11]. In terms of digitalisation, the most lagging sectors in Russia are mining, manufacturing, industry and transport[12]. The share of exports in digital goods and services remains extremely low, around 0.5% of GDP, indicating a weak competitiveness of Russian ICT products and services in global markets.

Figure 6 shows the use of digital technologies by industry in the Russian Federation.

Figure 6 Usage of digital technologies in the Russian market depending on the industry, 2019



Source: KPMG, Russia[13]

2.2 Government policies towards technology development and adoption

The Presidential Decree '*Executive Order on National Goals and Strategic Objectives of the Russian Federation by 2024*' was issued on 7 May 2018. The main goals of this long-term strategy are to accelerate technological development and support high-productivity export-oriented businesses in the basic sectors of the economy. A further objective is to improve the availability of the necessary skills and form highly qualified employees.

The National Technological Initiative (NTI) was created by Vladimir Putin in 2014 with the objective to establish Russian global technological leadership. The federal budget for the implementation of the activities of the National Technological Initiative allocated more than €8.6 m (6.2 bn rubles) in 2019.

Sub-programmes under NTI include the following:

- The *NTI Technological Breakthrough Programme* is intended for researchers, small and medium-sized technology-oriented companies and research centres that are developing breakthrough products in the NTI area. The allocated budget is €3.1 m (165 m rubles).
- The *NTI Infrastructure Programme* is aimed at developing infrastructure projects for the areas of NTI (testing ranges, engineering and certification centres, data libraries, accelerators) and provides for the possibility of obtaining grants and investments up to €9.3 m (495 m rubles).
- The *Spin-Off NTI Programme* supports the creation of new businesses in the areas of NTI. Partial subsidy on the interest rate of the target loans is provided, as well as entry into the capital of project companies with the amount of up to €9.3 m (495 m rubles).
- The *NTI Export Programme* is intended for medium and large companies at the final stage of their development and launch of export product solutions to the market. A possible format of support is grants and investments with budget amount up to €9.3 m (495 m rubles).
- '*Technet*'[14] is an action plan (road map) of the National Technological Initiative for the Development of the Cross-Market / Cross-Industry Direction 'Advanced Production Technologies' (APT), which will strengthen the competitiveness of domestic companies in markets related to science and technology and in high-tech industries. Technet is the first roadmap within the NTI framework for the development and effective application of 'end-

[11] McKinsey, 2017 http://www.tadviser.ru/images/c/c2/Digital-Russia-report.pdf

[12] Direct INFO; Rosstat; IHS EU KLEMS

[13] https://assets.kpmg/content/dam/kpmg/ru/pdf/2019/01/ru-ru-digital-technologies-in-russian-companies.pdf

[14] http://fea.ru/compound/national-technology-initiative/

to-end technologies' and new production technologies.

The National Digital Economy Programme of the Russian Federation[15] has the objective to create a safe and powerful infrastructure for high-speed data transfer, processing, and storage which is made available for all organisations and households of Russia. The national programme was adopted in accordance with the Decree of the President of Russia in 2018 with an estimated annual budget of €162 m until 2025. International best practices in the field of digital transformation have been used when setting up this initiative.

The programme called '**Digital Economy of the Russian Federation**' also addresses digital government, digital business, digital innovation and skills development among others. One of the focus areas of the programme is to develop up-to-date legal regulation, which is expected to create favourable competitive conditions for digital transformation and to introduce uniform requirements for electronic operations. Another important area is cybersecurity. Russia is developing standards in order to protect the interests of individuals, companies and the state from cyber threats. In addition, the programme includes the development of robotics and sensors.

Prospective standardisation programme for the priority area 'Artificial Intelligence'[16] for the period 2021-2024 is designed to overcome existing regulatory and technical obstacles to the implementation of the federal 'Artificial Intelligence' project in Russia. The programme was developed by the Ministry of Economic Development of Russia with the participation of experts from the Technical Committee for Standardisation 'Artificial Intelligence' and also was sent for approval to 164 organisations, including government bodies, as well as companies, organisations and development institutions involved in the digital economy[17].

The **'Comprehensive Programme for the Development of Biotechnologies in the Russian Federation'**[18] **in 2012** has been launched by the Government in order to stimulate the development of the biotechnological industry for the period until 2020. The strategic goal of the programme is to secure Russia's leading position in the field of biotechnology, including biomedicine, agrobiotechnology, industrial biotechnology and bioenergy, as well as the creation of a globally competitive bioeconomy.

There are several implementation stages of this programme:

- Stage I (2011-2015) - development of domestic demand and export of biotechnological products;
- Stage II (2016-2020) - formation of institutional conditions for the modernisation of the technological base of relevant industries.

It is financed from the federal budget and extrabudgetary sources with an estimated budget of €22.6 bn (1.2 tn rubles) until 2020.
The main supporting mechanisms in the framework of the state programmes include the following:

- subsidies for the partial reimbursement of the investment loans costs;
- subsidies for the implementation of integrated investment projects;
- provision of financing for R&D and production organisations;
- support for exhibition activities.

Table 2 indicates several key government programmes which are aimed at developing the biotechnology industry.

Federal S&T programme for the development of genetic technologies[19] for 2019-2027 is aimed at delivering comprehensive solutions to the problems of the development of genetic technologies, including genome editing technologies, the creation of scientific and technological groundwork for medicine, agriculture and industry, improvement of the biological emergency prevention and control system.

[15] https://digital.ac.gov.ru/
[16] https://www.economy.gov.ru/material/news/v_rossii_poyavyatsya_standarty_v_oblasti_iskusstvennogo_intellekta.html
[17] https://www.cnews.ru/news/line/2020-12-22_utverzhdena_perspektivnaya
[18] https://fs.moex.com/files/8579
[19] https://minobrnauki.gov.ru/action/fntp/

Table 2: Key government programmes aimed at the development of biotechnological industry in the Russian Federation

Government programme	Subprogramme	Subprogramme Focus
Pharmaceutical and medical industry for 2013-2024 period (amended on March 31, 2020 No. 396)[20]	'Development of drug production' 'Development of the production of medical devices' 'Comprehensive development of pharmaceutical and medical Industry'	Pharmaceutical products; medical devices;
State Programme for the Development of Agriculture and regulation of agricultural markets, raw materials and food for 2013-2025 (The programme has been changed from April 2, 2021 - Decree of the Government of Russia of March 18, 2021 N 415)[21]	Federal Target Subprogramme 'Technical and technological modernisation, innovative development' 'Development of branches of the agro-industrial complex' 'Providing conditions for the development of the agro-industrial complex'	Biological plant protection products and microbiological fertilisers; agricultural waste processing by biotechnological methods; bioenergy facilities; innovative development of the meliorative complex;
Industrial development and increase competitiveness for 2013-2030[22]	'Development of transport and special mechanical engineering'; 'Development of production of means of production'; 'Development of production of traditional and new materials'; 'Development of industrial infrastructure and infrastructure for supporting industrial activities' and other	production of competitive equipment; production of modern high-tech industrial products; updating the technological and material base of industries.

Source: author's compilation

The biotechnology market in Russia is growing rapidly. The Russian Government has adopted a number of programmes supporting the development of biotechnology in various industries. Several investment strategies exist for a ten years period. Technological platforms such as the 'Medicine of the Future', 'Biotech 2030' and 'Bioenergy' play an important role in linking business and science[23].

According to the results of 2011-2013, a so-called 'innovative elevator' was formed in Russia representing a system of institutions created by the state. They support innovative projects at various stages: from pre-seed and seed phases to the stage of expansion and restructuring. The main partners of this 'innovative elevator' are RVC OJSC, Rusnano OJSC, Skolkovo Fund, Vnesheconombank (VEB), Russian Bank for Small and Medium Enterprises Support (SME Bank), the Fund for Assistance to the Development of Small Forms of Enterprises in Scientific and Technical sphere ("Bortnik Fund") and the Russian Fund for Technological Development (RFTR). The system is supplemented by regional venture capital funds, public organisations (such as OPORA Russia), the Russian Venture Investment Association, as well as a specialised trading platform of the Moscow Exchange for high-tech companies.

2.3 Government initiatives to foster specific advanced technologies

Blockchain technology

Blockchain technology in Russia is just beginning to develop. The Moscow Technical University of Communications and Informatics (MTUCI) became a member of the technical committee for standardisation for the so-called 'Software and hardware for distributed registry technology and blockchain' in 2018. MTUCI together with the Central Bank of the Russian Federation, Sberbank, Rostelecom and other committee members will standardise the architecture and ontology of blockchain, develop requirements for its hardware and software tools, and regulate the scope of application for this technology in Russia, as well as work towards the security and privacy of a distributed registry.

In 2018 the Unified State Register of Legal Entities (USRLE) has already declared more than fifty registered organisations, where the name of the company contains a blockchain word[24]. Extrabudgetary funding for blockchain development projects in Russia is expected to

[20] https://ach.gov.ru/upload/iblock/bcb/bcbb25d9c2f0fa643c231402d386163b.pdf
[21] http://gov.garant.ru/SESSION/PILOT/main.htm
[22] http://government.ru/rugovclassifier/862/events/
[23] https://cyberleninka.ru/article/n/razvitie-biotehnologiy-v-rossii
[24] https://cyberleninka.ru/article/n/tehnologiya-blokcheyn-v-rossii-dostizheniya-i-problemy/viewer

reach €731 m (50.17 bn rubles) by 2024. About 43% of the budget is planned to be spent on "technologies for creating and executing decentralised applications and smart contracts." It is proposed to direct 50% of the budget to stimulate the implementation of solutions based on priority sectors[25].

In September 2017, the National Research Nuclear University (Moscow Engineering Physics Institute) and the M9 group of companies announced the opening of the Mephius Blockchain Development Centre at the Institute of Intelligent Cybernetic Systems. At the first stage, it is planned to invest €125,000 (10 m rubles) in the project.

The Exonum platform has been launched, which has been designed to help private companies and government agencies securely create blockchain-based solutions and services. The Blockchain Fund is the first non-profit organisation to promote the development of blockchain technology.

The coronavirus pandemic has become a powerful trigger for public sector innovation. During this period, the **law on digital financial assets (DFA)** was adopted, which approves a roadmap for the development of distributed ledger technology and the active involvement of many government agencies working with the blockchain: from tax and customs services to party organisations as well as the Bank of Russian Federation[26]. It is expected that the accelerated usage of blockchain technology, due to the pandemic situation in Russia, will reduce the turnover of counterfeit goods and the volume of the shadow economy by €10.2 m (853 bn rubles) by 2024[27].

Internet of Things (IoT)

The volume of the IoT market in Russia was estimated around €3.1 bn in 2018[28]. The total IoT market for the next 2-3 years was expected to grow by an average of 22% and by the end of 2021 it is predicted to reach €8 bn. As a result of 2019, the IoT market in general grew by 9%, although the forecast was 14-15%[29]. By the end of 2022, the Internet of Things expenses from end users in Russia is expected to amount around €6.8 bn (521.7 bn rubles). Many Russian industries have not yet started to adopt IoT. The number of IoT / M2M devices connected to the Wide Area Network reached 23 million units, an increase of 21% compared to 2017.

The Ministry of Industry and Trade launched a programme called '**Development of industrial production of fifth-generation networks and the Internet of Things in the Russian Federation in 2019-2024**'. At the first stage, it is planned to allocate about €408 m (28 bn rubles) to create hardware and software for 5G and IoT networks in Russia.

During 2020-2021, a recession period is expected in the development of IoT in Russia due to the impact of COVID-19 pandemic. Due to the forced quarantine measures, the demand from the B2B sector is foreseen to drop down as the forces of many industrial enterprises will target recovery, and not the implementation of IoT technologies[30].

Artificial Intelligence

In 2018 the market of artificial intelligence in the Russian Federation was estimated around €28.4 m (2.1 bn rubles), which is 0.2% of the actual share in the global market [31]. By the end of 2024 the market is expected to reach €2.3 bn (160 bn rubles) (1.8% of the world market). About 43% of Russian businesses do not use artificial intelligence in their work and do not plan to do this. At the same time, 91% of business representatives are aware of the existence of such technologies, 31% are already using them in their work, and another 23% are going to introduce artificial intelligence in the future[32].

In 2019, a '**National Strategy for the Development of Artificial Intelligence for the period until 2030'** was approved. This strategy ensures the accelerated development of artificial intelligence in the Russian Federation through conducting research in the field of artificial intelligence, the availability of information and computing resources for users and improvement of the training system in this area.

Training programmes have been launched in artificial intelligence in 100 universities in Russia in 2019. These initiatives are free for students and teachers. In addition, a separate work will be carried out with researchers.

The Russian government has allocated €1.7 m (1.4 bn rubles) to support startups engaged in artificial intelligence technologies in 2021. This support will be provided for developers of electronic services, commercially profitable IT solutions using AI technologies and creation of open libraries. In January 2021, Russian President Vladimir Putin highlighted the need to implement

[25] http://www.tadviser.ru/index.php/%D0%A1%D1%82%D0%B0%D1%82%D1%8C%D1%8F:%D0%91%D0%BB%D0%BE%D0%BA%D1%87%D0%B5%D0%B9%D0%BD_%D0%B2_%D0%A0%D0%BE%D1%81%D1%81%D0%B8%D0%B8#cite_note-0

[26] https://www.rbc.ru/crypto/news/5feadd249a7947b4da846630

[27] Ministry of Telecom and Mass Communications, 2020

[28] http://pltf.ru/wp-content/uploads/2019/02/internet_veschey_v_rossii_10_02_2019.pdf

[29] http://sk.ru/foundation/itc/iot/

[30] https://center2m.ru/iot-development-perspective

[31] https://digital.gov.ru/ru/documents/6658/

[32] https://raec.ru/activity/analytics/11002/

federal laws by the 1st of May 2021 on the large-scale use of AI in the country, which in turn facilitates the introduction of experimental regimes in certain industries to expand the use of AI[33].

Augmented & Virtual Reality

The number of Russian companies actively involved in this technology increased from 60 to 183 . Most of them are located in Moscow (105 companies), 25 companies are registered in St. Petersburg, and the rest are located in cities across the country. The AR/VR market is experiencing a clear rise not only in the number of companies, but also in the level of ongoing projects compared to the beginning of 2016[34]. This is facilitated by the interest of investors, both venture capital funds and business angels, who together have invested more than €9.5 m (700 m rubles) in AR/VR companies in 2016. In 2015, the total investment amounted around €2.9 m (200 m rubles) in AR/VR market in Russia[35].

In order to promote AR/VR technologies in Russia, the so-called VAMR community has been launched, uniting up to 1,500 companies. The community organises trainings of specialists, which is expected to increase the number of AR/VR business.

Robotics

Large public and private companies indicate growing interest in robotics. The Russian industrial robotics market grew by 42% in 2018 compared to the previous year. In 2018, 1007 robots were installed at industrial enterprises (in comparison with 713 robots in 2017). The industrial robot market in the Russian Federation was estimated at 3 billion rubles in 2018. The market for robotic solutions amounted to €12.6 m (9.1 billion rubles). In 2019, about 5 000 robots were used by Russian enterprises[36].

The Russian Government undertakes certain efforts in developing technologies, organising specialised education and government regulation[37]. Notable initiatives from the private sector include the following:

- Ozon is one of the largest online stores in Russia which intends to robotise processing orders.
- Gazprom Neft concluded several cooperation agreements with CRI RTK in the field of development of robotics and unmanned control systems, and already showed prototype of a robot for loading petroleum products to the airfield tanker.
- Severstal invested money to the Chrysalix RoboValley Foundation, which finances robot development and artificial intelligence.
- Alrosa Group of Companies and OMZ (United Engineering Plant) together with the Skolkovo Foundation launched contest "Technostart-2019", in the framework of which is looking for projects including robotics.
- SIBUR Holding launched a corporate accelerator, in the framework of which the organisation is looking for projects in robotics.

Connectivity (5G technology)

The Russian operators have spent several years on testing 5G technologies, using prototypes and pre-5G standards. The Russian operators are still focused on 4G deployment, and this technology has not yet exhausted its potential. In terms of 5G technologies, Russia is in the second stage[38]. It is expected that the **first 5G commercial networks in Russia will begin to appear in 2020**, and the number of 5G connections will reach 46 m by 2025. This is 20% of the total number of connections with coverage of 60% population. By January 2021, the prospects for the development of 5G in Russia remain uncertain due to the decision on the allocation of frequencies and the understanding at which frequencies the deployment of 5G will take place, as well as the limitations related to the use of Russian equipment exclusively. Development expenditures of 5G networks in Russia will exceed €1.7 bn (1 tril rubles) by 2027 (ACRA, 2021)[39].

According to this forecast, growth indicators in Russia will exceed the global average, but at the same time, they will be below the level of the leading 5G markets (the USA, South Korea and China). The costs of implementing the roadmap for the development of wireless technology amount to €1.5 bn (105.16 bn rubles), where extrabudgetary sources allocate €1 bn (69.16 bn rubles) from this amount, and the federal budget assigns €0.5 bn (36 bn rubles). Additionally, another €2 bn (139 bn rubles) are allocated outside the roadmap support tools.

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[37] https://adindex.ru/files2/access/2019_07/273895_sberbank_robotics_review_2019_17.07.2019_m.pdf
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About the 'Advanced Technologies for Industry' project

The EU's industrial policy strategy promotes the creation of a competitive European industry. In order to properly support the implementation of policies and initiatives, a systematic monitoring of technological trends and reliable, up-to-date data on advanced technologies is needed. To this end, the Advanced Technologies for Industry (ATI) project has been set up. The project provides policymakers, industry representatives and academia with:

- Statistical data on the production and use of advanced technologies including enabling conditions such as skills, investment or entrepreneurship;
- Analytical reports such as on technological trends, sectoral insights and products;
- Analysis of industrial value chains and policy needs;
- Analysis of technological trends in competing economies such as in the US, China or Japan;
- Access to technology centres and innovation hubs across EU countries and city mapping.

You may find more information about the 16 technologies here: https://ati.ec.europa.eu.

The project is undertaken on behalf of the European Commission, Directorate General for Internal Market, Industry, Entrepreneurship and SMEs and the European Innovation Council and Small and Medium-sized Enterprises Executive Agency (EISMEA) by IDC, Technopolis Group, Capgemini, Fraunhofer, IDEA Consult and NESTA.

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