# 5G in Russia:
# a local and global view on the way forward

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Analytical Center for the Government of the Russian Federation provides on-demand information analytics and expert support to the Government of the Russian Federation on the key issues of the socio-economic development of the country. Since 2013 the Analytical Center has been rated in the annual Global Go To Think Tank rating (compiled by the University of Pennsylvania in the USA) among the best think tanks in Central and Eastern Europe and among the Top Social Policy Think Tanks, Think Tanks to Watch, and the Best Government Affiliated Think Tanks. According to the Government of the Russian Federation's Resolution, the Analytical Center for the Government of the Russian Federation has been tasked with performing the functions of the project management office for the implementation of the Digital Economy of the Russian Federation Program.

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LTE Union is a nonprofit organization, with the mission to foster mobile network deployment within the Russian Federation by promoting of advanced technologies, enabling legislation and access to new spectrum bands for mobile networks. Currently, the LTE Union includes VimpelCom PJSC, MegaFon PJSC, MTS PJSC and T2 Mobile LLC. Executive Director of the LTE Union is Gulnara Khasyanova.

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**This report has been produced through collaboration between GSMA Intelligence, Analytical Center for the Government of Russian Federation and LTE Union.**

# Contents

# Executive summary

Over the last 30 years, the global mobile industry has proven its ability to connect and transform society through the development and deployment of 2G, 3G and more recently 4G networks across the globe. 5G is set to build on these successes by delivering a platform that not only enhances existing services but also enables new business models and use cases. GSMA Intelligence expects commercial 5G networks to be widely deployed in all regions from 2020, by which point the 5G era will have truly started.

Russia is a relatively mature mobile market, with a unique subscriber penetration rate of 89% at the end of 2018 – a figure that will remain broadly unchanged to 2025. Mobile users in Russia are already significant consumers of mobile data, with data volumes set to grow further as the adoption of smartphones increases. As a result of significant operator investments in LTE networks, the country is now rapidly migrating to 4G. 4G as a proportion of total connections is set to more than double over the next five years to reach two-thirds of the total by 2023.

A stabilisation in competitive pressures and ongoing strong growth in data traffic are driving a near-term improvement in the Russian industry revenue trend, but the medium-term outlook remains subdued. Overall ARPU levels remain low by developed market standards, highlighting the need for operators to build new revenue streams. 5G offers new use cases in both the consumer and enterprise markets, as well as lower operating costs – both potential positives for Russian operators as they look to improve financial performance.

While Russia is not among the first wave of countries to launch 5G, there is a growing focus within the industry and among relevant policy-makers on the importance of 5G to the sector and broader economy. Forecasts for 5G adoption in Russia suggest commercial deployments from 2020, with the total 5G base set to reach 46 million by 2025, equivalent to 20% of connections. On this forecast, Russia would be above the global average but trailing leading 5G markets such as the US, South Korea and China.

5G is widely viewed in Russia as a necessity for the creation of a new and more competitive national economy. The implementation of 5G networks should be considered by regulators not as just a new technical advancement in telecoms but as a condition for delivering the digital economy and driving the transformation of industries. With such a mindset, the regulation of the mobile industry should shift from controlling and supervising the industry to fostering its development. A key factor in the successful deployment and operation of 5G networks is the availability of a state-supported comprehensive development plan for 5G communications.

To ensure that Russia is able to realise the promise of 5G and the broader digital economy, this report includes a number of policy recommendations to facilitate timely deployment of 5G networks in Russia. The recommendations cover the following areas:

- **Creating an innovation ecosystem** for developing 5G, potentially with state support, to enable the development of new services.
- **Providing new spectrum:** 5G requires significant amounts of new spectrum, provided under the right conditions and in a timely manner.
- **Deployment procedures and provisions:** it is important for regulators to consider new approaches to network development to allow for rapid and efficient 5G rollouts. A move from permission-based authorisations to notification procedures might provide an important condition to allow operators to speed up 5G development.
- **Wireless emissions standards:** to keep up with the development of 4G and 5G networks, there is a need to revise wireless radiation limitation standards towards the higher allowances based on international standards, already proven through 20 years of application in many countries. The safety of these standards for consumers has been reviewed by the appropriate international bodies.
- **Network architecture regulation:** to avoid delaying the introduction of 5G networks, network regulations should be updated to reflect the deployment of new technologies such as virtualised nodes and more software-orientated networks, with new compliance procedures developed at a national level based on testing software capabilities rather than hardware measurements.
- **Network neutrality and data regulation:** legislation covering personal or IoT data should be balanced to address the need to protect sensitive data but also to enable new innovative services based on the use of big data.
- **Encouraging investments for 5G networks:** the main objective of government and policy-makers should be to create a supportive environment for 5G investments.

# 1 Global perspective on 5G

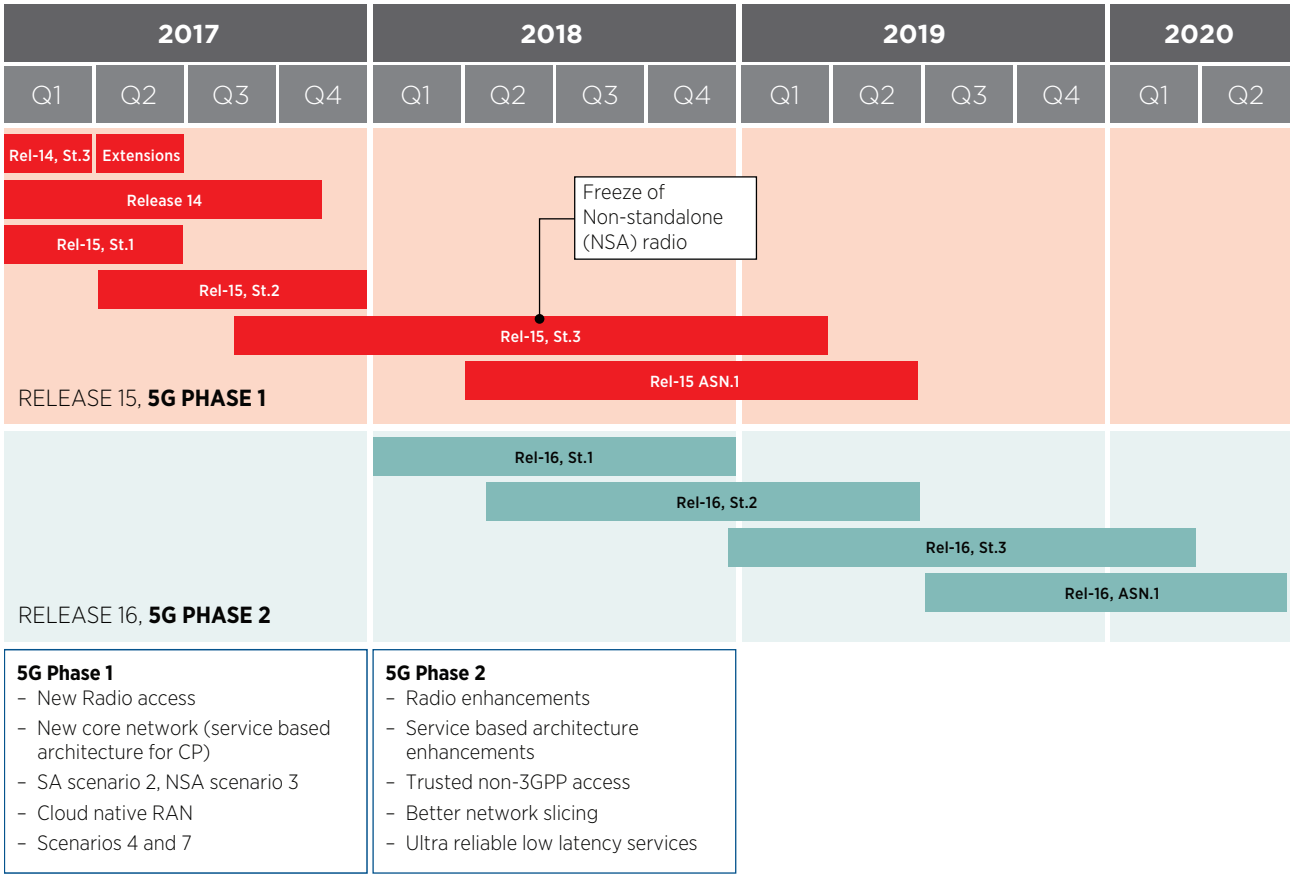
## 1.1 Rapid progress on standards facilitates early deployments

The standardisation roadmap from the 3rd Generation Partnership Project (3GPP) established the timeline for when different parts of 5G technology will be ready for deployment. The accelerated schedule agreed to by the 3GPP in 2017 has allowed operators around the globe to bring forward their 5G commercial launch plans. Non-standalone 5G new radio (NSA 5G NR) specifications were officially approved in December 2017, while the standalone (SA) version was approved in June 2018, which represented the full 3GPP Release 15.

The relatively rapid agreement of 5G specifications (at least compared to earlier generations) has also allowed hardware vendors, chipset manufacturers and other suppliers to make progress with their tests, and to build and design components that implement the 5G NR specifications while awaiting final standardisation across all NSA and SA models. The focus of future 5G specifications will be on additional use cases, including industrial IoT solutions such as robotics and telepresence systems. This covers 3GPP Release 16 for ultra-reliable and low-latency communications (URLLC); the goal is that this should be completed by December 2019.

Figure 1

## The 3GPP roadmap for Release 15 and 16



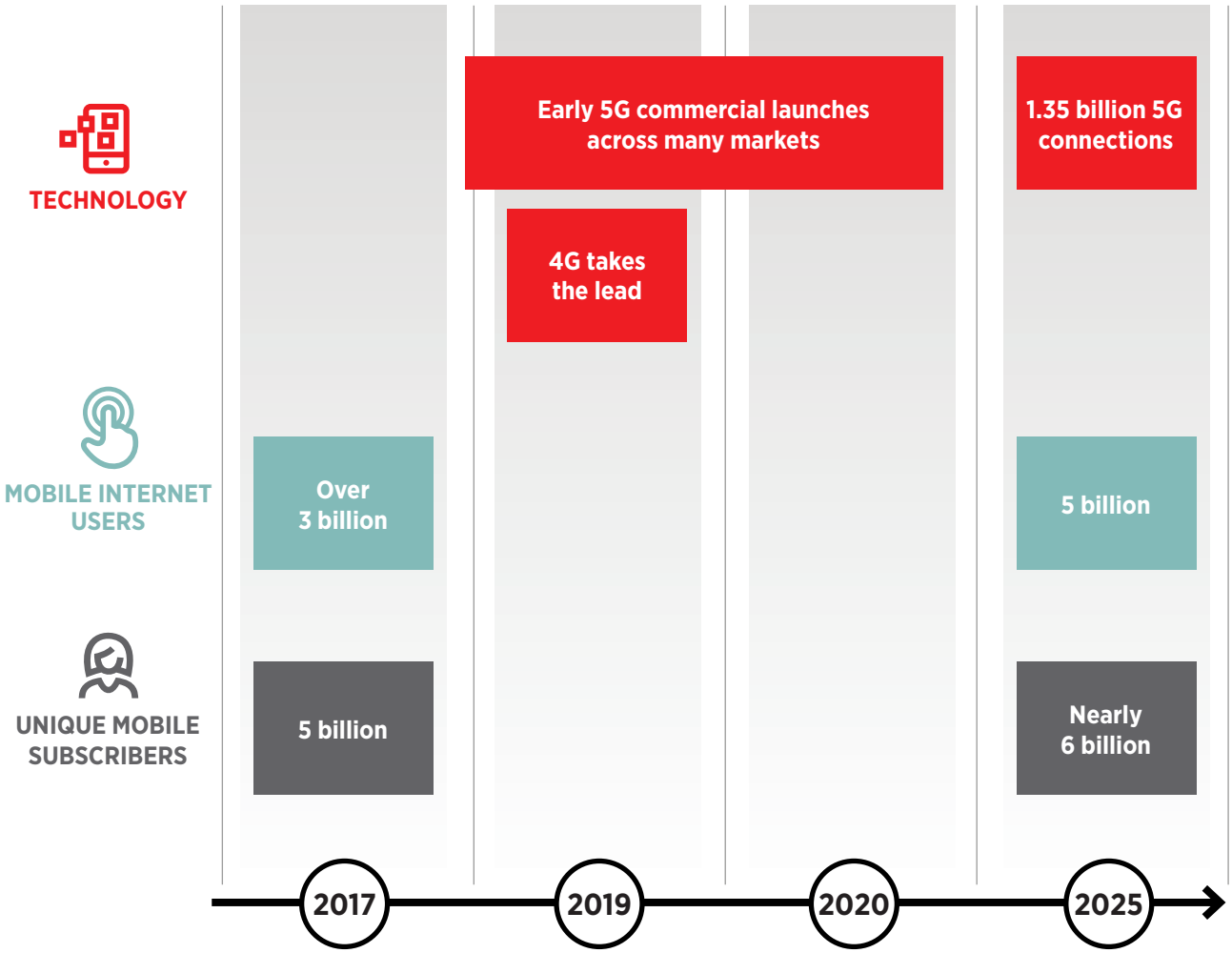

Source: GSMA

# 1.2 5G an increasing reality around the world

Over the last 30 years, the mobile industry has demonstrated its ability to connect and transform society through the development of previous network generations, with 2G, 3G and more recently 4G networks deployed across the globe. 5G is set to build on these successes by delivering a platform that not only enhances existing services, but enables new business models and use cases to emerge. GSMA Intelligence expects commercial 5G networks to be widely deployed in all regions from 2020, by which point the 5G era will have truly started.

Figure 2

## The 5G era will begin fully from 2020



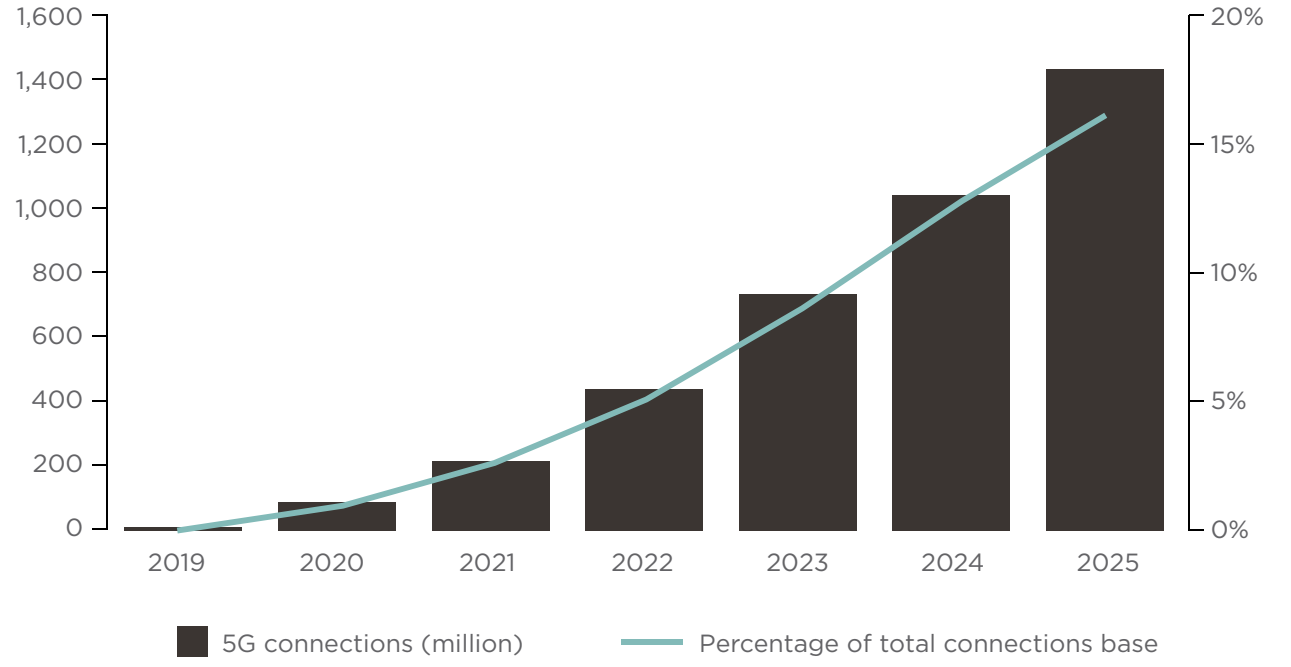

Source: GSMA Intelligence

There have already been extensive 5G trials; some 147 operators across 72 markets have undertaken trials as of the end of March 2019. The focus now is increasingly shifting to commercial launches. At the end of the first quarter of 2019, 81 operators from 52 markets across the world have announced plans to launch mobile 5G services. After the initial (yet limited) launches by the three South Korean operators in late 2018, the second quarter is expected to see commercial launches in a number of markets including the US, Australia, Switzerland and several Gulf Cooperation Council (GCC) states.

From 1% of the total global connections base at the end of 2020, 5G adoption is forecast to accelerate rapidly and reach 16% of total connections by the end of 2025, by which time there will be 1.4 billion 5G connections globally. At a regional level, North America will have by some way the highest level of 5G adoption, with almost half the connections base running 5G services by 2025. At a country level, the outlook is more nuanced: for example, South Korea is set to have the highest adoption rate at almost 60% of connections by 2025, with the US on 50%.

Figure 3

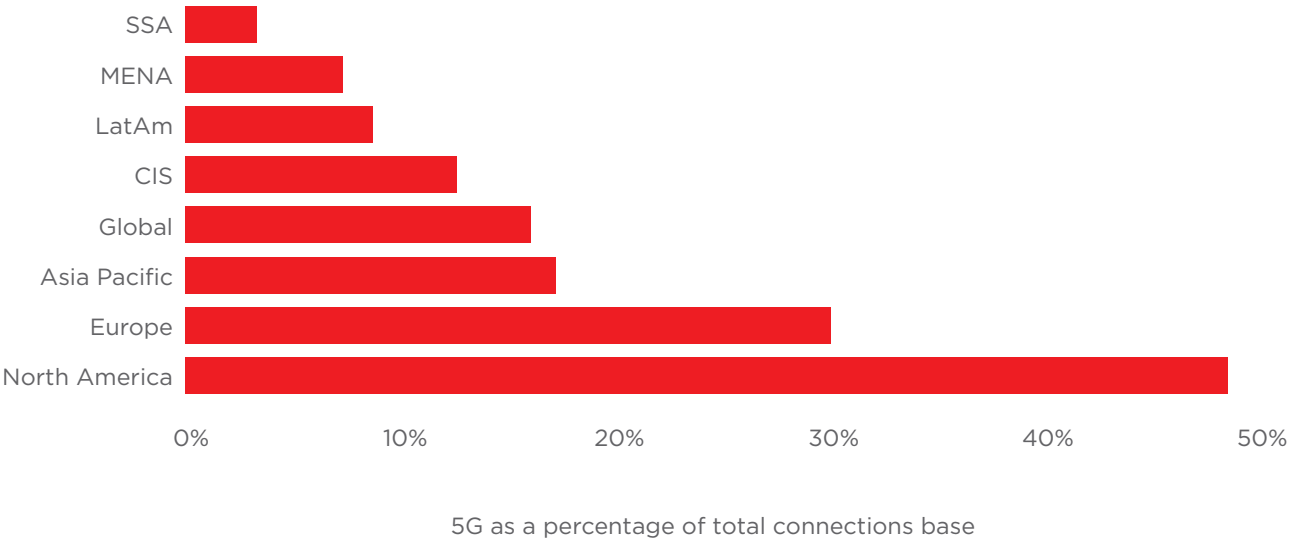
## 5G global adoption forecasts




Source: GSMA Intelligence

Figure 4

## 5G adoption by region in 2025




Source: GSMA Intelligence

Handset availability will play a key role in near-term 5G adoption levels. On a positive note, the first 5G-compatible smartphones are now coming to market and it is expected that the range of devices will expand significantly over the next year. For example, six compatible handsets were announced at MWC19 Barcelona in 2019, while Vivo (Apex 2019) and Samsung (Galaxy S10 5G, Galaxy Fold) unveiled phones ahead of the event.

To date, 5G devices have been characterised by high retail prices and limited support for new frequency bands, though these issues should be addressed as more vendors launch devices and as the technology begins to mature. By the end of 2020, all the main Android handset manufacturers will have launched 5G-capable smartphones that support the major frequency bands.

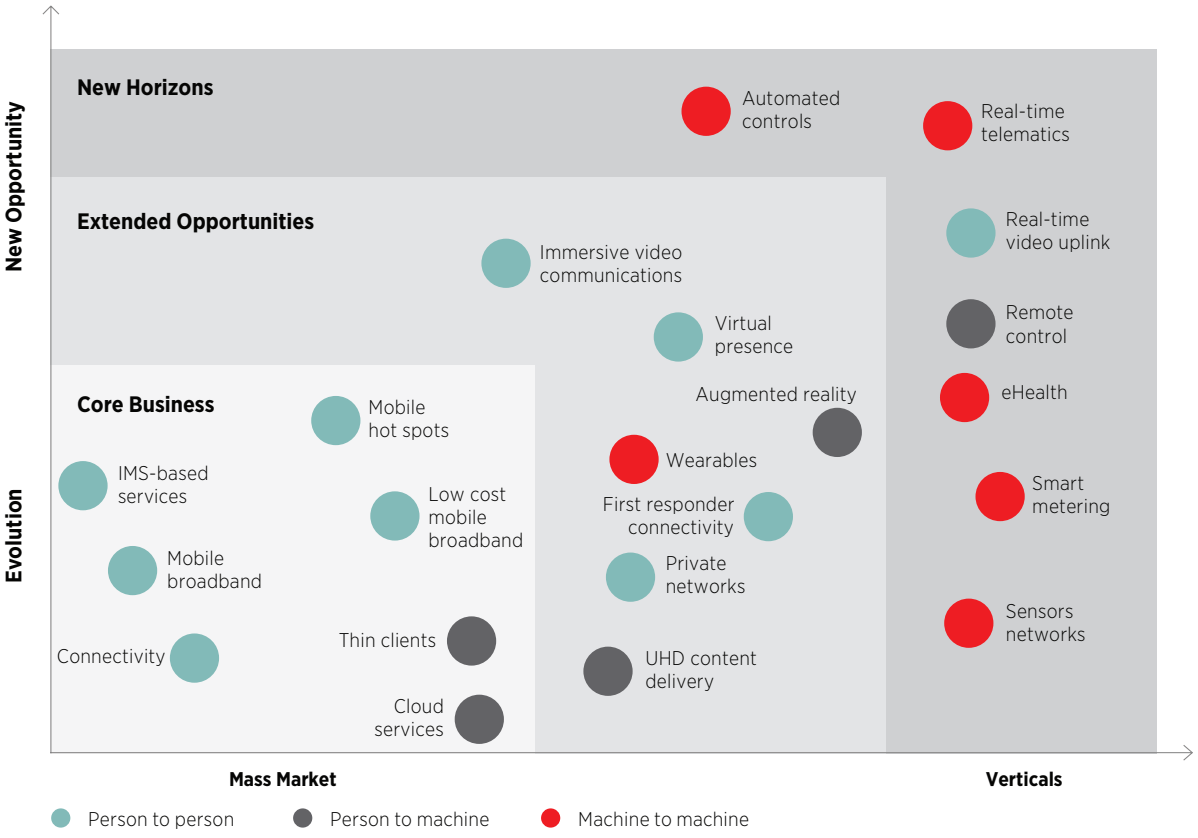
# 1.3 Global view on 5G use cases

5G will support a broad range of new use cases in addition to evolving current use cases supported by previous mobile generations. The business opportunities for operators that will be supported in the 5G era are enhanced along product and customer dimensions, as shown in Figure 5.

Operators will need to evolve their current business models while tapping into new opportunities enabled by a more efficient technological framework. The evolutionary consideration is crucial to ensure that customers continue to enjoy the services they do today. While operators have historically focused on use cases that appeal to the mass market, new capabilities will provide opportunities for operators to develop new use cases for specific segments within industry verticals. While some of these opportunities can be addressed by evolving the 4G network, they will come to full fruition in a mature 5G system.

Figure 5

## 5G will support existing and new products and markets




Source: GSMA

Three factors will affect the pace at which 5G is adopted in specific markets and the value that it will generate:

**1. Opportunities:** Operators generally agree the provision of enhanced mobile broadband (eMBB) to the consumer market will be the core proposition in early 5G deployments, along with, in some cases, 5G-based fixed wireless access (FWA) services offering a potentially lower cost and faster means – compared to FTTH – of expanding high-speed services to households and businesses.

Enterprise use cases that use massive IoT and/or ultra-reliable, low-latency communications to transform existing verticals (such as manufacturing, utilities, healthcare, retail, agriculture and automotive) could gain scale at a later stage. Further currently unknown use cases could be developed, with the potential to revolutionise industries and consumer experiences.

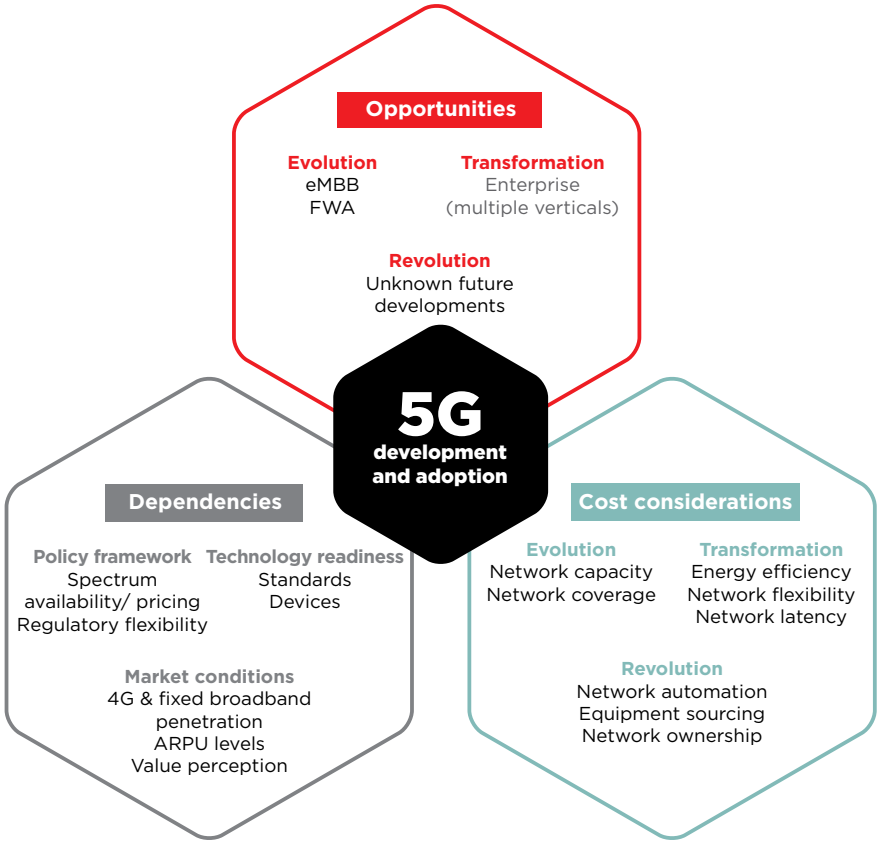
**2. Cost considerations:** 5G networks are distinct from previous generations because of the level of heterogeneity, flexibility and automation inherent in their design. The cost dynamics of 5G networks will therefore not only be influenced by traditional factors (e.g. capacity and coverage), but also new factors such as network flexibility and network ownership. Some of these are already being addressed in 4G networks (for example, network function virtualisation/software-designed networks for network flexibility and edge computing for low-latency capabilities), but their impact on the cost of 5G network rollout and operations is less clear. However, with sufficient new additional spectrum, 5G networks promise a significant reduction in the cost per gigabyte of data, which should support ongoing traffic growth.

While much of the industry consensus has been shaped by infrastructure competition among operators (with networks built by established equipment vendors and managed by engineers), the 5G era will likely see the introduction of new models of network ownership (e.g. private 5G networks), new ways of building networks (e.g. using open source concepts) and new network management approaches (e.g. using AI-based automation).

**3. Dependencies:** Various elements will act as barriers to 5G development if not in place, such as a supportive policy framework (spectrum is key), completion of standards and availability of 5G devices. The rate of 5G adoption will also be determined by prevailing market conditions including legacy network availability, affordability and customer value perceptions.

Figure 6

## 5G is an inevitable network evolution




Source: GSMA Intelligence

With 5G deployments still at early stages in even the leading markets, operator business models and specific use cases are still evolving. Beyond the consumer space, 5G will bring new capabilities and the flexibility for mobile operators to better serve the specific needs of different enterprise customers. 5G will be a key enabler of the Fourth Industrial Revolution, as technology is seamlessly embedded within society and especially in commercial and industrial processes. However, to capture this opportunity fully, operators will need to tailor their value propositions to large organisations (including municipalities and government agencies) as well as SMEs.

IoT is a key focus for operators looking to expand their enterprise revenues in the 5G era. Many IoT applications are already well supported by existing 4G networks, but a number can also benefit from enhanced 5G capabilities for massive IoT, such as by providing more capacity for scale, for critical IoT, and by supporting enhanced quality of service and lower latency. It will be crucial for operators to expand their IoT business models beyond connectivity towards the platform and analytics layers to capture additional revenues.

# 1.4 5G contributing to economic growth

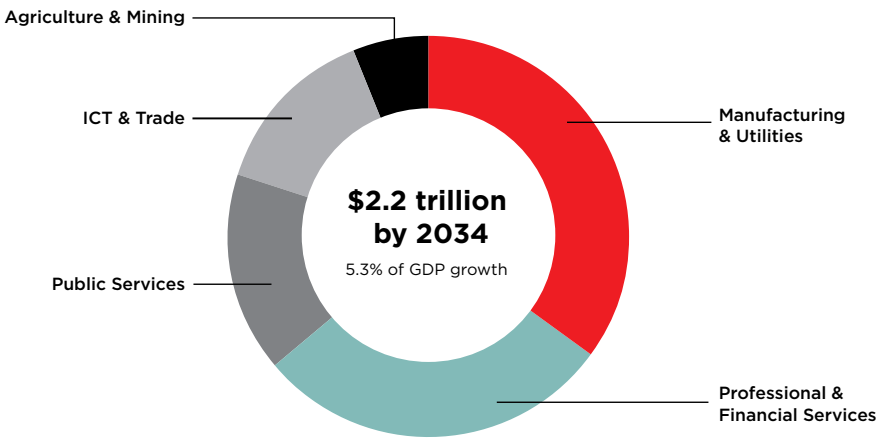
The global mobile ecosystem created $1.1 trillion in economic value in 2018, while additional indirect and productivity benefits brought the total contribution of the mobile industry to $3.9 trillion (equivalent to 4.6% of total global GDP). Mobile operators account for more than 60% of the economic value created by the mobile ecosystem. The rest, including infrastructure providers; retailers and distributors of mobile products and services; mobile device manufacturers; and mobile content, application and service providers, contribute the remaining 40%.

The direct economic contribution to GDP of the mobile ecosystem is estimated by measuring the value added to the economy, including employee compensation, business operating surplus and taxes. Most of the value-added increase will be due to productivity gains. In the developed world, the adoption of IoT solutions will drive increased productivity. In developing countries, productivity growth will be mostly driven by the adoption of mobile internet services.

5G will generate significant incremental value for the global economy, reflecting in large part the strong relationships between broadband availability and economic growth. 5G alone is forecast to contribute $2.2 trillion to the global economy over the next 15 years, as well as $588 billion in worldwide tax revenue cumulatively over the period from 2020 to 2034.[1] Millimetre wave 5G use cases will account for an increasing proportion of the overall 5G contribution to global GDP, achieving around 25% of the cumulative total by 2034, which amounts to $565 billion in GDP and $152 billion in tax revenue.

Figure 7

## 5G will contribute $2.2 trillion to the global economy over the next 15 years




Source: GSMA

[1] "Mobile Industry Could Generate $565 Billion in Additional Global GDP by Unlocking the Right 5G Spectrum: GSMA Study", GSMA, December 2018

# 1.5 The role of national 5G plans

Many countries have recognised the strategic importance of 5G networks and have developed national plans to help promote the timely deployment of new 5G networks and stimulate the development of new services, with a particular focus on ensuring these are tailored to meet the specific needs of the local market. Initiatives include the creation of high-level committees to produce guidance and advice for policy frameworks, and sponsoring the creation of local testbeds and 5G trials (often with direct government funding).

The UK government commissioned two reports to help shape its digital strategy and then in 2017 set out its 5G strategy in a report published in 2017, 'Next Generation Mobile Technologies: A 5G Strategy for the UK'.[2] As well as supporting an enabling regulatory environment, the government allocated funding to help accelerate the deployment of new fibre infrastructure and a national programme of 5G testbeds and trials. In addition, the government created a national 5G Innovation Network to coordinate the development of 5G services and applications under a common framework and to help create the appropriate conditions for innovation to emerge in the 5G ecosystem.

Similar initiatives have been launched in developing markets. For example, the Indian government has created a 'High Level 5G India 2020 Forum',[3] the goals of which include ensuring that India can play an active role in the development of 5G, and ensuring 5G can assist in delivering existing government initiatives such as Digital India, Smart Cities & Smart Village missions. The particular attraction of 5G to the Indian government is the potential to leapfrog earlier technological generations and compensate for the lack of various types of physical infrastructure in the country, whether in areas such as transport, education or healthcare. The Making India 5G Ready report recommended establishing application and use case labs in India, which could serve a number of purposes. These include interoperability testing for new applications, fostering innovation and developing locally tailored solutions.

There are also initiatives to promote the development of 5G in the European Union (EU). The EU 5G Action Plan of 2016 presents a clear roadmap for public and private investment in 5G infrastructure in the EU and calls for trial commercial 5G rollout by 2020 in at least one major city in each member state before the end of 2020. As of August 2018 there were 28 trial cities identified, with a target of 45. The focus of these city trials is on areas such as e-health, energy, transport, smart buildings and digital service portals, under the overall umbrella of the smart city concept. In support of these EU initiatives, the Electronic Communications Committee (ECC) of the European Conference of Postal and Telecommunications Administrations (CEPT) has also developed the CEPT roadmap for 5G[4], focusing on spectrum provisioning for 5G networks across Europe.

A recent report by the European Commission compared the outlook for 5G deployments in the EU with other leading economies, including the US, China, Japan, South Korea, Singapore and Taiwan.[5] The report included a number of recommendations that aim to improve the likelihood of the long-term success of 5G in Europe:

- Increasing R&D efforts on understanding the technology of 5G, particularly questions around propagation.
- Revisiting 5G business models: more detailed study of business models is needed to better define the goals, scope and revenue source.
- Promoting infrastructure sharing for 5G: policy for 5G networks should be based on encouraging infrastructure sharing, with the separation of infrastructure and services.
- Lightweight regulation for small area wireless access points (SAWAPs), supporting the use of large numbers of (standardised) SAWAPs. This is aimed at small base stations for 5G, which are typically required for dense urban environments. Developing an EU-wide framework for their permit-free deployment in all member states will be essential.

[2] Next Generation Mobile Technologies: A 5G Strategy for the UK, gov.uk, 2017

[3] "India Joins Race in 5G Ecosystem, Constitutes High Level Forum on 5G India 2020", Government of India, September 2017

[4] https://cept.org/files/18334/ECC(19)042%20Annex%2032_CEPT%20Roadmap%205G.docx

[5] 5G Deployment: State of play in Europe, USA and Asia, European Parliament, 2019

# 2 Russian market perspective

## 2.1 A mature market now moving to 4G

Russia is a highly penetrated mobile market, with a unique subscriber penetration rate[6] of 89% at the end of 2018 – a figure that will remain broadly unchanged to 2025. The penetration rate in Russia is ahead of the global developed market and European averages, which stand at 84% and 85%, respectively.

Although Russia compares favourably on the general availability of mobile services, the market has been slower than many of its developed market peers to deploy high-speed 4G networks. At the end of 2018, 4G accounted for less than a third of the country's connections base, compared to Europe where half of all connections were 4G.

However, all the main Russian operators have been investing heavily in 4G network deployments in recent years to improve network coverage and speeds. For example, MegaFon has seen its 4G population coverage increase from 50% in 2014 to almost 80% in 2018, while LTE-Advanced (LTE-A) networks are now available in 46 regions across Russia. Veon deployed an additional 11,000 LTE base stations in 2018, while MTS has recently launched large-scale rollout of LTE network infrastructure in small and remote settlements using refarmed 3G frequencies in the 2.1 GHz band by integrating it into operating UMTS-2100 sites. This builds on MTS's existing build-out of its LTE-2100 network to cover 19 regions of the country. The company's goal is to cover a further 20 regions by the end of the current year.

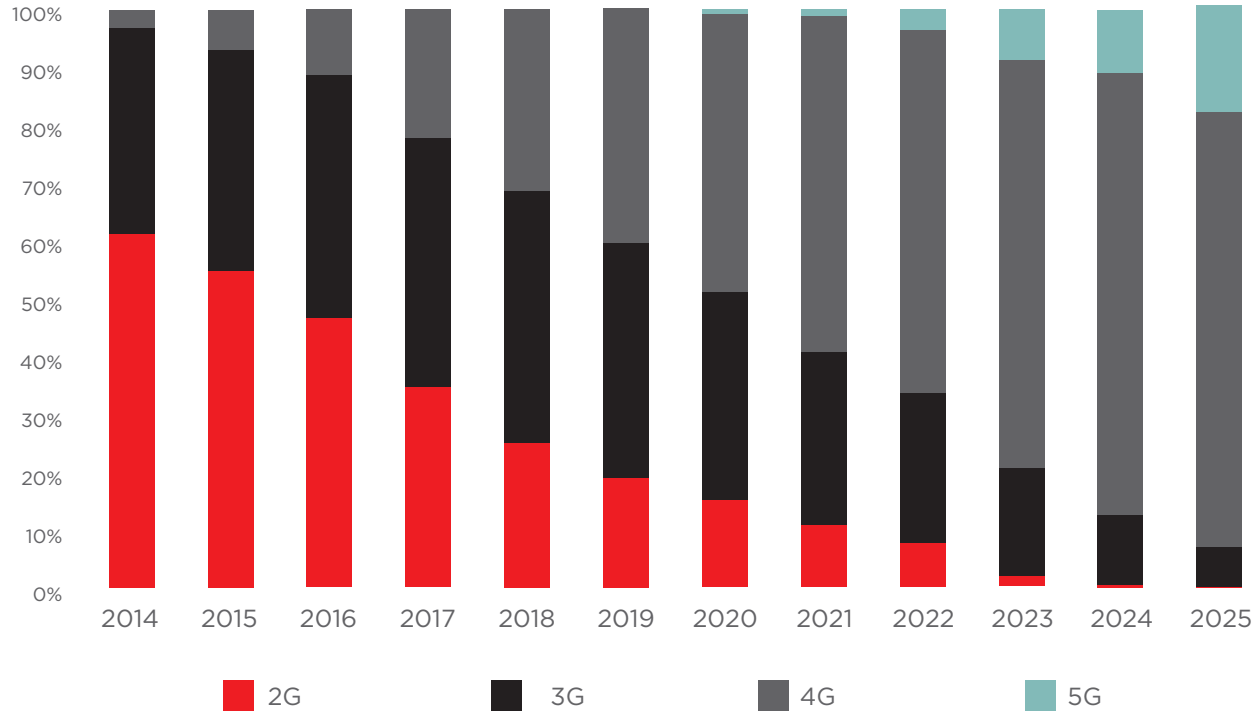
[6] A unique subscriber is defined as a unique user who is subscribed to mobile services at the end of the period, excluding M2M. Subscribers differ from connections such that a unique user can have multiple connections.

As a result of these investments, the country is now rapidly migrating to 4G networks. The proportion of 4G connections is set to more than double over the next five years to reach two thirds of total connections by 2023. In fact, the proportion of mobile broadband capable devices (3G, 4G and 5G) by that date will stand at 97%.

Figure 8

## Russia increasingly migrating to 4G

**Percentage of total connections**




Source: GSMA Intelligence

Smartphones accounted for just over 60% of mobile connections in Russia at the end of 2018, a figure that leaves Russia trailing the developed market average of 73%. This reflects a number of dynamics, including the fact that Russia is a largely prepaid market with few handset subsidies and limited handset-financing offers. However, the accelerating move to 4G is increasing levels of smartphone ownership in the country, with smartphones forecast to account for almost 80% of connections by 2025.

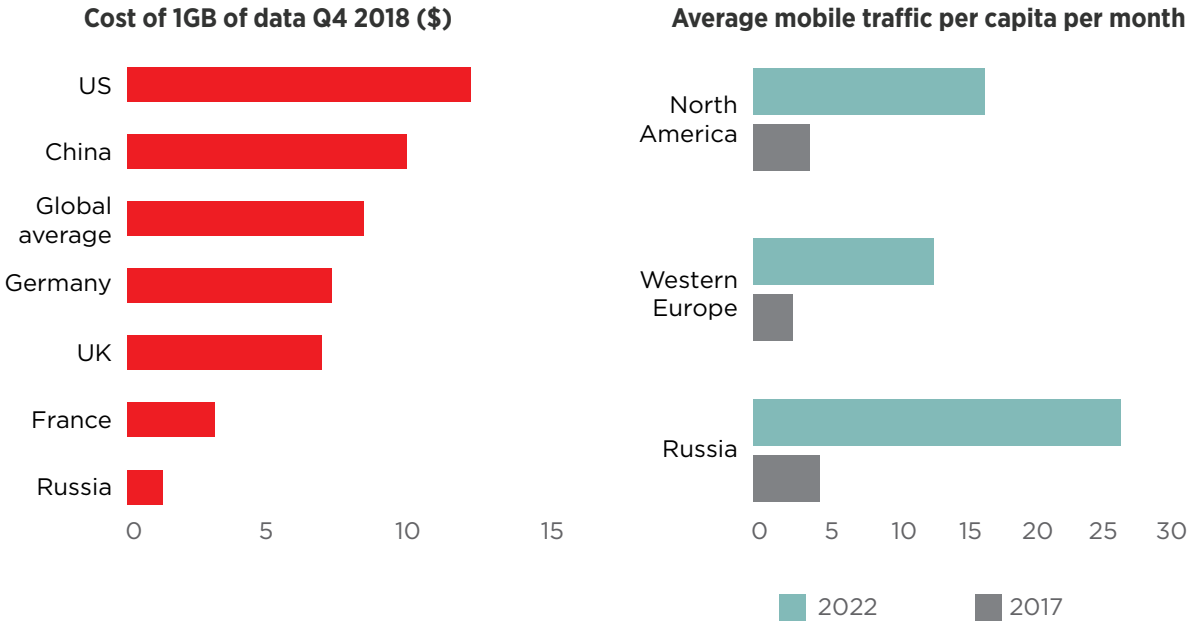
Despite trailing on smartphone adoption, mobile users in Russia already generate high volumes of data traffic. Operators are developing a range of new digital services to boost revenues and stimulate data usage. Video remains the largest single driver of traffic growth in Russia, as is the case in other regions. Operator-led initiatives include Veon's BeeLine TV platform (which offers both live TV and video on demand) and MegaFon TV, which had over 1 million monthly active users at the end of 2018. Other digital initiatives from the Russian operators cover e-commerce, music and financial services. MTS has seen significant adoption of its My MTS mobile app (14.1 million users as of year-end 2018, an increase of 50% year-on-year) which offers more than 25 apps covering a range of services from entertainment to finance.

MegaFon reports that 4G data traffic alone grew by 63% in 2018, while MTS reported 56% growth in smartphone data traffic in the final quarter of the year, with total smartphone data traffic for the quarter reaching 866,118 terabytes. Data from Cisco indicates that in 2017 the Russian market generated more mobile data traffic than both North America and Western Europe. Accelerating moves to 4G (and the first phase of 5G) and rising smartphone adoption are set to drive further data growth. Cisco forecasts that consumer mobile traffic in Russia will reach 3.0 exabytes per month by 2022, up from 508 petabytes per month in 2017.[7]

[7] https://www.cisco.com/c/m/en_us/solutions/service-provider/forecast-highlights-mobile.html#

Figure 9

## Data cost and usage



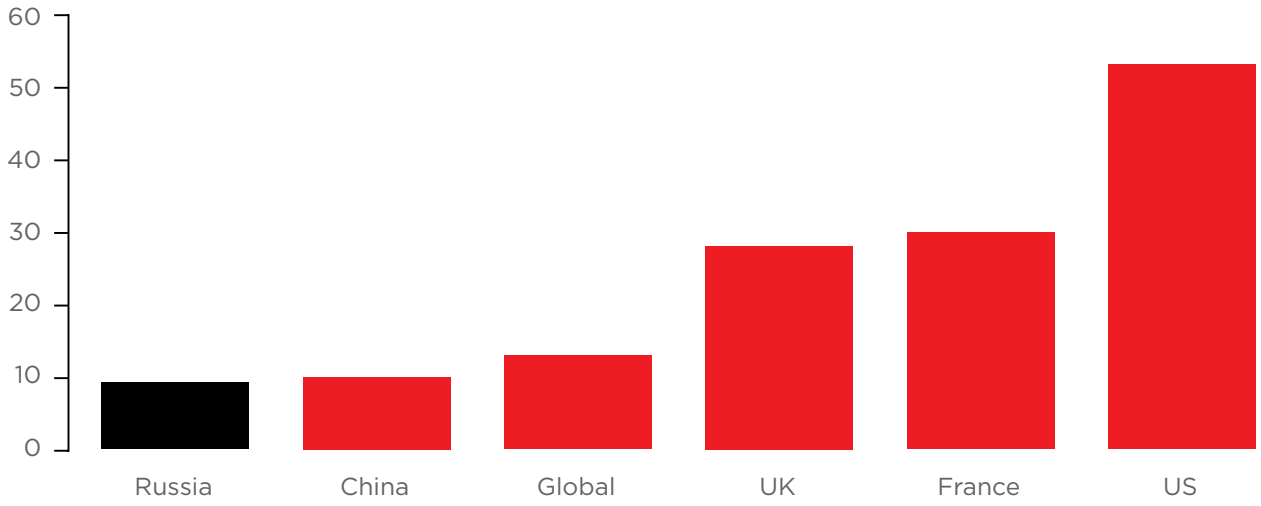

Source: Cable[8]

Source: Cisco VNI 2018

Data traffic growth has been fuelled by significant competitive pressures in Russia, which have led to some of the lowest prices globally for mobile data and have impacted overall ARPU. While the industry tried in recent years to move away from unlimited data plans, the last few quarters have seen these offers re-emerge. A recent survey of mobile data pricing across 237 markets showed data prices in Russia well below the global average and the level of many other developed markets.

Figure 10

## ARPU per subscriber, Q4 2018 ($)




Source: GSMA Intelligence

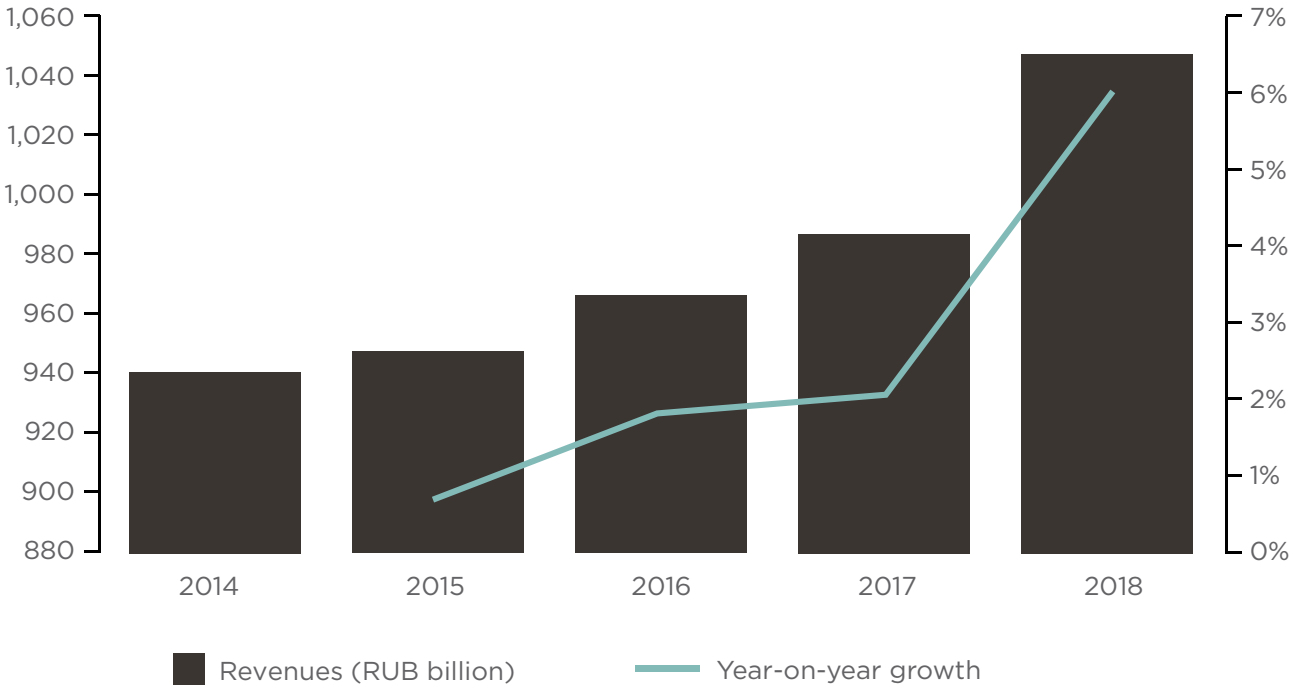
[8] https://www.cable.co.uk/mobiles/worldwide-data-pricing/

ARPU levels for the Russian operators are now among the lowest of any developed markets. Recent quarters have shown some signs of a recovery in ARPU, but the outlook for revenues in Russia is likely to remain subdued until operators succeed in more effectively monetising the ongoing strong growth in data traffic and developing new revenue streams. 5G offers some clear potential for the latter, though material new revenue streams are unlikely to be realised in the short term.

The recent recovery in revenue trends is likely to continue into 2019, but the medium term outlook for revenue growth to 2025 is more subdued.

Figure 11

Russian mobile market revenues




Source: GSMA Intelligence

## 2.2 5G trials in Russia

Russian operators have been testing 5G technologies using prototypes and pre-5G standards for a number of years. As well as continuing to test pre-commercial 5G equipment, Russian operators are deploying LTE-A networks including NB-IoT features and massive MIMO antennas at 2.6 GHz, which are important building blocks for the migration to 5G.

The most significant 5G trials took place in 2018 during the FIFA 2018 World Cup. MTS created 5G demo zones at various sites during the tournament, demonstrating a series of 5G capabilities, including HD video calls, ultra-low latency video games and high-definition video streaming. MegaFon also undertook trials, including a test of an autonomous bus using connectivity in the 3.4-3.8 GHz band that carried supporters from the fan zone to the Kazan Arena, as well as the virtual reality broadcast in the 28 GHz band of the football game between Russia and Turkey. Rostelecom has been undertaking trials with Ericsson in the State Hermitage Museum in St Petersburg to demonstrate the remote control of a robotic arm to undertake the restoration of artefacts, while the company has also set up a 5G pilot zone in Skolkovo in collaboration with Nokia.

Beeline and Huawei held a demonstration in the Museum of Moscow in October 2018 during which dialogue between speakers was conducted using a hologram and viewed through mixed reality (MR) glasses, showcasing the high-bandwidth and low-latency capabilities of 5G technology in the 28 GHz band.

As well as demonstrating the potential of future new services, additional trials were conducted to investigate sharing and compatibility issues in the new spectrum bands for 5G. A dedicated trial zone has been created in Moscow using the 27 GHz band to assess interference with satellite earth stations. The trial demonstrated that coexistence was possible assuming careful 5G network planning around the earth station. For the 3.4-3.8 GHz bands, several test zones were deployed in the Moscow, Kaluga and Tver regions to investigate potential interference with earth stations for fixed satellite services. These trials exposed significant challenges on 5G deployment in this band without special measures to reallocate ground stations outside major cities and without proper band segmentation.

In 2019, additional trials are planned to assess new applications and use cases, and to explore issues around spectrum sharing and compatibility. However, due to a challenging spectrum situation in the 3.4-3.8 GHz bands, the regulator has proposed these trials are instead carried out in the 4800-4990 MHz and 24.25-27.5 GHz bands. Equipment availability will play a central role in determining when selected bands can be used for commercial deployments.

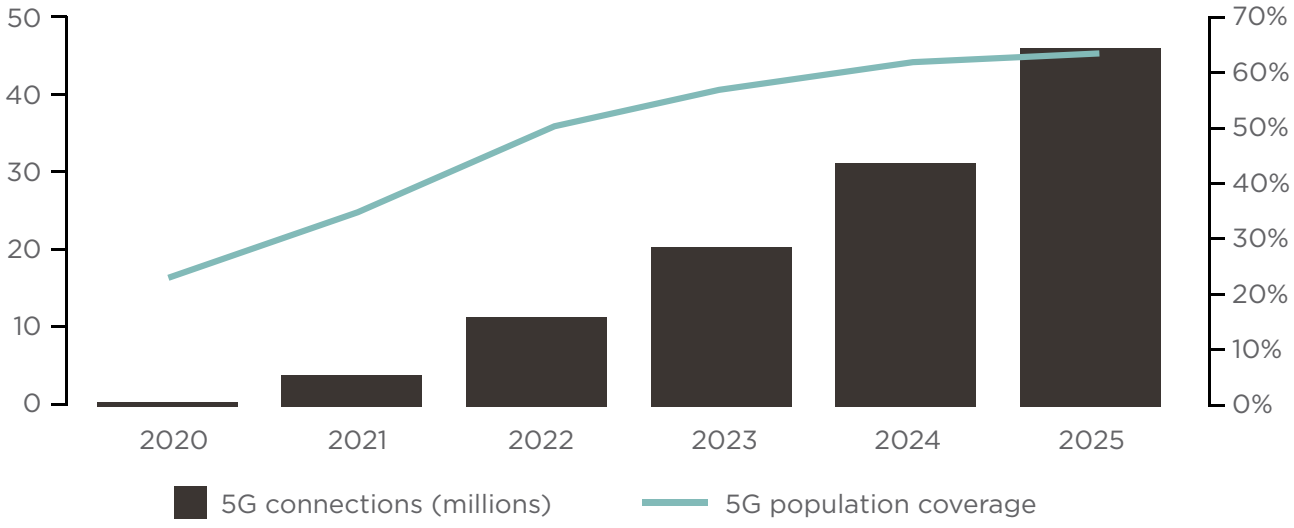
## 2.3 The outlook for 5G adoption in Russia

With Russian operators still focused on 4G rollouts and with that technology still showing significant room for further uptake, Russia is set to be among the second wave of markets in terms of 5G launches. However, there are also benefits for the industry from being a fast follower, including the scope for lower equipment prices as production ramps up and the technology matures, as well as reducing the near-term investment burden. Operators are already facing investment demands beyond the further 4G build-outs, including the costs of implementing the new Yarovaya law.

Forecasts for 5G adoption in Russia suggest the first commercial deployments in 2020, with the total 5G base set to reach 46 million by 2025. This is equivalent to 20% of the total connections base. Population coverage is forecast to be at 60% by then. On this forecast, Russia would be above the global average but trailing the leading 5G markets such as the US, South Korea and China.

**Figure 12**

### Russia 5G adoption forecasts




Source: GSMA Intelligence

# 2.4 5G use cases in Russia: the consumer perspective

In common with the majority of other markets around the world, it is likely that operators in Russia will follow a non-standalone (NSA) deployment model, with 5G acting as a supplementary capacity overlay to the 4G network. This approach will contain overall investment levels by avoiding the need for a new set of base stations and should therefore improve the rate of return from incremental revenues from early 5G use cases (such as eMBB). LTE data traffic offload onto new 5G networks is a further benefit to operators given the high monthly data volumes.

Under an NSA deployment model, operators are able to use existing macro sites and LTE spectrum as an anchor connection, with a densified network of small cells and use of mid-band (1-6 GHz range) and upper-band (above 6 GHz) spectrum to facilitate high-speed data. There have been recent discussions in Russia around the potential for the creation of a single 5G wholesale network, whether on a national or regional basis, which could suggest a standalone deployment model.

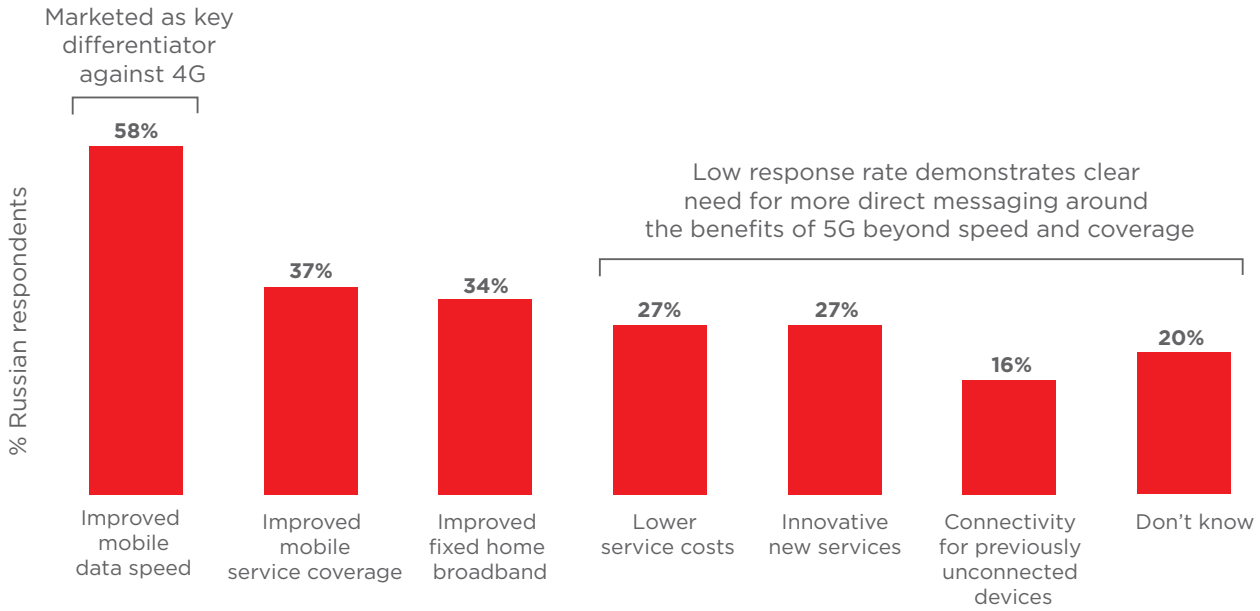
Russia has a relatively mature and well penetrated fixed line market, suggesting a limited role for 5G-based fixed wireless deployments in the country, though more geographically targeted deployments remain a possibility in the medium term. MegaFon has indicated it will explore the FWA opportunity as part of its planned 5G trials for the current year. As a result, early 5G deployments are likely to focus on easing congestion in urban hotspot areas and providing higher speed mobile broadband services.

In common with consumers in many markets, consumers in Russia currently expect 5G networks to primarily deliver improved data speeds and coverage, in line with the transition from earlier generations of mobile technology. The challenge for operators therefore lies in developing new use cases and convincing consumers of the incremental value these offer.

Figure 13

## Russian consumer perceptions of 5G

Question: "From what you know of 5G, what do you expect it will deliver?"




Source: GSMA Intelligence Consumer Survey 2018

5G networks also offer the promise of a range of new and enhanced consumer experiences, drawing on higher data throughput and lower latency. These new services include 4K and 8K ultra-HD video, 3D video, holograms, AR/VR devices and applications for gaming and immersive TV, as well as digital services and content for connected stadia and smart cities. A number of these have already been trialled in Russia, with further trials in use cases such as AR/ VR expected over the next 12 months.

These new services will provide clear opportunities for Russian operators to enhance the customer experience while driving incremental revenue in the consumer market. However, a number of challenges need to be addressed over the next five years, at both the regional and global levels:

- Advances in immersive digital entertainment are key to driving incremental revenue for operators. However, some of the use case developments in applications and content for immersive reality, eSports and enhanced in-venue digital entertainment are still at an early stage even in advanced markets.
- Device costs: 5G smartphone models are likely to cost more than the most advanced 4G devices currently available, as they will offer enhanced features (potentially including advanced video capabilities such as 4K and 8K displays) and additional cameras and sensors to support AR and VR applications. These handsets will also need to support multiple spectrum bands as well as 4G and 5G in the same form factor.

## 2.5 5G use cases in Russia: the enterprise perspective

Numerous companies from the mobile ecosystem and beyond are working on the development of new enterprise use cases for 5G. For example, the Skolkovo Foundation's technology park already has collaborative test centres with laboratory equipment and instrumentation that have the capabilities necessary for the development and testing of equipment in the whole range of frequencies used in 5G.

**Skolkovo Foundation: Igor Drozdov, Chairman of the Board**

Drozdov has highlighted a number of potential use cases currently under review, including the following:

- Massive Machine Type Communications for IoT solutions: these include property monitoring systems, smart agriculture, smart cities, smart electricity metering, smart homes and remote control. 5G should encourage the development of smart cities and IoT in general through the deployment of a large number of low-capacity networks for various sensors in cities and rural areas.
- Super reliable communication with low latency of the type needed for controlling autonomous vehicles, remote monitoring of patients, and for industrial automation.
- Safety and reliability offered by 5G make it a good fit for public security systems, as well as for use in services aimed at helping solve business-critical problems, such as smart grids, police and security services, water utilities and healthcare systems. The network latency characteristics of 5G make this technology a good fit for factory automation and process control in real time. The low network latency and high security features of 5G will also play an important role in the evolution of smart transportation systems by allowing them to communicate with each other in real time.

**PAO Sberbank: A. Vedyakhin, First Deputy Chair of the Management Board**

'5G is also an important development benchmark for Sberbank. By combining 5G and artificial intelligence, clients will be able to get unique personalised services, as well as augmented reality service, with lightning fast response to requests submitted via digital channels; the transformation of processes will speed up; the time and cost of decision-making will decrease, while its quality will improve. Cyber-security measures will also be taken to a whole new level.

If we use next-generation networks, we're going to have more opportunities. Commercialisation of 5G must be based first and foremost on the most relevant use cases of the new technology for users and business.'

**Yandex: Elena Bunina, CEO**

'The entire country needs 5G networks to get to the next level of quality of communications. It is not just quantitative growth in terms of the amount of information being transmitted; it is a qualitative leap forward that is bound to completely change all internet-related industries.

5G will bring about a similar kind of change in the transport industry. Motor vehicles constantly sharing information with each other via broadband wireless communication channels represent a whole new level of traffic awareness. Accurate information about the position and movement of every specific motor vehicle in a city will create unique traffic routing opportunities and will help improve the effectiveness of traffic lights, public and private transport.'

**ANO Digital Economy: Evgeny Kovnir, CEO**

'It is generally believed that 4G is more than enough to meet the basic needs of most people with regards to digital communication. However, 5G is needed to enable autonomous transport, and deploy VR/AR technologies that can bring the quality of interaction between the human being and the world around them to a whole new level. 5G communications are badly needed by businesses to develop artificial intelligence, as well as services dependent on the internet of things, industrial internet and others. But a key advantage of 5G communications is that it can boost the overall economy, making it truly digital by enabling real-time transmission of huge amount of primary data that can then be used to drastically improve the quality of decision-making. In other words, it is fifth generation communications that are going to bring us closer to the digital economy in the sense of a data economy.'

**Rostec: Sergey Chemezov, CEO**

'The development prospects for 5G solutions over the next two to five years have a lot of potential. In order to expedite the creation of 5G networks, we need to ensure maximum support for domestic manufacturers of telecommunication equipment and come up with incentives for the creation of technology clusters for the transfer of technologies, as well as creating facilities for manufacturing electronic components of the kind that we do not have in the Russian Federation yet. Rostec is ready to head up this process in conjunction with our partners and lead the way both strategically and in terms of technology.'

# 3 Delivering an enabling policy environment for 5G

## 3.1 The GSMA's global perspective on policy for the 5G era

To accelerate 5G to commercial use, governments and regulators across the world need to consider market structures that will foster a pro-investment and pro-innovation environment for the mobile ecosystem. Mobile operators in many markets face significant headwinds from the prevailing policy and regulatory environment, in terms of investment, spectrum access, network management flexibility and infrastructure deployment.

It is important to note that across a broad range of policy and regulatory issues, the industry position is no different in a 5G world to earlier generations of mobile network technology. Positions published in the GSMA Mobile Policy Handbook,[9] spanning infrastructure sharing, taxation and spectrum, to name but a few, are as relevant and applicable as ever.

Policy-makers, as vocal proponents of mobile network evolution and technology-led economic growth, should play a driving role in the realisation of 5G, creating the conditions for efficient and timely mobile network deployment while bringing down the regulatory costs for operators. Their attention should focus on key areas to bring 5G to fruition: network deployment, network flexibility, spectrum access and regulatory costs.

[9] https://www.gsma.com/publicpolicy/mobilepolicyhandbook/

Figure 14

Key policy considerations for the 5G era


Source: GSMA

# 3.2 Russian market policy considerations

Due to ongoing competition and low data prices, Russian operators need to continue to innovate and generate cost efficiencies to accommodate growth in data traffic. They are also looking for new business models and markets to sustain the pace of development and to generate incremental revenue streams. 5G mobile networks offer the promise of a range of new services for enterprises, in addition to serving the consumer market. In this regard, 5G is considered a necessity for the creation of a new and more competitive national economy. The implementation of 5G networks should be considered by regulators not just as a new technical advancement in telecoms, but as a condition for delivering the digital economy and driving the transformation of a range of industries. With this mindset, the regulation of the mobile industry should shift from controlling and supervising the industry to fostering its development. Successful deployments of 5G networks in other countries suggest that a key factor in successful deployment and operation of 5G networks is the creation of a comprehensive national development plan for 5G communications. Below are a number of policy asks to facilitate the timely deployment of 5G networks in Russia:

### Creating an innovation ecosystem for developing 5G services

A key role for the government is to help expand the existing innovation ecosystem to enable the development and commercialisation of new 5G services and solutions. This should enable the development of new technologies, promote further improvements in 5G, and facilitate the emergence of new digital services as well as digitising specific sectors of the economy. These developments will in turn drive further demand for 5G communications services.

In addition, the government should consider the creation of a special support system for innovative projects related to the development of 5G technologies and new 5G-based services. This process could include supporting the testing and subsequent commercialisation of new services through the provision of research and development grants from special foundations, as well as supporting the development of pilot zones for the deployment and testing of 5G services. This could be achieved in partnership with existing research institutions and through the provision of state subsidies for certain research and development activities.

## Spectrum for 5G

The main constraint on Russia's ability to reap the benefits of 5G is the availability of radio frequency bands for 5G. Therefore, the first step for 5G network development should be to establish a comprehensive and transparent spectrum policy and roadmap for the release and award of spectrum. To support this goal, an inclusive dialogue is essential among all relevant parties.

An important factor in the allocation of radio frequency bands is ensuring that spectrum sharing is possible should market players agree on commercial terms. Analysis of international and national deployment experiences for previous network generations, as well as scenarios for 5G development using different models, shows that voluntary shared use of 5G infrastructure leads to significant network deployment cost reduction, while preserving a high level of competition. In addition, the principle of technology neutrality should be extended within the existing frequency bands to allow the migration to 5G technology.

This new spectrum needs to be right in terms of amount and type, and provided under the right conditions. It also needs to be made available in a timely manner. There are three key ranges: sub-1 GHz, 1–6 GHz and above 6 GHz.

The sub-1 range can provide wide area coverage as well as deeper indoor coverage, with the coverage issues particularly relevant outside urban areas. This spectrum will be crucial for many new 5G services supporting the development of the digital economy. Spectrum between 1 and 6 GHz is required to address network congestion in major cities, with spectrum in these bands offering an effective compromise between coverage and capacity.

Spectrum above 6 GHz has the potential to transform the mobile broadband experience with ultra-high speeds and low latencies. However, such spectrum can generally only be used in local areas due to its limited coverage characteristics, and will need to be used in conjunction with the lower frequency bands.

As well as making sufficient spectrum available, regulators are urged to reassess the spectrum pricing and annual spectrum fee approaches. Suitable pricing will stimulate investment in 5G infrastructure.

## Deployment procedures and provisions

Rapid and efficient 5G rollout will require new approaches from regulators. Strict regulations and procedures historically used during the deployment of 2G, 3G and 4G networks will become significant constraints on 5G networks. The rapid pace of technological progress will require operators to roll out and upgrade networks faster using network automation. Initially, it is recommended that mechanisms are identified to simplify the administrative procedures regulating the construction and deployment of 5G communication networks. Non-discriminatory, simplified access to federal and municipal infrastructure facilities, connection to municipal or transport energy infrastructure, and facilitating permissions and standard processes are needed. At the same time it is important to simplify and standardise the land plot allotment procedures and the procedure for granting construction permits for information infrastructure facilities. A move from permission-based authorisation to notification procedures for certain infrastructure such as small cells might provide appropriate conditions for operators to speed up 5G deployments, providing a headstart in terms of overall competitiveness of the economy.

## Wireless emission standards

Notwithstanding the need to provide a safe and healthy environment for all citizens, the existing wireless emission allowances in Russia are based on studies and practices that date back decades. In order to enable the use of modern antenna systems (one of the key elements of 5G technology in both existing and new frequency bands), it is necessary to harmonise requirements for radio frequency exposure limits for base stations applicable in the Russian Federation. The existing requirements inherited from the USSR effectively make it impossible to deploy cost-effective 5G networks even if the problems of spectrum access are resolved. Russia needs to introduce new sanitary and epidemiological requirements based on those established by the International Commission on Non-Ionising Radiation Protection.

### Network architecture regulation

The core of the telecoms regulatory framework in Russia dates back to the deployment of the original fixed line networks, as is the case in many other countries. The original regulation was easily transferred to 2G, circuit-switched cellular networks, and then subsequently to 3G circuit-switched networks. A major overhaul for national regulatory provisions was introduced with the proliferation of data networks. However, all regulatory requirements and national compliance procedures are still applied to localised nodes and hardware equipment. Through the introduction of additions and clarifications, this regulatory framework was able to adapt to internet-based services.

The next leap in network architecture is associated with deployment of new technologies such as software-defined networking (SDN) and network function virtualisation (NFV). These technologies will require further adjusting of the existing provisions to allow evolution of mobile networks. With the proliferation of SDN and NFV in the 5G core network, the notion of specific hardware or equipment will start to lose its meaning, as control and user plane traffic will be processed by different logical entities, which in turn will be virtualised in a cloud infrastructure in a distributed manner. So as not to stall the introduction of 5G networks, it is pragmatic to adjust once again the existing regulation by introducing virtualised nodes and new compliance procedures at a national level based on testing software capabilities rather than hardware measurements.

In updating the regulatory provisions, particular attention should be given to lawful intercept mechanisms. The existing lawful intercept equipment is based on hardware interconnection to operator infrastructure to receive required control and user plane traffic. With the introduction of virtualised core network and technologies such as mobile edge computing, the hardware implementation of lawful intercept may be impractical for some of the services due to the establishment of redundant connections to re-route significant traffic into lawful intercept systems. The development of lawful intercept based on virtualised functions needs to be addressed in advance so it does not hinder the introduction of new technologies and services.

### Network neutrality and data regulation

Legislation covering personal or IoT data should be balanced to address the need to protect sensitive data but also enable innovative services based on the use of big data. For example, the data collected by mobile networks on the movement of subscribers across a city is crucial input for city transportation system design. Strict legislation may prohibit the collection and exchange of such information even though it could benefit society. Furthermore, where such legislation is introduced, it should cover not only mobile operators but also other ICT players involved in data collection and data exchange so as not to create uneven conditions between telecoms companies and other stakeholders.

Operators require the flexibility to manage their network traffic and create innovate service propositions, albeit mindful of the need to sustain an open internet. This is particularly important with the introduction of mission-critical services and network slicing in 5G networks. There will be an occasional need to balance best-efforts traffic (such as for video streaming) with traffic at guaranteed data rates (such as for public safety services). It is important not to limit operators in the provision of services and allow for differentiated customer propositions. The existing legislation in Russia is already enabling such flexibility for operators. Any approaches to regulate this area without considering all the complexities of 5G networks may harm development.

### Encouraging investments for 5G networks

The main objective of the government should be to create a supportive environment for 5G investment, potentially through both financial and non-financial measures. At the same time, it is important to fully utilise existing investment and infrastructure through the use of private-public partnership mechanisms.

To support the investment efforts of the mobile operators, a flexible pricing policy should be used at auctions and in setting the prices that operators have to pay for frequency band allocations. The development of 5G networks involves significant technology and business risks for operators, as well as significant investments. These are all factors that policy-makers should consider in the interests of all market players.

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