

# *Internet of Things*

Future technology  
available today

*The IoT is also at the top  
in terms of investment in new  
and emerging technology*

*Paper #1*





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## *The Internet of Things (IoT) has the potential to drive digitalisation to a new level*

*Based on PwC's 2017 Global Digital IQ® Survey, the IoT ranks first among the eight most disruptive technologies that have the potential to completely alter business models or entire industries, displacing artificial intelligence, augmented reality, UAVs, blockchain and a number of other technologies*

**I**n the twentieth century, societies went through two significant periods of economic transformation: industrialisation (in the first half of the century) and computerisation (in the second half). These two processes led to massive productivity gains, economic growth and major improvements in living standards.

devices by 2020), IoT solutions are finding more and more applications in different sectors of the economy, from utilities and manufacturing to agriculture, transportation, healthcare and beyond.

International experience has demonstrated that the adoption of the Internet of Things is most

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***However, despite the rapid adoption of innovative technologies in telecommunications, data sharing and the Internet in the 2000s, we have yet to see the productivity gains promised by automation***

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In order to push this forward, we believe that a critical mass of new technologies must be adopted by consumers and businesses alike.

Many countries have pinned their hopes on the digital economy, a term that covers various types of automation. The Internet of Things (IoT) has the potential to push digitalisation to a new level.

With the growing number of connected devices worldwide (according to industry analysts, we will have 20 to 50 billion connected

successful when both government and business are involved.

For example, in the EU, South Korea, China and India, the deployment of smart city technologies has enabled more efficient management of energy consumption and vehicle traffic.

The United Kingdom and the United States have enacted large-scale programmes that encourage the use of smart meters that help households manage their energy use remotely.

IoT has a number of benefits over other disruptive technologies. First, IoT solutions have broad applications in the service industry and in business as a whole. Furthermore, we already have the necessary infrastructure in place to start using IoT technologies, including mobile and fixed networks. Any further additions (sensors, applications or platforms) will be rather cost efficient.

The expansion of IoT has been driven by four key technological trends:

- Computing has become less expensive, including processors, memory and data storage systems;
- Data transmission has become more affordable;
- Thanks to big data and cloud technology, flexible systems for storing and analysing data have more capacity to cope with the ever increasing amounts of data;
- The number of connected devices is rapidly growing.

The emergence of IoT is driven not only by specific technological advances, but by the emergence of an entire ecosystem, including a variety of developments in data collection, sharing and aggregation, as well as data processing platforms that have the capacity to generate smart solutions.

### **The Internet of Things is already becoming a reality.**

### **It is giving businesses a competitive edge by lowering costs and opening new revenue streams**

Consumer markets are becoming increasingly flooded with smart technology. According to a PwC survey conducted in the US, one in every four consumers uses a device with built-in smart home technology.

### **We believe that the use of the IoT technology will**

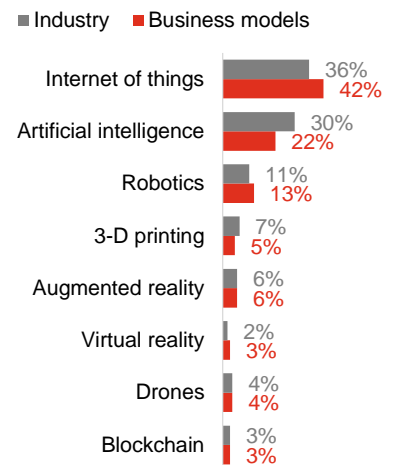
### **allow devices, environments and people to communicate more actively, and this gives us reason to hope that the world will become a smarter and more convenient place to live in.**

The continuous and ever-expanding exchange of data is creating demand for new services that will keep us connected to the physical world around us. Moreover, these services are being built on completely new business models and are leveraging new financial flows.

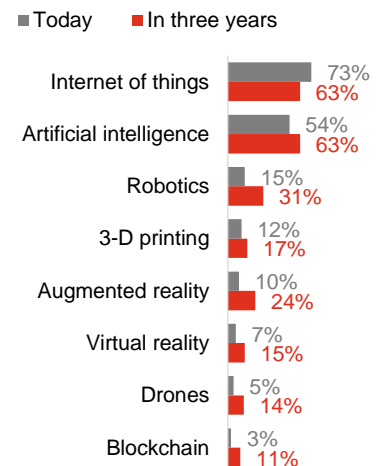
The adoption of IoT in Russia faces a number of challenges related to the nature of the economy, technology, legislation, geography and culture. On the consumer side, the population's relatively low income level presents one barrier. On the business side, the market for IoT products is hindered by a number of factors, including: the lengthy process of decision-making on new technology; the short planning horizons in companies; the difficulties with transforming internal processes, workflows, and approaches to receiving and processing information; and the challenge of integrating IoT technology into existing IT architecture.

We believe that it is important to consider the multiplier effects that IoT could have on various economic sectors by ensuring higher performance and lower costs. If these effects are to be achieved, a systemic approach to developing IoT in Russia will be needed. The government must play a vital part in this process, as it has the capacity to improve the regulatory framework, develop IoT support levers, create a stimulating environment to develop human capital and promote Russian best practices abroad. By taking a systems approach, the Internet of Things could become an economic game changer for Russia in the long term.

**Figure 1. Impact of technologies on business models or entire industries\***



**Figure 2. Investment value of various technologies**



\*percentage of respondents who took part in the survey and highlighted a particular technology

# The expected impact from introducing the Internet of Things in Russia

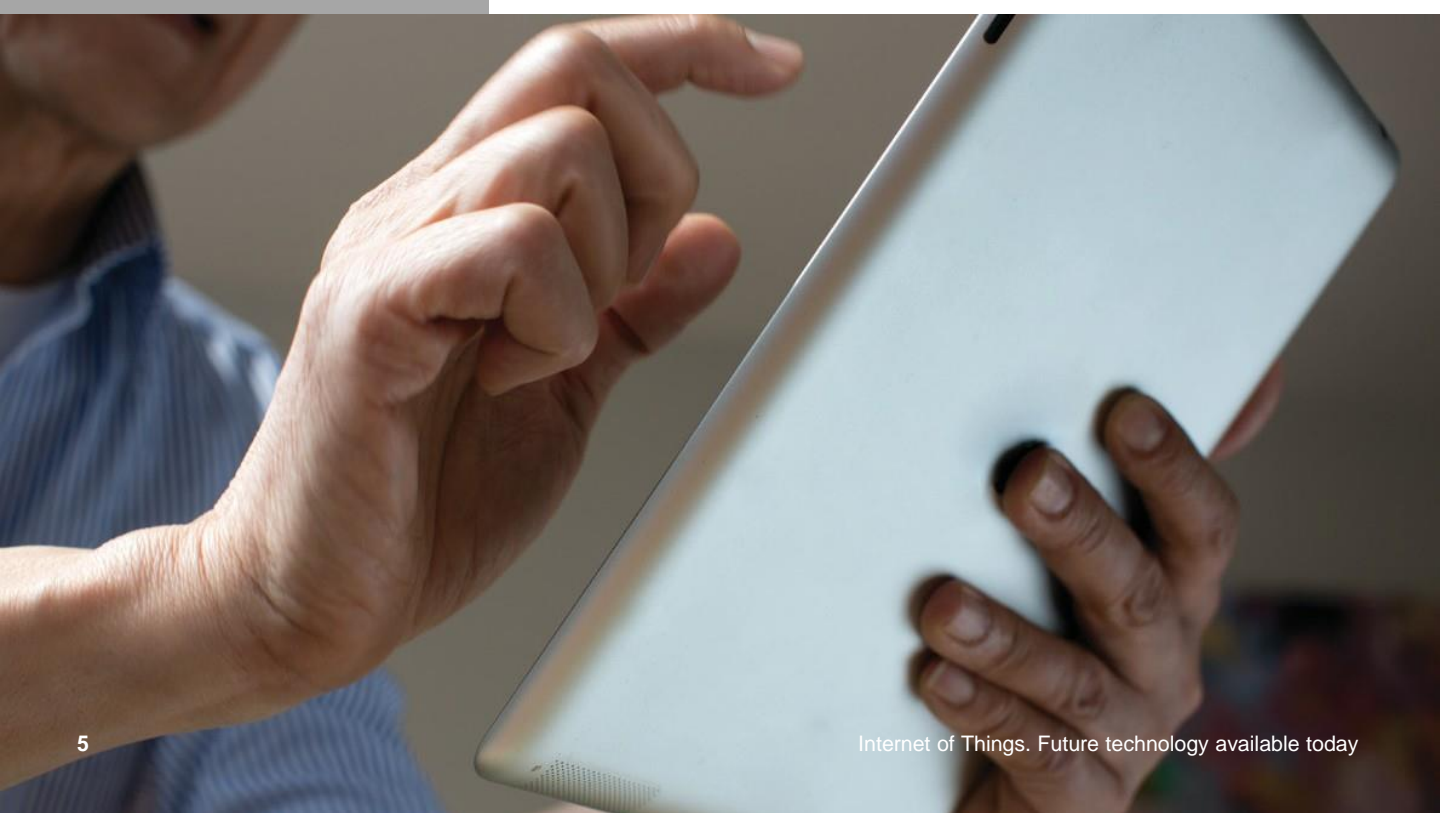
*According to our estimates, the cumulative impact from adopting IoT technology in six industries (electricity, healthcare, agriculture, transport and storage, smart cities and smart homes) will reach around 47 bln \$ by 2025*

The figures on the potential capacity of the IoT market vary. While it could exceed USD 1.2 trillion worldwide by 2020, the share of the Russian market is still relatively moderate. The range of estimates depends on who makes the calculations and what segments are included in the market structure. From our viewpoint, the most important indicator is not the size of the market for technological solutions and IoT consulting, but the multiplier effect that these technologies can produce on various industries by improving productivity and lowering costs.

According to our estimates, the cumulative impact from adopting IoT technology in six sectors (electricity, healthcare, agriculture, transport and storage, smart cities and smart homes) will reach around 47 bln \$ by 2025. The contributing factors behind this outlook include, first and foremost, the reduced costs for repair and maintenance of production assets, more energy-efficient production facilities, buildings, and other structures, optimised transport and logistics flows, and improved production processes.

In this respect, the Internet of Things has significant advantages over other promising technologies, including readiness for direct implementation, the wide range of potential applications and the scale of the resulting impact. A more or less complete infrastructure is already in place for IoT, including data sharing networks, data processing centres and computing resources for collecting, storing and processing large amounts of data.

However, the multiplier effect from IoT will not be achieved in Russia unless the government adopts a systems approach to the implementation of IoT solutions. This approach includes improving the regulatory framework, developing support measures, creating a favourable environment to develop human resources, promoting Russian best practices abroad, and consolidating and coordinating industry-wide communities. We are currently witnessing a rise in the number of government initiatives in this area, but not all have been put into practice so far. With a systems approach, IoT could become a game changer for the Russian economy in the long term.



Most CEOs believe that investing in IoT could help cut costs (indeed, this was the most popular response among manufacturing companies). CEOs in the financial services, technology and consumer goods mainly expect a better customer experience, while financial companies also predict fewer risks. Most CEOs in the technology sector hope that IoT will generate more revenue.

The integration of IoT in the **electricity sector** will make it possible to boost performance and reliability, while cutting expenses for both suppliers and consumers. For electricity grids, the key factors will include better control over substations, power lines and other grid elements via remote monitoring. As a result, operating and maintenance costs will drop, as will technological and business losses. On the power generation side, the use of IoT will reduce fuel consumption (fuel accounts for a majority of the operational expenses at power stations).

The introduction of IoT solutions in power engineering will provide an impetus to develop a competitive retail power market, which would give consumers the opportunity to choose their service providers.

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***According to our estimates, the economic impact from introducing IoT in the electricity sector will reach roughly 8 bln \$ by 2025***

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The use of IoT in **healthcare** will open completely new frontiers in diagnosing disease with the use of precision treatment and smart monitoring devices equipped with micro- and nano-sensors. This, in turn, will make the healthcare sector

more efficient. Remote monitoring in particular will lower the risk of emergency hospitalisation and reduce the burden on inpatient hospitals, while remote communication between patients and doctors will be made easier.

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***We estimate that the economic impact from adopting IoT in healthcare will reach 9 bln \$ by 2025***

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IoT in **agriculture** will improve performance and provide the industry with a competitive advantage in the context of growing demand for agricultural products. Smart farms and smart greenhouses will help to increase crop yields (by optimising the use of seeds, fertilisers and water), improve product quality, cut fuel and water use, and reduce crop waste during storage and transport. As of today, innovative technologies are already being implemented in this sector, but mostly by major market players.

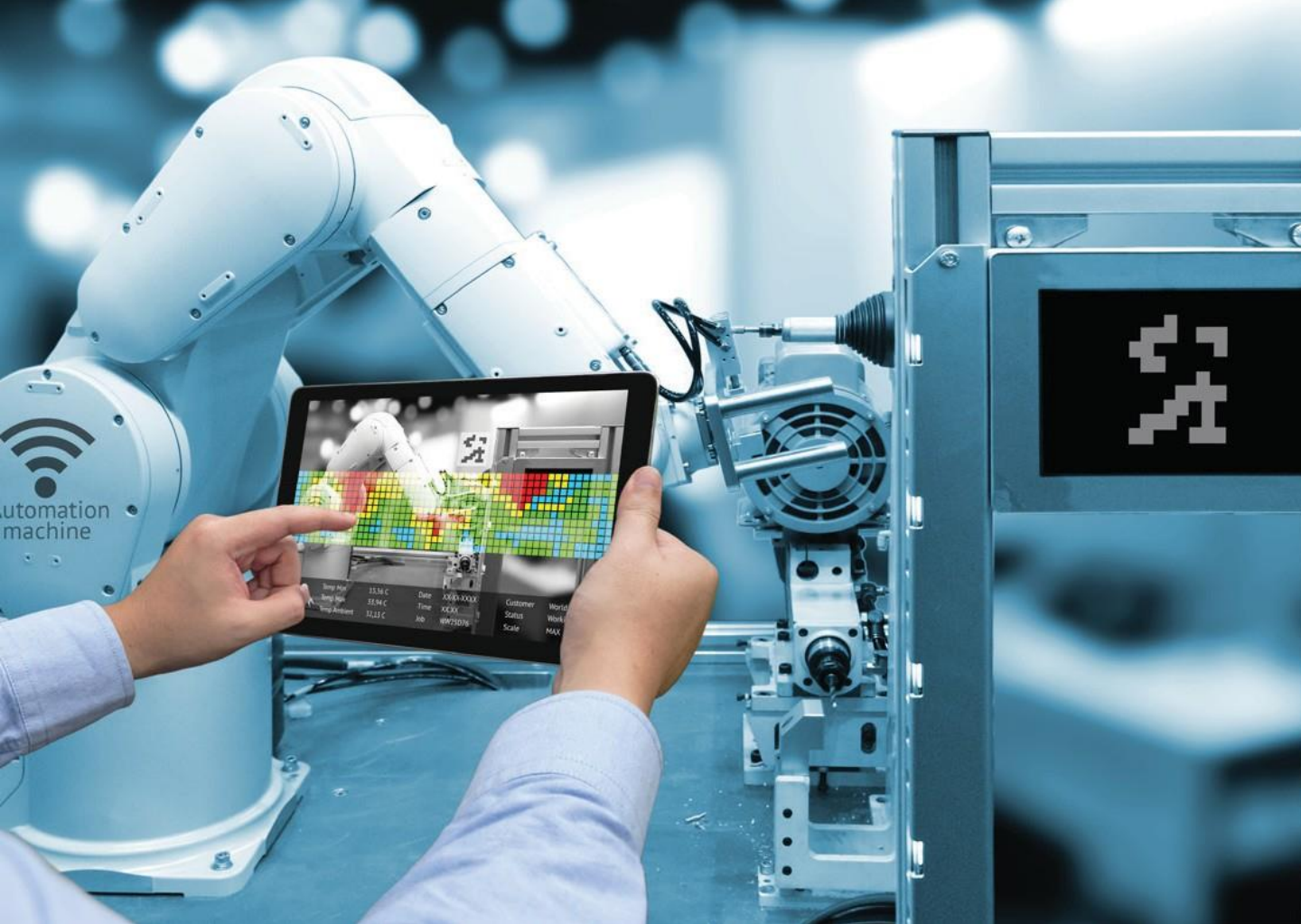
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***The minimal economic impact from implementing IoT in agriculture will reach 8 bln \$ by 2025***

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In **logistics**, IoT solutions will make it possible to deal with a number of urgent challenges. IoT will help to reduce the cost of transporting goods (as well as of shipping delays), make transport more transparent (including with the help of RFID markers) and minimise the potential for human error. Connected vehicles and remote fleet monitoring will optimise repair and maintenance, thus reducing operational expenses. Furthermore, the widespread “Uberisation” of logistics will no longer require the services of shipping agents.

*As for the business community, expectations regarding the economic impact of IoT vary by sector*



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***The economic impact from the introduction of IoT in logistics is expected to be 9 bln \$ by 2025***

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The introduction of IoT in **city environments** will move urban economies to a new level, while improving safety and living standards via more efficient management of public transport, utilities and infrastructure. Energy consumption will drop, infrastructure maintenance will be optimised and human resources will be put to better uses. It is particularly important that smart city projects receive the support of government, business and the public. This has helped to bring a series of such projects to fruition in today's Russia.

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***The minimal economic impact from implementing IoT in the urban environment will reach 6 bln \$ between 2018 and 2025***

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**Smart home** devices and systems are already appreciated by consumers, as they make their homes more secure and help reduce utility bills thanks to smart water meters and, in the near future, smart power meters as well. Apart from conserving resources, these devices help home owners to spend less time and money on cooking and cleaning and avoid substantial expenses related to property damage and loss caused by water leaks, fires and even burglaries. 🚫

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***The economic impact from introducing smart home devices will reach 6 bln \$ by 2025***

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## 1. Threats

The threats faced by both producers and consumers of new technology can be grouped into several categories.

### Cyber-security

For companies and consumers alike, cybersecurity is one of the most serious threats presented by the widespread adoption of IoT technology. Devices that previously lacked digital components (and therefore could not be hacked) are now connected to the Internet. As the market for IoT expands, cyber-attacks could affect vehicles, urban infrastructure, private homes and flats, or even entire production facilities. If manufacturers fail to design devices and systems with comprehensive anti-hacking protection, the consequences could be far-reaching. Security systems need to keep pace with technological innovation.

A particularly sensitive issue is the protection of personal medical records (for users of telemedicine services). Obviously, healthcare apps and solutions must be able

to guarantee data security and confidentiality. As a result, however, these IoT solutions could become more expensive and less market ready.

### Legal threats

According to experts, one factor that could hamper the adoption of IoT in Russia is the lack of an appropriate legal framework, including such critical matters as data protection and privacy rights. Location data collected by IoT devices could be used for malicious purposes. Who should be responsible for storing this data? Who should be given access to it, and on what terms? Can personal information be collected without the data subject's consent? These issues are especially important for telemedicine, which is currently operating in a legal vacuum. Major market players in Russia have placed their hopes on a new telemedicine law ("Telemedicine") that will provide a legal foundation not only for remote healthcare services and diagnosis, but also for e-document management, online authentication of patients and doctors, digital prescriptions and electronic consent forms, among other matters.

# Adopting IoT in Russia: threats and opportunities

*Based on our analysis across six areas, we have identified the key threats and opportunities to the adoption of IoT in Russia*





## Regulatory threats

Above all, the widespread adoption of IoT across Russia requires an enabling regulatory environment, including liberalised laws on UAVs, remotely operated services, etc. Policymakers not only need to remove legal barriers to new technology adoption in particular sectors, they also need to develop new industry standards. For example, the registration of wearable devices and sensors that remotely monitor patient vital signs can take up to one year under current regulations. In the area of logistics, tasks such as customs clearance and terminal handling can also be quite time consuming.

## Lack of standards

Technology standardisation poses yet another barrier. The government needs to make a systematic effort to update technology standards and protocols. Comprehensive plans for expenditures on IoT solutions and precise estimates on the potential impact of specific projects could help to produce better outcomes (so far, this has not happened).

## 2. Opportunities

IoT provides an extensive range of opportunities to companies that want to provide new goods and services and improve existing ones.

### New goods and services

The adoption of IoT will help companies from various sectors to create new goods and services that disrupt the very principles of how these goods and services work and provide consumers with new conveniences.

Thanks to the growth of distributed power generation in the electricity sector, IoT can help to create virtual power plants. With guaranteed access to vast power supplies, electricity producers of all sorts (including households) can use IoT technology to become independent players on the wholesale market.

In healthcare, IoT will enable smart systems that monitor patients remotely, which will help doctors

to collect and analyse critical information in real time. The market already offers cutting-edge devices (micro- and nano-sensors, nano-biochips) that are capable of detecting signs of stroke or heart failure and then notifying healthcare providers.

Thanks to IoT, logistics companies can offer new services, including fleet management systems that make use of connected sensors and automatic routing systems to manage traffic flows and keep records of goods and vehicles throughout the supply chain by using RFID markers. The “Uberisation” of commercial transport (GoCargo and iCanDeliver) is already helping hauliers and customers to do business without relying on intermediary agents like forwarding companies.

In urban environments, IoT is helping to develop unique services, such as automated resource consumption monitoring systems that collect, process, share, and store data on hot water use. In the area of security, IoT is making it possible to implement centralised surveillance systems that can recognise unlawful activity. In addition to the above, Moscow has already integrated and automated environmental control systems to analyse and evaluate noise levels, as well as air, soil and water quality across 26 different variables.

All sorts of innovative services that rely on smart devices are increasingly available and growing in popularity, including smart electricity and water meters, as well as smart appliances controlled by smartphones (for home security, air pollution control, and houseplant care).

### Quality improvements for existing products and services

Many new IoT solutions seek to improve existing products

and services, for example, by ensuring continuous operation, preventing malfunction, optimising raw material consumption, and mitigating the impact of human error. Ultimately, all these solutions serve the purpose of enhancing the consumer experience.

For example, smart grid technology significantly improves the robustness of power grids and guarantees that people will have power in their homes at all times. IoT technology also helps to increase the capacity of existing grids. RFID markers on bags help prevent lost luggage at airports. With smart micro-indicators and nano-sensors, doctors are able to detect diseases earlier and with better accuracy. In agriculture, precision technology helps to increase harvest yields, while smart farms are enhancing livestock productivity and quality. In cities, IoT is creating a more secure and comfortable living environment, while letting homeowners redefine the quality of life and levels of convenience, functionality and security.

When equipped with motion sensors, street lamps can be turned on and off automatically. Dimming technology, in turn, makes it possible to control brightness depending on the time of day and weather conditions. Home entrances can also be outfitted with smart lighting systems.

### Cost reduction

Reducing costs is one of the key drivers of the IoT market. The industrial use of new technology helps to cut expenditures and achieve unprecedented productivity levels. Cutting costs is an important factor for consumers as well, as they can now decide, for instance, whether they want to install a smart meter that will make their water (and eventually, power) consumption more efficient. No less important is optimising the workload of employees who develop and maintain smart city infrastructure. 🌐



**The government** has an important role to play in supporting the adoption of IoT technology. We are already seeing an increase in the number of government initiatives in this area, but not many have been launched so far. By following a more comprehensive approach, IoT could become a game changer for the Russian economy in the long term by helping to increase productivity.

Government institutions and state-owned companies are in a difficult position. On the one hand, they control a vast infrastructure (including roads, utilities, buildings, facilities, power and heating networks) and, therefore, have the capacity to launch IoT solutions on improving energy conservation and optimising their maintenance expenditures. On the other hand, much of the infrastructure is outdated, and requires serious investments in maintenance and repairs. In an economic situation where investment budgets have been cut and utility fees frozen, many companies simply lack the resources to introduce new technology.

The Russian government is currently consolidating its efforts to promote IoT in the agricultural and industrial sectors. Healthcare, in turn, requires both government subsidies and incentives for private investment. The government is interested in lowering its healthcare expenditures by making medical facilities more efficient and

promoting telemedicine. IoT technology can unlock new opportunities to provide public services. Large cities are more promising for IoT technologies, including systems for managing public transport, parking facilities, street and entrance lighting, centralised heating, waste collection and storage, and telemedicine services.

The government could launch pilot projects and then extend best practices. All of this would help to optimise budget spending, enhance the quality of life and ensure better security throughout the country, or at least within certain regions.

**IoT service providers** operate in a diverse market, where the success of new technology depends largely on the industry, whether it is for the energy, healthcare, agriculture or consumer sector. The IoT market is developing dynamically: new players and corporations that have already established market niches and developed market-ready technologies are constantly appearing on the scene.

IoT vendors can be roughly divided into three groups. The first group produces basic components for IoT devices, such as sensors, indicators, chips, microcomputers, processors and operating systems. The second includes vendors that manufacture IoT devices for specific sectors, from manufacturing and mining

## *Key stakeholders and their role in developing IoT in Russia*

*Five key groups of stakeholders are driving the large-scale introduction of IoT in Russia. The process is a reflection of the country's economy, technology, legislation, geography and culture*

to transport, retail and smart home components. The third group develops platforms to monitor smart devices, prevent errors and ensure the uninterrupted data transfer between devices and servers.

**Companies and government organisations** are interested in adopting new technology that will make their work more efficient and improve the quality of their goods and services, as well as help them expand into new markets. However, companies need time to analyse markets, formulate an understanding of their technology needs and approve investment levels before they can launch and complete projects. The entire process could last several years.

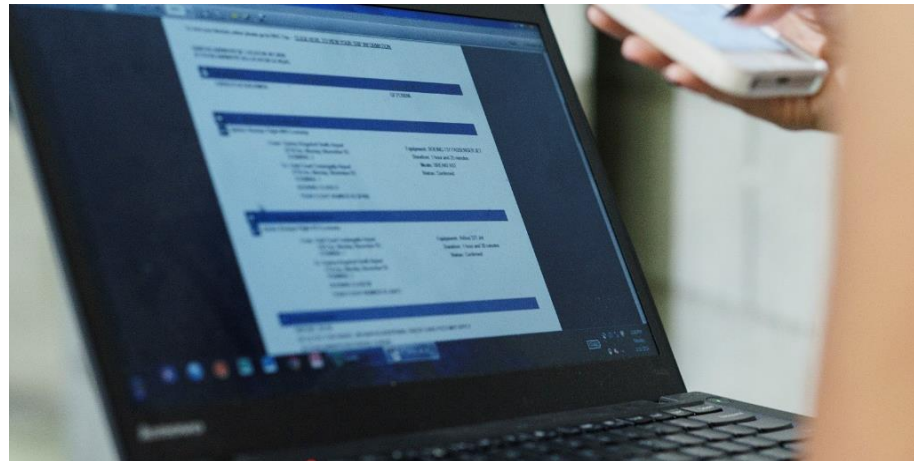
Furthermore, Russia faces a number of challenges that complicate decision-making around IoT adoption. For instance, the return on investment in IoT is usually around two or three years. Some companies may not want to invest in technologies that do not bring immediate profits. In addition, it has always been difficult for companies to change their internal processes, policies, document workflows and approaches to receiving and processing information. This is especially true of information processing, because this task requires rapid managerial decisions and a redefined level of communication between business units. Many companies do not have the necessary flexibility to do this, because it would require a complete cultural transformation among top managers, personnel, partners and contractors.

Another no less challenging task is integrating IoT technology into existing IT systems, as various economic factors often drive companies to try patchwork or manual integrations, as opposed to building end-to-end IoT processes from scratch.

Finally, Russia's vast geography, diverse landscapes, relatively low population density and market

structure mean that companies must pay more attention to the regional aspects of their businesses when introducing new technology. This may require sizeable investment.

The **consumer goods sector** is one of the main growth drivers for IoT, as consumers are more receptive towards new technologies and products. Influenced by the latest trends, consumers take decisions quickly. Some are ready to save money over several months just to buy a new gadget. However, since the average income in Russia is 75% lower than the one in the EU<sup>1</sup>, consumers have to put off purchasing certain goods and services into the future, as they must spend a greater portion of their income on basic needs like food, transport, housing and utilities.



In the mid-term, we believe that the consumer goods sector will see an increase in demand for cloud-based IoT solutions (public transport monitoring, public infrastructure management, etc.). Such solutions will be provided to the population at no charge and monetised via the sale of related services, such as taxis, advertising, and paid access to large personal databases.

**Research institutes and universities** serve as a source of expertise for the IoT market. Research staff at many Russian higher education institutions (especially those that

are part of the 5-100 Project) have the necessary expertise to provide unbiased, third-party perspectives on IoT projects, even though some of them are working on their own devices and software solutions in this field. This mostly concerns research on self-driving vehicles, UAVs, public transport monitoring, smart electricity meters, and environmental monitoring devices, including smart city initiatives on developing systems for monitoring the fill rate of waste containers.

An essential part of current R&D efforts covers platforms and protocols for data sharing and cross-platform communication between different types of IoT devices, a major research challenge. There are also R&D projects to strengthen the security of IoT devices of all categories,

as connecting any gadget to a network could threaten the integrity of personal data and the operation of computer networks.

Most R&D efforts in IoT are being carried out by professors and students at research institutes and universities as part of educational or research programmes. Sponsored research is far less common. As the Russian IoT market is only in its early stages, R&D and educational organisations have not yet become part of the process, although their significance may grow in the future. 🚫

<sup>1</sup>Source: OECD Employment and Labour Market Statistics



**F**or this study, we explored how Russian companies are implementing IoT technologies. We assessed the performance of Russian companies in technology adoption, as well as evaluated the potential effect that IoT could have on the Russian economy as a whole. Our analysis relied on the expertise of many individuals who have personally been involved in rolling out IoT solutions in their organisations. This has allowed us to deliver an unbiased perspective on IoT from the consumer's point of view.

We selected industries based on their level of capacity for utilising IoT technology. Our preliminary selection was driven by an analysis of international best practices. We also excluded a number of industries that could be topics for further study.

We chose organisations and experts for data collection and interviews based on their prior IoT experience. This approach helped to ensure objectivity and provided insights into the advantages and disadvantages

of IoT. We also interviewed a number of representatives of regulatory bodies and developers of IoT solutions in order to draw a complete picture.

We worked together with our experts to analyse the economic impact of IoT, as well as the barriers to its further implementation. Our study also covered new opportunities that companies have discovered thanks to IoT.

When evaluating the potential economic impact of IoT, we focused on cost savings and efficiency. We based our research on the actual amount of money saved by the companies involved, which we extrapolated to the entire economy, assuming that IoT technology would reach most relevant industries by 2025. For this, we used macro figures from the *Forecast for Russia's Long-term Social and Economic Development up to 2030*. 📄

## Research methodology

### **The key stages of our research included:**

-  1. Selecting specific industries for analysis
-  2. Selecting organisations and experts for data collection and interviews
-  3. Reviewing the findings
-  4. Evaluating the potential impact of the adoption of IoT in Russia

# PwC's IoT Centre of Excellence in Russia

We believe that the Internet of Things is not just another technology, but a foundation for a new production system and philosophy that will guide companies from across various industries. As any other production system, the Internet of Things requires a massive overhaul of methodologies, internal business processes, and operational and managerial cultures. For this reason, from our perspective, the key objective of IoT adoption is to alter business models rather than simply to use new technologies and IT solutions.

According to our 2017 Digital IQ survey, many respondents say that the Internet of Things is the number one technology in terms of its potential to transform business models of companies and whole sectors. It goes without saying that such large-scale changes demand the involvement of senior management, including CEOs, COOs, and CTOs.

It is our commitment to support companies as they plan, implement and use the Internet of Things. To achieve this, we have built a cross-functional team in Moscow to provide IoT services to companies in various sectors.

Our competencies delivering completing strategic and operational projects, such as:

-  **Strategic planning for IoT**, including: seminars for senior managers and shareholders; design of strategies on initial market entry for IoT solutions and service providers; design of business and technical strategies; development of general roadmaps of resources and competencies; development of use cases, operational models and business cases;



**IoT implementation**, including setting up a project management office, ensuring the transformation of processes and methodologies, introducing a new corporate culture, conducting analyses of production data, testing and certifying IoT solutions, and providing training on new technologies and work practices;



**Operation of IoT solutions**, including equipment monitoring, data analysis and business analytics, preparing (and providing support) for operational processes and auditing financial impact.

In the past two years, we have completed a series of projects for mobile operators and power companies both in Russia and abroad. We would be happy to provide additional information about our services and competencies, or to arrange a personal meeting where we could have a detailed discussion on the challenges that your company intends to tackle in the area of IoT and digitalisation. 

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