

Competing in the Digital Age

POLICY IMPLICATIONS FOR THE RUSSIAN FEDERATION



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RUSSIA DIGITAL ECONOMY REPORT

Competing in the Digital Age

POLICY IMPLICATIONS FOR
THE RUSSIAN FEDERATION

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TABLES OF CONTENTS

Forewordix
Acknowledgmentsxi
Abbreviationsxv
Introduction.....	.xix
The Russia Digital Economy Report Structure.....	.xx
Executive Summaryxxiii
Referencexxvii
Digital Economy in Russia: Key Results of the Digital Economy Country Assessment	2
1.1 Non-Digital Foundations	5
1.2 Digital Foundations.....	6
1.3 Digital Transformation of the Different Sectors of the Economy	7
1.4 The Social and Economic Impact of Digital Transformation	11
References	15
Digital Economy Today: Global Trends, Technologies, and Policy Implications ..	18
2.1 The Rise of the Digital Economy	18
2.2 Disruptive Technologies as Drivers of the Digital Economy	20
2.3 The Data Revolution.....	24
2.4 The Transformative Power of New Business Models	25
2.5 Implications for Policy Makers and Recommendations	30
References	31
Global Best Practice for Catalyzing Digital Platforms in Russia	36
3.1 Global Trends in Digital Platforms	36
3.2 Digital Platforms in Russia.....	40
3.3 Policy Recommendations	42
References	42
Global Best Practice for Driving Digital Transformation in Russia’s Public Sector.....	46
4.1 Digital Government – Global Best Practice	46
4.2 Digital Government Transformation in Russia	53

4.3 Policy Recommendations	57
References	58
Global Best Practice for Accelerating Business Transformation in Russia	60
5.1 Global Best Practice for Driving Russian Industry Transformation	60
5.2 Global Best Practice for Enabling the Digital Transformation of Russian Agriculture ..	73
5.3 Global Best Practice for Advancing Services Transformation: The Case of Digital Finance in Russia	85
References	96
Global Best Practice for Boosting Digital Innovation and Entrepreneurship in Russia	100
6.1 Global Trends in Digital Entrepreneurship	100
6.2 Digital Entrepreneurship and Innovation in Russia	110
6.3 Policy Recommendations	120
References	122
Conclusion	126

Boxes

1.1 Digital Economy Country Assessment Methodology	3
1.2 Digital Education Platforms in Russia	9
1.3 The Ulyanovsk Oblast of the Russian Federation	13
1.4 Digital Transformation in the Kaluga Oblast	14
2.1 Boosting the Digital Economy in China	19
2.2 Dubai Roads and Transportation Authority	21
2.3 Dubai Real Estate Blockchain	22
2.4 Formulating a National Strategy in Artificial Intelligence in Finland	23
2.5 Enabling Inclusive Growth through Digital Trade Platforms in China	27
2.6 Ethics in the Digital Age	28
2.7 Measuring the Impact of the Digital Economy	29
2.8 Strategic Foresight Best Practices	31
3.1 The Digital Ecosystem	38
3.2 B2B-Center	41
4.1 Applied Data Analytics in Action: A Case Study of Dutch VAT Refund Risk Model ...	49
4.2 Use of Blockchain in Sweden's Land Registry	49
4.3 Basic Data Management in Denmark	50

4.4	Devising a Strategy for Data-driven Government	51
4.5	Joinup: An EU Collaboration Platform for Digital Government Solutions	52
4.6	Agile Approaches in Russia's Largest Public Bank	56
5.1	Piloting a Digital Industry Platform at Gazprom	67
5.2	4.0 RU and TechNet NTI	69
5.3	Virtual Testing for Aurus	70
5.5	CompMechLab Group of Companies	70
5.4	Factories of Future	70
5.6	Digital Shipyard to Be Built in St. Petersburg	70
5.7	Artificial Intelligence in the Management of Energy Networks in the Kaliningrad Oblast	71
5.8	Robotics at a ST. Petersburg Plant	71
5.9	Enabling Precision Agriculture	74
5.10	Globalization of Agriculture Know-How through Digital Technologies: Internet of Food & Farm 2020	75
5.11	Internet of Things in the Forest Industry	82
5.12	Innovation in the Financial Sector	86
5.13	MasterChain	91
5.14	Cashless Payments in Russia	93
5.15	Attitudes Toward FinTech in Russia	94
6.1	Assessing the Effectiveness of Government Innovation Policies	102
6.2	Israel, the Start-Up Nation: Success Factors	103
6.3	Start-up Community Building in Finland	105
6.4	Start-up Support Infrastructure Matters	106
6.5	New York Tech Start-ups	109
6.6	Crowdfunding in Russia	117
6.7	Policy Responses to Digital Skills Development	117
6.8	University 20.35	118
6.9	Digital Skills in the Tula Oblast	119
6.10	Driving Regional Innovation in Korea	119

Figures

I.1	Report Structure	xxi
1.1	Digital Economy Country Assessment Framework	4
1.2	Russia's Digital Economy Assessment Summary	4
1.3	Russia's Digital Economy Assessment: Digital Infrastructure	7
1.4	Russia's Digital Economy Assessment: Digital Government	8

1.5	Russia’s Digital Economy Assessment: Digital Education	9
1.6	Russia’s Digital Economy Assessment: Digital Transformation of the Private Sector . .	10
1.7	Russia’s Digital Economy Assessment: Social and Economic Impact	11
1.8	Results of DECA in Russia versus Ulyanovsk Oblast	15
3.1	Physical and Virtual Enablers	37
3.2	Market and Behavioral Enablers	37
3.3	The Platform Ecosystem	39
3.4	Revenue of Russian and Global Digital Platforms in Russia	41
4.1	Digital Government Maturity Levels.	47
5.1	Industry Receptiveness to Digital Adoption by Sector.	61
5.2	Industry Digitization Index.	61
5.3	Russian Industrial Production Index	66
5.4	Digitization Levels: Russia and Europe	66
5.5	Deloitte 2016 Global Manufacturing Competitiveness Index	68
5.6	Agriculture Exports in Russia, 2004–2017	81
5.7	Investments in FinTech by Business Segment.	87
5.8	Groups of Countries in Terms of Digital Banking Maturity	90
5.9	FinTech Market Map in Russia	92
6.1	Networking Assets (Ecosystem’s Support Infrastructure)	104
6.2	Funding for Finnish Early Stage Growth Companies in 2010–2016.	105
6.3	Accelerator Multipliers in Different Cities Worldwide.	107
6.4	Employment Generated in New York City by the Tech Start-Up Ecosystem (2003–2013).	109
6.5	Number of ‘Unicorn’ Companies	111
6.6	Maturity of BRICS Countries Ecosystems	112
6.7	Russia IT Exports 2002–2017.	112
6.8	VC Investments	115
6.9	Comparison of Moscow to Top-10 Metros in Europe	116

Tables

5.1	Digital Industry Strategies: China, Germany, and the United States	64
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FOREWORD



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We live in an era of digital transformation. Digital technologies, the data they generate and the connections they enable are changing the way we live, learn, work and play, plan, think and make decisions. The accelerating pace of technological change is not only increasing risks and threatening established business models but also creating new opportunities at all levels of government, business and social development. Policy-makers must find new ways to manage economic and social change caused by digital adoption whilst enabling the potential for growth which digital technologies unleash. This is not simple. The nature and impact of this transformation is still evolving.

The Report, **Competing in the Digital Age: Policy Implications for the Russian Federation**, is a result of a two-year global exercise between the World Bank's global community of specialists and Russian experts. This collaborative network identified and analyzed current global best practices in digital transformation spanning a broad spectrum of business and government issues, policies and approaches. It then explored ways to apply these global insights locally. The resulting Report includes an analysis of international policies aiming to stimulate digital adoption whilst being alert to the disruption caused by new business models and the rapid emergence of new technologies. This collaboration looked at a number of trends, such as the emergence of digital platforms, as well as considered the transformation taking place in government, business, and the importance of policy in innovation, skills and employment, from a digital perspective.

There are several fundamental factors affecting the digitalization and growth of the economy that this Report explores:

- Strengthening the non-digital foundations of the economy, including digital leadership; ensuring an agile and enabling regulatory environment, as well as assisting the general population, decision-makers, institutions and organizations to adapt to the digital world

- Strengthening the digital foundations, ensuring there is a scalable, intelligent, secure infrastructure capable of responding to the anticipated substantial demand for the digital economy.
- Strengthening the interactions, integration and operations of the digital ecosystem - horizontally across industries and sectors, and vertically across all government jurisdictions - in order to support innovation and technological breakthroughs envisioned by the Russian leadership.
- Boosting digital skills to support a thriving digital economy and developing a highly-trained workforce.
- And finally, the interdependency between digital advancement, open innovation and the cultural transformation of traditional governance structures, and how to (re)shape the environment accordingly.

We hope that this Report assists policy-makers as they think through the many ways to adapt to and harness the opportunities created by digital and emerging technologies to boost Russia's global competitiveness by accelerating its pace of digital transformation.

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ABBREVIATIONS

ADMS	Asset Description Metadata Schema
AI	Artificial Intelligence
AML	Anti-Money Laundering
API	Application Programming Interface
ASI	Agency of Strategic Initiatives
ATD	Agency of Technological Development
B2B	Business-to-Business
B2C	Business-to-Consumer
BASE	Big Analytics Skills Enablement
BAT	Baidu, Alibaba, Tencent
BEA	Bureau of Economic Analysis, United States
BCR	Binding Corporate Rules
BCG	Boston Consulting Group
BDA	Big Data and Business Analytics
BMBF	Federal Ministry of Education and Research, Germany
BMWI	Federal Ministry for Economic Affairs and Energy, Germany
BRICS	Brazil, Russia, India, China, and South Africa
CBPR	Cross Border Privacy Rules
CCC	Consumer Credit Counseling
CCEI	Centre for Creative Economy and Innovation
CDO	Chief Data Officer
CIO	Chief Information Officer
CNIL	National Commission for Information Technology and Liberties, France
CTO	Chief Technology Officer
DECA	Digital Economy Country Assessment
DETE	Digital End-to-End
DDP	Digital Development Partnership
DLD	Dubai Land Department
DLT	Distributed Ledger Technology
DMU	Digital Mock-Up
e-CF	e-Competence Framework
EAEU	Eurasian Economic Union
ECDB	European Soil Database
EEC	Eurasian Economic Commission
ERP	Enterprise Resource Planning
ERES	Emirates Real Estate Solutions
ESCO	European Classification of Skills/Competencies
EU	European Union
Euro NCAP	European New Car Assessment Program
FinTech	Financial Technology
FET	Future and Emerging Technologies
FSB	Financial Stability Board
G2B	Government-to-Business
G2C	Government-to-Citizen

GaaP	Government as a Platform
GDP	Gross Domestic Product
GE	General Electric
GIS	Geographic Information System
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System
GRP	Gross Regional Product
HELP	High-Level Experts, Leaders, and Participants
HSE	Higher School of Economics
ICT	Information and Communication Technology
IDC	International Data Corporation
IFC	International Finance Corporation
IIC	Industrial Internet Consortium
IIDF	Internet Initiatives Development Fund
IIoT	Industrial Internet of Things
IIS	Institute of the Information Society
IMF	International Monetary Fund
INSPIRE	Infrastructure for Spatial Information in Europe
IoF2020	Internet of Food & Farm 2020
IoT	Internet of Things
IOTAS	Association of IoT Market Participants
IPR	Intellectual Property Rights
ISRIC	International Soil Reference and Information Centre
IT	Information Technology
ITMO	Information Technologies, Mechanics, and Optics
ITU	International Telecommunication Union
KAMAZ	Kama Automobile Plant
KPI	Key Performance Indicator
KYC	Know Your Customer
MGI	McKinsey Global Institute
MPV	Multi-Purpose Vehicle
MSP	Multi-Sided Platform
MTO	Money Transfer Operation
NAFI	National Agency for Financial Studies
NAMI	Central Scientific Research Automobile and Automotive Engine Institute
NBS	Chinese National Bureau of Statistics
NCTA	Dutch Tax and Customs Authority
NDVI	Normalized Difference Vegetation Index
NGO	Nongovernmental Organization
NRCS	Natural Resources Conservation Service
NSPC	National System of Payment Cards
NTI	National Technology Initiative
OECD	Organisation for Economic Co-operation and Development
P2P	Peer-to-Peer
PER	Public Expenditure Review
PISA	Program for International Student Assessment
PPP	Public-Private Partnership
PSP	Public Sector Pension Investment Board
R&D	Research and Development
RAAI	Russian Association of Artificial Intelligence

RABIK	Russian Blockchain and Cryptocurrency Association
RAII	Russian Association of Industrial Internet
RAR	Russian Association of Robotics
RAS	Reimbursable Advisory Services
Rosstat	Russian Federal State Statistics Service
RTA	Dubai Roads and Transportation Authority
RTTN	Russian Technology Transfer Network
RUSNANO	Russian Corporation for Nanotechnologies
RUSSOFT	Russian Association of Software Developers
RVC	Russian Venture Company
RVCA	Russian Venture Capital Association
SMEs	Small and Medium Enterprises
SMEV	System of Inter-Agency Electronic Interaction
SNA	Social Network Analysis
SoE	State-Owned Enterprise
SSURGO	Soil Survey Geographic Database
STATSGO	State Soil Geographic Database
STEM	Science, Technology, Engineering, and Mathematics
STI	Science, Technology, and Innovation
SUV	Sports Utility Vehicle
UAC	United Aviation Corporation
UAV	Unmanned Aerial Vehicles
UAZ	Ulyanovsk Automobile Plant
UEC	United Engine Corporation
UN	United Nations
UNI	Union Network International
USDA	U.S. Department of Agriculture
VAT	Value Added Tax
VC	Venture Capital
WDR	World Development Report
WEF	World Economic Forum
WRB	World Reference Base for Soil Resources



INTRODUCTION

This report was prepared as the final output of “Developing the Digital Economy in Russia” initiative—a joint effort of the World Bank and a number of Russian partner organizations to establish a multi-stakeholder collaboration to foster the development of the digital economy in the Russian Federation.

In recent years, digitization of the economy in Russia has been a top priority at the highest level of leadership, and a number of digital initiatives have been implemented in the country at the national and subnational levels. Russia has also been driving the development of the common digital space in the Eurasian Economic Union (EAEU).

In June 2016, the former Russian Minister of Telecom and Mass Communications, Nikolay Nikiforov, expressed his interest in collaborating with the World Bank on the development of the national Digital Economy Strategy. In October 2016, the Eurasian Economic Commission (EEC) invited the World Bank to collaborate on the EAEU Digital Agenda development.

In response to the minister’s invitation, the World Bank team proposed the “Developing the Digital Economy in Russia” initiative, whose main goal was to support national and subnational stakeholders in Russia in developing a strong future-proof digital foundation for the country’s economy by drawing on international best practices and local expertise. The initiative was also aimed to operationalize the findings and recommendations of the World Development Report 2016: Digital Dividends and to adapt them to the country context.

To achieve this ambitious goal, the World Bank team partnered with the government counterparts and several leading Russian think tanks and mobilized expertise of the World Bank-facilitated “High-Level Experts, Leaders, and Practitioners” (HELP) network. The initiative was announced in November 2016 during the Smart Russia International Congress at the Plekhanov University of Economics and was officially launched on December 20, 2016, during the seminar that was held at the World Bank office in Moscow and featured prominent international experts from the HELP network.

In the two years since this initiative has commenced, the World Bank team, in cooperation with the Institute of the Information Society (IIS), Analytical Center under the Government and other Russian organizations has developed a Digital Economy Country Assessment (DECA) methodology¹ that uses a set of indicators to assess the current level of digital economy development, conducted pilot assessments in Russia at the national, as well as at the regional level in the Ulyanovsk Oblast. The team established a working group and online community on digital economy in Russia² mostly comprising Russian and Eurasian experts and other stakeholders, and organized a series of international and local seminars. The main goal of these activities was to catalyze and help design a national digital economy program; facilitate joint articulation of key challenges and opportunities, guiding principles, and policy recommendations to help Russia unlock the socioeconomic benefits of digital economy development, including inclusive economic growth, job creation, and better services; and help position Russia among the global leaders in digital transformation.

1 The development of the methodology and the assessments were co-financed by Smart Nations and Digital Development Partnership grants.

2 The community is hosted by the Facebook Group “Digital Economy in Russia.” To date, this group has over 3,400 actively engaged members, and many regularly post and comment in the community space and attend the digital economy-related events organized by the World Bank and its partners, both online and offline.

In parallel, in 2017, under an agreement with the Ministry of Telecom and Mass Communications, the World Bank team provided advisory support in the design of the Russia Digital Economy Program. With a demanding time frame of only six months from inception to the adoption of the program, the Russian government set up a number of multi-stakeholder working groups tasked with designing key components of the Digital Economy Program. The World Bank team engaged leading international experts from the HELP network and experts within the World Bank, who provided global perspectives on best practices and innovations for digital economy strategy and program design. The team also produced analytical briefs on various aspects of digital economy and provided recommendations on improving the draft of the program.

In July 2017, the program was formally adopted by the government to provide the digital foundations for the accelerated social and economic development through 2024. In 2018, the government approved roadmaps in all five priority areas outlined in the program and allocated RUB 3,040.4 million for their implementation. Implementation of the EAEU Digital Agenda that was adopted in 2017 will also be a priority under the Russian chairmanship in 2018.

The Russia Digital Economy Report synthesizes the main findings and recommendations that emerged from this co-creation process. It also builds on the findings of the study conducted in 2016–2017, in partnership with the Eurasian Economic Commission (EEC). Based on the analysis of international experience and best practice, the study offered recommendations to help maximize the economic impact of the development of the common digital space in the EAEU. The present report was also informed by the findings of the World Bank’s “Reaping Digital Dividends in Europe and Central Asia” report and the special focus on Russia’s digital economy in the Russia Economic Report May 2018 issue.

The Russia Digital Economy Report Structure

This report provides an overview of the role of emerging technologies in digital transformation and the global best practices in policy responses to the disruptions they cause across a broad spectrum of economic activity. It analyzes the successes and challenges of digital transformation in Russia and attempts to develop key recommendations to help policy makers accelerate the pace of digital transformation across the main sectors of the Russian economy.

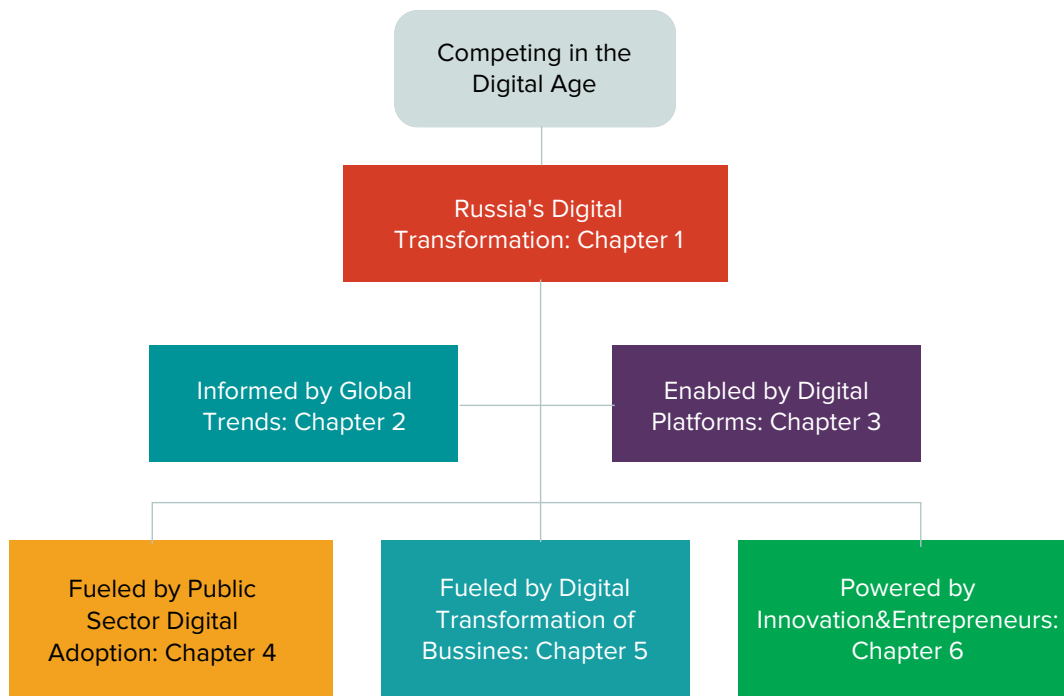
In its current version, the report starts with discussing the results of the Russia DECA and offers an analysis of international best practice in formulating policy approaches to stimulate digital adoption while easing the disruption caused by the rapid emergence of new technologies. The objective is to help policy makers think through ways to harness the opportunities created by emerging technologies to enable Russia to accelerate the pace of digital transformation.

The report then discusses the emergence of digital platforms as key enablers of digital transformation and proceeds to explore sectoral dynamics in the key digital transformation areas outlined in the Russia Digital Economy Program, including digital government, digital business, as well as digital innovation and skills building.

Sector-oriented chapters follow a similar structure by analyzing international best practice in the transformation of a particular sector, offering an assessment of the current state of transformation of that sector in Russia and concluding with proposing a set of recommendations that may help accelerate the digital transformation of the sector in light of international best practice and the local experience (Figure 1.1).

Due to the rapid pace of technological change and space limitations, this report does not pretend to offer in-depth analysis of Russian digital transformation at the sectoral level, but

FIGURE I.1 Report Structure



is rather an attempt to analyze global best practice to inform Russian policy making and an invitation to the policy-maker and expert community to continue the digital co-creation experience started two years ago in the hope that it is an effective way to share the just-in-time global expertise of the World Bank whenever and wherever it is needed most in order to help accelerate Russia's digital transformation process.



EXECUTIVE SUMMARY

The pace of technological change is accelerating. The rapid emergence of new disruptive technologies creates new challenges for global digital leaders, followers, and late adopters alike. The risks of disruption inherent in new technologies add many layers of complexity to government policy making. The role of government becomes an increasingly difficult balancing act between protecting the fundamental interests of the country and its constituents, on the one hand, and harnessing emerging technologies to ensure national competitiveness and accelerate economic growth, on the other hand.

These challenges are evident in Russia, where digital transformation has been a top priority for the Russian government, and the country has achieved some impressive successes in this sphere. As Russia prepares for a technological breakthrough—a key strategic objective formulated by its leadership in the May 2018 Presidential Decree (The Decree on the National Goals and Strategic National Development Tasks of the Russian Federation until 2024)—policy makers need to build upon the country’s traditional strengths, create mechanisms for the rapid adoption of new technologies across all key areas of competitive strength, and proactively address the existing challenges that may create barriers to breakthrough success.

An assessment of **Russia’s current state of digital economy development (DECA)** recently performed by the World Bank in cooperation with the IIS and other partners concludes that the country’s ambitious vision for growth through breakthrough innovation, its investments into national broadband infrastructure, relative strengths in science and technology, a developed legislative and policy framework, and the global competitiveness of its cybersecurity industry position Russia to become a global digital leader. Yet, it also warns that structural weaknesses in the digital transformation ecosystem, inadequate digital skills, restricted access to capital markets, and a lack of an open innovation culture constrain Russia’s ability to achieve fundamental technological breakthroughs in the near term. Critical to Russia’s midterm success are improvements in the transparency of its business environment, investment into digital skills, adoption of new technologies in key areas of competitive strength, and enhanced links among all the key stakeholders in the digital ecosystem, including the public sector, the private sector, civil society, and the scientific community.

Global experience indicates that disruptive technologies such as the Internet of Things (IoT), data analytics, quantum computing, artificial intelligence (AI), robotics, blockchain, and so on transform business models and challenge policy makers to find ways to maximize social and economic gains at the regional, national, and global levels. Policies should focus on creating an enabling environment for innovation and devising mechanisms for effective governance, strategic future planning, and institutional agility supported by a flexible legal and regulatory framework. Global best practice emphasizes the need to catalyze digital innovation across the economy by strengthening the innovation ecosystem, balancing stimulation and competition policies, ensuring the availability of funding, and building new skills for the digital age while providing for adequate protection of national security, personal privacy, consumer interests, and intellectual property rights.

In an increasingly digital world, **digital platforms** are the enablers of cross-sectoral transformation as they empower the performance of ecosystems by facilitating rapid and continuous communication, cooperation, and co-creation across organizations, borders, and time zones. Government as a platform (GaaP) enables the co-creation of a wide range of services by all economic actors. Platform-based digital factories revolutionize industrial production. Platform-based marketplaces transform services and agriculture. Educational platforms empower learners of all ages, social groups, and so on. In a number of areas, Russian **digital platforms** today dominate the Russian market, in spite of competition from global giants. Some Russian companies have emerged as global leaders. Thus, Russian policy makers need to pay special attention to encouraging this model for digital transformation across economic sectors. It is important to strike the right balance between the protection of national interests and consumer interests and the support of the growth of digital platforms to gain digital dividends in all the areas of economic activity these platforms transform.

In terms of public sector transformation, Russia has adopted global best practices and achieved a degree of success in developing a robust national broadband infrastructure, extensive mobile penetration, and e-government service delivery, as well as in launching digital adoption in education, health care, culture, and social services. Barriers remain at the cross-agency level and in back-end government transformation, as well as in data management. There are also significant disparities at the level of regions and municipalities. Strong leadership is required to ensure enhanced cooperation between federal, regional, and municipal governments, as well as for the implementation of a data-driven GaaP approach for offering user-centric services. The transition to data-driven administration and the innovative use of emerging digital technologies such as data analytics, blockchain, IoT, and AI will accelerate the transformation to the next level of digital government in Russia and create the foundation for future technological breakthroughs.

Conversely, Russian business, with the exception of a few leading enterprises, is generally lagging in digital adoption, especially in the traditional sectors. Russia needs to adopt digital tools to strengthen the competitiveness of its key industry sectors while exercising a top-down approach to accelerate the transformation of the dominant state-owned enterprises (SoEs). Leveraging existing initiatives such as TechNet NTI and 4.0 RU for the development of a single digital industry strategy would help achieve industrial development objectives. Engaging the private sector in digital transformation partnerships, fostering connections with the scientific and research and development (R&D) community, ensuring cooperation among the key stakeholders in the digital industry ecosystem, prioritizing resources, and creating favorable taxation regulation to incentivize investments into digital technologies and R&D are all mechanisms that need to be used to maximize breakthrough opportunities.

Boosting R&D into new digital technologies and understanding their potential to transform traditional industries and create new ones should be high on the government and private sector agendas. Understanding the impact of emerging technologies on existing business models is key to gaining competitive advantage. The digital industry strategy should ensure a high level of coordination between industrial development objectives and digital transformation goals to accelerate the creation of clusters of innovative companies and new drivers of economic growth.

Digital innovation has also started **a revolution in agriculture**. In recent years, Russian agriculture has experienced significant growth and became a leader of Russian exports, as some large Russian agribusinesses started to drive the adoption of cutting-edge digital technologies in farming practices. In developing the Digital Agriculture Project to be included into the Russia Digital Economy Program, Russian policy makers should focus on encouraging broader adoption of digital technologies by large agribusiness farms as well as empowering small and medium farms to take advantage of digital tools to transform their business and service models. It is critical to focus on the digital

transformation of the entire agribusiness cluster that includes not only production but also storage, transportation, and logistics companies, financing and telecom service providers, the scientific community, venture capital (VC), machinery, biotechnology and chemical industry players, and others and use digital platforms and other tools to enable collaboration, gain access, and provide products and services to new customers and market segments regionally, nationally, and globally.

The services sector in Russia was generally faster to react to the opportunities inherent in digital adoption. E-commerce, digital marketplaces, and digital platforms have been growing rapidly, while some service sectors, notably Russian digital finance, have become global leaders.

Digital finance solutions underpin digital platforms and drive the transformation across the services sector. The Russian market for financial technologies has been experiencing rapid growth driven by the adoption of online payments and remittances characteristic of emerging economies, on the one hand, and the adoption of FinTech solutions for more mature markets such as insurance, lending, and investment management, on the other hand. The sector has also been an early adopter of cutting-edge technologies such as biometrics and blockchain and has been driving the adoption of a national digital ID system. Policy makers should further encourage innovation in this sector by adopting appropriate regulation and fostering partnerships in the digital finance ecosystem, including the public sector, regulatory agencies, FinTech companies, banks, and other financial organizations.

For more Russian companies to emerge as digital leaders on the global stage, support of innovation and digital entrepreneurship is key. Today it is supported by a number of government initiatives, yet weaknesses in the innovation ecosystem as well as a historical lack of an open innovation culture that respects entrepreneurs and encourages risk taking have led to stagnation in this space. VC investments have plateaued and the number of successful exits has declined in recent years. Improving the coordination between different policy instruments, incentivizing SoEs to drive demand for innovation, ensuring the predictability of the business environment, and internationalizing the Russian start-up ecosystem are necessary.

Specific policies should be implemented to **encourage innovation and entrepreneurship** in the digital transformation context. Sustainable innovation requires close coordination between the government, the private sector, and the academic community. The public sector should not only support fundamental research and drive the development of world-class R&D units in Russia but also implement policies to encourage the commercialization of R&D outputs, while the private sector should focus on go-to-market strategies and new business model development. An efficient regulatory system encouraging innovation should be further developed, with a special focus on intellectual property rights protection and patent regulation.

To accelerate the digital transformation of Russian business, policies should be aimed at the **development of a receptive domestic market that values the processes and outputs of digital transformation**. These include specific steps aimed at improving the local business climate and focused market development initiatives to boost local demand, especially through driving digital transformation of the large dominant state-owned enterprises (SoEs). Initiatives aimed at building the public's trust in the digital economy are also important.

Policy makers should also focus on ways **to leverage digital technologies to alleviate disparities in the development of Russia's regions and municipalities** and to enable the less-advanced regions to take advantage of and effectively localize the implementation of the national digital economy programs. Policies should focus on local digital skills development, management training, local public-private sector partnerships and innovation cluster building, local market development, and funding mechanisms. Special

attention should be given to the development of digital infrastructure in remote and rural areas and to educating rural populations about the benefits of digital services. There are several overarching takeaways from this study.

First of all, to prepare for digital disruption and to uncover opportunities for digital creation, policy makers around the world and in Russia need to **strengthen the non-digital foundations** of their economies by maintaining leadership focus on the role of digital transformation in achieving national performance objectives; ensure agility in revising regulation to address the rapidly changing needs of the new digital economy; and empower an ecosystem of decision makers, institutions, and organizations responsible for stimulating digital transformation and managing digital disruption.

Effective project management is also of the essence. Detailed road maps need to be developed and implemented in line with key strategy objectives and project portfolios prioritized to identify quick wins, as well as longer-term strategic initiatives. New governance mechanisms that engage all the key stakeholders in the decision-making and governance process should be introduced to accelerate the pace of transformation in line with stated goals. Budgets and financing mechanisms need to be firmly in place.

The dividends of building a competitive digital economy are high, and a high-level leadership focus on tightly targeted policies and flawless execution is required to accelerate the pace of this transformation.

Second, the government needs to continue to **strengthen the digital foundations** by preemptively investing into a scalable intelligent secure infrastructure capable of anticipating the exploding demand for the digital economy.

Third, it is about **strengthening the digital transformation ecosystem** both horizontally, across all sectors of the economy at the national, regional, and municipal levels, and vertically, throughout the sectors and subsectors of government, industry, and services.

Weak links between the government, private sector, research organizations, and academic institutions negatively affect the pace of digital transformation, the implementation of key government programs, the adoption of new technologies and business models, proactive responses to technological and economic disruptions and crises, and the speed of innovation. A strong and effective operational ecosystem is the foundation of the technological breakthrough envisioned by the Russian leadership.

Fourth, it is about **boosting digital skills**, as any technological breakthrough requires a **highly-trained workforce**. In spite of its traditional strength in theoretical science, the Russian education system is not sufficiently agile to respond to the digital transformation requirements in all economic spheres. Strengthening the training and education ecosystem, starting at the level of kindergarten and all the way up to higher education, including coordination between enterprises and educational institutions in higher education and R&D, is a must. So are investments into educational platforms for the rapid development of digital economy skills across the country and training and upskilling the existing workforce with a focus on learner-centric life-long educational models. Policy makers should also focus on reversing brain drain and attracting and retaining talent, as well as attracting the best and brightest back into the country.

And finally, it is about **cultural transformation**. As digital transformation breaks down barriers between sectors, regions, organizations, and individuals, it challenges traditional centralized hierarchical governance structures and requires a new culture of ongoing innovation. Key elements of this culture include open communication and knowledge sharing, horizontal cross-team collaboration and co-creation, proactive experimentation and problem-solving, risk taking, and the ability to translate failure into opportunity. Specific initiatives aimed at promoting a culture of open innovation should become a priority for Russian policy makers.

In summary, the ongoing Russian government commitment to digital transformation as a national priority, if complemented by effective policies across key economic sectors and a results-oriented focus on implementation, will enable the country to join the world's digital transformation leaders and position it for a technological breakthrough and the achievement of the economic and social benefits it implies.



DIGITAL ECONOMY IN RUSSIA: KEY RESULTS OF THE DIGITAL ECONOMY COUNTRY ASSESSMENT

Russia's ambitious vision for growth through breakthrough innovation, investments in national broadband infrastructure, relative strengths in science and technology, a developed legislative and policy framework, and a competitive cybersecurity industry position it to become a global digital leader. Yet, structural weaknesses in the digital transformation ecosystem, inadequate digital skills, restricted access to capital markets, and a lack of an open innovation culture constrain Russia's ability to achieve fundamental technological breakthroughs in the near term. Critical to Russia's midterm success are improvements in the transparency of its business environment, investment into digital skills, adoption of new technologies in key areas of competitive strength, and enhanced links among all the key stakeholders in the digital ecosystem, including the public sector, the private sector, and the scientific community.

In July 2017, Russia adopted the Russia Digital Economy Program with an expected **annual budget of US\$1.8 billion until 2025**³ to address the current weaknesses preventing the country from joining global digital economy leaders.

The program is quite comprehensive, **focusing on both analogue and digital foundations** of digital transformation and addressing the legal, technical, organizational, and financial aspects of this process. In preparing this program, its authors were able to draw upon international best practice in digital transformation.

They prioritized changes in the legal and regulatory framework; addressed key aspects of building digital skills, education, and research and development (R&D); proposed investments in digital infrastructure and cybersecurity; emphasized strict program management requirements; and proposed specific initiatives in e-government, smart cities, and e-health. Given the high priority assigned to this program at the most senior levels of government, along with the funding allocated through the federal budget, there are reasons to believe that if properly implemented, this program will allow Russia to make significant progress in its digital transformation process.

To gain a better understanding of the challenges that are likely to face the Russian government in implementing the Russia Digital Economy Program, in 2017, the World Bank in cooperation with the Institute of the Information Society (IIS) and other local partners in Russia conducted a Digital Economy Country Assessment (DECA) for Russia by doing the first global pilot of this holistic benchmarking tool being developed under the Digital Development Partnership initiative.⁴

3 Government of the Russian Federation 2017, "Digital Economy of the Russian Federation" program. Approved by the Federal Government on July 28, 2017, No. 1632. <http://government.ru/docs/28653/>, accessed July 5, 2018.

4 See <http://www.worldbank.org/en/programs/digital-development-partnership>, accessed July 5, 2018.

The approach to the DECA was based on the digital development vision initially presented in the World Bank's World Development Report 2016: Digital Dividends (WDR 2016).⁵ The report examined the socioeconomic effects of digital transformation—the digital dividends—and the conditions for achieving them.

The assessment focused on evaluating the key conditions for the development of a digital economy: its non-digital foundations; the use of digital technologies to transform key sectors of the economy and the society at large; and the impact of digital technologies on socioeconomic development in terms of economic growth, jobs, and quality of services. The assessment yielded several important findings (Figure 1.2).

5 World Bank 2016a.

BOX 1.1

DIGITAL ECONOMY COUNTRY ASSESSMENT METHODOLOGY

The DECA methodology is focused on assessing the existing level of digital economy development to determine the current maturity level of the digital economy in a country. The assessment helps identify key gaps, challenges, and opportunities for future growth as well as areas that require more careful analysis. The digital economy—the economy based on the development and use of digital technologies—is built on foundations that enable economic and social transformation (see Figure 1.1). It consists of:

- **Non-digital foundations**, including policy and strategic planning, leadership and institutions, regulatory framework, human capital, innovation, business environment, trust, and security, which provide the enabling environment within which digital transformation can occur;
- **Digital foundations**, including digital infrastructure, shared digital platforms, and emerging digital technologies; and
- **The digital sector** of the economy, comprising the ICT-sector and the content and media sector.

Digital transformation affects the public and private sectors of the economy, as well as society at large. Thus, the methodology includes the assessment of the:

- **Digital transformation of the public sector**, which includes digital and non-digital foundations, as well as the use of traditional and emerging digital technologies in the public sector;

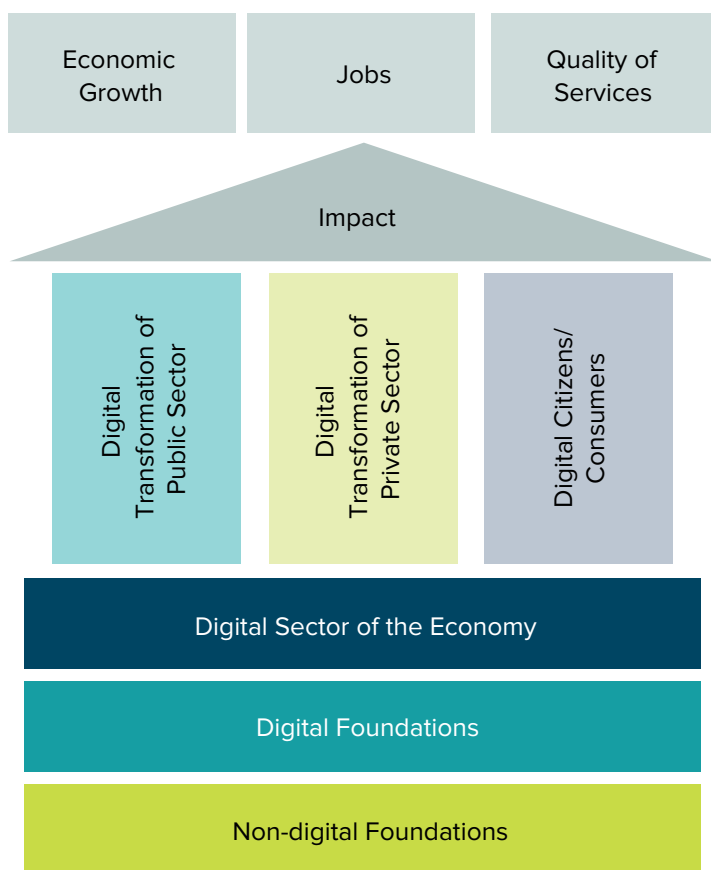
- **Digital transformation of the private sector**, consisting of digital and non-digital foundations, as well as the use of traditional and emerging digital technologies in the private sector; and
- **Digital citizens and consumers** addressing citizen access to and use of digital technologies for social and economic activities, including work, the purchase of goods and services, education, social networking, political participation, and so on.

Digital transformation has a significant **impact on economic and social processes**, primarily on economic growth, the labor market, and the quality of services.

Each subject area of the assessment is characterized by a set of indicators of two types—quantitative indicators (including those used by international organizations) and qualitative indicators that characterize important aspects of development, which do not have metrics. To determine the relative strengths and weaknesses and the focus areas for the digital economy development in a country, all the indicators are assessed on a five-point scale based on benchmarking of global international experience and best practices.

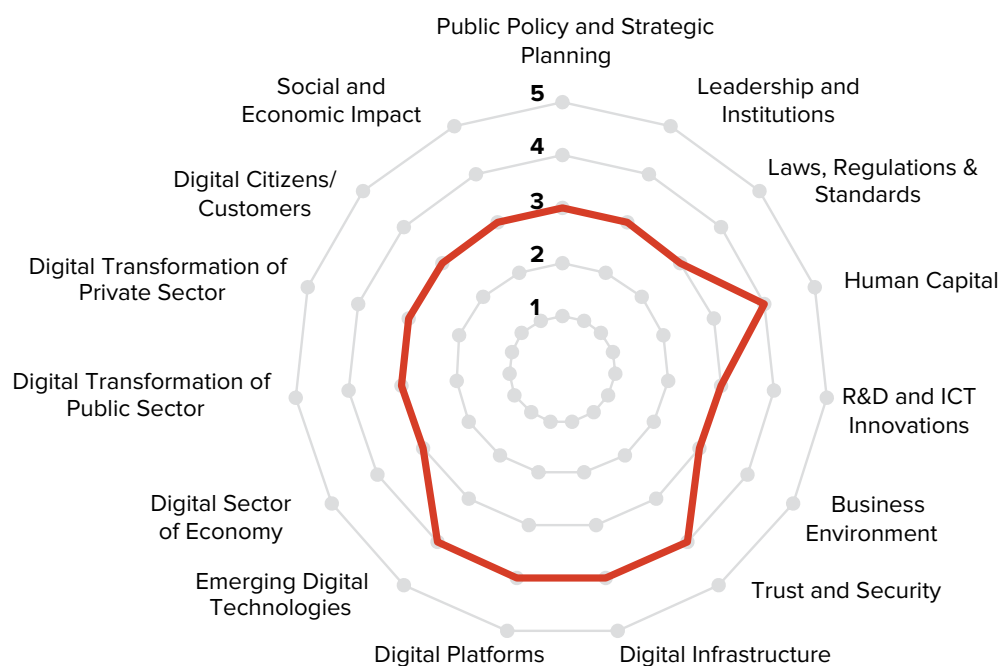
The DECA framework is designed following the “matryoshka doll” principle: a common set of indicators can be applied to an entire country, a region, or to a particular sector of the economy (for example, education or health care).

FIGURE 1.1 Digital Economy Country Assessment Framework



Source: World Bank 2017b

FIGURE 1.2 Russia's Digital Economy Assessment Summary



Source: World Bank 2017b

1.1 Non-Digital Foundations

PUBLIC POLICY AND STRATEGIC PLANNING

While Russia has developed a clear vision and strategy for its digital transformation and has set ambitious goals, more work needs to be done in devising detailed action plans and creating road maps for the implementation of this strategy.

More effort needs to be invested into optimizing the governance of this process (for example, creating strategic foresight units to improve agility) and into the development of monitoring and evaluation tools to assess the effectiveness of the implementation of the strategy.

It is also critical to develop a mechanism for ongoing engagement of all the key stakeholders in the transition to a digital economy and for ongoing coordination at the federal, regional, and municipal levels.

LEADERSHIP AND INSTITUTIONS

There is a very high level of leadership commitment to and responsibility for the acceleration of digital transformation in Russia, which was once again emphasized as a top strategic priority in the May 2018 Presidential Decree. The decree targets a threefold investment in the digital economy relative to 2017 levels. However, the commitment of the traditional enterprise and commercial sectors in digital transformation is not as strong. Incentives may be required to stimulate a more active adoption of digital tools and strategies by the business sector and the public at large.

LEGISLATION AND REGULATION

Hard work on Russia's legal framework in the last decade has led to the development of updated regulations on digital payment systems, digital infrastructure, and cybersecurity policy. Moreover, according to the 2016 World Bank Global Indicator of Regulatory Governance, Russia was ranked 4 out of 6 in transparency and general public inclusion in the legislative process.⁶ In 2018, Russia's top standard-setting agency, Rosstandart, ordered the expansion of responsibilities of the technical committee for standardization in "cyber-physical systems" to cover the Internet of Things (IoT), smart cities, big data, smart manufacturing, and artificial intelligence (AI).⁷ The May 2018 Presidential Decree emphasizes the need for a flexible approach in regulating digital adoption in different sectors of the economy. More work needs to be done in the area of protecting the rights of online users and in terms of regulation of digital transactions.

Another area for development is creating the mechanisms to stimulate the use of digital goods and services. Existing gaps in the regulations create barriers for the implementation of digital technologies in the private sector, which in turn slows down its digital transformation.

HUMAN CAPITAL

In terms of human capital, in 2016 Russia scored a fairly high 28th place out of 130 countries on the World Economic Forum (WEF) Index of Human Capital 2016.⁸ High international rankings in human capital development have been a reflection of Russia's strength in this area

⁶ World Bank 2016b.

⁷ Rosstandart 2017.

⁸ WEF 2016.

since Soviet times. Program for International Student Assessment (PISA) rankings in reading, science, and math skills remain high to this day. However, most current educational programs have not been updated in line with digital economy requirements, and training in digital competencies remains insufficient, so there is a lack of skilled digital economy graduates. Most educational programs have not been updated and do not provide for the development of core competencies in digital transformation.

RESEARCH AND DEVELOPMENT

Boosting innovation and R&D is a key objective that requires focused efforts to enable digital economy growth. While Russia has a reasonably well-developed innovation infrastructure, the innovation mentality and the institutional commitment to innovation are lacking. This is evident from a low overall share of R&D spending, low levels of enterprise R&D spending, low share of R&D in ICT spending, weak links between businesses and universities, insufficient research in the digital economy field, and low availability of venture capital (VC) resulting in few start-ups. A joint effort by the government, business leaders, and the scientific community is required to overcome the barriers to effective R&D, entrepreneurship, and innovation.

This situation is exacerbated by the continuing challenges in Russia's overall business environment. While the country was ranked 35 in the World Bank's 2018 Doing Business index,⁹ up from 53 in 2016 and 112 in 2013, some key challenges need to be addressed. For example, a relatively high total taxation rate impedes business innovation. In the WEF Global Competitiveness Report 2017–2018, Russia ranked 101, at 47.4 percent taxation¹⁰ (compared to 44 percent in the United States, 30.9 percent in the United Kingdom, and 21 percent in Canada). Access to new technologies remains limited, the protection of intellectual property rights is insufficient, the perception of corruption remains high, and judiciary independence is seen as low.

1.2 Digital Foundations

In the past years, Russia has focused on developing broadband access and has built a fairly strong and advanced digital infrastructure marked by a competitive telecommunications market, high rates of mobile penetration, affordable broadband, and a high level of cybersecurity (Figure 1.3). This infrastructure has enabled the growth of strong domestic and localized digital platforms and should now be used to launch 4.5 and 5G mobile networks to create a more efficiently distributed network of data centers, to develop local companies in the data analytics space, and to introduce new/emerging technologies such as the IoT, AI, robotics, and blockchain. The interest in the new/emerging digital technologies in Russia is very high, with Russian products starting to appear in the AI, blockchain, and robotics space.

More broadly, however, this interest has yet to translate into specific strategies, new products and services, commercialization models, and national projects that could bring Russia into a leadership positions in this field.

Investment into a globally competitive secure infrastructure to support the growth of a data-driven economy remains a top priority, as emphasized in the May 2018 Presidential Decree.

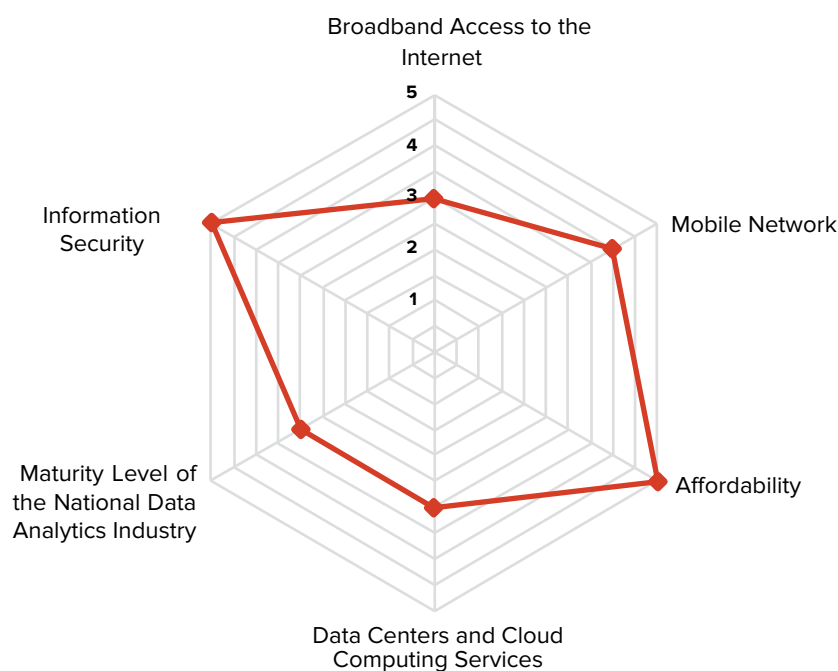
35th

Doing Business
2018

⁹ World Bank 2017a.

¹⁰ A combination of profit tax (% of profits), labor tax and contribution (% of profits), and other taxes (% of profits).

FIGURE 1.3 Russia's Digital Economy Assessment: Digital Infrastructure



Source: World Bank 2017b

1.3 Digital Transformation of the Different Sectors of the Economy

DIGITAL TRANSFORMATION OF PUBLIC ADMINISTRATION

In the development of digital government, Russia has achieved some successes in recent years, most notably an increase in the number of digital state and municipal services using the e-government infrastructure and an increase in the number of registered users (70 million as of March 2018¹¹) of the Unified Public Services Portal (Figure 1.4).

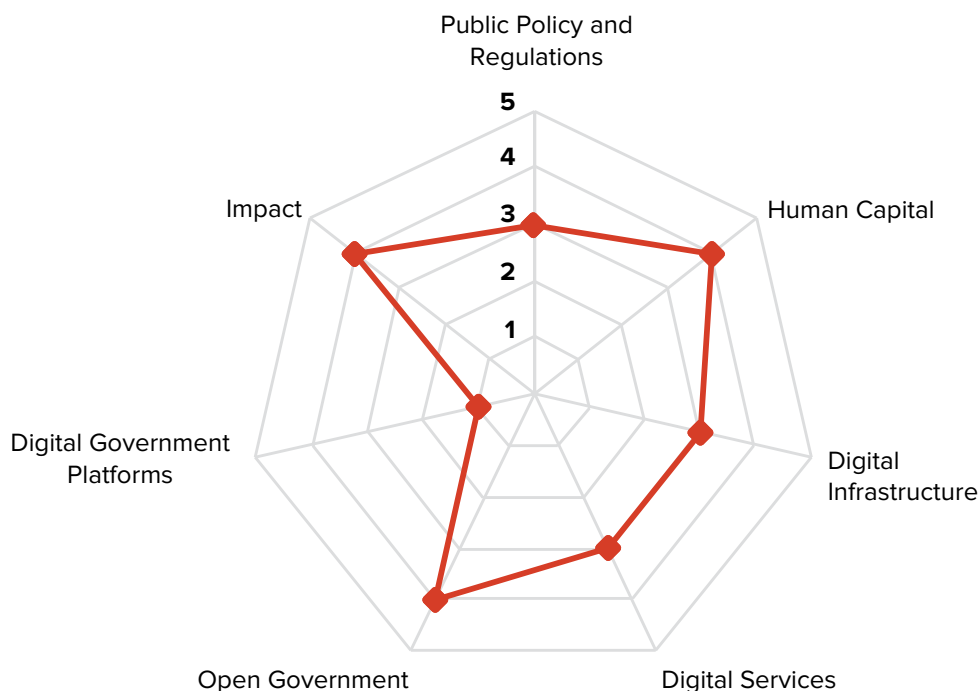
The impact of digital government implementation has been felt by citizens and corporate users alike and the former have reported particularly high levels of user satisfaction. Russia has also done well in setting the stage for open government. Disparities still exist in the use of digital technologies at the federal, regional, and municipal levels of government, with only 10 percent of local self-government organizations in line with national digitization requirements. To move to the next stage of maturity of digital development, a significant transformation of the current e-government architecture will be required, including the reengineering of administrative processes and the emphasis on the use of national databases, the sharing of digital services by local governments, and the provision of proactive digital government platform services for direct citizens and businesses interaction.

In cybersecurity, Russia is among the global leaders, ranking 10 in the 2017 International Telecommunication Union (ITU) Global Cybersecurity Index.¹² Still, two-thirds of Russian companies believe that in the last three years, the number of cybercrimes has risen by 75

¹¹ MinComSvyaz Rossii 2018.

¹² ITU 2017.

FIGURE 1.4 Russia's Digital Economy Assessment: Digital Government



Source: World Bank 2017b

percent,¹³ which suggests that cybersecurity should become a focus for the private sector as well. Also, further work is required to educate the public about cybersecurity threats as more Russians become active online.

DIGITIZATION OF SOCIAL SERVICES SHOULD BE HIGH ON THE GOVERNMENT AGENDA

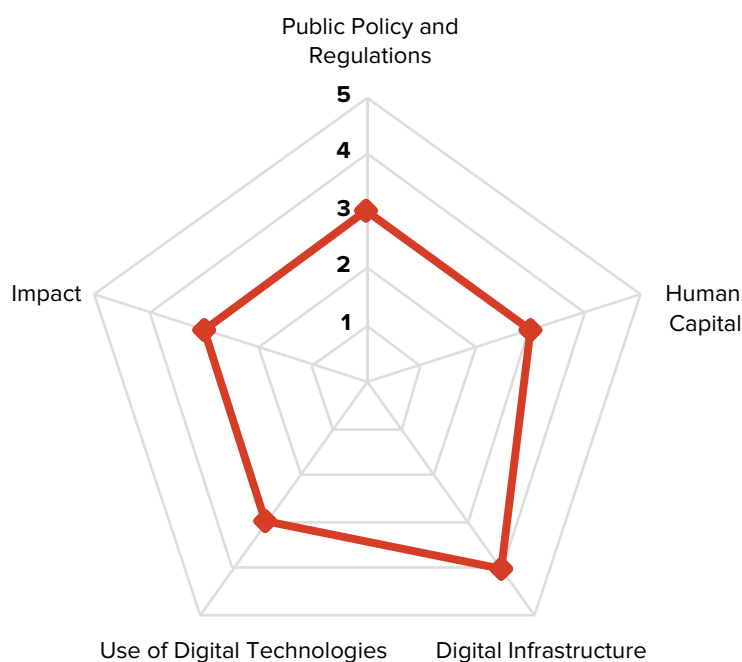
E-health implementation is still in its early stages. While the digital infrastructure required for e-health transformation is largely in place, and legislation has been adopted to enable the use of electronic medical records nationally as well as for providing telemedicine services, the use of digital and innovative technologies in health care remains low and requires further effort. There are also significant regional disparities in e-health adoption. While large cities are making progress, most of the country is still far behind.

In e-education, the digital infrastructure is also in place, available to educational institutions of all levels. There is a strong focus on training teachers and administrative staff in digital education skills and on creating new education materials and curricula. Digital education platforms are emerging, with more opportunities for course selection and personalization. Distance learning and digital exams and certifications are gaining popularity. The private sector is an active provider of a variety of digital education services, though the budget allocated to digital services in public educational institutions is low. Still more needs to be done in increasing the quantity, quality, and variety of online education content in line with the growing demands of the digital economy. The continuing lack of highly qualified teachers and trainers is yet to be addressed (Figure 1.5).

A lot has been done to develop a digital culture in terms of the use of digital technologies to transform arts and culture-related organizations such as libraries, museums, archives, and theaters. Here again, the digital infrastructure is in place, complete with the necessary

¹³ Government of the Russian Federation 2017, "Digital Economy of the Russian Federation" program.

FIGURE 1.5 Russia's Digital Economy Assessment: Digital Education



Source: World Bank 2017b

regulations and program documents. The digital transformation is taking place in a number of cultural institutions, with new databases and formats of interaction defined. Still, digital platforms in this field are underdeveloped, partly due to unresolved conflicts between copyright owners and ICT firms.

DIGITAL TRANSFORMATION OF THE PRIVATE SECTOR IS PROGRESSING SLOWLY

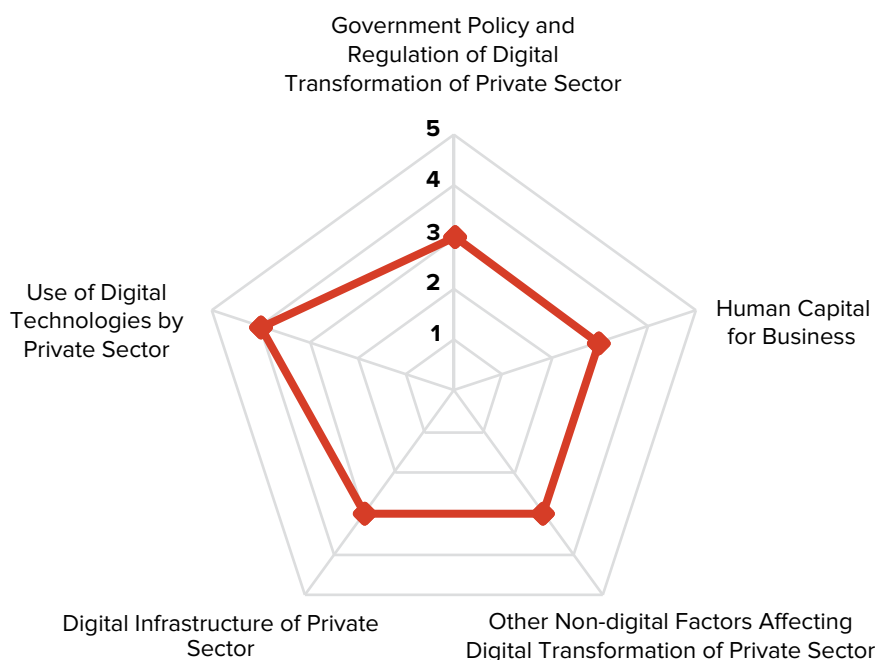
Apart from some automation initiatives, including the implementation of enterprise resource planning (ERP) systems in some large enterprises, there are few examples of digital transformation successes in the private sector. The government-led digital transformation has focused on top-down public sector digitization, while the private sector, for the most part, has suffered from a lack of relevant knowledge and management experience among enterprise managers and employees, as well as a lack of competitive pressures caused by a high degree of market consolidation in key sectors and high barriers to entry for new players. Private sector innovation is stagnating due to limited corporate R&D budgets and taxation regulations that do not provide incentives to invest in R&D. Links with the academic

BOX 1.2

DIGITAL EDUCATION PLATFORMS IN RUSSIA

In 2015, the “National Platform for Open Education” association, with the support of the Ministry of Education and Science of Russia, created the online “Open Education” platform linking the top 9 out of 814 Russian universities. Today there are more than 120,000 students attending 140 courses on this national platform for online training. In addition, there are several popular nongovernment digital educational platforms: the Lectorium (www.lectorium.tv), the Universarium (www.universarium.org), Uniweb (www.uniweb.ru), and so on. Leading Russian universities are also represented on global educational platforms like Coursera and EdX. Data analysis is widely used to monitor student progress.

FIGURE 1.6 Russia's Digital Economy Assessment: Digital Transformation of the Private Sector



Source: World Bank 2017b

community locally and internationally are weak, and little has been done to set industry standards for data analysis and integration (Figure 1.6).

These trends are observed across large emerging economies, notably the so-called BRICS. According to the World Bank's Digital Adoption Index,¹⁴ public sector transformation in Brazil, China, India, and South Africa (BRICS) is significantly ahead of digital technologies adoption by the private sector.

Despite the challenges the private sector is facing, there are enterprise leaders pioneering digital technologies in a number of sectors and competing with foreign players in their fields. Overall, according to the McKinsey, digitization-level assessment,¹⁵ ICT, education, and finance are ahead. But in key industrial sectors such as mining, manufacturing, transport, and agriculture, Russia is behind global leaders.

The e-commerce market is growing, despite the relatively underdeveloped logistics channels throughout the country and competition from cross-border players.

The national focus on digital transformation in Russia and the rollout of digital services has caused a rapid rise in the numbers of online users and the participation of the population in the digital economy. This is particularly visible in large cities, less so in rural areas. It is worth noting that there are no gender disparities relating to the utilization of digital services, and in the rural areas, women outnumber men in most areas of Internet use.¹⁶ More and more households enjoy broadband connectivity, including on mobile devices. Expert assessments point to a growing confidence of the Russian population in digital government, digital participation, the sharing economy, and the use of payment cards.

¹⁴ World Bank 2016a.

¹⁵ McKinsey 2017.

¹⁶ Rosstat 2016.

41st

reaping social and economic benefits from digital transformation

61st

impact of ICT on government efficiency

75th

impact of ICT on new forms of organization

88th

impact of ICT on accessibility of basic services

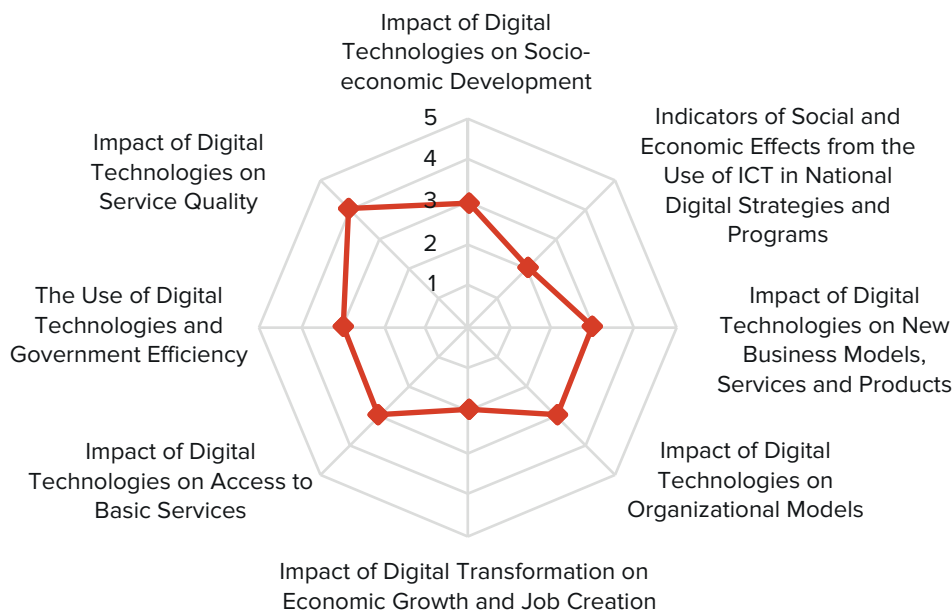
1.4 The Social and Economic Impact of Digital Transformation

In terms of the social and economic impacts of the transformation to the digital economy, Russia is beginning to experience certain benefits and gains (Figure 1.7). According to a composite subindex for impact assessment created from the WEF Network Readiness Index 2016,¹⁷ Russia ranks 41 on reaping social and economic benefits from digital transformation. The lowest rankings for Russia are on the impact of ICT on new business models, goods, and services (97th place), on accessibility of basic services (88th), on new forms of organization (75th), and on government effectiveness (61st).¹⁸ It rates higher on the impact of new forms of financial services related to digital technology (FinTech) developed in Russia, mainly due to two widely used products in the country: online payments and transfers of funds.¹⁹

In 2011–2012, both McKinsey and the Boston Consulting Group (BCG) estimated the contribution of the Internet to Russia’s economic growth to be between 1 percent and 2 percent.²⁰ The Economist proposed the existence of a “threshold effect,” whereby the use of ICT starts to positively influence economic growth after reaching a certain level of penetration of technologies into the economy and/or after a certain period.²¹

Given the ongoing discussion and lack of consensus to date among digital development academics and practitioners on ways and methodologies to measure the size of the digital economy and the impact of digital transformation, these rankings and calculations should be taken with a grain of salt.²²

FIGURE 1.7 Russia’s Digital Economy Assessment: Social and Economic Impact



Source: World Bank 2017b

17 WEF, Cornell University, and INSEAD 2016.

18 Ibid.

19 Ernst & Young 2016.

20 McKinsey Global Institute 2011.

21 Economist Intelligence Unit 2004.

22 Ahmad, Nadim, and Bachene 2016.

In 2015, McKinsey estimated that the share of the digital economy in Russia's gross domestic product (GDP) rose to 3.9 percent (compared to 8.2 percent in the European Union (EU), 10 percent in China, and 10.9 percent in the United States),²³ whereas BCG suggested 2.1 percent²⁴ — a significant increase over five years, yet still not on par with global leaders. Russia's business climate shortcomings continue to negatively affect potential digital dividend gains. Moreover, given the reliance of the Russian economy on oil and gas, economic growth is strongly affected by fluctuations in global oil prices that may overshadow the measurement of a smaller digital economy. Yet, that share is growing, and BCG predicts that by 2021 the share of the digital economy in Russian GDP will reach 5.6 percent.²⁵

CONCLUSIONS AND RECOMMENDATIONS

In summary, the DECA analysis results (Figure 1.2) confirmed the World Bank's earlier assessment of Russia as a country that is transitioning to a digital economy, having created a solid platform for the digital leap in terms of both non-digital and digital factors. It has built on its traditional strengths such as human capital, scientific excellence, strong leadership, and security, while its recent focus on digital infrastructure, strategic planning, and regulation has started to pay off. However, the digital transformation of the public sector (government, education, health, and culture), especially the transformation of business through the application of digital technologies, needs to be accelerated. R&D, innovation, and entrepreneurship are underdeveloped by global standards. Adoption of digital technologies by the general public outside the large cities is quite low. All of these may explain the lack of significant quantifiable social and economic effects—the digital dividends—from the digitization process.

The work ahead requires specific policies and steady dedication to accelerate the pace of private and public sector transformation; raise public awareness of the use of digital technologies, to foster links between the scientific community and private and public sectors; and focus on developing a business climate conducive to innovation, R&D, and entrepreneurship—all of which are key elements of a digital economy culture now in short supply in Russia. Improving the regulatory and taxation environment, boosting investment in innovation, and fostering entrepreneurship should become top policy priorities.

ASSESSING DIGITAL ADOPTION AT THE REGIONAL LEVEL

To join global digital leaders, it is critical for Russia to address the disparities in digital adoption at the regional level, which could slow the progress of its digital transformation. Differences in the economic development of the different parts of the Federation are likely to be reflected at the digital level too.

To better understand the challenges Russian regions are facing in implementing digital transformation, the World Bank has conducted a **Digital Economy Assessment (DECA) of the Ulyanovsk Oblast of Russia** by applying the same methodology principles used in the assessment of Russia at the national level. This was the first global pilot of the DECA at the subnational level.

²³ Digital McKinsey 2017.

²⁴ BCG 2016.

²⁵ See <https://www.bcg.com/en-ru/d/news/17oct2017-digital-economy-174478>, accessed July 16, 2018.

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Russia has built on its traditional strengths such as **human capital, scientific excellence, strong leadership and security**, while its recent focus on digital infrastructure, strategic planning, and regulation has started to pay off

BOX 1.3

THE ULYANOVSK OBLAST OF THE RUSSIAN FEDERATION

The Ulyanovsk Oblast is located in the heart of the Volga region, in the southeast of European Russia. It has a population of 1.3 million and an area of 37.2 km²—0.22 percent of the Russian territory. Its location at the heart of the Volga federal region puts it advantageously at the crossroads of transport and logistics links between the Volga region and Europe, Central Asia, China, and the Middle East. Industrial development historically focused on mechanical engineering, hosting Europe's largest aircraft factory, Aviastar-SP, and the Ulyanovsk car factory, which traces its roots back to World War II with the production of the UAZ off-road vehicles. In 2018, Ulyanovsk announced a plan to open a competence center for unmanned systems set in the "Ulyanovsk-Avia" cluster. The fifth International Air Transport Forum will be held in Ulyanovsk in August 2018.^a

The region is also active in tool making and machine tools, as well as textiles, food processing, construction, woodworking, and forestry. A nuclear innovation cluster has been created in the city of Dimitrovgrad. Innovation in Dimitrovgrad and at Ulyanovsk Avia has led to the formation of the region's Innovation Cluster that made it to the national list of the top 11 advanced development territories of the country. Industrial development zones and special economic zones have been established to attract investment by Russian and foreign companies. More recently, the city has adopted a smart region development program aimed at transforming the region by using digital technologies.

^a Agreement of the AERONET Association with Ulyanovsk Oblast; see https://aeronet.aero/news/2018_04_09_ulyanovsk_agreement, accessed June 5, 2018.

98.9%

users satisfied
with online
government
service

The regional government's commitment to driving digital transformation and attracting investment has translated into a relatively well-developed digital infrastructure, a competitive telecommunications market, high mobile penetration rates, affordable broadband access, and high user awareness of cybersecurity issues. Municipal services are provided electronically, and 98.9 percent of users are completely or partially satisfied with online government services.²⁶ The region also has a reasonably well-developed infrastructure for innovation: it ranks 16 out of all Russian regions and is among the most innovative regions in Russia and the share of R&D expenditure in the gross regional product (GRP) is quite high.²⁷ **The region's government lends strong support to the development of the digital sector of the economy, specifically encouraging small and medium enterprises (SMEs) and offering taxation and other preferences to the ICT sector.** The region was among the first in Russia to do this. As a result, 3.3 percent of the local workforce is employed by the region's almost 200 ICT companies (compared to 2 percent in the ICT sector in Russia overall).²⁸

16th

among the
most innovative
regions in Russia

Nevertheless, despite the relatively well-developed infrastructure, there is a lack of innovation in traditional industry and few start-up successes. Persistently weak links within the innovation cluster may be a cause, with insufficient communication and few partnerships between businesses, the R&D scientific community, the public sector, and other players. The business environment, which is reflective of Russia's general business climate challenges such as corruption, limited access to new technologies, and insufficient protection of intellectual property rights, is also a constraint. In line with the general trend in Russia, emerging technology services such as cloud computing and data analytics are underdeveloped.

3.3%

employed in ICT
(overall in Russia
– 2%)

In terms of private sector transformation, the situation is also reflective of that in Russia, as examples of digital transformation leadership in the private sector and of resulting changes in business models are limited to a few individual enterprises. Moreover, the share of enterprises engaged in innovations related to digital transformation is half the Russian average, although the share of business expenditure on R&D is more than double the Russian and even global average. This should be cause for concern and a call to action for

²⁶ Estimates provided by the government of the Ulyanovsk Oblast.

²⁷ Gokhberg, L. 2016.

²⁸ Expert RA 2016.

BOX 1.4

DIGITAL TRANSFORMATION IN THE KALUGA OBLAST

The Kaluga Oblast has positioned digital transformation at the heart of its economic development strategy whose goal is to create an economy driven by digital technologies and digital services in all the key areas of production, as well as in education, health care, and urban management. Regional business should also be actively engaged. The region intends to focus on developing an appropriate legislative framework, defining its competitive advantages, and selecting the priority areas for digital transformation. The northern areas of the region and the city of Obninsk—the first science city in Russia—will become the testing ground for rolling out key digital transformation projects.

Source: See <https://www.techcult.ru/technology/4929-regiony-gotoviyatsya-k-cifrovomu-budushemu>, accessed June 6, 2018.

the region's leaders, who possess sufficient authority to formulate policy and implement meaningful reforms without waiting for solutions from the federal level.

As elsewhere in Russian regions, a shortage of ICT specialists and of ICT training is a key factor holding back the digitization of the Ulyanovsk Oblast. This is another issue that can be addressed locally, without waiting for a solution at the federal level.

As the case of Ulyanovsk Oblast demonstrates, the impact of digital transformation may be more tangible at the regional than at the national level. Today, **100 percent of doctors have access to online medical information, 25 percent of students have used distance learning courses to improve their qualifications, and the rate of growth of the digital sector of the economy is five times higher than that of the real economy of the region.** In terms of social dividends, Ulyanovsk is already ahead of the national Russian impact, according to statistics related to the provision of basic services (medical, educational, financial, and so on).²⁹

CONCLUSIONS AND RECOMMENDATIONS

The Ulyanovsk DECA results (Figure 1.8) are broadly in line with the World Bank's findings in the Russia DECA, and the differences, especially with respect to weaknesses, are indicative of the situation at the regional level across Russia.

Overall, both the digital and non-digital foundations required to succeed in the digital transformation process of the region are in place. In Ulyanovsk, the commitment of the region's leadership to digital transformation is perceived as even higher than at the national level, as is the strength of public policy and strategic development plans.

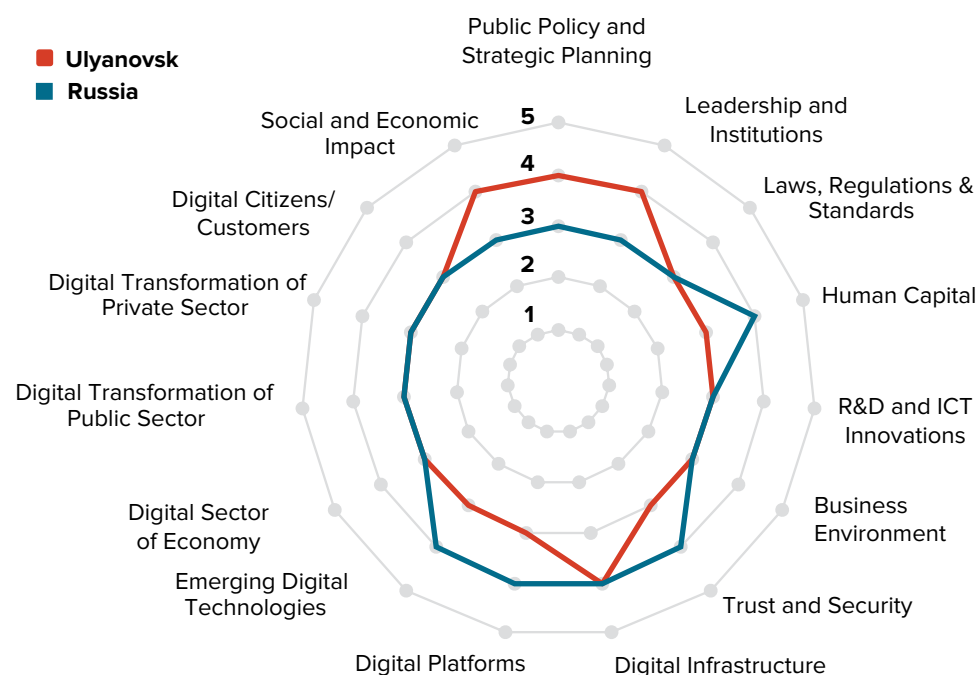
More work needs to be done to overcome the challenges posed by the business environment and to address the digital literacy and skills gap of the population. It is critical to find ways to **counteract the brain drain** from the region and raise and attract qualified personnel, as well as to **build trust** in the digital economy and **encourage the public to actively engage in economic activity online**, through shared digital platforms, digital content creation, and other digital mechanisms.

Specific incentives are required to accelerate the back-end digital transformation of public and private sector entities and to encourage innovation. The government, business, and nonprofit sectors in the region will have to work closely together to overcome these challenges and achieve further dividends inherent in digital transformation success.

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Commitment of the region's leadership to digital transformation is perceived as even higher than at the national level

²⁹ World Bank 2017c.

FIGURE 1.8 Results of DECA in Russia versus Ulyanovsk Oblast



Source: World Bank 2017c

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DIGITAL ECONOMY TODAY: GLOBAL TRENDS, TECHNOLOGIES, AND POLICY IMPLICATIONS

The spread of disruptive technologies such as the IoT, data analytics, quantum computing, AI, robotics, blockchain, and so on transforms business models and challenges policy makers to find ways to maximize social and economic gains at the regional, national, and global levels. Policies should focus on creating an enabling environment for innovation and on devising mechanisms for effective governance, strategic future planning, and institutional agility supported by a flexible legal and regulatory framework. Global best practice emphasizes the need to catalyze digital innovation across the economy by strengthening the innovation ecosystem, balancing stimulation and competition policies, ensuring the availability of funding, and building new skills for the digital age while ensuring adequate protection of national security, personal privacy, consumer interests, and intellectual property rights.

2.1 The Rise of the Digital Economy

The digital economy is rapidly transforming countries, regions, and continents. The use of digital technologies, tools, and data is dramatically changing traditional business practices and service delivery across all sectors. Extending far beyond e-commerce, the digital economy now permeates all aspects of society, changing the way people live, work, interact, make decisions, learn, and play.

Digitally advanced countries have taken full advantage of the power of the digital economy to drive inclusive economic growth, enhance the productivity of traditional sectors, expand and diversify trade, and create new services and markets. WDR 2016 identifies three mechanisms through which digital technologies affect economic growth: inclusion, efficiency, and innovation.³⁰ Digital technologies promote inclusion by enabling companies, including SMEs, to expand trade. They increase efficiency by helping companies make better use of capital and labor. New technologies enhance innovation and intensify competition by enabling companies to exploit scale effects through online platforms and services that compete with conventional business models.

Disruptive technologies such as the IoT, additive manufacturing, AI, blockchain, quantum computing, robotics, 3-D printing, drones, and cryptocurrencies are used to create innovative solutions in transportation, financial services, manufacturing, education, health care, agriculture, retail, media, entertainment, and other sectors. Big data analytics is becoming a source of competition, productivity growth, innovation, and consumer surplus.

New business models are disrupting traditional industries. Horizontal platforms are eliminating insufficiently agile players. Consumer-to-consumer transactions through online platforms, websites, or apps have spurred a new “sharing” economy. The so-called “gig” economy is transforming the labor market as more individuals break away from traditional lifelong jobs

³⁰ World Bank 2016.

How do we regulate when the technology has come and gone in 5–7 years?



to take advantage of remote working, short-term, and temporary positions where they act as independent contractors.

As WDR 2016 shows, countries that couple investment in cutting-edge technologies with strong leadership, a favorable business environment, a creative workforce, and the ability to foster a culture of innovation can reap digital dividends in the form of faster growth, jobs creation, and better services. With the appropriate enabling environment, digitally advanced organizations are reinventing operational processes, using new business models, and delivering innovative and personalized experiences to customers.

Change is often driven by the public sector. For example, the Chinese government plays an active role as a supporter, investor, developer, and consumer of digital technologies allowing digital players to experiment before enacting official regulation. The result—a rapidly growing digital economy in China (Box 2.1). Conversely, weakness in leadership, policy, regulatory frameworks, and institutional and human capacity leads to a lack of impact of digital innovation, when investments do not result in boosted growth and productivity or in reduced inequality in economic and social development.³¹

New and disruptive technologies will continue to develop, and the challenge for policy makers is to continuously address this accelerating pace of change.

³¹ World Bank 2016.

BOX 2.1

BOOSTING THE DIGITAL ECONOMY IN CHINA

China's double-digit GDP growth in the mid-2000s was fueled by even faster growth in the flow of goods out of the country. As exports surged from US\$257 billion in 2000 to US\$2.4 trillion in 2016, China became the world's top exporter. China now has the world's largest e-commerce market, accounting for more than 40 percent of the value of worldwide e-commerce transactions.

In 2016, China had 731 million Internet users, more than the EU and the United States combined. It also became a major global force in mobile payments, with 11 times the transaction value of the United States. The share of digital payments in China is 68 percent, compared to just 15 percent in the United States. Available, affordable, and easy-to-use digital tools facilitate rapid adoption of innovation by Chinese consumers and make Chinese digital players and their business models competitive. One in five Internet users in China relies on mobile only, compared to just 5 percent in the United States.

China has one of the most active digital investment and start-up ecosystems in the world. One in three of the world's 262 unicorns (start-ups valued at over US\$1 billion) is Chinese. The digital ecosystem is now spreading beyond giant companies such as Baidu, Alibaba, and Tencent (BAT), eliminating inefficient and fragmented offline markets. The BAT companies have been developing a multifaceted and multi-industry digital ecosystem that touches almost every aspect of consumers' lives. The functionality offered by their "super apps" has increased about seven times since 2011. In 2016, BAT provided 42 percent of all VC investment in China. Other digital innovators and traditional players are rapidly building their own ecosystems, taking advantage of close links to domestic hardware manufacturers, such as, the producers of connected devices in the Pearl River Delta industrial hub.

The Chinese government initially gave digital players space to experiment, before enacting official regulation. Now it plays an active role in building world-class infrastructure to support digitization as an investor, developer, and consumer. Recognizing the catalyzing power of cutting-edge technologies, China became a leader in public and private VC investment in virtual reality, autonomous vehicles, 3-D printing, robotics, drones, and AI. As its capacity for innovation deepens, China has become one of the leading global hubs for AI development. Recognizing that the nation's vast population and diverse industry mix can generate very large volumes of data and drive demand for innovation, China's biggest tech companies are making significant R&D investments in AI.

The public is becoming increasingly aware that today “there is a mismatch between the change in the pace of change and our ability to develop the learning systems, training systems, management systems, social safety nets, and government regulations that would enable citizens to get the most out of these accelerations and cushion their worst impacts... if it is true that it now takes us ten to fifteen years to understand a new technology and then build out new laws and regulations to safeguard society, how do we regulate when the technology has come and gone in five to seven years? This is a problem.”³²

To realize the full potential and transformative power of disruptive digital technologies, governments should identify the trends with the greatest potential for economic impact. To leapfrog, the focus should be on creating an enabling environment with an adequate legal and regulatory framework and fostering agile institutions. Leadership should be strengthened at all levels of government. New partnerships, funding mechanisms, and incentives for the business community to innovate should be explored. Building digital skills and nurturing and retaining digital talent should be a top government priority.

At the same time, effective policies should be adopted and implemented to guarantee data privacy, cybersecurity, consumer protection, and intellectual property rights and to address ethical issues arising from digital disruption.

2.2 Disruptive Technologies as Drivers of the Digital Economy

Digital technologies are becoming a powerful catalyst of inclusiveness, linking companies, customers, communities, professionals, and the general public. Today, people everywhere rely on mobile communications, Internet access, and social media to interact, learn, access services, and even share assets. Governments and businesses in many countries favor online channels for cost-effective delivery of services, marketing, and doing business. However, technology trends are changing rapidly.

Some illustrative examples of opportunities as well as risks and challenges for policy makers caused by digital disruption are presented in the following paragraphs.

LEVERAGING OPPORTUNITIES OF THE INTERNET OF THINGS

According to a recent World Bank report on IoT,³³ governments and businesses around the world have already begun to use connected devices to tackle global development challenges and solve problems such as pollution, road safety, urban transportation, and energy conservation. Innovative IoT solutions include sensors mounted on lampposts that measure and share environmental or pollution data, GPS devices that track and provide real-time updates on transit, and smart meters that monitor energy consumption.

Moreover, the Industrial Internet of Things (IIoT) is giving rise to the next generation of industry, as universal wireless connectivity, cloud computing, cheap sensors, and AI are combined with data analytics to transform industries such as manufacturing, energy, mining, and transportation in digitally advanced countries. IIoT adds a new layer of technology that helps optimize operations, track and analyze equipment, implement predictive maintenance, interpret massive amounts of data, and make real-time decisions that were not possible before.³⁴

³² Friedman 2016.

³³ Lal Das et al. 2017.

³⁴ Desjardins 2018.

BOX 2.2

DUBAI ROADS AND TRANSPORTATION AUTHORITY

IoT has been used to reduce traffic congestion in Dubai. In 2014, the Dubai Roads and Transportation Authority (RTA) created 29 smart transport initiatives, ranging from smart bus stations to journey planners to building the city's ability to optimize transport, streamline services, and improve the lives of its residents using IoT. Among the initiatives is a smart parking system that identifies open spaces in real time. Using a network of 2,000 sensors installed in public parking, multilevel lots, and shopping malls, motorists can use an app to locate open slots. Since Siemens estimates that the search for parking is the cause of as much as 40 percent of all inner-city traffic worldwide, this initiative reduces congestion while saving drivers' time.

Sources: See <http://www.nedapmobility.com/news/rt-unleashes-smart-parking-project-in-dubai>, accessed July 16, 2018; Siemens AG 2011.

DIGITAL TWINS: MERGING THE PHYSICAL AND VIRTUAL WORLDS

By 2020, there will be more than 21 billion connected sensors and endpoints, creating digital twins for billions of things.³⁵ Digital twins are a recent phenomenon with important applications for business, industry, and government. Digital twins are a complete digital representation of individuals, objects, places, or processes and can be used to reconstruct, simulate, test, and predict real-world behavior, performance, and products. Created through IoT, smartphones with sophisticated cameras, and advances in augmented, virtual, and mixed Reality devices and applications, digital twins are increasingly high-fidelity digital representations of the real world. They increase agility, reduce time to market and production costs, and dramatically improve the efficiencies of supply and production chains.

More and more industries and businesses in digitally advanced countries are taking advantage of the opportunities created by digital twins. For instance, Siemens (Germany) has integrated digital twins into manufacturing processes, including simulations of products, manufacturing process, and maintenance, enabling virtual verification before manufacturing begins.³⁶ General Electric (USA) is also among the earlier adopters, exploiting digital twins in production³⁷ to operate on its Internet operating platform, Predix—an open community of partners and systems integrators.³⁸

There are also early public sector adopters of digital twin technology. Singapore has announced the “Virtual Singapore” program in 2014. With a budget of US\$73 million and a tentative launch date of July 2018, the program is being implemented collaboratively by the National Research Foundation, the Prime Minister's Office, and the Land Authority.³⁹ A 3-D digital twin of the city will be used for virtual experimentation, modeling, and simulation of crowd dispersion in case of emergency evacuation, as well as for R&D, planning, and decision making. The digital twin will be available to government agencies, businesses, the research community, and the public.

Like many other disruptive technologies, IoT and digital twins are at the early stages of incorporation into government services. To leverage the full potential of IoT, governments should strengthen the legal and regulatory environment to ensure privacy, security, and the appropriate use of data collected from connected devices and develop business models to sustain the required high-capacity infrastructure. Managing disruptive technologies requires superior managerial and technical skills both in the public and private sectors.

\$73
million

for “Virtual
Singapore”
program

35 Pettey 2017.

36 Siemens AG 2017.

37 GE 2018.

38 Internet of Things Institute 2018.

39 Singapore NRF 2018; GovTech Singapore 2017.

TRANSFORMING TRADITIONAL SECTORS WITH BLOCKCHAIN TECHNOLOGIES

Blockchain is another disruptive technology that is beginning to transform industries, reconfigure financial processes, and create new markets. Blockchain is a type of distributed ledger technology (DLT) that is a cryptographically secure, decentralized, distributed, tamper-resistant ledger. Along with other DLTs, blockchain has the potential to reduce costs across global value chains.

Recognizing the benefits of blockchain, the Dubai government recently announced a comprehensive blockchain strategy to help its agencies run more securely and efficiently, with projected savings of US\$1.5 billion per year.⁴⁰ Estonia developed a scalable blockchain solution to protect the integrity of data stored in government repositories against cyber threats.⁴¹ In 2016, the Estonian E-Health Foundation launched a development project using blockchain as an additional layer of security to help ensure the integrity of patient health records.⁴²

One of the most interesting blockchain applications is emerging in the area of land registries. Over the last few years, pilots have been conducted in Russia (Rosreestr), the city of Dubai (ERES/ConsenSys), Georgia (Bitfury), Ghana (BenBen), and Sweden (Chromaway) to test blockchain technology's applicability in the land sector.

Blockchain solutions challenge traditional business and government models. As a DLT, it can operate without the need for a central authority, partially or entirely replacing the authority of the government in identity authentication, certification, land titles issuance, health records storage, social security benefits management, and voting and civic participation management.⁴³ For a blockchain-based solution to work effectively, other "off chain" issues need to be kept in mind. Policy makers and regulators should establish an appropriate framework to ensure the security of private blockchains. In addition, adequate capacity should be built to promote the understanding of blockchain advantages and disadvantages, manage data storage (particularly ownership history), and address issues of customary ownership and legal recognition of blockchain transactions.

40 Dubai Blockchain Strategy 2016, see <https://smartdubai.ae/en/Initiatives/Pages/DubaiBlockchainStrategy.aspx>, accessed July 10, 2018.

41 See <https://e-estonia.com/solutions/security-and-safety/ksi-blockchain/>, accessed July 10, 2018.

42 See <https://e-estonia.com/blockchain-and-healthcare-the-estonian-experience/>, accessed July 10, 2018.

43 IFC 2017.

BOX 2.3

DUBAI REAL ESTATE BLOCKCHAIN

The Dubai Real Estate Blockchain links the Dubai Land Department (DLD) with other government agencies (for example, utilities), commercial banks, developers, and brokers to create a one-stop-shop solution for citizens and businesses, thus increasing the security and transparency of records and transactions and providing accurate real-time real estate information in a market that is worth close to US\$75 billion. As of March 2018, the DLD platform has already placed 0.5 million titles and 1.5 million records on the blockchain. Additionally, roughly 250 titles are created daily on the blockchain. The DLD is planning to launch services that are based on smart contracts or self-executing programs encoded on a blockchain that are triggered once predefined requirements or conditions are met. The DLD's planned services include smart checks for payments, smart mortgages integrated with smart sale contracts and commercial banks, and smart escrows to oversee real estate transactions while reducing the risk taken by transacting parties.

DISRUPTIONS BY ARTIFICIAL INTELLIGENCE

AI systems such as robots, autonomous vehicles, computer vision, natural language processing, virtual agents, and machine learning are increasingly used to deliver benefits in retail, electric utilities, manufacturing, health care, and education. AI can help improve forecasting and sourcing, optimize and automate operations, develop targeted marketing and pricing, and enhance user experience. The most promising applications of AI are machine learning and deep learning, where algorithms are created and iterated from a collection of data. Accenture estimates that AI uptake can double economic growth rates by 2035.⁴⁴ Recognizing the tremendous opportunities of AI, digitally advanced countries are investing in AI R&D, with China taking the lead in this space.

Public sector applications of AI are growing worldwide. Early experiments used AI to make government agencies more efficient, improve public servant job satisfaction, and increase service quality. Governments are using AI, for example, to make welfare payments and immigration decisions, detect fraud, plan new infrastructure projects, answer citizen queries, adjudicate bail hearings, triage health care cases, and establish drone paths.⁴⁵ The potential benefits of AI are perhaps greatest in health care, given AI's ability to discern patterns in the vast amount of data generated by patient analysis, R&D, retailers, and caregivers. For example, IBM Watson for Oncology is a cognitive computing system that uses deep learning technology to read health care data and help identify individualized treatment options.⁴⁶ McKinsey Global Institute estimates that optimizing innovation, improving research and clinical trial efficiency, and developing new tools to individualize treatment could generate up to US\$100 billion revenue a year in the United States alone.

44 See <https://www.accenture.com/us-en/insight-artificial-intelligence-future-growth>, accessed July 10, 2018.

45 Martinho-Truswell 2018.

46 <https://www.mskcc.org/about/innovative-collaborations/watson-oncology>, accessed July 10, 2018; MSV 2017;

BOX 2.4

FORMULATING A NATIONAL STRATEGY IN ARTIFICIAL INTELLIGENCE IN FINLAND

Finland has prioritized AI as a source of national competitiveness and has created a plan to accelerate AI adoption^a:

- Enhancement of business competitiveness through the use of AI: Reduce the threshold for innovation through long-term investments in ecosystems, while creating incentives for enterprise-driven AI.
- Effective utilization of data in all sectors: Create a clear legislative framework for the availability of data, including opening up the Finnish MyData network of citizen data.
- Ensure AI can be adopted more quickly and easily: Apply the accelerator model to AI by ensuring an enabling environment and a simple process to pilot products.
- Ensure top-level expertise and attract top experts: Create centers of excellence for AI, while investing in AI education, including a Master of Artificial Intelligence degree program.
- Make bold decisions and investments: Fund AI research and innovation and enable AI research networks.
- Build the world's best public services: Leverage AI in public services delivery and in interagency communication.
- Establish new models for collaboration: Enhance public-private collaboration and adopt AI legislature.
- Make Finland a frontrunner in AI: Position Finland as a global AI knowledge leader and influencer through leveraging its advanced digital infrastructure and strong innovation ecosystem.

a. See <https://aiera.fi>, accessed July 10, 2018.

Policy makers should prepare for the next wave of AI growth. As McKinsey highlighted in its recent study,⁴⁷ many of the challenges of AI are global in nature, but the implications for specific governments vary across countries. Concerns about ethics, morality, values, potential risks of labor disruption due to automation, algorithmic bias, privacy concerns, and security have all been identified as fundamental issues by the WEF.⁴⁸

GROWING DEMAND IN QUANTUM COMPUTING

Quantum computing is among the most far-reaching and challenging of disruptive technologies. Through quantum computing, machine learning could scour enormous datasets of video or audio, find new ways to isolate risk and improve financial models, simplify complex chemical reactions to yield new biomedical innovation and research, and analyze supply chains to optimize shipping routes or logistics processes and eliminate bottlenecks and delays.⁴⁹ It can also be used to solve very large prime numbers needed to develop bulletproof cryptography or decipher highly encrypted communications.⁵⁰

Quantum computing has been hailed as an industry changer, offering unfathomable computing power and opening the door to new applications through quantum effects.⁵¹ The first company to sell a commercially available quantum computer was D-Wave Systems, a Canadian firm backed by Public Sector Pension Investment Board (PSP) Investments, Goldman Sachs, NSA, and Jeff Bezos. Major tech companies such as Google, Microsoft, and IBM have now entered the field. Google tested the D-Wave Systems in 2013 but is concurrently developing its own quantum system. Microsoft set up Station Q at the University of California, Santa Barbara, to research topological quantum computing. IBM has made quantum computing available on its cloud since 2016 and developed both a machine capable of breaking the barrier between quantum computing and traditional supercomputing and IBM Q, a division developing quantum computing for commercial and scientific uses.

At the same time, governments in various countries have started investing considerable resources in quantum computing. For instance, the EU's Future and Emerging Technologies (FET) program was launched to promote quantum technologies aiming to transform Europe's academic achievements into competitive advantage.⁵² Recently the Chinese government has built a 2,000 km link between Beijing and Shanghai to test quantum cryptography. A public-private sector partnership between technology titan Alibaba and the Chinese Academy of Sciences is developing a quantum computing prototype of 50 to 100 qubits by 2030.⁵³

2.3 The Data Revolution

Data fuel the growth of the digital economy, where they are constantly produced by sensors, mobile devices, digital cameras, social networks, digital platforms, and so on. Data have grown exponentially in recent years.⁵⁴ The United Nations (UN) describes high-quality data as “the lifeblood of decision-making and the raw material for accountability.”⁵⁵ Data management transforms business models through increased personalization of services and products, communication, asset sharing and collaboration, and usage-based pricing.⁵⁶ The explosion of data requires new ways of data management not just at the company or organizational

47 McKinsey Global Institute 2017b.

48 Bossmann 2016.

49 See <https://www.research.ibm.com/ibm-q/learn/quantum-computing-applications/>, accessed July 10, 2018.

50 Beall, Abigail, and Reynolds 2018.

51 Accenture 2017.

52 Lewis, Adam M., Krämer, and Travagnin 2016.

53 See <https://www.nextplatform.com/2017/03/27/china-making-swift-quantum-computing-gains-u-s/>, accessed July 10, 2018.

54 McKinsey Global Institute 2016c.

55 Independent Expert Advisory Group on a Data Revolution 2014.

56 Kavadias, Stelios, Ladas, and Loch 2016.

level but across the full spectrum of economic, social, and cultural interactions as the “data continuum” spans the public and private sectors as well as society at large.

The explosion of data also poses increasing threats to privacy, safety, and national security. Cybercrime costs the global economy some US\$400 billion in annual losses through consumer data breaches, financial crimes, market manipulation, and theft of intellectual property.⁵⁷

Government policy makers should carefully consider the risks of data theft and fraud and adopt effective consumer protection laws and appropriate supervision and enforcement mechanisms.

The EU has launched an initiative to build a data economy, promoting data-driven innovations to harness the opportunities from data and analytics. The EU is currently enhancing its data policies and laws and encouraging investment, aiming to more than double the value of the European data economy to reach 4 percent of EU GDP by 2020,⁵⁸ mainly through improved analytics and processing of data.

DATA ANALYTICS FOR COMPETITION, PRODUCTIVITY GROWTH, AND INNOVATION

Data analytics are becoming fundamental to maintaining competitive advantage. The latest global survey on data and analytics indicates that more and more companies are using data and analytics to generate growth.⁵⁹ It is expected that worldwide revenues for big data and business analytics (BDA) will grow to more than US\$203 billion in 2020.⁶⁰ By leveraging the value of aggregated data, companies are changing their core business functions, marketing, and sales practices, developing new business models, providing new services to their customers, and even directly selling data-enabled products. For example, China’s Tencent built a big data platform that can access information from different applications such as QQ, WeChat, video, and games in real time.⁶¹ Big data and predictive analytics are transforming service industries by creating innovative information products and services, to increase productivity across all economic sectors through improved business intelligence.

Moreover, predictive analytic tools are helping to better address social challenges, improve research and accelerate innovations, and increase efficiency in the public sector through cost reductions and more personalized services. The city of Seoul used data to build a widely used and very popular late-night public transportation system, lowering commute times and improving user satisfaction.⁶² Big data and predictive analytics can be used by law enforcement to anticipate and prevent crime (for example, PredPol and HunchLab in the United States).

2.4 The Transformative Power of New Business Models

Disruptive technologies affect the fundamentals of economic activity. Three main trends are rapidly evolving in this space: the platform, the sharing, and the “gig” economies. Business process transformation across the entire value chain characterized by agility

57 McKinsey Global Institute 2016a.

58 See <https://ec.europa.eu/digital-single-market/en/towards-thriving-data-driven-economy>, accessed July 16, 2018.

59 McKinsey Analytics 2017.

60 IDC 2017.

61 See <https://www.tencent.com/en-us/system.html>, accessed July 26, 2018.

62 See <http://blogs.worldbank.org/transport/what-does-big-data-have-do-owl>, accessed July 16, 2018; Seoul Metropolitan Government 2014;

<http://www.citiesalliance.org/sites/citiesalliance.org/files/Seoul-Owl-Bus-11052014.pdf>, accessed July 16, 2018.

and adaptability translates into a high level of flexibility for producers and consumers, an emphasis on collaborative production, consumption, co-creation, and human relationships. New business models improve efficiency and the ability to reach global markets by leveraging communications and data processing capacity. At the same time, competition from new business models provide incentives to traditional businesses to innovate.

To benefits from these trends, policy makers should adopt effective consumer protection laws and appropriate supervision and enforcement mechanisms. Governments should also be actively involved in ongoing global and regional discussions on how to tax goods and services provided through digital platforms at the national, regional, and global levels. For instance, the Organisation for Economic Co-operation and Development (OECD) has recently initiated public consultations on tax challenges raised by digitization and is seeking inputs on possible ways to address these challenges.⁶³ Tax policy reform is being debated in the EU to address emerging digital economy taxation challenges and ensure a fair and efficient tax system for the digital single market.⁶⁴

\$400
billion

losses to
cybercrime

PLATFORM-BASED APPROACH IN PUBLIC AND PRIVATE SECTORS

The platform-based business model is now well accepted in both the private and public sectors. Governments in most digitally advanced countries, and some nongovernmental organizations, are adopting the “government as a platform” (GaaP) approach to enable them to deliver innovative public services in more efficient and user-friendly ways. In the United Kingdom, the Government Digital Service has adopted this approach, allowing government agencies to build faster and cheaper digital services for citizens and business; currently, more than 100 services across 26 government departments and agencies are using GaaP tools, components, and guidance.⁶⁵ Equipped with this new business model, “government acts as an intermediary—orchestrating participants, facilitating collaboration, connecting people and providers, and ultimately, overseeing public service delivery models that will advance beyond what we can even imagine today.”⁶⁶

E-commerce platforms are giving small businesses access to regional and global markets and connecting customers and suppliers in other countries. They facilitate the creation of new jobs and help generate economic benefits. It was estimated that the value of cross-border e-commerce will grow to US\$994 billion in 2020.⁶⁷ Unprecedented opportunities exist for start-ups, which can more efficiently promote their products and services and process payments through platforms provided by big companies. According to a recent study,⁶⁸ 176 platform companies already represent US\$4.3 trillion in market capitalization worldwide through the value-creating power of their platform ecosystems and digital assets. It is expected that platform-driven interactions will enable approximately two-thirds of the US\$100 trillion value at stake from digitalization by 2025.⁶⁹ China’s TaoBao is an example of the way digital platforms contribute to inclusive economic growth by creating new jobs not only in cities but in rural areas as well and enabling previously excluded populations to engage in economic activity (Box 2.5).

63 See <http://www.oecd.org/unitedstates/public-consultation-on-tax-challenges-of-digitalisation-1-november-2017.htm>, accessed July 16, 2018.

64 See https://ec.europa.eu/taxation_customs/node/993_en, accessed July 16, 2018.

65 See <https://www.gov.uk/government/policies/government-as-a-platform>, accessed July 16, 2018.

66 Accenture 2016.

67 AliResearch – Accenture 2015.

68 Evans, P. C., and A. Gawer 2016.

69 See <http://reports.weforum.org/digital-transformation>, accessed July 16, 2018.

BOX 2.5

ENABLING INCLUSIVE GROWTH THROUGH DIGITAL TRADE PLATFORMS IN CHINA

In China, the giant platform company Alibaba hosts Taobao, the world's largest online marketplace for peer-to-peer (P2P) buying and selling. This approach has produced a curious side effect in China: small, previously ignored rural areas found new life as producers and sellers of goods on the platform. China's massive investments in rural connectivity and the sheer scale of Taobao have created millions of new jobs, in effect becoming a new strategy to rebuild the countryside and integrate it into the digital economy.

Alibaba designates "Taobao Villages" as those where at least 10 percent of households are actively running online outlets and netting e-commerce sales of more than CNY 10 million (US\$1.58 million) per year. Alibaba's research arm Ali Research reports that in China today there are 2,118 Taobao Villages and 242 townships that include three or more Taobao Villages. Two-fifths of merchants are female and one-fifth were previously unemployed. These home industries make trinkets to sell on Taobao: a variety of items ranging from theater costumes to handicrafts, bicycles, and shoes. They are driving the rejuvenation of areas previously hampered by

low incomes, an outflow of labor, and poor infrastructure. Taobao's platform and ecosystem keep fees low, reduce the cost of advertising, and enable quick delivery. Online ratings, escrow services, and conflict resolution mechanisms build online trust. The increased sales volume has created new jobs for rural population, enticing villagers to return from large cities to take advantage of rising income rates.

Due to their success at providing jobs and reducing poverty, Taobao Villages are now a national policy priority in rebuilding rural China. In 2016, the State Council Office on Poverty Alleviation joined 16 other ministries in calling for a massive expansion of e-commerce in rural areas as a poverty reduction strategy. Some local governments have sponsored training classes, provided low-cost loans, and encouraged hiring locals who are below the poverty threshold.^a Alibaba has also offered its support, investing CNY 10 billion to build 100,000 service centers in remote areas, expanding logistics and last-mile buildout, and assisting young people to start their own businesses.^b

a. See <http://www.worldbank.org/en/news/speech/2016/10/29/the-taobao-villages-as-an-instrument-for-poverty-reduction-and-shared-prosperity>, accessed July 16, 2018.

b. See <https://qz.com/899922/once-poverty-stricken-chinas-taobao-villages-have-found-a-lifeline-making-trinkets-for-the-internet/>, accessed July 16, 2018.

NEW BUSINESS OPPORTUNITIES FROM THE SHARING ECONOMY

Sharing economies operate via consumer-to-consumer transactions through an online platform, website, or app, in which access is temporarily provided to a good or service with no transfer of ownership.⁷⁰ The sharing economy model helps individuals better utilize assets such as homes or cars, providing unprecedented business opportunities and reducing the need for ownership, and generates broader benefits by lowering transaction costs for consumers and delivering better-quality products and more convenient services. According to the U.K. Secretary of State for Business, Innovation, and Skills, "the contribution to the wider UK economy of this sector goes far beyond just an economic one – it's creating new networks within communities and having a positive impact on the environment by using resources more efficiently." In the United Kingdom, it is estimated that the sharing economy, worth £0.5 billion in 2014, will be worth £9 billion to the U.K. economy by 2025.

THE GIG ECONOMY: CHANGING THE NATURE OF WORK

The gig economy, characterized by an abundance of short-term and temporary positions staffed by independent contractors, often arranged remotely via digital platforms, is changing the nature of employment. The arrangement has potential benefits for both organizations and contractors. Independent work enables people to work flexibly and

70 UK Office for National Statistics 2017.

specialize, increasing work productivity. Companies that may not need or be able to afford employees for specialist roles can engage freelance experts as needed. The gig economy also provides potential opportunity for previously excluded populations, such as women, people with disabilities, the unemployed, and those living in remote areas—to access employment.

In some countries, governments have taken the lead in helping unemployed and low-income individuals to take advantage of opportunities provided by the gig economy. Increasingly, digital platforms such as TaskRabbit, Upwork, Freelancer.com, and Thumbtack create efficient online marketplaces to connect organizations seeking to hire with professionals looking for contracts. A recent estimate suggests that up to 162 million individuals in the United States and the EU are engaged in independent work.⁷¹ To prevent exploitation, issues of worker protection, income security measures, benefits, access to credit, and training and credentials must be solved. Training initiatives will also be necessary to integrate low-skilled workers into the gig economy.

ADDRESSING THE CHANGING NATURE OF WORK

The changing nature of work makes it important to develop a strategic approach to managing the workforce of the future. Increasing automation of organizational and decision-making processes, in both public and private sectors, has given rise to a major concern that large numbers of low-skilled and even semi-skilled jobs may be eliminated, with resultant unemployment or underemployment.

To be well prepared for the outcomes of digitization, coordinated decisions and actions are needed from governments, the private sector, and educational and training institutions. This requires innovative ways to help workers adjust to fast-moving labor market shifts due to automation and other types of technology disruption. This could be achieved through organizational restructuring, investments in people and infrastructure, building new relationships inside and outside the organization, and overcoming resistance to change. Expected positive impact can be produced through significant transformation of processes and organizations as well as changing managerial mindsets. By creating a culture of rapid yet sustainable change, organizations are turning technology-driven disruption into business advantage.

At the same time, it is also expected that new technologies will create entirely new categories of jobs that will require a combination of digital and soft skills such as critical thinking, problem solving, creative design, digital marketing, and data analytics. In



**New technologies
will create
entirely new
categories of jobs**

71 McKinsey Global Institute 2016b.

BOX 2.6

ETHICS IN THE DIGITAL AGE

Ethics-related concerns are the subject of government regulation and public debate. For example, France adopted the Law for a Digital Republic, which entrusted the National Commission for Information Technology and Liberties (CNIL) with the task of organizing an in-depth ethical debate to allay such fears.^a The Union Network International (UNI) Global Union, a global union federation for skills and services that brings together national and regional trade unions,^b has identified key principles for Ethical AI to ensure workers' rights in the age of digitalization.^c

a. Government of France 2017.

b. See <http://www.uniglobalunion.org/about-us>, accessed July 16, 2018; McKinsey 2017.

c. Colclough 2018.

particular, the central role of big data in the economy is creating a significant need for new jobs. Policy makers and business will need to meet the challenge of designing and implementing innovative education programs and new models of training and retraining.

Governments should encourage new forms of technology-enabled entrepreneurship and intervene to help workers develop skills best suited for the automation age. The full potential of data and analytics cannot be realized without appropriately skilled data experts and those who have been termed “business translators,” whose task is to turn analytical insights into profit and loss impact.

In addition, data visualization is an increasingly important skill set, particularly for data scientists and business translators, requiring visual design skills as well as experience in creating effective user interfaces.⁷² Governments should use the tools of the digital economy: strategic foresight, big data, and AI for predictive analytics—to identify demand for new jobs and inform the design of new education programs to meet the needs of future employers. Given the growing demand and existing shortage of data experts, governments should also work with the private sector to ensure that such gaps are filled, establishing new institutions along with new education and training possibilities. The Singapore government recently launched Big Analytics Skills Enablement (BASE)⁷³ in collaboration with public and private sector partners to develop the future workforce of data professionals.

72 McKinsey Global Institute 2016c.

73 See <https://www.opengovasia.com/articles/7049-data-is-the-new-currency-singapore-government-to-invest-s120-million-in-ict-and-cloudera-rolls-out-big-analytics-skills-enablement-initiative>, accessed July 16, 2018.

BOX 2.7

MEASURING THE IMPACT OF THE DIGITAL ECONOMY

Internationally comparable statistics on the digital economy combined with robust cross-country analyses are crucial for developing and implementing effective evidence-based policies. The WEF has consistently engaged in monitoring the development of the Information Society and, more recently, the digital economy. The World Bank in collaboration with the IIS has developed a DECA methodology to help countries and regions assess their readiness for digital adoption. To maximize the benefits of digital transformation for innovation, growth, and social prosperity, the OECD is constantly refining its measures of the digital economy and member countries’ capacity to reap the benefits of digital transformation. It recently incorporated measures to assess the barriers to entrepreneurship, trade, and investment and the degree of restrictiveness of regulations on telecommunications, professional services, retail trade, and international trade.

Recognizing concerns that existing macroeconomic statistics may not fully capture the gains from digital and digitally enabled products or cross-border transactions,

the International Monetary Fund recently initiated discussion among policy makers, researchers, and the business community on how to measure the digital economy.^b Some of the unresolved questions are how to assess the contribution of the sharing, platform, and gig economies to GDP and productivity growth.

Digitally advanced countries are also addressing the issue of impact measurement. The Chinese National Bureau of Statistics (NBS) released an index of China’s digital economy.^c The Republic of Korea plans to add the digital sharing economy to its GDP measure in 2019.^d The U.S. Bureau of Economic Analysis (BEA) is developing tools to better capture the effects of fast-changing technologies on the U.S. economy and on global supply chains. The BEA wants to calculate the digital economy’s contribution to GDP and improve measures of high-tech goods and services, international trade, the sharing economy, and free digital content and to explore economic measures beyond GDP to better understand the contribution of the digital economy to well-being in general.^e

a. OECD 2017.

b. Gaspar 2017.

c. Garcia-Herrero 2017.

d. Kim 2017.

e. See <https://bea.gov/digital-economy/>, accessed July 16, 2018.

2.5 Implications for Policy Makers and Recommendations

Given the pace of technological disruption, policy makers should prioritize investment into scalable digital infrastructures investments that anticipate demand while at the same time focusing on strengthening non-digital foundations for digital transformation. Strong public and private sector leadership and cooperation is required to deal with new challenges as they arise and to create mechanisms to foresee future opportunities and crises. An agile regulatory environment, connected and adaptive institutions, and a proactive approach are prerequisites for catalyzing digital innovations, nurturing talent, and ensuring targeted investment. Specifically, policy makers should consider the following recommendations:

- Adopt a strategic foresight approach to scenario planning, horizon scanning, and prioritizing technologies that are likely to become important and may offer significant opportunities or present significant risks.
- Boost collaboration between the public and the private sectors for uncovering where the most significant bottlenecks are, designing the most effective interventions, periodically evaluating the outcomes, and learning from the mistakes being made in the process.⁷⁴ Experiment with public and private sector regulatory sandboxes and “Challenge Tenders” (for example, Israel’s Ministry of Health). Several countries have started to experiment with actively breaking down siloed government structures, creating innovation and co-creation-oriented horizontal structures, and appointing Chief Data Officers to manage the explosion of data and the emerging cross-sectoral “data continuum.”
- Increase the agility of regulation and institutions. Encourage cross-sectoral policy making between government agencies to translate strategic foresight into actionable policies and projects. Agile approaches are already being mainstreamed for digital government initiatives, for example, in the United Kingdom (Government Digital Service). In the private sector, ING Bank, for instance, has put in place an organizational model with a focus on agility.⁷⁵
- Review legacy laws and regulations that obstruct digital adoption and cross-border business and prevent the emergence of new digital technologies, new business models, and services.
- Update competition policies to support platform-based business models, multi-sided markets, and network effects⁷⁶ with special attention to guarantee consumers choice, lower prices, and high quality of new Internet, broadcasting, and transmission services.
- Strengthen cybersecurity through the development of a cybersecurity ecosystem focused on implementing a cybersecurity strategy, mitigating cyberattacks, strengthening cybersecurity in the critical sectors, and ensuring effective coordination and deployment in response to cyber threats, as well as education and outreach programs. Adopt a secure-by-design approach.
- Develop a mechanism to address ethical issues.
- Strengthen the digital innovation ecosystem. Encourage VC investments and crowdfunding of innovative start-ups. Create sandboxes to enable high-tech companies

”
China leads in virtual reality, autonomous vehicles, 3-D printing, robotics, drones, and AI

”
Singapore’s Monetary Authority is creating a **sandbox for FinTech start-ups** to implement new and promising innovations without fear of whether they meet legal or regulatory guidelines

74 Rodrik 2008.

75 McKinsey Quarterly, 2017.

76 See <http://www.oecd.org/daf/competition/digital-economy-innovation-and-competition.htm>, accessed July 16, 2018.

BOX 2.8

STRATEGIC FORESIGHT BEST PRACTICES

Many digitally advanced countries, including Korea, Singapore, the United Kingdom, Canada, Australia, France, Finland, and others, have established strategic foresight agencies to track risks and opportunities ahead and develop or maintain their competitive advantage. One of the best examples of the use of strategic foresight by governments is that of Singapore. Strategic foresight in Singapore is anchored in the Prime Minister's Office and is tightly coupled with the planning, budgeting, and implementation process. In response to the fourth Industrial Revolution, Korea has recently adopted a Master Plan for the Intelligent Information Society^a and established a Joint Steering Committee for the Intelligent Information Society, comprising government ministries and private sector experts to better anticipate and manage the social and economic impact of rapid technological change.

a. Government of the Republic of Korea 2017.

to experiment within a well-defined space and duration without fear of breaking laws and with safeguards to limit the consequences of failure and maintain the stability of the technology-enabled systems.

- Invest in the future digital economy workforce. Develop a mechanism to identify demand for new jobs and inform the design of new education programs to meet the needs of future employers. Support SME growth to drive new jobs creation and remove barriers to cross-border digital flows.
- Improve tools for measuring the impact of the digital economy.

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GLOBAL BEST PRACTICE FOR CATALYZING DIGITAL PLATFORMS IN RUSSIA

Digital platforms enable transformation across all sectors of the economy. They empower the performance of ecosystems by enabling rapid and continuous communication, cooperation, and co-creation across organizations, borders, and time zones. While supporting this model for digital transformation across economic sectors, it is important to strike the right balance between the protection of national security and consumer interests and the support of the growth of digital platforms to gain digital dividends in all the areas of economic activity these platforms transform.

3.1 Global Trends in Digital Platforms

Digital platforms are “multisided marketplaces with business models that enable producers and users to create value together by interacting with each other.”⁷⁷ Multi-sided platforms (MSPs) allow for members of each side to interact through tools that facilitate matching, searching, exchanging, and carrying out transactions.⁷⁸ Platforms can be internal to a production process or supply chain based (enabling coordination between clients and suppliers) or multi-sided industry platforms, where “a platform leader pools external capabilities from complementors.”⁷⁹ The total size of the global platform economy in 2016 was approximately US\$4.3 trillion, based on the total value of 176 platform companies.⁸⁰

The impact of digital platforms on a global scale is often captured by their ability to displace and disrupt existing business models. For example, Airbnb created the equivalent of 257 hotels for guests during the 2016 Olympics in Rio.⁸¹ Similarly, the value of crowdfunding as an alternative to traditional means of funding projects reached US\$34.4 billion in 2015.

Digital platforms are the product of an evolutionary process mixing physical as well as market and behavioral enablers (Figure 3.1 and Figure 3.2). Moreover, individuals participate in economic activities through privately owned resources such as assets and labor, which would otherwise remain idle, or participate in the ownership of privately owned assets in a shared mode, as in crowd-funded ownership of a real estate project. Platform business models allow for the “asset-as-a-service” mode, such as shared access to tractors and agricultural equipment. This is sometimes called collaborative consumption.⁸²

Digital industry platforms aim at the aggregation of different players in a specific industry cluster or across industries. They facilitate the digitization of industry and the promotion of R&D, innovation, and technology transfer within a specific industry or firm. For example,

77 Still et al. 2017.

78 Evans 2013

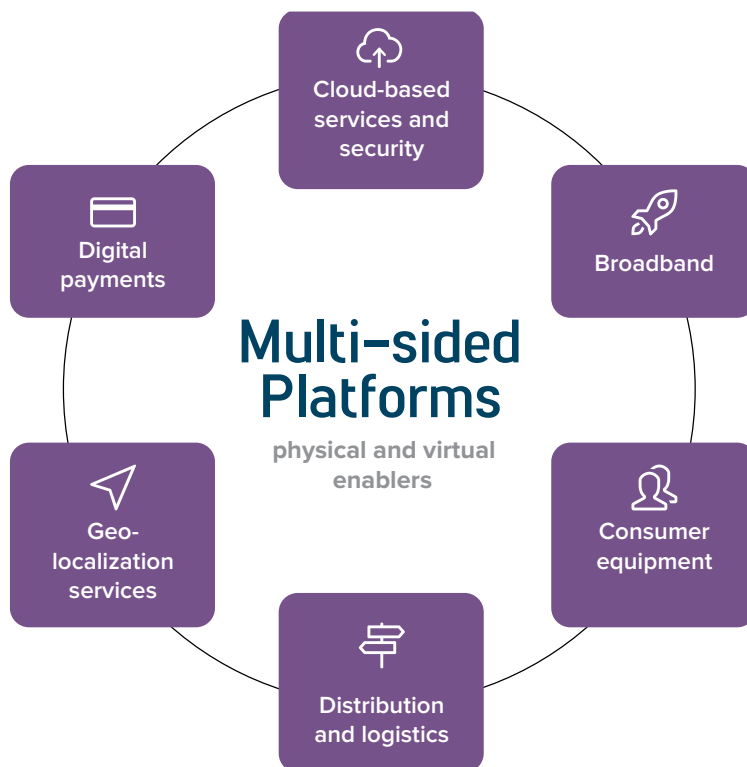
79 Gawer 2014.

80 Evans and Gawer 2016.

81 Gawel, Machur, and Pennington 2016.

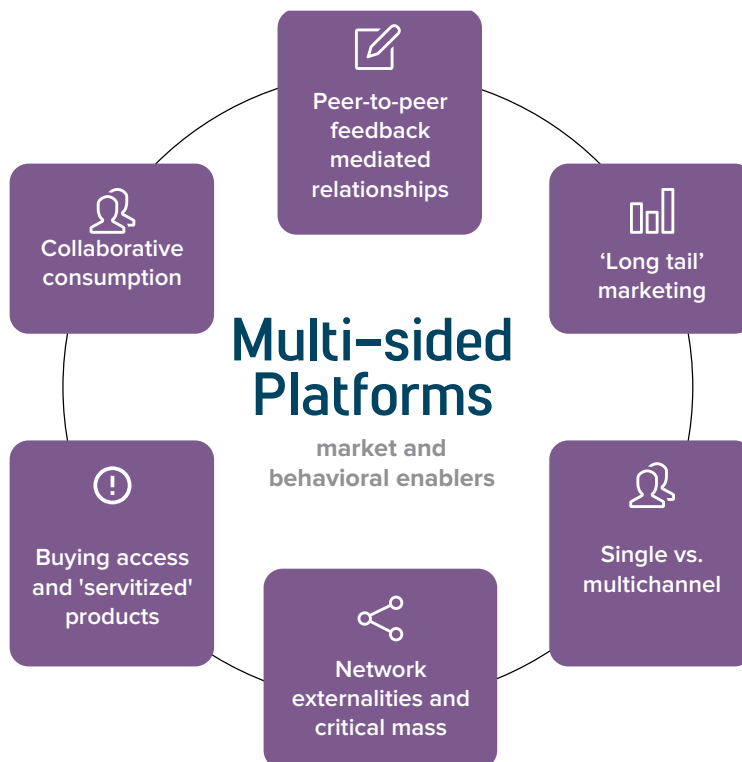
82 Constantiou, Marton, and Tuunainen 2017.

FIGURE 3.1 Physical and Virtual Enablers



Source: Rossotto et al. 2018.

FIGURE 3.2 Market and Behavioral Enablers



Source: Rossotto et al. 2018.

AstraZeneca has adopted an open innovation model that crowdsources research and innovation solutions across a range of scientists and technicians. A global community of researchers is activated around specific problem-solving tasks, without being formally integrated in AstraZeneca production or research facilities. Similar experiments have been launched by FIAT in Brazil and Procter and Gamble.

DIGITAL PLATFORMS CAN ALSO BE OWNED AND LED BY THE GOVERNMENT

In these cases, the ecosystem around these platforms (Figure 3.3) follows a hub-and-spoke model, where particular applications and services are linked to an open architecture and open application programming interfaces (APIs) enabled by a government-managed digital platform. Digital identity platforms are examples of how a single platform related to a concrete government service (the provision of identification) can be used to develop a host of interdependent applications and services.

Platforms are both a disruptive and a creative force in many economic sectors and their influence is likely to spread. Successful platforms can be a source of competitive advantage, but they can also potentially suppress SMEs or crowd out competition. Platforms have also attracted the attention of regulators given concerns about labor practices (for example, the conflict between Uber and local taxi drivers), arbitration issues (measures for users to resolve online disputes), discrimination, taxation issues, and the risks involved in large platforms using the massive amounts of data they accumulate to manipulate and overcharge consumers.⁸³ Thus, regulation to protect both service providers and consumers and prevent platforms from monopolizing entire sectors is important.

As noted in the *Harvard Business Review*, while in a traditional world strategy revolves around erecting barriers, in a world of platforms, while guarding against threats remains critical, the focus of strategy shifts to eliminating barriers to production and consumption to maximize value creation. To that end, platform executives must make smart choices about access and control.⁸⁴

Policies should include tools that not only manage the sociopolitical issues surrounding platforms but also encourage the growth of platforms and support entrepreneurs creating or participating in them. Regulators should specify performance objectives rather than dictate behavior or manner of compliance that platforms must adopt, using available alternatives to direct regulation.

83 Calo and Rosenblat 2017.

84 Van Alstyne, Parker, and Choudary 2016.

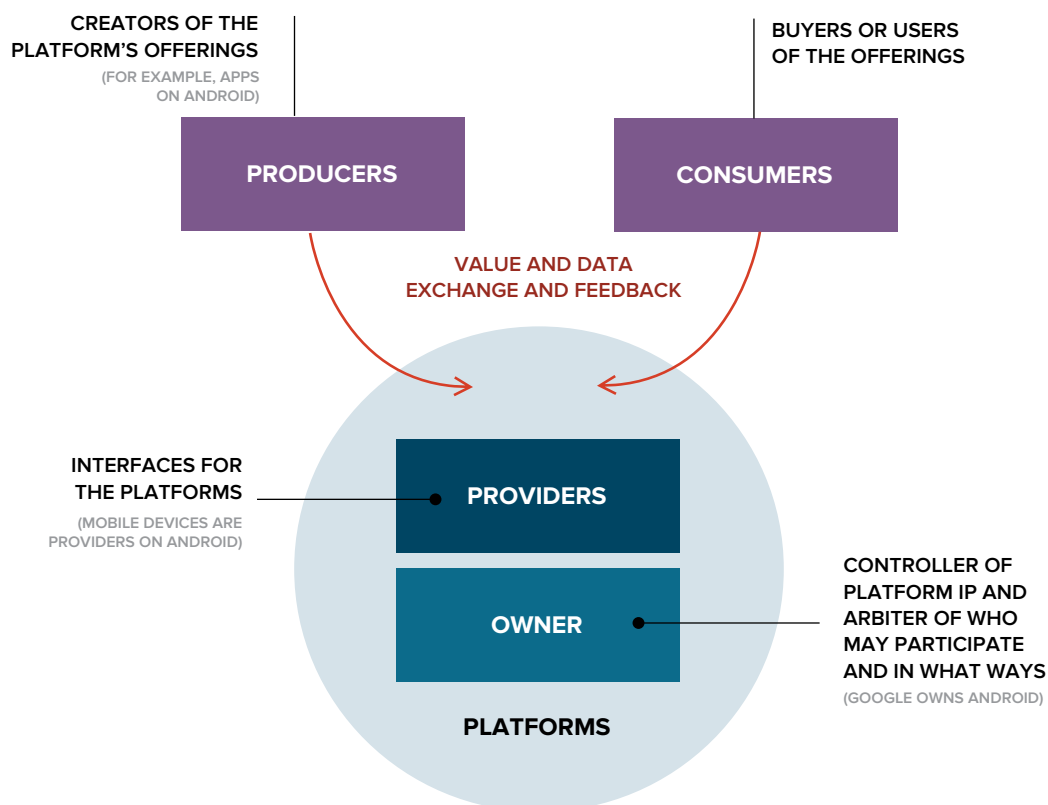
BOX 3.1

THE DIGITAL ECOSYSTEM

Gartner defines the digital ecosystem as an interdependent group of actors (enterprises, people, and things) sharing standardized digital platforms to achieve a mutually beneficial purpose. In 2017, Gartner surveyed 2,598 chief information officers (CIOs) across 93 countries, representing approximately US\$9.4 trillion in revenue/public sector budgets and US\$292 billion in information technology (IT) spending. One important conclusion from this survey was that enterprises that were more mature in their digital transformation process (the leading performers) were also more actively involved in leveraging the digital ecosystem. In fact, 79 percent of the survey's top performers indicated that they participated in a digital ecosystem while far fewer average (49 percent) and trailing (24 percent) performers did.

a. Gartner 2017.

FIGURE 3.3 The Platform Ecosystem



Source: Van Alstyne, Parker, and Choudary 2016.

In many countries around the world, platform companies face barriers to working in multi-sided markets. Airbnb and Uber, for instance, have faced outright hostility and bans from numerous cities and countries around the world. Sometimes regulators are justifiably concerned about national security, taxation issues, public safety, and labor standards.

Trust is an essential component of the platform economy

However, outright bans may also be indicative of the challenges that regulators face struggling to understand the platform’s business model or of a desire to protect entrenched interests as exemplified by the resistance Uber and Airbnb are facing from traditional hospitality and transportation service providers. The inclination to overregulate may slow down economic growth and digital adoption, as is already evident in the EU where the desire to limit competition from foreign platforms has led to an overreliance on antitrust regulation and overshadowed the need to deregulate offline service markets and adopt SME-friendly privacy and taxation legislature to boost competitiveness. In many cases, policy responses from governments are not based on a fully considered cost-benefit analysis.

One of the solutions for this can be co-regulation. In the co-regulatory model,⁸⁵ a variety of stakeholders, including companies and platforms, academics, think tanks, and regulators, gather and combine information from different sources to create timely and evidence-based regulations. The main advantage of the co-regulation model is that it decreases the information asymmetry between platform operators, who hold essential data about their operations, and regulators who need these data to make informed decisions. This simplifies the regulatory environment by reducing barriers to entry into new sectors or services for platform companies.

⁸⁵ Finck 2017.

Trust between buyers and sellers is an essential component of the platform economy and platform owners go to great lengths to demonstrate that they are secure, reliable, and transparent. eBay, for instance, provides an elaborate review mechanism, encompassing a range of techniques including one-sided reviews, multi-sided reviews, and third-party reviews. Much of this trust is earned through activities and features on the platforms themselves, but regulators have a role to play in building consumer/seller trust in platforms, especially ones that may not yet be very well known in markets they are trying to serve.

PUBLIC INFRASTRUCTURE, PAYMENT SYSTEMS, AND LOGISTICS

These are essential attributes for platforms to develop, in common with all elements of the digital economy. E-commerce platforms in particular cannot flourish in the absence of sound logistics.

Data policies are increasingly critical to manage digital businesses and platforms. An OECD report on key issues for digital transformation⁸⁶ prepared for the 2016 G20 Summit in Germany includes recommendations on the importance of standards and interoperability, relevant legislature, and measurement tools, all of which are also needed for the promotion of effective digital platform operations.

Finally, it is important to consider international competition when regulating the platform economy. **Data localization** is one of the more widely used tools to control international firms operating within national boundaries and support local players. Data localization laws refer to requirements that “data about a nation’s citizens or residents be collected, processed, and/or stored inside the country, often before being transferred internationally, and is usually transferred only after meeting local privacy or data protection laws”.

Localization creates its own set of winners and losers in the domestic market. Defenders of localization laws cite national security, local cultural and historical context, and economic nationalism as arguments in favor of such an approach. Opponents see such laws as a major barrier to trade and competitiveness. As with most emerging technologies regulation issues, a balance should be found between protecting the interests of national security, on the one hand, and encouraging economic growth through digital adoption, on the other.

3.2 Digital Platforms in Russia

The May 2018 Presidential Decree emphasizes the critical importance of digital platforms as a key enabler of cross-sectoral digital transformation across the Russian economy.

The government has implemented a policy of data localization, which allows a degree of control over transnational companies operating in Russia and helps support the development of national players.

The revenue of Russian digital platforms exceeds US\$17 billion with a value of about 1 percent of Russian GDP. Digital platforms cover a range of sectors, including social networking, employment, tourism, construction, health, e-commerce, and so on (Figure 3.4).

While global players have a strong position in the Russian market, there are several Russian platforms with a dominant market share in their respective segments.

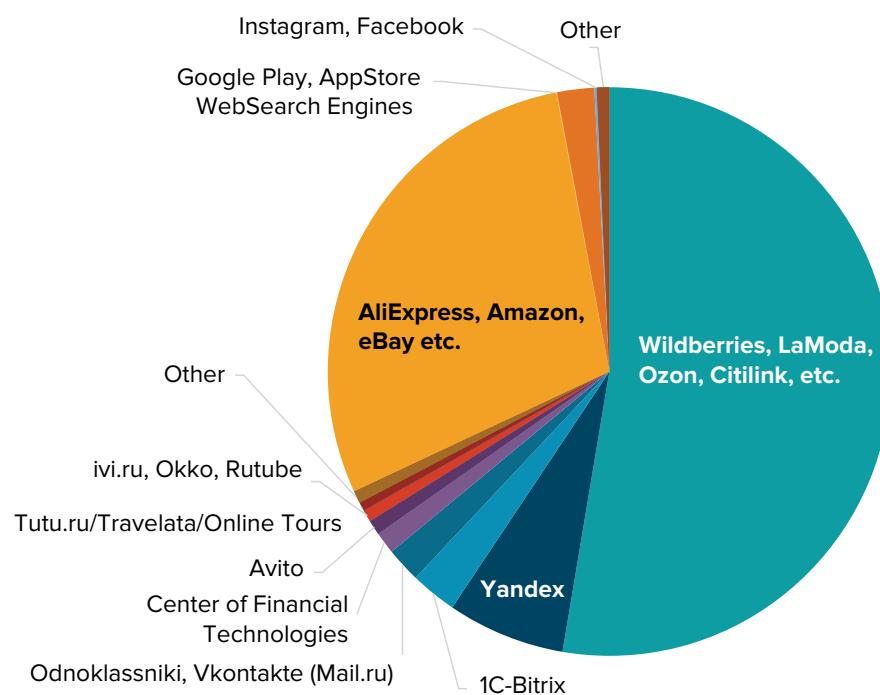
Yandex, the largest Russian web search engine, enjoys a user share of 46 percent⁸⁷ and triple the revenue of Google in Russia.⁸⁸ Russian social media network Vkontakte outranked

86 OECD 2017.

87 See <http://gs.seo-auditor.com.ru/sep/>, accessed July 26, 2018.

88 See <https://www.vedomosti.ru/technology/news/2017/07/27/726470-google-dohodi>, accessed July 26, 2018.

FIGURE 3.4 Revenue of Russian and Global Digital Platforms in Russia



Source: Elaborated by the authors, based on open sources.

\$17 billion

revenue of Russian digital platforms

Instagram, Facebook, and Twitter in messages sent per month and the number of authors per month by a large margin: almost 60 percent of all publicly posted messages were on V Kontakte. In general, foreign social media platforms have much lower revenues than national platforms such as V Kontakte and Odnoklassniki. In total, the market size of foreign digital platforms adds around US\$8 billion to the overall digital platform market in Russia and represents about 30 percent of the overall digital platform market.

Digital platforms are playing an increasingly important role in enabling economic growth in the country. Recent years have seen the emergence of digital finance platforms that enable online banking,⁸⁹ P2P lending,⁹⁰ and trade. A good example is the launch of the Russian MIR⁹¹ payment system managed by the National Payment System of Russia, a

⁸⁹ See <https://www.tinkoff.ru/>, accessed July 26, 2018.

⁹⁰ See <https://www.avito.ru/>, accessed July 26, 2018.

⁹¹ See <http://mironline.ru/>, accessed July 26, 2018.

BOX 3.2 B2B-CENTER

B2B-Center is an electronic trading platform connecting the supplier and the customer over its electronic trading system. Established in 2002, the service offers 43 types of trade services in different sectors of the economy, including energy, petrochemistry, metallurgy, and the automotive industry. In addition to its trading function, the system's capabilities include data and financial analysis, insurance and logistics services, as well as electronic digital signature issuance. Around 350,000 companies run their businesses on the system, and 15 years of B2B-Center operations enabled nearly a million trades worth US\$238 billion. B2B-Center ranks 13th in the Forbes Top 20 list of the most expensive Russian Internet companies.

wholly owned subsidiary of the Central Bank. The system was created in 2014 when several Russian banks were denied Visa and MasterCard services. The first cards operating in the MIR payment system were launched in December 2015. By the end of 2017, the number of national payment cards issued by Russian banks exceeded 30 million.

3.3 Policy Recommendations

To promote the effective development of digital platforms as a key element of Russia's digital economy, policy makers should focus on the key areas that affect digital development, including investment into a scalable broadband infrastructure, creation of an enabling and regulatory environment, and an effective data management policy. Additionally, digital platforms adoption requires:

- Investment into the development of national transport and logistics capacities that will significantly increase the use of digital e-commerce platforms and improve the quality of services;
- An ecosystem approach to the co-regulation of digital platforms in Russia, involving all the key players and stakeholders in the public and private sectors, as well as the academic community that will enable effective regulation of digital platforms and help regulators maintain an often-uneasy balance between ensuring national and public security and promoting economic growth through digital technologies;
- Policies aimed at building trust between digital platform participants and enabling safe and secure transactions, as well as effective arbitration and dispute resolution that will bring more participants to Russian digital platforms;
- Launch of open government-driven digital platforms to enable a variety of interactions between public and private sector players; and
- Stimulating the emergence of industry platforms as a mechanism for the digital transformation of traditional industry.

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GLOBAL BEST PRACTICE FOR DRIVING DIGITAL TRANSFORMATION IN RUSSIA'S PUBLIC SECTOR

Russia has achieved some impressive success in building a robust national broadband infrastructure enabling extensive mobile penetration and interagency interaction required for the provision of digital services through a single national portal. It has also made some early strides in transforming education, health care, culture, and social services. Barriers to digital transformation remain at the cross-agency level, and disparities still exist at the level of regions and municipalities. There is a need for strong leadership to ensure enhanced cooperation between federal, regional, and municipal governments, as well as the implementation of a data-driven GaaS approach for offering user-centric services. The transition to data-driven administration and the innovative use of emerging digital technologies such as data analytics, blockchain, IoT and AI will accelerate the transformation to the next level of digital government in Russia and create the foundation for future technological breakthroughs.

4.1 Digital Government – Global Best Practice

Digital transformation is disruptive, forcing governments around the world to rethink their role and operations from top to bottom. For many OECD countries, making progress in digital government has emerged as a top priority.

Digital government builds on previous e-government reforms and aims to enhance government services by leveraging new possibilities afforded by digital technologies so that government can better serve the public and create an enabling environment where its businesses and industry can be competitive. Going beyond simply enhancing government efficiency, transparency, and accountability, digital government involves a re-engineering of back-end processes that enable a digital workflow. It establishes horizontal integration across government, and close collaboration between government and businesses to ensure a balance of interests of all involved, particularly in the design of regulatory approaches. Most importantly, it deploys a user-centric model to the design and delivery of public services.

The five stages of transformation to digital government have been visualized by Gartner as a transition from the initial stage of e-government to open government, onwards to data-centric government that then evolves into a fully digital government and finally becomes smart government (Figure 4.1).

Government designed and operated to take advantage of digital data in optimizing, transforming and creating government services⁹³

⁹² Di Maio, Mechling, and Howard 2014.

FIGURE 4.1 Digital Government Maturity Levels

	E-GOV	OPEN	DATA-CENTRIC	FULLY DIGITAL	SMART
Maturity Level	1 INITIAL	2 DEVELOPING	3 DEFINED	4 MANAGED	5 OPTIMIZING
Value Focus	Compliance, efficiency	Transparency and openness	Constituent value	Transformation	Sustainability
Channel Strategy	Portal	Government as a Platform	Nongovernment channels	Truly multichannel	Automation replaces portals
Leadership	CIO/CTO	CDO	Departments	CIO and departments	(New) CIO
Technology Focus	SOA	Open data, open service	Open any data	Things as data	Smart machines
Sourcing Strategy	Mixed	Re-insourced, cloud first	Multisourced	Partner-sourced	Outsourced
Key Metrics	% services online	% open data	Number of data-driven services	% data from things	% decrease of services

Source: Di Maio, Howard, and Archer 2015.

Note: CDO = chief data officer; CTO = chief technology officer; and SOA = service-oriented architecture.

In practice, however, the rollout of digital government across the world has faced a number of important limitations. In some cases, e-government initiatives have been limited to the digitization of existing government services rather than a fundamental remodeling to deliver better services to citizens, especially the underserved. In many cases, e-government delivery models have been driven by supply-based approaches. This has often been at the expense of users, with the deployment of complex and difficult-to-use platforms and resulting in low user satisfaction. There have also been persistent gaps in the deployment of digital services within and across government departments. The result is often a lack of cross-platform interoperability, which is a requirement for many businesses. Finally, the gap between efficient, digital, and interactive outward-facing government platforms and traditional, largely manual, back-end processes persists, failing to enhance efficiency as was initially envisioned.

As government transformation progresses toward further maturity, key principles of digital government as distinguished from e-government are emerging. These include the following:

- Adopting a whole-of-government approach that is digital by default
- Committing to a process of digital end-to-end (DETE)
- Building a user-centric service design
- Deploying services in a way that is device agnostic
- Ensuring that policy is data driven
- Promoting open data
- Adopting open standards and open source solutions
- Being open to innovation and disruption

Digital, by default, implies that all government processes should be performed digitally without resort to other means. Going digital, however, requires a substantial reengineering of administrative processes and digital by default is therefore closely linked with another principle.

DIGITAL END-TO-END

In the early days of digitalization, digital front-end infrastructure coexisted with traditional, paper-based back-office workflows. This discrepancy often resulted in procedural delays and red tape. By contrast, DETE ensures the production and circulation of digital documents and products at all stages as a standard administrative routine. Besides the obvious benefits of cost – and time-efficiency, DETE brings greater transparency and accountability, and makes possible the use of data analytics at scale, which in turn can give rise to major improvements in administrative processes. Fully digitized public services can also be delivered instantly: electronic visas for foreign citizens, for example, eliminate the need for physical distribution systems, enabling greater efficiency and transparency of process and almost instant delivery.

At its best, digital government is built on a user-centric service design. This principle is a radical departure from traditional procedures. It requires public officials to eliminate red tape to perform their duties and promotes horizontal cooperation and coordination between departments at federal, regional, and municipal levels. As the United Kingdom's *Digital Design Principles* reinforce, users need to be at the center of this design:



The design process must start with identifying and thinking about **real user needs**. We should design around those—not around the way the 'official process' is at the moment⁹⁴

Essential to this change of mindset is a shift from one-size-fits-all public services to a more personalized approach, informed by data analytics that can predict customer needs based on past behavior and user preferences. This approach becomes even more possible and powerful when all things and people are connected to the Internet, as the IoT envisages.

User-centric design is closely associated with another key principle: device-agnostic service delivery. The digitization of the public service was initially designed around fixed computer-based solutions. The rapid growth of mobile devices since the mid-2000s has changed the way people access the Internet and services. In fact, in most developed countries more people go online using smartphones and tablets than personal computers. Digital government reforms must consider this change, making digital portals that are mobile compatible. The design of ICT infrastructure must also adhere to cross-platform/cross-device connectivity to deliver integrated, user-friendly services to multiple channels, including mobile devices.

A key difference between initial models of e-government and digital government is the shift from simply placing services online to a data-centric approach. Central to this is understanding the role that data plays in supporting evidence-based policy decisions that shape administrative processes. Governments need to ensure that their services are demand driven and adapt to changing realities. This means that government services should not operate from a preset menu but on an iterative, data-driven approach capable of customizing services.⁹⁴

In a world of limited government spending, smart predictive models that generate scenarios based on data-driven probabilities can help governments make decisions about where to allocate resources more rapidly and accurately. Such models, for instance, have been used by law enforcement agencies to predict crime. Using algorithms and GPS-enabled devices that track crime data in real time, police departments can deploy their resources to areas where crime is more likely to occur. Predictive analytics is also being used to track financial crime, tax fraud, and cyber-crime.

93 U.K. Government 2012.

94 Kettl 2008.

BOX 4.1

APPLIED DATA ANALYTICS IN ACTION: A CASE STUDY OF DUTCH VAT REFUND RISK MODEL

Over the past 20 years, the Dutch GDP has doubled, accompanied by a corresponding increase in refund claims for value added tax (VAT). With the volume of claims rising beyond its capacity to process, the Dutch Tax and Customs Authority (NCTA) has started to implement a new risk model that uses predictive analytics and social network analysis (SNA) to map and detect possible VAT-related fraud. SNA identifies connections between nodes (for example, executives, bank accounts, or contact information) and visualizes them as graphs. Using a predictive model based on historic data, these networks can be scored and weighted against risk scales, allowing human analysts to focus selectively on high-risk cases. In addition to SNA methods, the NCTA also uses models that predict the likelihood that a particular claim will be fraudulent or incorrect. For the NCTA, data analytics are valuable in both revealing areas of risk and allowing more efficient allocation of human resources for detailed forensic investigations.

Disruptive technologies are transforming the private sector but also have significant potential to improve public services around the world. Blockchain and other distributed ledger technologies can be used to record and store transaction data in a high-quality form that is secure, efficient, transparent, and resistant to tampering. Governments worldwide are already experimenting with the technology for land registries, ID systems, and smart contracts. Because of their security and efficiency, government use of these technologies has the potential to enhance trust among users.

Similarly, machine learning and AI can fundamentally change administrative processes. They have already enabled effective chatbots that can be used in customer service and in generating automated answers to the most common questions. Social media and other messaging platforms also allow governments to communicate directly and inexpensively with large segments of the population, some of which are inaccessible through traditional means of communication. These technologies are not only effective but may also eventually eliminate the need for fixed assets such as call centers.

With the benefits of these technologies, however, there are also challenges. Some technologies and platforms demand a level of digital skill that may not be widespread in all countries. Others, like blockchain, are still relatively untested, with their scalability remaining to be proven. Privacy and data governance issues about data collection, storage, and sharing must also be addressed and resolved, but regulation and legislation lags considerably behind technological advances, thereby opening up governments and users to risks unanticipated in the past. All of these opportunities and risks need to be considered in a comprehensive fashion and in a way that builds on best practice.

BOX 4.2

USE OF BLOCKCHAIN IN SWEDEN'S LAND REGISTRY

Sweden's Lantmäteriat (land registry) is currently in the third phase of testing a blockchain land title system that integrates smart contracts into real estate purchases. Built on a private blockchain accessible only to parties to the contract, the system allows the process to be tracked digitally from the signing of the contract to the transfer of title by buyers, sellers, realtors, mortgage lenders, and government agencies. The end user interface is a mobile app through which parties can sign documents, review progress, and automatically receive electronic copies of documentation. In addition to being much more transparent, accurate, and secure than the existing system, the blockchain land registry will reduce processing times for land title transfers from four months to a few days and is expected to save the country more than €100 million each year.

BUILDING BLOCKS OF DIGITAL GOVERNMENT

Current evidence shows that governments need, as a basic foundation, four building blocks to successfully implement a digital government strategy:

- A unified data governance framework
- Re-envisioning GaaP
- A commitment to cybersecurity and privacy
- A culture open to innovation

UNIFIED DATA GOVERNANCE

Data will play a fundamental role in organizing administrative processes in the future. To effectively harness the potential of data, governments will need a robust data governance framework that includes three elements:

- Unified data governance, shared across the public sector
- A shared data infrastructure
- The use of advanced data analytics to turn data into smart policy and services

Efficient data governance requires the establishment of a unified data management policy that regulates the collection, storage, sharing, and reuse of data across government departments in accordance with established legal and ethical standards. The principle of unified data implies not only data characteristics but also an agile storage infrastructure that allows for prompt, secure updates supporting the once-only principle for data reuse. To ensure a unified approach, some countries have established the position of CDO, while others have chosen to create specialized agencies responsible for digitizing the public sector. In both instances, the mandate is to coordinate, control, and ensure a unified national approach to data governance.

Closely related to data governance is the idea of *shared data infrastructure*. This implies the modernization of government IT infrastructure, building standardized infrastructure components such as state-of-the-art data centers capable of processing unified data instead of investing in application-specific facilities. Cloud computing is an example of such

BOX 4.3

BASIC DATA MANAGEMENT IN DENMARK

In 2011, the Danish government introduced the 'Good Basic Data for Everyone - A Driver for Growth and Efficiency' strategy. The strategy included initiatives for data and registry optimization to promote reuse of data and prevent duplicative registration. Six types of databases were prioritized: maps, cadasters, business and company registrations, property, and address data. The government then analyzed all the databases and eliminated redundant registers. It then developed measures to ensure basic data complied with a unified standard that included cross-referencing to optimize interoperability and a set of IT solutions to establish a Common Public-Sector Data Distributor to convey updated information from basic data registers to the relevant public or private-sector administrative field or business area.

Denmark then created a cross-governmental authority, the Agency for Digitization, responsible for the efficient use and development of basic government data. Technologies such as the eID and digital signature were mandated for standardized use. The program also created a national citizen portal as a single access point for all public services and information, and NemHandel, an open e-business framework allowing businesses to send standardized electronic invoices in a secure and reliable way. Converting to a fully digital format yielded tangible benefits, reducing the cost of some services by as much as 50 percent.

BOX 4.4

DEVISING A STRATEGY FOR DATA-DRIVEN GOVERNMENT

Given the emerging importance of data as the driver of the next phase of government transformation, several countries have adopted some form of a national data strategy.

For instance, the U.S. Government adopted a Federal Big Data Research and Development Strategic Plan in 2016 to build a big data innovation ecosystem that helps develop new capabilities for government agencies and the nation at large. Korea's recent Master Plan for the Intelligent Information Society defines strategies and priorities that focus on creating next-generation capabilities by leveraging emerging big data foundations, techniques, and technologies.

Given its great potential for impact, a national data strategy should highlight the importance of improving access to anonymous machine-generated data, facilitating and incentivizing the sharing of such data while avoiding disclosure of confidential data and minimizing lock-in effects. It should address the issues of data standardization, free flow of data, access to machine-generated data, liability and safety issues related to data, creation of data maps, providing support to data-matching services, and helping grow data exchanges and markets.

At the same time, cross-border dimensions of data should be properly considered as well. Cross-border data flows can improve economic efficiency, raise productivity and afford greater opportunities for digital enterprises. Regional approaches like the APEC Privacy Framework and Cross Border Privacy Rules (CBPR) and the EU's Binding Corporate Rules (BCR) aim at dealing with privacy in a regional context.

infrastructure that enabled governments to achieve a flexible, cost-effective, and rapid deployment of services. In 2012, Singapore introduced a government cloud service (G-Cloud), a private cloud infrastructure built in cooperation with SingTel and Hewlett Packard.

The third component of data governance is the use of *advanced data analytics* to gain more value from collected information and increase the productivity of the public sector through IoT. Advanced data analytics are being used to support road traffic control and public transit through sensors that adjust traffic signals to manage transit volumes in real time. They are also increasingly being experimented with in health care systems to manage patients and supply chains.

GOVERNMENT AS A PLATFORM

The transition to GaaP is a critical leap in the transition to a smart government. GaaP is commonly referred to as "the use of digital technologies to support the resolution of collective action problems at various levels through shared software, data and services."⁹⁵ The philosophy is to make data and decisions made by government open for use by others through a platform accessible by all.⁹⁶ GaaP takes government past its role as a service provider and re-envision it as an enabler of activities in the public space. The model encourages citizens to be active participants in policy making and in delivering digital government services with the state responsible for creating an ecosystem of participation.

Based on a private sector model, GaaP outsources to reduce costs and enhance efficiencies. The government's role is to create the platform; deliver public services; maintain the infrastructure; and regulate, mediate, and oversee its use and the service delivery process including third-party applications. The platform should enable effective customization of public services and provide users with greater flexibility with respect to choosing and customizing government-enabled services.

⁹⁵ Margetts and Naumann 2017.

⁹⁶ New Zealand Government 2017.

Essential components of GaaP include the following:

- Open government data, which is collected, processed, and stored in a coherent and easy-to-use format
- Access to data, through open APIs
- A set of rules that regulates access and use of data produced and provided through the platform

In some cases, governments also allow third-party applications to “write” into government databases: the U.K. Verify Service, for example, gives permission to trusted intermediaries such as banks to “write” transactions. Yet, overall the need to grant broad access to government databases remains an open question. GaaP puts into action unified and standardized solutions where users determine and shape how services are packaged and delivered, while the government enables and regulates where required.

CYBERSECURITY AND PRIVACY

Citizens will only use digital services if they believe there are sufficient protections in place to safeguard their personal information from threats outside government and misuse within government. Because trust is an essential component of the social contract between state and society, the acceptable risk threshold for governments is usually lower than for private sector actors. As a result, citizens expect that governments will adopt best-practice, rigorous, and ethical cybersecurity and privacy solutions instead of minimal, compliance-based approaches.

A CULTURE OPEN TO INNOVATION

Digital government is about technology, but it is also about a culture shift. Those governments successful in their digital transformation have leadership that has promoted a culture change that enabled digital government. In Singapore, a commitment to digital has permeated all levels of government, and government officials are constantly experimenting

BOX 4.5

JOINUP: AN EU COLLABORATION PLATFORM FOR DIGITAL GOVERNMENT SOLUTIONS

Joinup is a collaborative platform facilitating the sharing and reuse of software, semantic assets, and other interoperability solutions developed for public administrations. It offers several services that aim to help e-government professionals share their experiences with each other. In the past, information on IT solutions for the public sector used to be scattered across numerous repositories and websites, making it hard to find data and to reuse already available tools. The European Commission answered this problem by establishing Joinup, a platform that gathers interoperability solutions and good practices, and gives everyone an opportunity to share and reuse them across Europe and beyond. Joinup is a single-access point to more than 2,800 interoperability solutions for public administrations, included in the collections of more than 40 standardization bodies, public administrations, and open source software repositories. It includes a catalogue where users can easily find and download already developed interoperability solutions (software, specification, data models). The interoperability solutions are described using the Asset Description Metadata Schema (ADMS). It provides freely reusable software under an open source licence. The platform allows developers to learn from best practices and experiences and collaborate with others. It facilitates communication and collaboration on common projects between public administrations, IT professionals, and academia. Users can share information about new developments, guidelines, events, or studies with others. News items are also provided by a professional team of journalists. Finally, Joinup can also be reused itself. The source code is available on GitHub for anybody interested in setting up a similar collaborative platform.

with agile technologies and testing products using a sandbox approach. Risk taking and being open to change are fundamental to digital transformation. Sticking to hard-and-fast rules, as most governments are accustomed to doing, often proves counterproductive when making the transition to digital government.

These various building blocks are reshaping not only government-to-citizen (G2C) and government-to-business (G2B) interactions but also create new opportunities for business-to-citizen and citizen-to-citizen and business-to-business interactions on the government platform. By committing to a unified data governance framework, re-envisioning GaaP supporting transparency and participation, committing to best-practice cybersecurity, and adopting a culture open to innovation, governments have managed to shift supply-driven approaches to user-centric service models enhancing client satisfaction and, in many cases, saving time and money.

4.2 Digital Government Transformation in Russia

Over the past two decades, Russia has demonstrated a strong commitment to adapting its government institutions to the new realities of the digital era. Along with the Public Administration Reform process (2003–2013), the government launched its first “Electronic Russia 2002–2010” program, aiming to adjust the regulatory capacity of the state and improve the efficiency of the public service through ICTs. Initial efforts focused on the development of an e-government infrastructure. This led to the establishment of the Unified Portal of State and Municipal Services (gosuslugi.ru).

The second phase aimed to build e-government in Russia, envisioned as an integral part of the “Information Society 2011–2020” program. This included the further development of single-window access for public services through a unified Portal of Public Services and multifunctional centers of services delivery, the creation of an interagency system for electronic interaction and a document management system, and open access to information on the activities of government bodies.

In July 2017, Russia adopted the Russia Digital Economy Program with an expected annual budget of US\$1.8 billion until 2025



The Russia Digital Economy Program adopted in 2017 includes a special initiative on digital government to be implemented starting 2018 outlining the key directions to continue to implement digital government as well as to address the current weaknesses (such as the enabling environment) preventing the country from joining global digital economy leaders.

The May 2018 Presidential Decree emphasizes the need for accelerating the implementation of a platform approach in the provision of government services.

The ongoing focus on government digital transformation at the highest levels of government allowed Russia to rapidly ascend in international e-government ratings and achieve remarkable success. About 72.6 percent of Russian households enjoy broadband Internet access, with active mobile broadband penetration at 74.9 percent.⁹⁷ Internet access is affordable and high-speed. Russia has the highest number of fiber connections in Europe. The number of users of online government and municipal services has doubled in just one year to reach 40 million in 2016⁹⁸ and 70 million by 2018. In the overall ranking of citizens’ electronic participation conducted by the United Nations Department of Economic and Social Affairs in 2016, Russia shared 14th place with four other countries.⁹⁹

⁹⁷ ITU June 2017.

⁹⁸ ITU June 2017.

⁹⁹ United Nations 2016.

Digital public service delivery has seen significant improvement, with citizens reporting high levels of user satisfaction, though commercial customers are less pleased. According to a 2016 Rosstat survey, 66.1 percent of citizens are fully satisfied with the quality of public and municipal digital services, with another 32.4 percent partly satisfied.¹⁰⁰ Russia has also done well in setting the stage for open government.

In terms of transitioning to the next phase of digital transformation, Russia's flagship achievement has been the development of an upgraded digital infrastructure capable of supporting a "GaaP" approach. Key elements include:

- A Unified Portal of Public Services that catalogues services by agencies, categories, as well as life events with more than 20 different options. The latter design reflects the user-centered services delivery principle of digital government. The portal also has a built-in capacity to process transactions, thus enabling a fully digital service delivery;
- A System of Inter-Agency Electronic Interaction (SMEV 3.0) with advanced functionality that addresses the need to unite federal and regional segments of digital government;
- A Unified Identification and Authentication System with a growing number of registered users;
- The Interagency Electronic Document Management system with a universal format and register for electronic documents. The system reduces the time and costs of document circulation between government agencies. Most federal agencies participate in the system, yet the regional segment remains underrepresented;
- An extended network of multifunctional centers that can be used for developing the population's skills in using the online infrastructure of the digital government;
- A system to authorize and verify electronic/digital signatures, thus contributing to the expansion of fully digital services;
- A well-developed and fully digital system of public procurement that provides the infrastructure for open and equal access to government contracts. The government has also appointed five digital marketplaces that can conduct the entire public procurement process digitally; and
- A system of state and municipal payments (geographic information system [GIS] GMP).

A Unified Portal of Public Services (www.gosuslugi.ru) has been the front office of Russia's digital government since its inception in 2009, providing users with information, application forms, and payment services. It has undergone a series of revisions and upgrades, adding new technologies and functionalities as well as adjusting to the new user-centric principle of service delivery. The number of users has been growing steadily, although many still use the simple registration process (without verifying the identity in person), which limits the kind of services that are available to the user. To date there are some 70 million users registered, of which 57 percent (36 million) have verified their registrations. The percentage of Russians registered on the unified portal is comparable to rates in the United Kingdom and Australia.

To further improve, Russia will have to accelerate back-office transformation to increase the speed and quality of service delivery, incentivize ID verification to enable full functionality and adopt a more standardized approach to public service delivery, both horizontally (between agencies) and vertically (across different levels of government), thus erasing the legacy of earlier stages of e-government implementation. It will also have to develop a standard approach to data management, include data digitization, storage, management, and analysis.

72,6%

households
connected to
broadband

70
million

online government
services users

100 Results of federal statistical monitoring of the use of information technologies for the public in 2016, Rosstat. http://www.gks.ru/free_doc/new_site/business/it/fed_nabl-croc/index.html, accessed July 27, 2018.

As outlined in its “Strategy for the Information Society Development in the Russian Federation (2017–2030),” Russia has proposed the following objectives for the next phases of transformation to digital government:

- The development of a digital government infrastructure for federal, regional, and municipal administrations;
- The use of big data and advanced data analytics to improve public services;
- The use of new technologies to enhance public administration;
- The development of digital tools to enable the interactions between the government and the public at all levels of government while preserving the possibility of non-digital interactions.

To achieve these objectives, a significant transformation of the current e-government architecture will be required, including the reengineering of administrative processes and the emphasis on the use of national databases, the sharing of digital services between federal, regional, and municipal governments, and the provision of interactive digital government platform services to citizens and businesses and to enable the use of digital government platforms for direct citizen-to-business interactions. A few specific challenges will also have to be addressed.

REGIONAL DISPARITIES

A lack of interoperability across the different levels of government at the federal, regional, and municipal levels has resulted in disparities in the use of digital technologies. Today few local self-government organizations are in line with national digitization requirements. This persistent federal-regional-municipal divide has been negatively affecting the speed of government transformation in Russia.

The magnitude of the challenge is evident in the large number of municipalities including municipal districts, urban districts, and urban and rural settlements. Most municipalities do not have sufficient funds to finance ICT-related projects and rely on regional and federal contributions.

DATA GOVERNANCE ISSUES

Russia lags behind OECD countries in digitizing its databases. Civil registries were supposed to be fully digitized by 2015,¹⁰¹ but the process was delayed and has not been fully completed. Other challenges include data redundancy and the loss of sensitive data records such as land cadastral surveys and civil property registries in the process of amalgamation.¹⁰²

Russia’s underperformance in these areas can be attributed to three factors.

First, there is a lack of prioritization of enforcing interoperability standards for effective data management at the municipal, regional, and federal levels. Second, the federal structure of government in Russia has in some cases led to the creation of parallel and duplicative databases at multiple levels of government. Finally, there are problems of data ownership, sharing, and management, as the current system creates few incentives for agencies to release data specific to their domain of interest. For digital government to succeed, effective data management at all levels of government is essential.

101 See http://www.cnews.ru/news/top/vse_zagsy_rossii_dolzhen_byt_otsifrovany, accessed July 27, 2018.

102 See <http://www.gisa.ru/120819.html>, accessed July 27, 2018.

BOX 4.6

AGILE APPROACHES IN RUSSIA'S LARGEST PUBLIC BANK

Agile is an approach to quickly test hypotheses and deliver projects in a fast-changing IT environment. Sberbank, a state-owned Russian bank and the largest in the country, launched its Agile transformation process in September 2016 with the goal of revolutionizing its end-user delivery process (time-to-market). Before introducing Agile, the average time to market for IT-related systems was several years. This delay meant that newly deployed systems were obsolete by the time they were deployed. Sberbank adopted Agile to cut time to market and help improve the design of their IT products in a way that reduced routine functions of staff and minimized the bank's risks through active digitization of back-office processes. This led to the emergence of what has been called the 'SberGile culture' defined by cross-functional teams, flat process structures with client-task-based teams. The result has been quick and continuous improvements in IT product development. As of March 2018, there are over 200 IT products in development and over 11,000 employees engaged in the transformation process.

GOVERNMENT AS A PLATFORM IN RUSSIA

The implementation of GaaP in Russia is still in its very early stages. The website gov.ru aspires to reflect the federal nature of government and to provide centralized access to all federal-, regional-, and municipal-level services, yet today it remains largely a website offering links to other government websites. Back-end government transformation has also been slow, hampered by a lack of business process reengineering and data management challenges. The introduction of a system of interdepartmental electronic communication to support a digital workflow between government agencies and a system for identification and authentication of users on the government services portal with a broad network of authorization offices around the country has been a step in the right direction.

Going forward, it is important to make government services fully available online and support multiple channels for service delivery including mobile devices, call centers, and physical service points. The portal should evolve as a platform for public and private sector interactions including third-party applications.

G-CLOUD

With respect to cloud technologies, the government is in the planning phase and has committed to migrating 90 percent of data resources to the state cloud by 2024, but progress has been slow due to issues with data readability, conflicts between government agencies, and existing barriers in government procurement legislation, among other factors. Data remains unstructured and not conveniently accessible for stakeholders. This situation complicates the ability of external and internal users to apply advanced data analytics to build products and make evidence-based decisions. The regional segregation of databases also produces additional obstacles to optimization.

A CULTURE OPEN TO INNOVATION IN RUSSIA

The rapid emergence of new disruptive technologies requires the development of a pervasive culture of innovation, which is a challenge in the Russian government context where, as in most public administrations, innovation has not been sufficiently encouraged in the past. This is no longer an option and special policy measures have to be adopted and implemented at the highest level to encourage and stimulate innovation in the public sector at all levels of government.

4.3 Policy Recommendations

Solid progress has been made over the last few years, but given the accelerating rate of technological change, Russia's strategy for the next phases of digital government transformation needs constant review and updating.

Achieving a leading position in digital government entails a full back-end digital transformation of the public sector, as well as delivering customized services to citizens and businesses through multiple channels that are trustworthy, transparent, effective, and efficient. The system will have to be data driven based on the principles of data sharing and collaboration across all levels of government, as well as the private sector and the public.

This vision is in line with the President's address to the Federal Assembly in March 2018, calling for the digitization of the entire public administration system within six years. This will require revising the government's strategy in a way that commits to establishing a culture open to innovation and a consideration of changes in how the system is governed.

To move forward substantively the government will have to address the following interrelated areas:

- Prioritize data and data analytics for a data-driven administration. Recognize high-quality data as a reusable national asset and apply common data governance structures and data management principles. Commit to open data to increase public sector transparency.
- Implement GaaP delivering trusted, user-centric digital public services.
- Adopt a Russian Interoperability Framework at the federal, regional, and municipal levels and a federal government-wide enterprise architecture.
- Complete the rollout of the shared services and information resources of the digital government platform and make its usage mandatory for federal agencies.
- Adopt design guidelines for digital services incorporating user-centricity, digital-by-default, security and privacy, data reuse, and interoperability as the key principles. Delivery of these services must be through the digital government platform and through multiple channels to address issues of digital inclusion.
- Leverage the new digital technologies (data analytics, AI, the IoT, blockchain) to upgrade and reengineer government services as well as build new services.
- Use secure cloud infrastructures for all platforms and services.
- Remove legal barriers relating to the procurement of usage-based services to allow the use of existing underused private sector capacity in cloud-related infrastructures. Best-of-class security and 24/7/365 availability can form part of service-level agreements.
- Resolve conflicts between government agencies preventing the creation of an effective government cloud.
- Use hybrid public/private clouds to prevent issues of data confidentiality becoming obstacles to service delivery.
- Migrate all ministerial data centers to the government cloud.
- Drive a culture of innovation and digital skills for the public sector
 - Prioritize middle and senior management training and launch change management to support a data-driven public sector.
 - Develop a culture of effective data governance and data sharing across government agencies.
 - Adopt international best practices to build a culture of innovation by setting up sandboxes and innovation hotbeds to encourage free-to-fail pilot projects.

- Drive collaboration between the private sector, the public sector, and the scientific community at all levels.
- Ensure federal, regional, and municipal cooperation in a common Russian digital space with abovementioned characteristics
 - Create a platform and sandbox for IT professionals to share standards, solutions, and test application.
- Prioritize digital transformation of education, health care, and culture and leverage big data and AI for maximum near-term impact.

Taken together, these cross-cutting and sectoral action areas should form the blueprint for the next phase of digital transformation of the Russian public sector.

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GLOBAL BEST PRACTICE FOR ACCELERATING BUSINESS TRANSFORMATION IN RUSSIA

While traditional Russian industry, with the exception of a few leading enterprises, is generally lagging in digital adoption, its services sector, especially FinTech, is leapfrogging into the digital age. Russia should leverage lessons learned from local digital adoption leaders and international best practice to help late adopters across the rest of the economy and invest in entrepreneurship, innovation, and boosting digital skills.

5.1 Global Best Practice for Driving Russian Industry Transformation

To strengthen the competitiveness of its key industry sectors, Russia should leverage existing national initiatives such as TechNet National Technology Initiative (NTI) and 4.0 RU to develop a single digital industry strategy that would present a vision for adopting emerging technologies to achieve industrial development objectives and to accelerate the creation of clusters of innovative companies and new drivers of economic growth. Engaging the private sector in digital transformation partnerships, driving top-down digital transformation of the large dominant state-owned enterprises (SoEs), fostering connections with the scientific and R&D community, prioritizing resources, and creating favorable taxation regulation to incentivize investments into digital technologies are all mechanisms to maximize breakthrough opportunities.

5.1.1 GLOBAL TRENDS IN DIGITAL BUSINESS TRANSFORMATION

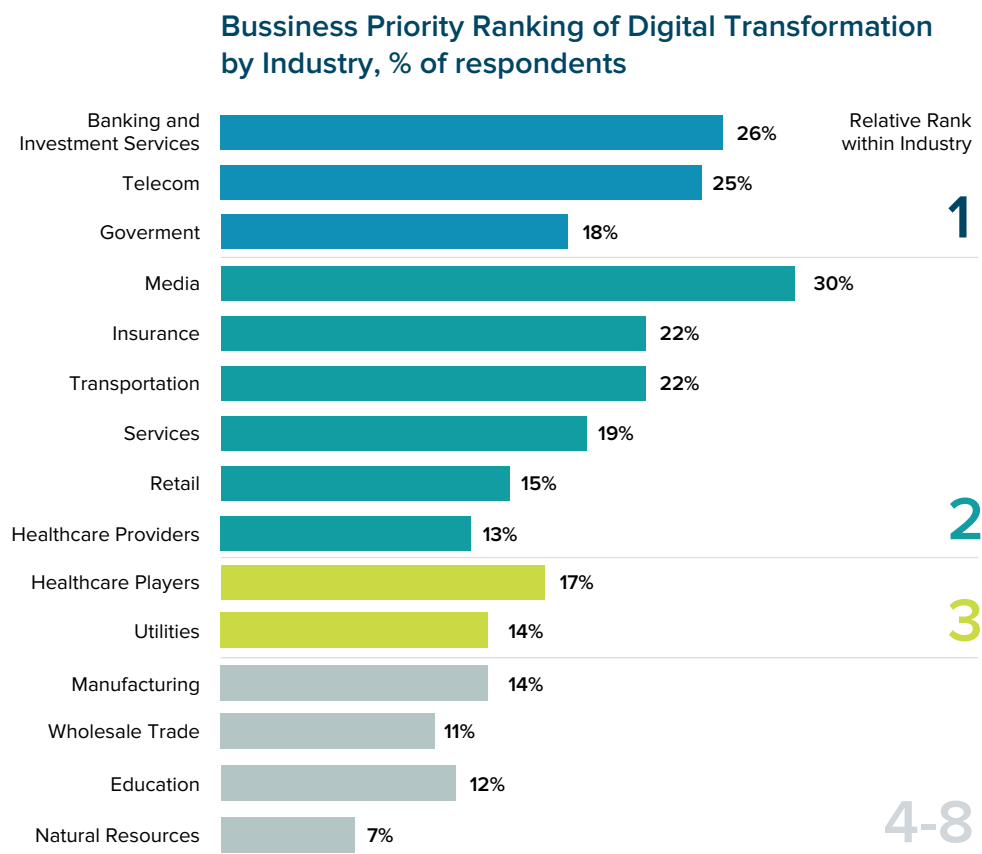
As nations develop digital business transformation strategies, it is important to identify priorities from a sectoral perspective. The approach should be based on an understanding of the importance of the sector to support national competitiveness, on the one hand, and the relative ease of driving digital adoption in that sector, on the other.

For example, a recent Gartner survey of a cross-sectoral group of leading industry CIOs from more than 90 countries determined that the services sectors, especially the media, financial services, and telecom sectors, were the most receptive to digital adoption while natural resources extraction sectors were the least aware of the potential impact of digital transformation on their businesses (Figure 5.1).

In assessing existing levels of private sector digitization in Europe, McKinsey also points to strengths in the finance, media, and telecom sectors while assessing transformation of the mining sector as average and assigning a low index to agriculture, construction, and hospitality (Figure 5.2). It also points to a large remaining potential for the digital transformation of industry,

”
Media, telecom and financial services are the most receptive to digital adoption

FIGURE 5.1 Industry Receptiveness to Digital Adoption by Sector



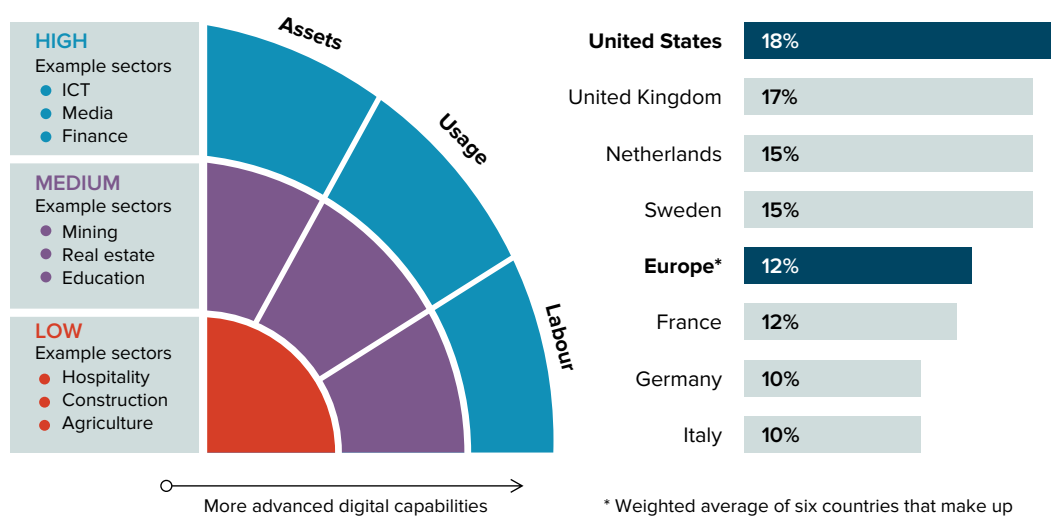
Source: Lowendal et al. 2017.

FIGURE 5.2 Industry Digitization Index

MGI's Industry Digitisation Index combines 20 indicators to measure digital assets, digital use and digital workers in each sector

MGI's European Industry Digitisation Index

Share of Digitisation Potential Realised



Source: McKinsey Global Institute 2016.

Note: MGI = McKinsey Global Institute.

indicating that to date even digital leaders are far from realizing the full potential of digital technologies adoption, with the United States at 18 percent of its digital transformation potential and Europe at just 12 percent¹⁰³.

GLOBAL TRENDS IN DIGITAL INDUSTRY

Digital transformation of the industrial sector is key to building a digital economy and reaping digital dividends, that is, achieving measurable economic results through digital adoption.

Digital transformation of manufacturing and related traditional industry sectors is a priority for all industrial nations that have built their competitive advantage during the 20th century Industrial Revolution. Digital transformation of manufacturing should aim to boost efficiency, productivity, and the global competitiveness of the sector. Today, industry is undergoing massive changes caused by the adoption of intelligent systems prompting the convergence of the physical and digital worlds. These enormous technological changes are accompanied by the development of fundamentally new business processes at all levels.

At the national level, countries manage these changes through the deployment of large-scale programs such as the Advanced Manufacturing Partnership in the United States, Industry 4.0 in Germany, “Factories of the Future PPP” in the EU, “Made in China 2025,” and so on.

At the sectoral level, industry transformation is characterized by the minimization of human involvement in the production process and the transition to effective data-based management. In addition to the broad implementation of ERP solutions, technologies driving the transformation of manufacturing into “digi-facturing” characterized by a total digital integration of production, logistics, and distribution supply chains include:

- Digital design and simulation as a combination of computer-aided design, engineering, simulation, optimization, and manufacturing with a special focus on additive manufacturing and the creation of smart models and smart digital twins;
- The use of new materials, especially composite materials, metamaterials, and metal powders for additive manufacturing;
- Additive technologies: additive manufacturing systems, materials, processes, and services;
- Industrial sensing: smart sensing and control systems embedded into manufacturing equipment, shop floor, or factory;
- Industrial robotics: primarily flexible manufacturing cells;
- Smart big data generation, collection, storage, management, processing, and transmission;
- IIoT;
- Virtual and augmented and mixed reality; and
- Expert systems and AI.

If taken separately, none of the advanced manufacturing technologies can provide a long-term competitive advantage in the market. Complex technological solutions are required for the rapid design and production of a new generation of globally competitive products.

These solutions come together in the so-called Factory of the Future, which is a new production model based on a multidisciplinary “smart manufacturing” approach, which includes:

- Creating digital platforms that enable new ways of value creation through the use of advanced digital technologies. By leveraging predictive analytics and big data, the platform approach enables integration of spatially distributed designers and

¹⁰³ McKinsey Global Institute 2016.

manufacturers and allows to increase flexibility and customization while fulfilling customer requests;

- Developing a system of digital models of both newly designed products and production processes. Digital models must have a high level of adequacy to physical products and actual processes enabling the convergence of the physical and digital worlds to generate synergy effects ultimately becoming digital twins; and
- Digitalizing the entire product life cycle, from concept and design to production, use, after-sales service, and recycling.

Digital platforms are becoming the key competitive production asset that enables the efficiency and flexibility of the production process and ensures the seamless integration of Industrial Internet-supported smart machinery, cloud resources, security solutions, data analysis, and digital workforce with logistics and business-to-business (B2B) and business-to-consumer (B2C) sales processes.



Use of robotics in smart manufacturing reduces risks of human error

Digital factories span the product life cycle from the R&D and product planning stage to the development of a digital mock-up (DMU) and digital twin—and to the creation of prototypes and small-batch production. A digital factory uses big data analytics to create smart models of products (for example, machines, structures, units, instruments, and installations) developed through the application of the new paradigm of digital design and simulation called “smart digital twin”.

The use of robotics in smart manufacturing reduces risks of human error, while the development of DMUs, smart digital twins, and prototypes dramatically drives down production and testing costs.

Virtual factories link digital and smart factories through a distributed network that allows developing and using virtual models of organizational, technological, logistical, and other processes to optimize global supply chains.

In addition to transforming supply chains and production processes, the spread of disruptive technologies leads to increased competition with other sectors in the digital age and the appearance of nontraditional competitors to entrenched industry giants. For example, given the emergence of data analytics as a key source of competitive advantage, the United Aviation Corporation (UAC), a leader in the Russian aircraft-building industry, sees itself competing globally not just with its aircraft-building peers but also with the likes of Google and Yandex, as well as RosNano, Sberbank, Tesla, and Space.¹⁰⁴ UAC sees the aircraft construction process as a constant source of massive amounts of critical data.

NATIONAL INDUSTRIAL TRANSFORMATION STRATEGIES: THE CASES OF CHINA, GERMANY, AND THE UNITED STATES

Emerging evidence indicates that countries with specific strategies that identify how they will integrate and capitalize on emerging digital technologies to address opportunities and challenges across multiple industries are best positioned to succeed. Leaders include China, with its comprehensive “Made in China 2025” initiative; Germany, with its Industry 4.0 strategy; and the United States, with its “Industrial Internet Consortium” (IIC).

In addition to shaping and capitalizing on digital technologies, these countries have developed policy and regulatory arrangements that are relevant for the digital transformation of industry in Russia, including ways to address competitiveness, productivity, local development, as well as skills and technology transfer (Table 5.1)

¹⁰⁴ See <http://uacrussia.ru/ru/corporation/>, accessed July 27, 2018.

TABLE 5.1 Digital Industry Strategies: China, Germany, and the United States

	China: “Made in China 2025”	Germany: “Industry 4.0”	United States: “Industrial Internet Consortium”
Objectives	Become a global and self-sufficient leader in manufacturing high-quality and high-technology products.	Enhance quality, lower costs, and increase efficiency by using emerging technologies to digitize processes.	An open “sandbox” to drive IoT adoption, develop reference architecture, set global development standards, share best practices, and build confidence around new approaches to security. ^a
Sectoral Focus	10 priority sectors, which account for nearly 40 percent of China’s industrial value-added manufacturing, including robotics, aerospace and aviation, maritime engineering, IT, energy, and biomedicine.	Cross-cutting focus on transformation of business models through enhancing interconnectivity and bringing digital innovation to supply chains and business models.	Telecommunications, data processing, manufacturing, and other sectors affected by digital technologies.
Institutional Arrangement	Led by the State Council of China with goals through 2025.	Publicly driven initiative that is enacted through stakeholder dialogue. Ministries coordinate relevant players, assist with financing, and drive targets with standards and so on.	The IIC is an open membership consortium comprising large multinationals in cooperation with academic organizations and government.
Funding	Total of US\$300 billion. ^c “Made in China 2025” program uses preferential access to capital for Chinese companies to enhance research and competitiveness and purchase technology from abroad.	Mixed public-private model. €200 million (US\$213.5 million) was provided by the German government for Industry 4.0 technologies, and the Federal Ministry of Education and Research (BMBF) and Federal Ministry for Economic Affairs and Energy (BMWi) have collectively given €200 million for research activities and programs. Industry partners provide in-kind and financial contributions.	The IIC is a nonprofit group. Testbeds receive funding from governments and industry, as well as foreign governments and mixed public-private partnership (PPP) funding. ^b

Sources:

- a. See <http://www.iiconsortium.org/about-us.htm>, accessed July 18, 2018
- b. Bradsher and Mozur 2017.
- c. Industrial Internet Consortium 2014.

The varying characteristics of each program demonstrate the range of choices available to governments as they invest in digital industry and the importance to develop strategies that emphasize unique comparative and competitive advantages. The scale of Chinese top-down government investment into its industry transformation program compared to that of its U.S. and European counterparts is also noteworthy as it is indicative of a very different approach to the role of the government in driving digital industry adoption.

While China chose to focus on enhancing its global position in high-technology manufacturing and invest in skill development and R&D, Germany preferred to focus on the impact of emerging technologies to enhance productivity, increase efficiency, lower costs, and improve quality. The United States has decided to promote the creation of coalitions between leading industries to reduce barriers to the digital transformation of industry. As a consequence, the sectoral focus of the IIC is very broad, while the “Made in China 2025” strategy has precise, quantifiable objectives and targets.

China has adopted a top-down approach as the State Council sets the strategy through a 10-year plan. This clarity of purpose enables the Chinese government to mobilize resources at a scale that outpaces others, allowing for the acquisition of a range of tools and technologies as well as the acquisition of foreign competitors or companies. Germany adopted a blended approach combining private and public sector initiatives, while in the United States, the approach is extremely broad, platform based, and organic.

China plans to develop 15 more innovation centers by 2020 40 more by 2025



In terms of tools to implement the strategy, China expects the development of 15 additional innovation centers by 2020 and 40 centers by 2025. The Chinese state also aims to protect domestic industry through licensing, limitation of market access, and regulations. Funded with US\$300 billion, “Made in China 2025” makes extensive use of preferential access to capital to Chinese companies to develop research and competitiveness, as well as purchase technology from abroad.

The **Industry 4.0** program is part of larger initiatives in support of the industry coordinated with EU programs such as Horizon 2020. The German budget funding of Industry 4.0 is €200 million.

IIC test beds are funded by governments and industry in the context of mixed PPP models. The IIC is also related to several programs of funding of R&D efforts. “Made in China 2025” is a large-scale focused government effort to stimulate the growth of national players that may influence global competition in emerging technologies adoption.

Two important elements of the abovementioned strategic approaches are SMEs and skills development. The IIC initiative in the United States is technology driven and does not identify SMEs as a particular class of players.

5.1.2 DIGITAL INDUSTRY IN RUSSIA

Industry plays a central role in Russia’s economy, contributing more than 38 percent of GDP and employing a third of the labor force.

The structure of the manufacturing industry in Russia is split among manufacturing (65 percent), mining (27 percent), and production/distribution of electricity, gas, and water (8 percent).¹⁰⁵ The past five years have been characterized by high variance in production rates by subsector with chemicals, food, and refined petroleum products exhibiting consistent growth, while other subsectors have seen production levels fall relative to 2012. Sectors such as machinery, metal products, and electrical equipment have exhibited the greatest decline in production (Figure 5.3).

The Russian economy continues to be highly concentrated in a few sectors. Despite the efforts to support a variety of sectors to increase the international competitiveness of Russian industry, its high-tech and manufacturing sectors remain laggards globally. This is compounded by the relative dependence of the Russian economy on the volatile oil and gas value chain.

The digital transformation of Russian industry is a top national priority, as discussed in the May 2018 Presidential Decree. Digital transformation of the processing industries as a way to boost exports has been given special attention in the decree.



With a few exceptions, Russia is behind its global peers in digitalization of mining and processing

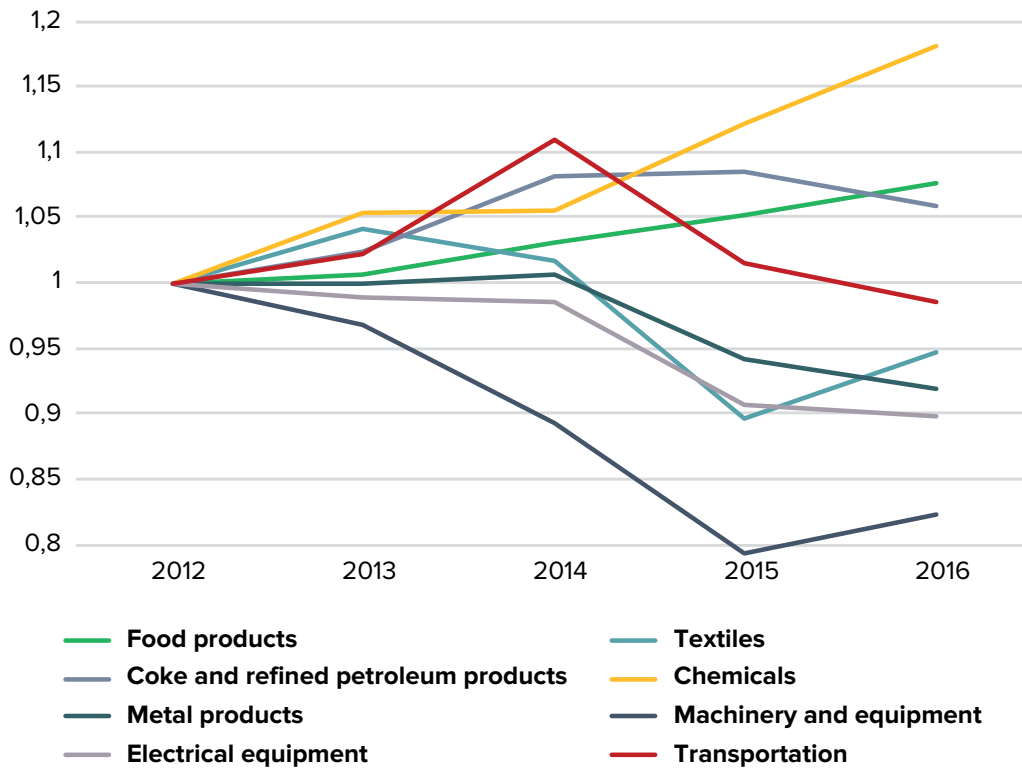
But when it comes to the digitization of key Russian industries such as mining and processing, with a few exceptions, for example, Gazprom, Russia lags behind its global peers (Figure 5.4).

While the overall level of digital adoption by Russian industry is lower than that of its global peers, Russian industrial leaders such as Gazprom, KAMAZ, the UAC, and several others have made impressive progress in digital adoption focusing on digital transformation as a strategic priority.¹⁰⁶ Their experience should be broadly shared as national best practice in the digital transformation of Russian industry to enable late adopters to accelerate their pace of digital development.

¹⁰⁵ Rosstat 2017b, see “The Volume of Shipped Goods of Own Production, Work and Services Produced by Own Strength.”

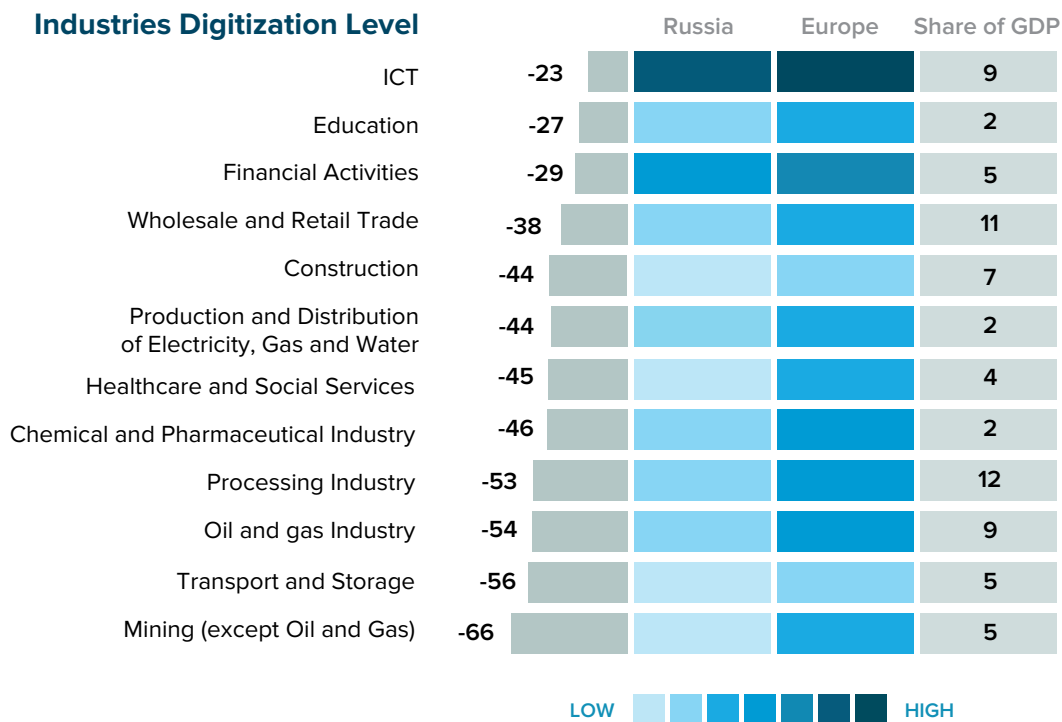
¹⁰⁶ CIPR-2018 (Russia’s digital industry conference), presentations by UAC, KAMAZ, and Gazprom. Kazan, 2018.

FIGURE 5.3 Russian Industrial Production Index



Source: Elaborated by the authors, based on Rosstat 2017b.

FIGURE 5.4 Digitization Levels: Russia and Europe



Source: Digital McKinsey 2017.

BOX 5.1

PILOTING A DIGITAL INDUSTRY PLATFORM AT GAZPROM

Gazprom sees the development of a digital industry platform as one of its top strategic priorities. It has recently launched EvOil, an open digital platform, bringing together all the supply, production, and logistics partners to enable uninterrupted production management and expand its position in national and global markets. It has initiated the launch of this platform in the context of its digital factory pilot at a bitum production plant in Kazakhstan.

Gazprom is driving the development of an industrial digital platform and believes in the huge potential of the digital industry platform market in Russia (which it estimates at US\$2,27 billion) to transform Russian industries, increase the competitiveness of industrial corporations, and boost regional development, including growth in rural areas. It considers digital platforms to be a key asset that enables efficiency and flexibility of the production process and is aiming to achieve a total integration of the production and logistics supply chain as well as B2B and B2C sales through leveraging Industrial Internet technologies, IoT and smart machines, AI, data analytics, cloud resources, and a digitally enabled workforce.

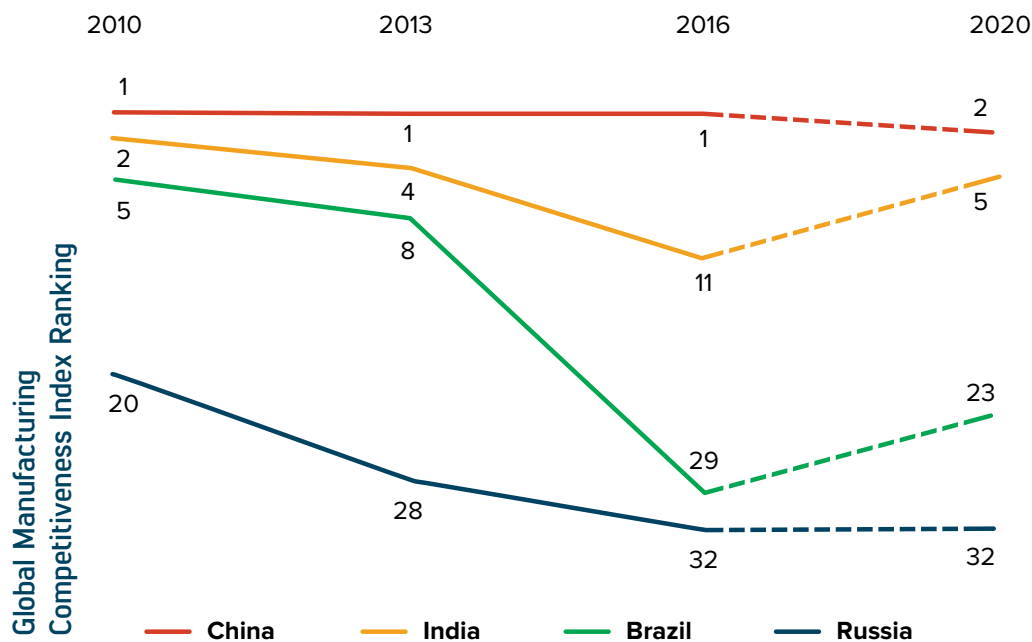
KAMAZ (a leader in the Russian automotive industry) has launched a Digitization Program that includes the implementation of a corporate digital platform and a transition to digital design/engineering, digital production, digital supply chain, digital sales and service, digital management, digital technologies, and information management, as well as the development of a digital corporate culture. It is also focusing on maximizing the value of digital technologies adoption inside the automobiles it produces to increase the competitiveness of its products in the local and global markets, taking advantage of digital twin technologies and data analytics.

The UAC is a good example of a corporation committed to implementing a comprehensive digital transformation strategy anchored in an ecosystem approach that aims to achieve a transition to a new business paradigm and a transformation in corporate “thinking.” This process starts with the creation of normative documentation to foresee and manage the arrival of new technologies and continues with the development of a single corporate digital platform and investment into the digital training and education of its workers to enable them to collaborate across the digital ecosystem, insists on direct customer engagement in corporate digital transformation initiatives, and develops an effective mechanism for identifying and applying new technologies and solutions.

This ongoing innovation drive in search of new products and solutions is also anchored in an ecosystem approach. The UAC has created a network of 13 higher education institutions where it has established special UAC departments that are engaged in researching and testing new technologies and solutions. The UAC conducts regular competitions and hackathons aimed at designing innovative solutions for the future of aviation. It invests in the Skolkovo Innovation Fund in search of new products, works closely with the Russian Academy of Sciences, and has created a corporate sandbox for testing potential applications of new technologies in a risk-free environment. The objective is not only to maintain a competitive edge in local aircraft building, but also to become a leading provider of technology and data services that enable the creation of factories of the future across the Russian economy, as well as to compete globally with the likes of Google, Tesla, and Space X.

For the UAC, its main product, the aircraft, is no longer just a product but an ecosystem that allows the corporation to extract and manage data that are used for continuous improvement of the production process.

FIGURE 5.5 Deloitte 2016 Global Manufacturing Competitiveness Index



Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness 2016.

To accelerate the speed of digital transformation in the company, the UAC has created several new executive positions, which, in addition to the CIO, include the digital innovation leader, the digital technology officer, and the chief analytics officer.

Unfortunately, this kind of local best practice is not consistently applied across the manufacturing sector, with some 65 percent of industry players relying on legacy systems. While there are cases of end-to-end automation and partial digitization, the potential has yet to be fully realized.

Many Russian industries have not yet started to adopt emerging technologies, such as IoT and cloud computing, and have few digital security safeguards in place. The number of industrial robots per worker in the manufacturing industries in Russia is 20 times less than in China.

As McKinsey underscores, the lack of a digital culture within Russian industry also has the compounding effect of making companies unattractive to relevant specialists.¹⁰⁷ With an inability to attract digital talent, companies simply do not have the ability to develop required digital tools, products, and services. This has had a negative impact on the competitive position of Russian industry.

In manufacturing, in 2016, Russia ranked 32nd among 40 countries (2016), far behind China, the United States, and Germany and down from being 20th in 2010 and 28th in 2013 (Figure 5.5).¹⁰⁸

The lack of focus on digital transformation is likely to further consolidate this downward trend in the future. If Russia is to reap the economic dividends of digital adoption, digital transformation of the industrial sector should be among its top national development priorities.

¹⁰⁷ Digital McKinsey 2017.

¹⁰⁸ Doitte Touche Tohmatsu Limited and US Council on Competitiveness 2016.

COMMITMENT TO DIGITAL INDUSTRY TRANSFORMATION

To help focus the country's attention on digital industry transformation, a clearly articulated vision and strategy is required. Today there is no specific document to bring together the various policies and programs in support of digital industry in Russia, although critical building blocks toward the development of a comprehensive strategy are in place.

Support for digital development exists at the highest levels of Russian leadership. Examples include the adoption of the Digital Economy Program in 2017, and implementation of the initiatives such as TechNet NTI and 4.0 RU, which have been supported by the Ministry of Industry and Trade.

Russia has invested into building an ecosystem of research centers, initiatives, technology parks, and industry associations in support of digital industry. These include the "Strategy of Scientific and Technological Development of the Russian Federation" and the "Russian Technology Transfer Network (RTTN)." For example, the 2017 TechNet NTI Roadmap aims to develop a set of core competencies that ensures the integration of advanced manufacturing technologies and related business models into the next generation Factories of the Future to create new globally competitive high-tech manufacturing products.

Several leading Russian enterprises such as KAMAZ, UAZ, UAC, UEC-Saturn, Russian Helicopters, and others have been investing in the creation of digital factories in several sectors such as defense, aerospace, engine building, automotive, aviation, and shipbuilding, with a focus on computer-assisted mathematical modeling, virtual integrated supply chains, virtual testing, and so on.

In 2016, the autonomous noncommercial organization, Agency for Technological Development (ATD), was created. The agency was established to promote Russian enterprises to implement world-class technology solutions with the goal of making

BOX 5.2

4.0 RU AND TECHNET NTI

4.0 RU envisions a single digital space to support Russian industry. The concept is the product of a joint initiative championed by the Ministry of Industry and companies such as ITELMA, Kaspersky Lab, Siemens, and STAN. 4.0 RU aims for integrated digital technology adoption at all stages and levels of industrial production. The objective is to shorten the time to market for new products, increase production flexibility, enhance product quality, improve production process efficiency, and stimulate innovation through new technologies with the ultimate effect of enhancing the competitiveness of Russian industry.

TechNet is an action plan produced by the NTI to support "advanced manufacturing technologies." The action plan was approved by the Presidium of the Presidential Council for Economic Modernisation and Innovative Development. TechNet promotes technologies including digital design and modeling, new materials, additive and hybrid technologies, robotics, sensors for industrial applications, Industrial Internet, big data, information systems for production management and enterprise, virtual and augmented reality, and AI. TechNet aims to enhance the global competitiveness of Russian high-tech industries, push forward advanced manufacturing technologies through long-term planning, and create an ecosystem that can support and sustain best-in-class technology transfers and development and the creation of an institutional and legislative environment that is conducive to the growth of the digital industry. It is expected that TechNet NTI will increase Russia's share in global markets of engineering and design by some 1.5 percent by 2035. The value of exports of products created using advanced manufacturing technologies is expected to increase by RUB 800 billion (in 2016 prices). Forty "Factories of the Future," 25 testbeds, and 15 experimental-digital certification centers (laboratories) are scheduled to be created. These solutions made up of the best world-class technologies and proprietary cross-industry know-how are referred to in the TechNet NTI Roadmap as Digital, Smart, and Virtual Factories of the Future.

BOX 5.3

VIRTUAL TESTING FOR AURUS

The Kortezh project implemented by the Central Scientific Research Automobile and Automotive Engine Institute (NAMI) focused on building a Russian-made official state car (a modular platform-based limousine, sedan, SUV, and MPV) for top government officials. In 2016, after a crash test at an independent test facility in Berlin, the new Aurus sedan received a maximum five-star European New Car Assessment Program (Euro NCAP) safety rating. This ranking validated the Russian-developed technology of virtual testing, virtual labs and virtual testing environments. The technology was developed by the specialists of the Computer Engineering Center at the Peter the Great St. Petersburg Polytechnic University and the CompMechLab® group of companies. The new model, Aurus, was officially launched at the Presidential Inauguration ceremony in May 2018.

Several research centers have started to work closely with leading Russian enterprises in developing smart manufacturing products and solutions in Russia. These efforts are strongly supported by the government.

BOX 5.5

CompMechLab GROUP OF COMPANIES

Russia's CompMechLab group of companies has developed a unique digital platform CML-Bench for the development of digital twins, which won the Russian National Industrial Award, INDUSTRIA, in 2017. It is a cross-sectoral multidisciplinary platform that enables virtual development and testing of globally competitive products. The platform already operates in automotive, aerospace, helicopter engineering, engine building, shipbuilding, machinery industry, oil and gas engineering, nuclear energy, and other sectors, enabling engineers, suppliers, and customers to work in a distributed collaborative environment across different companies, countries, and time zones.

BOX 5.4

FACTORIES OF FUTURE

The Factories of the Future project is a high-level government initiative aiming to enhance the competitiveness of the Russian high-tech manufacturing sector by addressing key industry challenges that companies are unable to solve on their own. Participants are Russia's leading enterprises, including the NAMI, Sollers, Volgabus, KAMAZ, UEC-Saturn, UEC-Klimov, Sredne-Nevisky Shipyard, United Aircraft Corporation/Sukhoi Civil Aircraft/Irkut Corporation, Russian Helicopters/Kamov/Mil Moscow Helicopter Plant, NPO OKB Simonov, Kazan Motor-Building Production Association, Kazan Helicopter Plant, ROSATOM/TVEL, and so on. A new NTI Center for Advanced Manufacturing Technologies has been established in 2018 at the Peter the Great St. Petersburg Polytechnic University, and the eligibility of those technologies to receive government support was confirmed.

BOX 5.6

DIGITAL SHIPYARD TO BE BUILT IN ST. PETERSBURG

St. Petersburg is among Russia's digital transformation leaders, positioning itself as Russia's "virtual design bureau" for the automotive, aircraft and shipbuilding, as well as defense industries. With support from the TechNet NTI, and as part of the Factory of the Future project, the Middle Nevsky Shipyard is planning to create a digital shipyard in the next three years. This will allow the company to increase productivity and shorten the development time of new products by utilizing advanced building technologies such as laser cutting and welding. Machines and machine tools will be linked to a single information management system to ensure accuracy, precision, and efficiency throughout the production cycle. Product testing will be done virtually. The goal is to double the plant's production capacity, increase export volumes, and reduce the time and costs of production and maintenance. The project will be initiated in 2018 and completed by the end of 2020.

Source: See <http://snsz.ru/?p=4846>, accessed July 27, 2018.

domestic products competitive. The agency has a broad mandate ranging from technological research to the introduction of finished projects on the Russian market.

There is also a rich infrastructure of science and technology parks. Today there are 747 such parks, 50 percent which are private, 46 percent public, and 4 percent operating under a PPP model. Overall, however, the quality of ecosystem enablement at these parks is not on par with global best practice.

BOX 5.7

ARTIFICIAL INTELLIGENCE IN THE MANAGEMENT OF ENERGY NETWORKS IN THE KALININGRAD OBLAST

By 2021, the entire power system of the Kaliningrad Oblast will be controlled by the automated system of operational and technological control “Olympus.” The “Digital Distribution Zone” project was already implemented in two districts of the Kaliningrad Oblast resulting in a fivefold decrease in the average time for accident resolution and a twofold decrease in power losses. Elements of AI have been introduced to promote automated responses to emergency situations including the establishment of reserve lines in cases of power outage. The automated emergency system kicks in within 27 seconds. Under the previous, manual system, workers spent approximately three hours on each case. The impact is a reduction in operating costs by more than 24 percent. It is expected that this system will be rolled out throughout the Kaliningrad grid by 2020.

BOX 5.8

ROBOTICS AT A ST. PETERSBURG PLANT

St. Petersburg’s LLC “NPO” StarLine produces electronic security systems for vehicles of its own design on nearly fully robotized assembly lines. The robotization index here is 1000—1,5 times higher than at similar plants in Korea and twice the level of world leaders such as Germany, Japan, and Singapore.

Source: See <https://productcenter.ru/producers/10674/npo-starlain>, accessed July 27, 2018.

Completing the ecosystem for digital industry are a number of industry and technology associations, funds, and organizations, including the Industrial Development Fund (with a focus on dual-purpose technologies), the Russian Association of Artificial Intelligence (RAAI), the Russian Blockchain and Cryptocurrency Association (RABIK), the Russian Association of Robotics (RAR), the Internet of Things Association¹⁰⁹ (IOTAS), the Russian Association of Industrial Internet (RAII), the SME corporation, the Internet Initiatives Development Fund (IIDF), Russian Venture Company (RVC), and the Innovation Promotion Fund.

While there is a wide range of institutions, policies, and strategies that affect the transformation of industry, they lack alignment and cohesion. This leads to the duplication of efforts among ad hoc initiatives, incurs higher coordination and transaction costs, and increases the likelihood that critical industrywide enabling investments are being overlooked.

Thus, a comprehensive digital industry strategy is required to bring an overarching vision to the future of digital industry development in Russia, complete with a clear strategy, a set of goals and an implementation roadmap. Potential elements of this strategy can be found in existing cross-agency or public-private initiatives, such as TechNet NTI, 4.0 RU, and others.

5.1.3 POLICY RECOMMENDATIONS

If Russia is to become a digital industry leader while ensuring that the existing industrial base remains competitive, all stakeholders including the government, private sector, academia, and research institutions will have to work in close coordination.

Lessons from the global context increasingly indicate that developing a coherent and comprehensive digital industry strategy is an essential starting point, but a strategy alone will not be sufficient. Digital transformation will bring rapid changes, many of which are

¹⁰⁹ IOTAS; the official name is the Association of IoT Market Participants.

difficult or impossible to predict, and competitiveness will increasingly depend upon the capability of governments, firms, and research institutions to quickly respond and adapt to the changing environment. In Russia, industrial competitiveness is hampered by a high degree of market consolidation and domination by SoEs, and thus, a top-down government-driven digital transformation approach in line with the Chinese model may be required to accelerate the transformation process and attempt to catch up with global leaders. Without strong top-down leadership, market forces hampered by continuing capital outflows and declining local competition are unlikely to force traditional industry to make the required significant investments into digital technologies and business process transformation. A top-down approach should be amplified by a dynamic horizontal strategy built upon platforms of coordination among key stakeholders.

It is also important to perform the following:

- **Develop a comprehensive digital industry strategy** that addresses both industrywide digital enablers and sector-specific issues, consistent with international best practice and looking both at defending the strategic positioning of Russia's industry and the opportunity to develop high-growth areas. The strategy would benefit from a high-profile national initiative, similar to "Made in China 2025" and "Industry 4.0," that is based on a sound analysis of Russia's comparative and competitive advantages; brings together public, private, and research actors; includes specific objectives and target sectors; is not limited to large enterprises but fosters a fertile environment for growth among SMEs; is backed by a coherent policy coordinated across regions; and is resourced adequately. This strategy needs to include concrete metrics against which progress can be continuously assessed. Key industrywide enablers that should be the focus of the strategy include boosting R&D and innovation, industrial standards alignment, and digital skills development.
- **Strengthen links in the digital industry ecosystem** to enable cooperation between the private sector (including large companies and SoEs, SMEs, and start-ups), government organizations, and academic institutions and research centers to accelerate the pace of digital industry transformation. Build partnerships or create consortia to jointly develop standards and solutions, drive legislation for emerging technologies, share infrastructure, execute large projects, implement training programs, and invest in technology start-ups.
- **Encourage the establishment of strong links** between the traditional industry sector and the dynamic Russian ICT sector by encouraging traditional industrial SoEs to drive demand for locally provided ICT solutions and thus boost both the digital transformation of traditional industries and ICT sector growth.
- **Leverage innovation and encourage spillovers from advanced dual use sectors** such as defense, aircraft and shipbuilding, space, and nuclear industry. Experience and know-how gained in these sectors can accelerate industry transformation and lead to the development of new products and services.
- **Support education initiatives to build digital industry skills:**
 - Create mechanisms to counteract brain drain and attract leading Russian and foreign specialists back to Russia.
 - Strengthen the competencies of digital technology specialists through ongoing local and international training programs.
 - Work with local universities and training institutes to help them understand specific industry requirements.
- **Promote a culture of open innovation** and risk taking and highlight successes in digital industry transformation.
- **Create demand for innovation.** Encourage digital industry innovation and start-ups, including through the creation of corporate venture funds, business incubators, and digital factories, as well as technological contests.

At the **sector level**:

- Assess potential digital industry impact on economic growth, jobs, and service delivery.
- For at-risk sectors¹¹⁰ (such as mining and processing), identify leapfrogging opportunities through the introduction of digital technologies.
- For emerging technology opportunities, prioritize sectors for new technologies application and develop short-, mid-, and long-term strategies and implementation-oriented product-focused consortia.

5.2 Global Best Practice for Enabling the Digital Transformation of Russian Agriculture

In recent years, Russian agriculture has experienced significant growth and become a leader of Russian exports and a champion in import substitution, as some large Russian agribusinesses have been driving the adoption of cutting-edge digital technologies in farming practices. Policy makers should now focus on encouraging large late adopters as well as boosting the agriculture ecosystem to empower small and medium farms to take advantage of digital technologies to transform their business and service models.

5.2.1 GLOBAL TRENDS IN DIGITAL AGRICULTURE

As in all sectors of economic activity, in agriculture, digital technologies are transforming farming and agribusiness across the globe, not only for large commercial players and small farms in the world's wealthier countries but increasingly in the middle-income and emerging markets as well.

LEVERAGING THE EXPLOSION OF DIGITAL INFORMATION

The adoption of digital technologies has led to an explosion of information and knowledge available to all players in the agriculture ecosystem.

One emerging source of information is remote sensing. Satellites are collecting field-level information about crop cover, soil, and weather conditions. Drones are capturing detailed information at the field level, monitoring crop diseases, soil moisture, property boundaries, and so on. This information is then analyzed and shared among farmers, public agencies, and industry observers alike.

Satellites are making field-level information available to farmers, agribusiness, and government



Satellites also help control farm machinery and customize the application of inputs in the fields. Hyper-local weather information drives field-level activity and marketing decisions. Digital platforms allow farmers to summon farm equipment for hire and find buyers and sellers for their products. Pests and diseases can be identified remotely (using digital imaging) and responses can be mobilized rapidly. Soil moisture monitors trigger irrigation and enable new customized approaches to water management. The ever-expanding availability of digital tools helps small and remote farms to link with partners and buyers, carve out niche markets, and explore new business models.

Digital solutions such as integrated agricultural production control systems, wireless monitoring and diagnostics, integrated sounding technologies, climate risk management, and so on help in soil and ground water restoration and pest management and enable


¹¹⁰ Following Digital McKinsey 2017, p. 41–42.

remote integrated monitoring of compliance with the certification requirements, for example, in organic agriculture.

Digital platforms empower farmers by expanding access to relevant practical information such as farm product prices and availability, local weather forecasts, best farming and animal breeding practices, seed varieties, pest and disease control, and so on (for example, Farmer Business Network in the United States, WeFarm and Twiga Food in Kenya, and eKutir Global in India).

The IoT enables “Precision Crop Management,” for example, monitoring wheat crop nutrition status in real time. Then, data analysis, digital task management, and automation enable precise water and nitrogen application. IoT is also used on-farm to establish real-time communication between farm machines.

IoT technologies also enable on-the-ground sensors to continuously relay information to farmers about water usage, soil moisture, field (or greenhouse) temperature, and other important production variables. This allows rapid response to current conditions by adjusting irrigation pumping, for example, or turning on or off water and heaters in greenhouses.

IoT is used on-farm to establish real-time communication between farm machines 

Strategically placed weather ground stations relay critical, detailed, and location-specific weather information to weather information services. Sensors on farm machinery record the location of the machinery as well as operational and performance data.

LEVERAGING DIGITAL TOOLS TO SUPPORT “PRECISION AGRICULTURE”

More than ever before, digital tools and services make it possible for knowledge to be made available directly (through push or pull services) to farmers and to other stakeholders in the agricultural sector. In Russian agriholdings, for example, detailed technical instructions are relayed from agriholding headquarters to staff in the fields, instructions can be sent directly from satellites to farm workers and farm machinery in real time, as they work with crops and livestock in fields and barns—adapting seeding rates, fertilization, feed mixes, etc. on the go—in what is called “precision agriculture.”

Farmers can also “pull” information about markets and prices, disease threats and ways to address them, weather data, and location-specific forecasts.

Digital soil databases and digital soil mapping manage data on the state of soils and soil cover to enable combating desertification, halting and reversing land degradation, and

BOX 5.9

ENABLING PRECISION AGRICULTURE

An example of a private sector initiative to make detailed and local information available directly to farmers and agribusiness is the platform developed by a U.S.-based firm called aWhere. aWhere operates a global-scale agronomic modeling environment with immense processing capacity that collects over 7 billion points of data every day to create unprecedented visibility and insight across the agricultural earth. aWhere’s hyperlocal information and insight support precision agriculture. Using proprietary blending and predictive modeling, aWhere provides field-level observed and forecast weather, growth stages, and pest and disease risks. aWhere’s information platform and tools transform agricultural decision making by grounding them in data and analytical insight that has never existed before.

improving agricultural land quality to support sustainable agriculture and enhance food security.

On a global level, the International Soil Reference and Information Centre (ISRIC) has created the SoilGrids soil information system.¹¹¹ The system provides public access to global soil map, as well as access to the World Reference Base for Soil Resources (WRB). The SoilGrids system is constantly updated, which facilitates reliable assessments of the impact of climate change and land degradation on food production.¹¹²

On a country level, in the United States, for example, collection, storage, management, and dissemination of information on the soil cover are the responsibility of the Natural Resources Conservation Service (NRCS), an agency of the U.S. Department of Agriculture (USDA). The NRCS has created soil-geographical databases, such as the Soil Survey Geographic Database (SSURGO) and the State Soil Geographic Database (STATSGO).

This database was developed mainly for the planning and management of natural resources at local and regional levels such as farms and ranches, settlements, and districts.

Another example of soil data use at the state level is the Department of Agriculture of Uruguay, which also provides public access to soil information. Soil types are classified according to their productivity and measured according to an index called “CONEAT.”¹¹³ The CONEAT index of a property also correlates with the price of the land and makes market transparent: it is easy to compare properties.

¹¹¹ Hengl et al. 2017.

¹¹² Folberth et al. 2016.

¹¹³ See <http://web.renare.gub.uy/js/visores/coneat/>, accessed July 27, 2018.

BOX 5.10

GLOBALIZATION OF AGRICULTURE KNOW-HOW THROUGH DIGITAL TECHNOLOGIES: INTERNET OF FOOD & FARM 2020

Technology deployment to obtain, extract, and manage agriculture information from and to farms is only economically viable at a large scale. The Internet of Food & Farm 2020 (IoF2020), a mega IoT pilot project in agriculture co-funded by the European Commission aims to convene key private, public, and not-for-profit stakeholders throughout the value chain to validate technology choices, for example, timely and precise farm data analysis; IoT for productivity enhancement and traceability; GPS and sensor for livestock movement; and machine learning technology for dairy quality assurance.

In addition, IoF2020 seeks to address issues of systems interoperability, data security, and localization to structure optimal business models and processes and to provide agri-tech entrepreneurs with relevant data and market entry support.

Along with Wageningen University Research in the Netherlands, the 70 partners of IoF2020 from

14 countries focus on five work pillars—(1) project management, (2) trial management, (3) IoT integration and capabilities, (4) business support, and (5) ecosystem development—and on five agriculture value chains: arable crops, dairy, fruits, vegetables, and meat. Notably, among the 38 private sector partners, 24 are SMEs. The project places an emphasis on actively involving end users, the farmers, to codesign and to provide feedback on user experience.

Launched in the first and second quarters of 2017, IoF2020 has developed 19 cases to date with various areas of progress. For example, “Within Field Management Zoning,” an IoT deployment for potato farming, aims to develop detailed soil maps and establish automation and machine communication. The pilot seeks to reach higher yield and quality with decreased production costs through improving farm management, serving small size farms of 50 to 200 ha.

In Europe, the main source of soil data is the European Soil Database (ECDB). It includes the territory of Belarus, Moldova, Russia, and Ukraine.¹¹⁴ In addition, soil information is included in the Infrastructure for Spatial Information in Europe (INSPIRE) as one of 34 themes. INSPIRE is a directive of the EU established in May 2007. It obliges all EU members to create an infrastructure of spatial data on the Internet to facilitate the standardized exchange of geographical information between countries. Different types of spatial data that are provided by different organizations are used simultaneously and are combined into layers in different user apps. It is believed that ensuring the wide availability of such information will allow many industries and government institutions to improve operating efficiency and reduce costs. The project implementation will end in 2019, with the expected economic effect estimated at more than €1 billion per year.¹¹⁵

HELPING SMALL FARMS THROUGH DIGITAL PLATFORMS

Digital tools are important not only for helping farmers to harness the power of technical knowledge and information. They also allow farmers and other agricultural actors to overcome traditional barriers such as isolation and asymmetric information to become much more effective participants in both input and output markets. Two important dimensions of these phenomena have to do with dramatically improving and expanding links between market participants and facilitating reliable and rapid transactions of financial assets even in remote and cashless locations.

LINKING MARKET PARTICIPANTS THROUGH DIGITAL PLATFORMS

Platform economics are transforming agriculture.¹¹⁶ Today, these platforms not only match supply and demand at digital marketplaces but also encourage collaboration, services exchanges, and create links to other economic sectors such as tourism, hospitality, and catering, to name a few. Digital technology allows these platforms to target the global market while still being rooted in the local (national) economy. From tractors to organic honey, the economics of platforms are emerging as an accelerator that is also simplifying trade in the fields of agriculture and food. But it also acts as a disruptor: farmers evolve into providers of services (from agricultural work to the accommodation of tourists).

Agricultural produce and food, as well as equipment and supplies, are available on many platforms. In France, Le Bon Coin sells second-hand equipment. In some U.S. cities, Amazon Fresh allows customers to do grocery shopping online. Airbnb offers farm holidays, while crowdfunding platforms aim to provide funding for agricultural projects. But there are also specific platforms for agriculture and food. They can be divided into five major categories.

NEW MARKETPLACES

Platforms are coming into being as “marketplaces,” or virtual meeting places, that match the supply and demand of goods and services by bringing together users and professional suppliers.

Initially, these marketplaces specialized in agricultural equipment and inputs. The Agriconomie platform, for instance, is a meeting place for distributors (retailers and wholesalers) and farmers in the market for inputs (seeds, fertilizers, and pesticides), spare parts, or small farming equipment. The “open” interface allows any company acting in a professional capacity to sell products on the website.

¹¹⁴ Stolbovoi et al. 2001.

¹¹⁵ INSPIRE Framework Definition Support Working Group 2003.

¹¹⁶ The discussion of platforms is based on Abelow, Abidi-Barthe, and Abiteboul 2016.

A global leader in agricultural equipment, Agriaffaires is an open platform that was established in 2000 and specializes in the wholesale distribution of agricultural equipment (cars, trucks, tractors, combine harvesters, and so on). Both new and used products are offered for sale or lease by dealers/distributors, traders, manufacturers, and farmers—in over 25 countries, including the United States, Germany, and Great Britain.

These marketplaces do not only involve intermediate consumption, but also agricultural production, thus replacing wholesale markets. The usefulness of these platforms is not limited to bringing together buyers and sellers. They also offer management services for contracts and invoices, to simplify administrative procedures. Furthermore, an independent lab analyzes and controls the products for sale.

Trade and sharing on collaborative sites, whether commercial or not, form a second category of platforms, which puts the emphasis on sharing and exchange and in which both users and providers are professionals.

WeFarmUp, a platform for the “sharing of equipment” among farmers, is the latest example in the world of agriculture to help solve two major problems facing farmers: massive debt and irregular income. Farmers rent out some of their equipment via the site, to obtain a source of income. Other farmers lease the equipment, to meet a specific need or to test a machine before purchasing it.

In the United States, MachineryLink solutions by Farmlink offers a similar platform. It works on the same principle, but on MachineryLink solutions, farmers renting out equipment can also offer their services.

Collaborative platforms promoting local production and combatting waste have also emerged in the food industry. In compliance with the public procurement code, the French platform Agrilocal tries to bring together local suppliers and “public buyers that need mass catering services” (secondary schools, retirement homes, hospitals, and so on). A buyer starts by expressing their needs. The information is then transmitted via the platform to local suppliers who may or may not respond. The buyer then chooses among the different propositions and places the order. The Loc’Halles Burgundy platform has a similar goal.

The Californian Copia platform aims, in turn, to connect companies that have a food surplus, such as restaurants, with people in need, to fight against food waste and assist the needy. The companies order a vehicle that collects leftover food and brings it to a food bank or a homeless shelter. The Food Neighbourly platform in Britain and Foodsharing in Germany work according to the same principle.

There is also another type of collaborative platform that brings together users who are private **individuals** and professional **suppliers**. The best-known example in France is La Ruche qui dit oui. Created in 2011, this platform links producers and consumers for selling/buying foodstuffs (fruits, vegetables, bread, cheese, meat, and so on) produced within 150 miles of the point of distribution. As of today, it comprises some 4,000 suppliers and over 100,000 regular users. The open platform allows any producer to sign up as long as the producer meets a number of agricultural production standards (environmentally responsible agriculture versus industrial agriculture). Its specificity consists, on the one hand, in the “hive”—a point of distribution close to consumers’ homes, where they can pick up their orders and even meet producers—and, on the other, in the “hive manager,” whether a private individual, an association, or a business. Producers determine the selling price of their products themselves and pay a commission on sales as compensation for the platform and the hive manager. Other French platforms that follow the same model include Locavor, Marchands de 4 saisons, and Label Fourmi.

Some such platforms allow customers to order food directly from producers and retrieve it in a locker inside a store (Au bout du champ) or to contact farmers directly to purchase their products. Others even organize visits, meals, and leisure activities on the farms themselves (Bienvenue à la ferme).

Crowdfunding platforms are also interested in the agricultural sector and the food industry. In this case, providers are private individuals, consumers, or professionals.

French start-up MiiMOSA provides a link between “project leaders” and “contributors” who are private individuals. The former present their project to the site and specify the amount of funding they need to carry it out. The latter fund the projects through donations in accordance with their means and wishes. They do, however, receive a sort of in-kind compensation (product, meal, or weekend). The platform is financed in the form of a commission of on the required amount.

The Blue Bees platform presents several distinctive features as compared to MiiMOSA. It finances environmentally friendly projects in the agro-food industry (especially organic farming projects), including abroad. It also provides funding in the form of loans. Finally, it involves “local actors” (design office, associations, NGOs, fair trade companies, and so on) who “identify and structure projects and support their implementation.”

On **P2P** platforms private individuals come into play. This type of platform only involves private individuals, who, according to a P2P logic, figure as both suppliers and users. These exchanges, whether commercial or not, concern mainly catering and gastronomy and involve private individuals eating together or sharing prepared meals or even food products.

VizEat is a collaborative platform for sharing meals (also known as food surfing). It aims at connecting tourists and hosts who wish to have them over for a meal at their homes. The site takes a commission on the price set for the user. VizEat is present in over 60 countries. Other platforms based on the same principle include VoulezVousDiner and BonAppetour in France, as well as Feastly and Bookalokal internationally.

Sharing also extends to food products via food barter platforms for exchanging fruits, vegetables, fish, meat, eggs, mushrooms, seeds, plants, honey, pasta, and spices. There are many examples in North America, such as LA Food Swap in Los Angeles and Chicago Food Swap in Chicago. As part of the LA Food Swap, the community organizes various “events,” during which its members, who previously registered on the platform, barter homemade or homegrown products.

Platforms are gaining ground in the emerging markets as well. For example, in Nigeria, Kenya, and South Asia, HelloTractor brings tractor services through mobile platform to farms upon request. A similar model to Uber, HelloTractor leverages the notion of the sharing economy to improve farm productivity through tractor rental. Instead of purchasing the machinery at a huge amount of up-front investment, the service creates a space for tractor owners to earn additional income when their fleet is idle and for renters to free up part of the financial resources through tractor service purchase on demand. HelloTractor equips compact tractors with GPS monitoring devices to keep track of the fleet’s location and workload, giving insights into the tractor’s status. With the wealth of data gathered through the devices, HelloTractor envisages capitalizing on data analysis possibilities to provide additional services in the future.

DIGITAL TOOLS ALSO FACILITATE ACCESS TO MARKET AND FINANCE

In emerging markets, specifically, digital technology is used to address issues stemming from the lack of market information, market information asymmetry, impediments to business development and access to finance due to distance, crop insurance, and the challenges of connectivity to various existing platforms.

For small farms, the barrier to accessing timely and appropriate financing is often a deal breaker or maker in operation planning and business investment. To address this issue by leveraging digital technology, in Kenya, for example, financial tech start-up Umati Capital

provides small agribusiness suppliers to 80 percent the value of its receivable amount in cash on behalf of the buyers. This financing method, also known as factoring and invoice discounting, can now be extended to small size agribusiness players by using digital tools for the evaluation of debtor credit worthiness. The digital solution also extends to the payment option. By partnering with Citi Bank, Umati Capital processes payments online, providing clients with quick access to funds within 24 hours upon receipt of relevant documents.

In Turkey, a FinTech company called Tarfin provides point-of-sale financing to small farms by working with input suppliers through an online platform and is developing an algorithm to structure a credit assessment tool for farmers without prior lending experience.

Designed specifically for the African market and supported by Vodacom's Mezzanine software, Safaricom rolled out "Connected Farmer Solutions," a mobile-based platform for agribusiness to process payment transactions with small farmers and "DigiFarm," for small farmers to receive extension services, input supplies, and financing through mobile devices.

In insurance, U.S. Climate Corporation/Monsanto, for example, uses data analytics, machine learning, and climate and agronomic models to produce weather simulations, measure potential loss, and price their products. After adjusting for climate change, Climate Corp names a price and creates customizable weather policy for each client. Policyholders get their checks automatically for the specific weather events that will cause them financial loss.

BLOCKCHAIN

Blockchain can benefit the global food system by improving the process in which food is produced, delivered, and sold¹¹⁷ by increasing the transparency of the food supply and facilitating mobile payments, credits, and financing. The improved traceability and the immutability of data can also help verify the accuracy of food production, certification, and food processing as well as reduce food loss and food waste. Moreover, smart contracts enable involved parties to transact without intermediaries, eventually lowering the final price of the product for the end consumers.



Blockchain can benefit the global food system

To date, the majority of the blockchain applications in agriculture is in the concept stage or early pilot phase with the private sector as the main driver of adoption.¹¹⁸ Most projects are housed in the United States, Europe, or Australia; around 30 percent of the pilots are in Sub-Saharan Africa.¹¹⁹

In Australia, AgriDigital recently piloted the blockchain technology in facilitating the national grain supply chain transparency.¹²⁰ On the blockchain system, digital title is created and the grower holds the title until payment is received from the buyer, after which the title is transferred, with quality and quantity of the commodity recorded in the system. In between, the system also handles auto-payment through cryptocurrency in parallel with standard banking methods. The exchange of digital currency and title can be processed at the rate of four transactions per second.¹²¹ The platform also tracks physical inventory routes, creating identification of authenticity of products through the various data points captured along the way.¹²²

In 2017, IBM piloted blockchain applications for the food industry and agribusiness financing in the United States and Africa, respectively. Working with major retail stores such as Walmart, Nestlé, and Costco, the IBM blockchain system aims to improve food products traceability to improve food safety.

¹¹⁷ Weston and Nolet 2016.

¹¹⁸ Stanford Center for Social Innovation 2018, p. 12.

¹¹⁹ Ibid., p. 13.

¹²⁰ AgriDigital and CBH Group 2017, p. 2.

¹²¹ AgriDigital and CBH Group 2017, p. 3.

¹²² Ibid.

In 2018, IBM Africa in Kenya partnered with a local agriculture logistics start-up Twiga Food to extend financing for the small agribusinesses it serves. Twiga Food helps smallholder farmers deliver their product to the kiosks across the country. By using blockchain, farmers are able to receive microfinance loans for working capital use, owing to the transaction data stored on the mobile money platform M-Pesa that is the main financing and transaction channel for majority of the population in Kenya. The blockchain platform assesses business creditworthiness through an AI algorithm to make lending decisions. Blockchain technology helps increase the transparency of lending processes and decrease fraud.

MANAGING DIGITAL INFORMATION WITHIN THE AGRICULTURE ECOSYSTEM

Digital tools are transforming the way that knowledge and information about agriculture is managed at every level. As discussed earlier, at the level of farms and agribusinesses, effective data analysis is key to increases in productivity and profitability.

At the level of ministries and public agencies, digital tools enable better communication and coordination, help formulate policies, adapt regulation, and collect feedback, thus improving the efficiency of agriculture public policy tools.

The leading international organizations and national governments are paying increasing attention to smart agriculture—the use of automated decision-making systems, integrated automation and production robotics, as well as technologies for the design of agriculture ecosystems.

As in other sectors, data analysis and AI enable evidence-based decision making, customization and tailoring, transparency, and measurement of public programs in this sector.

One of the most basic agricultural information functions of the public sector is in the area of agricultural statistics. Historically, public agricultural statistics systems in many countries have often been unreliable and difficult to use. A digital national agricultural statistics system (linked to the national statistics authority) can overcome earlier obstacles to ensure easy collection, storage, access, and analysis of agricultural data.

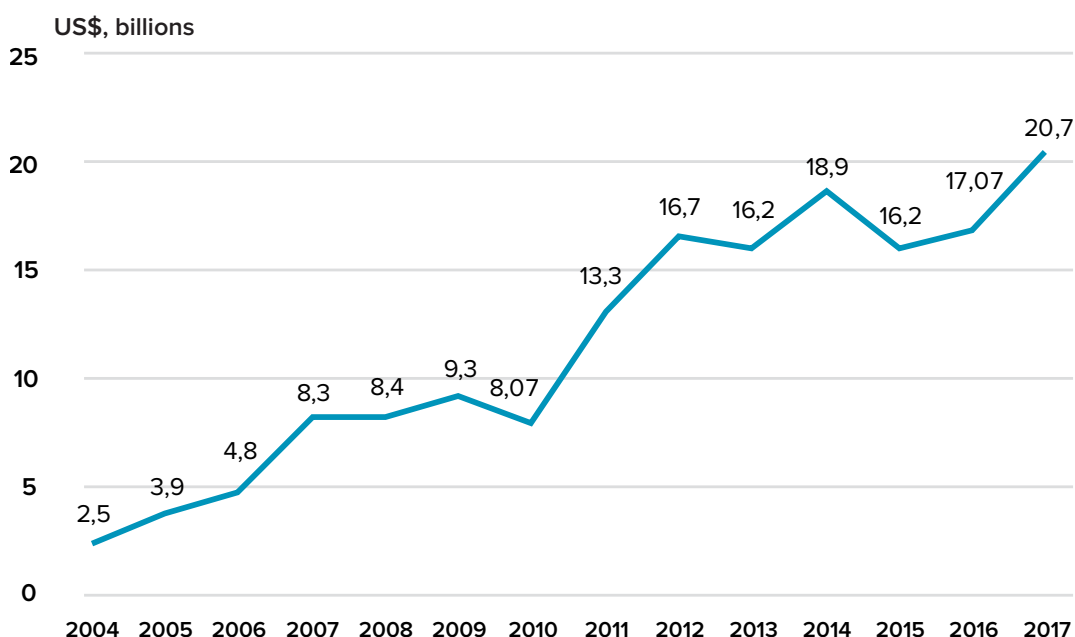
ROLE OF THE AGRICULTURE ECOSYSTEM IN DRIVING DIGITAL ADOPTION

For the adoption of technologies such as hyper-spectral imaging, the up-front investment required often proves prohibitive to small and even medium farms. Thus, a coordinated ecosystem approach is often required to devise the right mechanism to enable small players to benefit. Some private companies are working with the public sector to explore the option of flipping technology ownership: instead of farms owning the technology, the public sector can bear the up-front cost of installment, leveraging the data captured for program design, tailored extension, and advisory services delivery. The key is to make data available to relevant stakeholders beyond the financial and technical constraints that often hinder small farms' access to necessary information.

5.2.2 DIGITAL AGRICULTURE IN RUSSIA

The digital transformation of Agriculture has been highlighted as a top priority for export growth by the May 2018 Presidential Decree. In fact, digital technologies are already beginning to transform Russian agribusiness where some large agriholding companies operate at the cutting edge of the application of digital technologies. These industrial farms, with large land and livestock holdings, possess the financial resources and the management know-how to own and leverage the most advanced technology. Some have sophisticated IT staff to develop and manage the digital transformation of farm operations.

FIGURE 5.6 Agriculture Exports in Russia, 2004–2017



Source: Federal Customs Service of Russia.

At some large farms in Russia today, satellites control farm machinery and customize the application of inputs to specific areas in farmers' fields. Hyper-local weather information drives field-level activity and marketing decisions. Platforms allow farmers to plan and monitor the use of farm equipment and to find buyers and sellers for the products they use and produce. Pests and diseases can be identified remotely (using digital imaging from drones and satellites) and responses can be mobilized rapidly. Soil monitors measure soil moisture to trigger irrigation and enable new customized approaches to water management. Mobile phones send actionable signals to farm equipment. Sophisticated management applications help do farm planning. Production and harvest monitoring tools make it possible to control the quality of the farm products.

These developments have had a positive impact on the performance of the agriculture sector, leading to a boost in domestic consumption, ensuring import substitution, as well as increasing exports (Figure 5.6).

THE EMERGENCE OF PLATFORMS IN RUSSIAN AGRICULTURE

A cloud-based farm data management platform, ExactFarming, collects and analyzes satellite farm operation data including pesticide usage, farm vehicle operation, and vegetation status to inform farm decision making. The platform also tailors weather and soil data and enables the monitoring of farm vehicle location, tasks, and performance, such as completion rate and speed, through the Global Navigation Satellite System (GLONASS)/GPS.

Data analysis then enables agro-dealers to bridge gaps throughout the supply chains and financial institutions as well as agribusiness companies to extend credit to small and medium farms.

Among the 5,000 accounts on the platform, the majority of the farmlands under management are above 1,000 ha, with around 30 percent of accounts managing land below 1,000 ha.

USE OF DRONES IS ON THE RISE

Within the Russian agri-tech spectrum, the development of unmanned aerial vehicles (UAVs), commonly known as drones, for crop and soil quality monitoring is comparatively mature. Several products and services have undergone pilots and are moving on to mass commercialization. AgroDronGroup and GeoScan employ drones equipped with cameras to conduct aerial surveys. These surveys are capable of obtaining, among others, orthophotos, data for vegetative index mapping (NDVI), snapshots of crop conditions and levels of germination, and information about water erosion. As opposed to standard satellite images of 15–30 meters per pixel resolution, GeoScan UAV provides images of 5 centimeters resolution, covering farm sizes from 30,000 ha to 100,000 ha. Information resulting from image analysis helps farms with soil cultivation, disease monitoring, yield control, and flood modeling.

COLLECTING SOIL INFORMATION

The National Soil Database is in the experimental stage of development. It is compatible with similar databases of the EU, the United States, the Food and Agriculture Organization of the United Nations, and WRB. Work is under way to extend the functionality of the database for a wide range of practical applications. An internationally recognized standard GeoRSS was used in a pilot project in the Rostov region to enable data exchange between regional databases and the National Soil Database. Russian soil data are also available in the Global Soil Organic Carbon Map (GSOC17), which was created using technologies of data exchange between regional data collection centers.

Interestingly, there also exists a series of large – and medium-scale national soil maps of Russia as well as the rest of the world that remain from a large mapping effort undertaken in Soviet times. There is currently an initiative under way to update and digitize these maps by using satellite data and digital soil mapping technologies and taking into account more recent attempts to create a unified digital soils database at the country level.¹²³ The Russian Ministry of Agriculture relies on a digital database created from a 1987 soil map of Russia¹²⁴ and has launched its own data collection initiative.¹²⁵

¹²³ See http://web.archive.iiasa.ac.at/Research/FOR/russia_cd/guide.htm, accessed July 27, 2018.

¹²⁴ See <http://atlas.mcx.ru/materials/egrpr/content/intro.html>, accessed July 27, 2018.

¹²⁵ See <http://atlas.mcx.ru/>, accessed July 27, 2018.

BOX 5.11

INTERNET OF THINGS IN THE FOREST INDUSTRY

Russian timber reserves are estimated at 83 billion cubic meters and are among the world's largest. IT Metsa Group Russia has introduced the virtual forest concept by connecting forest resources to IoT. Monitoring, data collection, and ground assessment are done with the help of drones and using sensors installed on special harvest cars. One car can replace an entire logging team, and all its actions are recorded by the onboard computer, including the breed and the characteristics of the timber. Log trucks are also equipped with GPS sensors, allowing the company to control loading, unloading, and delivery.

Source: See <https://cointelegraph.com/news/russia-gets-first-sanctioned-cryptocurrency-and-its-tracking-beef>, accessed July 27, 2018.

Once it is completed, this initiative will enable the creation of many products and agribusiness applications in line with global best practices in “smart agriculture,” thus, for example, enabling the sustainable use of soils, creating a cadaster of land plots, and providing a platform for launching global projects in food security and the protection of the environment,¹²⁶ as well as equipping small farmers with modern tools to help them find a competitive niche for their products in the markets.

Data interoperability standards are key to allowing the use of and contribution to the database by all the members of the agriculture ecosystem, including government agencies, private sector organizations, related and supporting industry firms, and the farming communities.

ROBOTIC SOIL TESTING AND MAPPING

To complement the current soil test methods, RoboProb designed a robotic platform for automated soil sampling to minimize human error and to increase efficiency. The platform is a self-propelled complex that can work as a stand-alone device or as a trailing unit on any transport vehicle. The automation service of RoboProb soil sampling, labeling, and packaging is able to reduce farm labor from a team of five to a one-man team that can carry out 36 samples in one go. The data extracted from the farm are compiled into an electronic soil map, detailing the fertilizer application of each plot.

BLOCKCHAIN IN AGRICULTURAL VALUE CHAINS

There are several blockchain pilots in Russian agribusiness today (TakeWing, Agrivita Farm, LavkaLavka, and others). These include applications to improve meat products traceability, streamline payments, and other financial transactions. A company in Tatarstan, for example, is experimenting with cryptocurrencies to track meat bull health and trace meat throughout the supply chain.¹²⁷ In central Russia farms are beginning to leverage blockchain for smart contracts.

To encourage the adoption of blockchain beyond the initial pilots, the government should work with the private sector to assess the advantages and risks of this technology and to enhance regulation accordingly, as well as to launch initiatives to help the public understand the value the technology can deliver.

THE DIGITAL AGRICULTURE PROJECT

In spite of some success in the digital transformation of agriculture, the overall level of digital adoption in agriculture is quite low. Many Russian farms still lack the connectivity and skill sets needed to take advantage of such technologies. Today 63 percent of large agribusinesses, 42 percent of small farms, and 16 percent of individual farms are connected to the Internet.¹²⁸ There is a broad lack of general knowledge and understanding of new technologies and their potential application in the sector. Due to the insufficient level of digital adoption in Russian agriculture, in 2018, work has begun on the development of the Digital Agriculture Project. Once finalized, the project will be submitted for approval to the Russian government by the end of 2018.

Project goals are ambitious and include increasing agriculture exports growth from US\$20 billion in 2018 to US\$45 billion by 2025, achieving a RUB 8.9 trillion contribution to the GDP, as well as increases in efficiency and productivity in the sector, decreases in

¹²⁶ Alyablina et al. 2010.

¹²⁷ See <https://cointelegraph.com/news/russia-gets-first-sanctioned-cryptocurrency-and-its-tracking-beef>, accessed July 27, 2018.

¹²⁸ Rosstat 2017a.

production costs, creation of new technology-intensive products and services, and a rise in the overall standard of living in the rural areas.

The project rightly aims to mobilize all the key players of the digital agriculture ecosystem with the goal to accelerate digital adoption in the sector by providing fixed and mobile broadband connectivity, enhancing data collection, storage, management, and analysis, implementing digital platforms in the sector, launching innovative financing mechanisms, and taking advantage of the latest in AI and IoT technologies.

Participants in the digital agriculture ecosystem mobilized by this project include key government and private sector contributors as well as NGOs and the academic and scientific communities. Specifically, the Ministry of Agriculture, the Timiriazev Agrarian University, the HSE, Sberbank (the largest Russian public bank and a leader in digital transformation), Skolkovo Foundation, Rostech (a leading Russian technology company), Mobile Telesystems, agricultural equipment producers such as Rosselmash, agriculture production unions, IoT and Internet associations, as well as regional government administrations and ministries, such as the Tambov, Kaliningrad, Moscow, Stavropol, and Belgorod regions as well as the Republic of Tatarstan.

A Digital Agriculture Competencies Center was established in June 2018. It is expected that the project will set the stage for Russia's Smart Agriculture Strategy, contribute to the FoodNet initiative, and be integrated into the Russia Digital Economy Program by the end of 2018.

5.2.3. POLICY RECOMMENDATIONS

Overall, while large agribusiness companies have made some progress in leveraging the power of new digital technologies, small and medium farms in Russia are falling behind.¹²⁹ Accelerated digital adoption will help large agribusinesses further improve their performance and enable small and medium farms to expand production and build competitiveness in niche and premium markets underserved by large agribusiness companies.

The public sector should actively facilitate the engagement of small farmers with digital tools that will improve productivity and incomes on their farms.

The adoption of a single digital agriculture/smart agriculture strategy as part of the Russia Digital Economy Program will certainly help accelerate the digital transformation of this key sector.

Specifically, it is necessary to:

- Develop and strengthen cooperation in the digital agriculture ecosystem that links key stakeholders within the sector and at the cross-sectoral level. These include farmers, industry and services suppliers, telecom and digital solutions providers, transport and logistics providers, FinTech solution providers, tourism operators, and others;
- Improve the data infrastructure: a system of policy measures, institutional arrangements, technologies, data interoperability standards, and qualified staff to enable effective data collection, storage, management, and analysis;
- Launch open government-driven digital platforms for farms and agriculture communities to help them access relevant information, assets, and services and reach out to new markets and clients. Enable seamless mobile access to user-friendly applications;
- Develop financing mechanisms to bring digital transformation to small farms;

¹²⁹ Hakobyan et al. 2017.

- Develop greater capacity in the public sector at each level of government to use digital tools to manage and curate agricultural information;
- Launch education and training initiatives to help farmers understand and use digital tools effectively and stimulate broad testing and uptake of digital tools;
- Encourage entrepreneurship and attract investment into agri-tech start-ups to pilot and implement cutting-edge technologies in agriculture; and
- Promote Russia’s participation in global digital initiatives in agriculture.

5.3 Global Best Practice for Advancing Services Transformation: The Case of Digital Finance in Russia

The Russian market for financial technologies has been experiencing rapid growth driven by the adoption of online payments and remittances characteristic of emerging economies, on the one hand, and the adoption of FinTech solutions for more mature markets such as insurance, lending, and investment management, on the other hand. The sector has also been an early adopter of cutting-edge technologies such as biometrics and blockchain and has been driving the adoption of a national digital ID system. Policy makers should further encourage innovation in this sector by adopting appropriate regulation and fostering partnerships in the digital finance ecosystem, including the public sector, regulatory agencies, FinTech companies, banks, and other financial organizations.

5.3.1 FINANCIAL TECHNOLOGY IN GLOBAL CONTEXT

The financial sector is experiencing a dramatic shift caused by the rapid advancement of new financial technologies, widely referred to as “FinTech.” The financial sector has historically been an early adopter and an extensive user of new technologies. Yet, the focus to date has been on computerization, enhancing efficiencies of existing processes and introducing additional transactional channels. Recent developments in FinTech represent a fundamental transformation across the entire financial service industry. New players and incumbents are introducing business models that depart radically from a “business as usual” approach.

The terms digital finance and FinTech have generally been used synonymously, though there are subtle differences. Digital finance describes the broader trend of digitization in financial services and the overall financial sector component of a digital economy.¹³⁰ In its 2017 report on FinTech, the Financial Stability Board (FSB) put forward a working definition of FinTech as “technologically enabled financial innovation that could result in new business models, applications, processes, or products with an associated material effect on financial markets and institutions and the provision of financial services.” In this chapter, we use digital finance and FinTech interchangeably and have adopted the FSB definition of FinTech.

FinTech’s disruptive potential is attracting investment banks and other financial service providers, VC firms, and other investors. Private investment in FinTech ventures grew from US\$1.8 billion in 2010 to US\$19 billion in 2016, according to a recent report by Citigroup.¹³¹ As Figure 5.7 shows, recent investments center on the most profitable areas of global banking.¹³²

¹³⁰ World Bank 2016.

¹³¹ Citi GPS 2016.

¹³² Ibid.

BOX 5.12

INNOVATION IN THE FINANCIAL SECTOR

Payment services and market infrastructures. E-money and mobile money products; DLTs to restructure key market infrastructures (for example, payment systems, central securities depositories, clearing houses, and central counterparties) and cross-border payments.

Crypto-assets and Central Bank-issued digital currencies. Crypto-assets as a means of payment; bridge currency for cross-border payments; central banks' pilot programs to issue digital fiat currency alongside broader use of scriptural ledger and physical notes and coins.

ID, authentication, and know your customer (KYC) utilities. Digital interfaces to ID platforms for supporting account opening and authentication of transactions, leveraging DLTs to establish mechanisms for sharing KYC data, and establishing shared KYC repositories.

Alternative data and credit appraisals. Transaction data from e-commerce and payment platforms (for example, Alibaba and Paypal), mobile phone usage data, and social network-related data are all being used as alternative sources of information for assessing credit worthiness.

Trade finance and SME credit services. Risk management and payments are combined in a way that embeds and distributes financial services through nonbank companies while improving on previous models such as letters of credit.

New ways for deposits, lending, and capital raising. Crowdsourced ideas and fundraising through online crowdfunding and P2P lending platforms and using Internet-only banks. Initial Coin Offerings for raising capital sometimes through community engagement.

Investment management. Automated processing and dissemination of investment advice decreasing human interventions and reducing costs.

InsurTech. Insurance technologies that leverage new developments in big data, industrial sensors, and IoT to gather and analyze data to enhance underwriting processes, P2P insurance, and leveraging DLTs and smart contracts to automate insurance payouts.

Contextual finance. Finance-related services by retailers such as Alibaba, transport companies such as Uber, agri-tech firms, distributors, and other technology firms integrated into financial architecture.

RegTech. Services that leverage technology for increased effectiveness and efficiency of regulatory and compliance requirements (for example, 'big data' analytics for anti-money laundering/combating the financing of terrorism analysis, distributed ledgers to share statutory returns, smart contracts to enforce regulatory requirements).

Compared to traditional financial services, FinTech solutions are not limited to "licensed," or government-regulated, operators. Many FinTech players are not covered directly by the regulated financial system, including, but not limited to, mobile operators, FinTech start-ups, and digital companies. These drive innovations beyond the limits of traditional financial institutions—however, banks and other financial institutions remain key players in the financial inclusion landscape, particularly in emerging economies. The disruptive nature of new technologies challenges the traditional business models of financial institutions and drives them to create new strategies to stay profitable. Accordingly, banks and other regulated financial institutions are also rapidly embracing the FinTech developments and transforming their products and services.

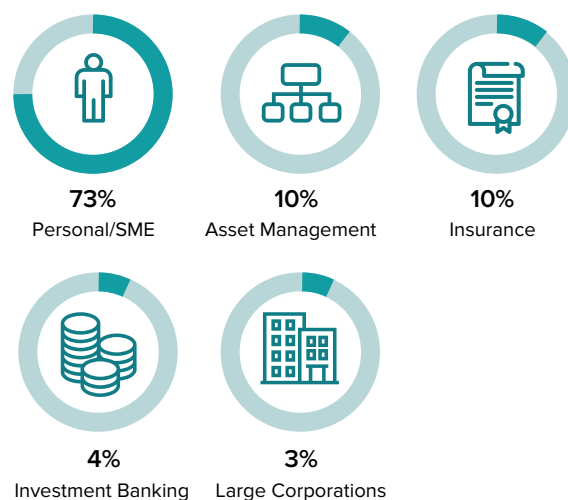
FinTech takes advantage of existing infrastructure to apply a range of emerging technologies to new service creation. At the same time, it can drive the improvement of existing financial infrastructure. Interoperability and open APIs of most solutions may contribute to the inclusivity of many FinTech solutions. Because of open APIs, it is possible to utilize the same technologies globally and enable entrepreneurs to develop, test, and refine services for consumers at a very low cost and develop solutions that may promote inclusion based on shared technology or platforms.

FinTech grew from \$1.8 billion 2010 to \$19 billion in 2016 

FIGURE 5.7 Investments in FinTech by Business Segment

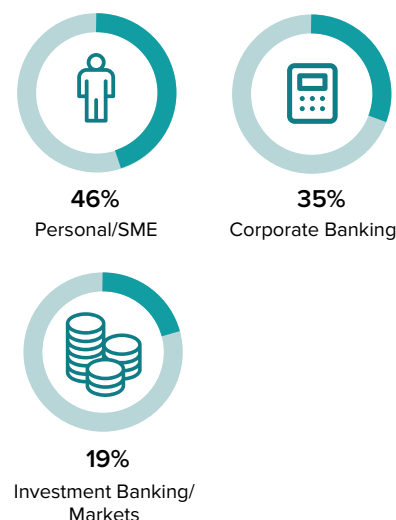
Capital deployment in FinTech sector

Source: CB Insights, KPMG, Crunch Base and City Research



Global Banking profit by segment

Source: Company reports & Citi Research



Source: Citi GPS 2016.

THE IMPACT OF FINANCIAL INNOVATION

Developments in the FinTech space offer banks new opportunities to enhance efficiency and grow their business. Traditional players in the financial sector have used these avenues to find new solutions to old problems, with large players investing heavily in FinTech and actively pursuing pilots for innovative programs. At the same time, new players are able to develop and bring new products to market directly through emerging delivery channels and new business models. The potential benefits of FinTech can be broadly summarized as follows:

- **Efficiency:** FinTech can bring about substantial efficiency gains for the financial services industry and its customers through removing constraints hampering the expansion of financial services and delivering a wider range of products to a broader range of consumers.¹³³
- **Competition and new business models:** Technological developments and supporting regulatory frameworks for services such as e-money and platform models have enabled a new class of players to unbundle various financial services and offer a wide range of targeted financial services to customers.
- **Data analysis:** Data from an ever-increasing number of digital platforms and applications—telephone call records, business performance on e-commerce platforms, devices connected to IoT, social media and professional networks, and digital transaction histories—can be used to better customize products and services, assess client credit worthiness, and evaluate risk.

These developments have encouraged the appearance of new forms of partnerships to serve a variety of market segments.

¹³³ Almost 60 percent of adults without an account cite “lack of enough money” as a reason, sometimes among other reasons. World Bank 2014.

PARTNERSHIPS WITH FINTECH SERVICE PROVIDERS

Traditional banks no longer regard FinTech firms as competitors, but rather partner with them to reach new populations and improve routine transactions. Partnerships allow financial institutions to quickly, cheaply, and efficiently reap the benefits of new financial innovations through the digitization of financial services.

These partnerships are mutually beneficial. Banks receive access to new markets and customers. They diversify their payments processes through mobile or digital payments. Both can rapidly respond to developments and adapt using agile techniques and new technologies. Furthermore, they can develop innovative services, such as mobile loan origination, without large capital expenditures and research costs. FinTech companies can operate without the constraints of market entry barriers and regulations. Banks also have huge customer networks, existing infrastructure, big data analytics, and name recognition that new start-ups may lack.

Examples of existing partnerships include use of open APIs to open the bank up to developers; use of new technology to provide digital payments procedures or equity investments, perhaps in small amounts that would be impractical or difficult for a large bank; improved customer authentication and KYC, including biometrics; data analytics to better understand and attract customers; and seamless delivery options.

Partnerships allow consumer credit cooperatives to partake of the benefits of digital financial services. Digital methods can allow credit cooperatives to provide basic financial products to the underserved quickly, cheaply, and easily. They use new marketing channels to reach and respond to customers, develop new tailored products and services, and use data to provide products to consumers considered risky due to a lack of traditional metrics.

Innovative ways of combining technology with the human “touch” at the front end are also important. Frontline agents can help customers with low digital literacy become more comfortable using the financial system, assisting in product adoption, solving problems, and facilitating trust when using new services.

Empowering the financial partnerships model through the use of cloud-based platforms dramatically reduces the costs and improves the efficiency of service provision.

EMPOWERING SMEs THROUGH DIGITAL FINANCE

Globally, FinTech companies have developed innovative solutions that can substantially improve efficiencies at each step of the lending process. Some of the benefits of FinTech for SMEs include the following:

- **Loan origination.** FinTech can reduce costs for banks to originate loans by using platform approaches. For instance, an aggregator’s platform or an online loan comparison platform can be used as alternate channels for customer origination. Sophisticated e-KYC solutions can be embedded for digital onboarding and the verification of customers.
- **Underwriting.** FinTech can use alternative data (such as utility bill payment, social data, mobile phone data such as call records, text messages, psychometric data, and so on) to determine the creditworthiness of potential borrowers through alternate credit scoring solutions. Manual intensive tasks such as analysis of borrower’s bank statement, company’s financial statements, and tax documents can be automated through FinTech solutions reducing the credit assessment time drastically. Other solutions such as geo-tagging provide additional information about the existence and location of the borrower’s property. These help financiers access additional information on small businesses, make more informed credit decisions, and potentially reduce collateral requirements.

- **Disbursements and collections.** E-mandate and pull-payment facilities are helping financial institutions collect payments on time with minimal manual intervention.
- **Service and monitoring.** Early-warning systems that use multiple-structured and unstructured data points assist financial institutions in loan monitoring by assessing potential to default.
- **Marketplace lending.** It provides credit to SMEs (and individuals) through online platforms that match lenders (savers, investors) with borrowers. The speed and convenience of such loans, as well as the lack of the need for collateral, are important advantages. They can also come with lower interest rates if low-cost structures are passed on to consumers.
- **Value chain finance.** A significant percentage of the suppliers and distributors are SMEs. Technology platforms and e-payment solutions can facilitate access to finance to product suppliers and distributors and help gather data about SMEs that would enable lending decisions, as well as provide SMEs access to business management tools.

LEVERAGING TECHNOLOGY TO ENHANCE REGULATION: REGTECH AND SUPTECH

Regulation and supervision of financial institutions are key areas for ensuring the stability and sustainability of the financial market, especially in the era of digitization. There has been a dramatic increase in the complexity of operations and the volume of data processed since FinTech emerged. This has led to the development of new financial services and caused a tightening of regulatory requirements, placing added expense on financial organizations to ensure compliance with these requirements. To deal with this fast pace of change and regulatory shake-up, a new area of development has emerged called RegTech (regulatory technology) and SupTech (supervision technology). RegTech represents the use of innovative technologies by financial organizations to improve the efficiency of regulatory compliance and risk management. SupTech involves the use of innovative technology by regulators to improve the efficiency of regulatory processes and the supervision of financial market participants.

THE IMPORTANCE OF DIGITAL ID

Stronger digital authentication and verification mechanisms can provide a necessary step toward better digital financial services and digital payment mechanisms. This requires striking a necessary balance between the multilevel identification of users and the verification of their digital activity online.

ENABLING FINANCIAL INCLUSION

FinTech has the potential to expand the reach of financial services to the unserved and underserved populations. Mobile money is illustrative of this potential. As per GSMA, 276 mobile money deployments are now live in 90 countries and count 690 million registered mobile money accounts worldwide. The overall revenue of the mobile money industry was estimated at US\$2.4 billion in 2017.¹³⁴

FinTech also has the potential to address the gender gaps in financial inclusion by giving women greater control over their finances, removing the barriers of distance and physical safety when clients can transact online and are no longer required to travel long distances carrying cash to banking institutions.

2.4 billion

mobile money
revenue in 2017

¹³⁴ GSMA 2018.

MANAGING GROWING RISKS

FinTech brings new challenges that may negatively affect financial integrity, consumer protection, and financial stability. Maintaining a level playing field between services and enhancing consumer protection are major challenges. While overly cautious or inflexible regulation may constrain the expansion of FinTech services unnecessarily, the absence of effective regulation could increase risks and vulnerabilities for the financial sector and for consumers. From a risk perspective, traditional risks pertaining to the underlying product and institutions remain while other risks such as money laundering/financing of terrorism, data piracy, and consumer vulnerability could be heightened. Specifically, the use of big data and new forms of data processing in credit risk assessments raises potential data protection and privacy concerns for consumers whose online activity and purchasing patterns are analyzed.¹³⁵

In terms of ensuring a level playing field, the challenge is in finding the right balance between regulating financial service providers and opening up opportunities for new entrants into the sector. Part of this has to do with ensuring that new entrants and incumbents have fair access to financial infrastructure and customer data (or customer interfaces).

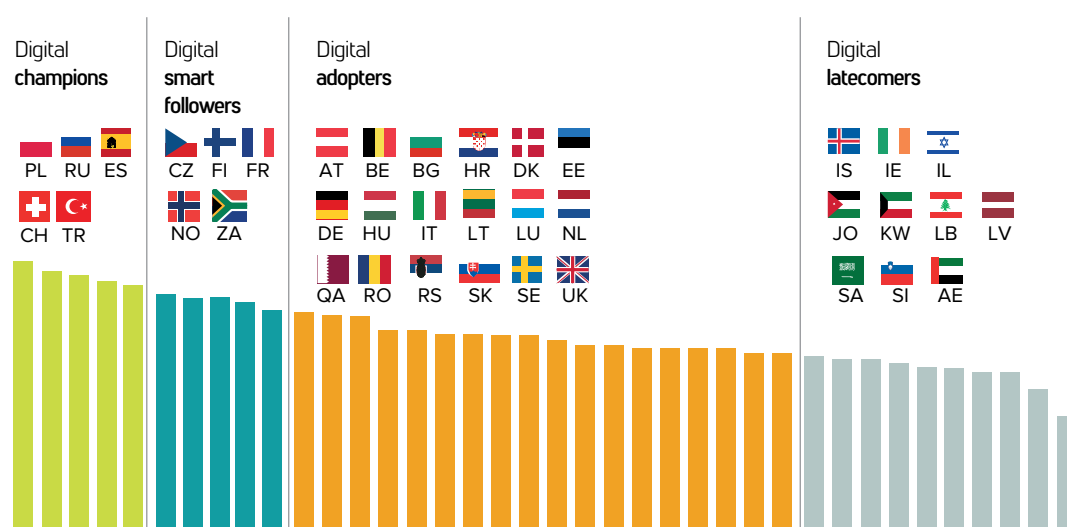
5.3.2 FINTECH IN RUSSIA

Digital transformation of the financial sector in Russia is advancing rapidly, setting an example for the transformation of other sectors and placing Russia among the top five global leaders in this space (Figure 5.8).¹³⁶

The digital transformation of the finance sector remains a top national priority as emphasized in the May 2018 Presidential Decree.

According to the Ernst & Young FinTech 2017 index, the penetration of FinTech solutions in cities with a population of over 1 million inhabitants is about 42 percent in Russia, compared to 33 percent in the United States. The most common services are e-payments and online

FIGURE 5.8 Groups of Countries in Terms of Digital Banking Maturity



Source: Deloitte Digital 2018.

¹³⁵ Montes et al. Forthcoming.

¹³⁶ Deloitte Digital 2018.

money transfers (68 percent), while savings and investment (12 percent), insurance (14 percent), planning (4 percent), and cash loans (3 percent) are less common. These solutions are provided by both traditional financial institutions such as banks and new market entrants.¹³⁷

Banks have been leading financial innovation. According to a 2017 survey by PriceWaterhouseCoopers Russia, 74 percent of financial service providers in Russia plan to prioritize FinTech partnerships in the next three to five years with investments in data analytics (76 percent) and mobile services (60 percent).¹³⁸

The world's largest independent online bank is Russia's Tinkoff Bank¹³⁹—with competitive interest rates and a net profit of RUB 7.6 billion (US\$131 million) in January–June 2017. The digital banking model is being adopted by many lenders, to lower operating costs and attract new customers.¹⁴⁰

At present, about 250 financial technology sector organizations are registered in Russia. These include lenders (microfinance institutions, P2P loans), cryptocurrencies (exchanges, digital wallets, digital coins), financial products, and financial management. P2P lending is offered by companies such as Loanberry (loans up to RUB 500,000), Fundico (P2P cofinancing with risk assessment and legal support), and platforms such as Zaymigo and Suretly. Financial management companies include Seeneco (cloud-based financial management service for SMEs) and FactorPlat (electronic factoring, integration with all accounting systems, a single electronic document management system). Personal financial management offerings include Sense (Alfa-bank product) and PandaMoney (Figure 5.9).

Two fully digital banks registered under their own banking license—Tinkoff Bank and Modulbank—have been operating since 2002.

According to the IIDF, in 2017, RUB 2.3 billion was invested in the financial technology sector and RUB 10.3 billion in solutions for business, totaling to RUB 12.6 billion.¹⁴¹

FinTech development is regulated by the Central Bank of Russia, which supervises financial markets, financial activities, and the licensing of new financial technologies. The Central Bank also monitors the cryptocurrency market. It has recently published a draft road map and strategy for FinTech development in Russia.

137 Ernst & Young 2017.

138 See <https://www.pwc.ru/en/press-releases/2017/partnership-in-fintech.html>, accessed July 27, 2018.

139 Digital McKinsey 2017.

140 See <https://themoscowtimes.com/articles/alfa-bank-plans-to-create-a-digital-bank-59164>, accessed July 27, 2018.

141 See <http://fintech-ru.com/развитие-отрасли-финтех-в-россии-2017>, accessed July 27, 2018.

BOX 5.13

MASTERCHAIN

Developed by the Fintech Association (under Russia's Central Bank), MasterChain is an Ethereum-based blockchain software enhanced by domestic cryptography to be tested first as a national payments system, and eventually as a supra-national payments system at the level of the EAEU.

Potential applications include a decentralized depository system for the registration of mortgages; Know-Your-Customer remote client identification initiatives to reduce the risk of fraud; increasing the security of bank guarantees through distributed registry and the use of smart contracts; increasing operational efficiency by automating financial transactions and reducing paperwork through issuing electronic letters of credit.

FIGURE 5.9 FinTech Market Map in Russia



Source: See <http://bankir.ru/publikacii/20160301/karta-rossiiskogo-fintekha-10007268/>, accessed July 27, 2018.

In February 2018, it issued the Guidelines for Financial Technologies Development for 2018–2020.¹⁴² The new guidelines propose a series of measures that govern the use of financial technologies, including the adoption of relevant legislation as well as the development of remote identification platforms, platforms for financial products and services, and the application of blockchain and cloud technologies in the sector. Open APIs are recommended to communicate effectively. The objective is to level the playing field for new entrants to the market and boost the competitiveness of the Russian finance sector.¹⁴³

THE CASHLESS ECONOMY IN RUSSIA

The move toward a “cashless economy” is one of the priorities of financial regulators in many countries, including Russia. The goal is to use digital technologies to dramatically reduce reliance on cash, thus helping to decrease the influence of the informal economy, improve efficiency in the financial sector, and enhance transparency, growth, and inclusion.

Cash is the most common payment method for retail payments in the Russia¹⁴⁴. Bank-issued debit and credit cards are by far the most popular mode of noncash payments. In addition to internationally branded cards, a domestic national debit card under the brand name “MIR” was launched in 2015 by the National System of Payment Cards (NSPC), a fully owned subsidiary of the Central Bank of Russia. International remittances are typically transferred through money transfer operators (MTOs), which are licensed as credit organizations under banking legislation to provide fund transfer services.

Today Russians are increasingly using online and mobile channels for transactions, providing an opportunity to increase both access and usage. About 22.0 percent of account holders used the Internet for transactions, and 13.9 percent of adults used mobile phones to make transactions, including making payments, purchases, or sending and receiving money.¹⁴⁵ This places Russia in line with Germany (12.8 percent) and well above the average of 3.8 percent in the Europe and Central Asia (ECA) Region.

¹⁴² The Central Bank of the Russian Federation 2018.

¹⁴³ See <https://www.finextra.com/pressarticle/72668/open-apis-digital-onboarding-and-dlt-feature-in-russian-central-bank-FinTech-plan/openapis>; <https://ibsintelligence.com/ibs-journal/russian-central-bank-sets-guidelines-FinTech-development-aims-competition-accessibility/>, accessed July 27, 2018.

¹⁴⁴ Skobelev 2018.

¹⁴⁵ World Bank 2014; NAFI and BDO UK LLP 2016.

BOX 5.14

CASHLESS PAYMENTS IN RUSSIA

According to a report from the Skolkovo School of Management, the share of cashless retail payments in Russia today is about 40 percent, while cashless payment methods are actively used by more than 50 percent of the population—yet the growth of cashless payments has remained slow.^a For Russia, cashless payments have benefits for the government in reducing the influence of shocks and increasing the speed and number of transactions. They help merchants, infrastructure, and technology service providers secure new clients while retaining old ones. They help banks become more profitable and devise new products through big data analytics. They also help consumers through offering added convenience and security and enable law enforcement agencies to conduct investigations and increase the transparency of financial flows, with the potential impact of shrinking the shadow economy. At the global economy level, it helps enhance efficiency of the customs union, lower costs across the value chain, and facilitate new decisions for regulators and the Central Bank.^b

a. Krivosheya et al. 2017.

b. Montes et al. Forthcoming.

In 2015, more than 317 million active e-money accounts (prepaid cards, e-wallets, and so on) were reported in Russia and over 1.2 billion e-money transactions were conducted, the total volume of which amounted to RUB 912 billion.¹⁴⁶ Internet payments are on the rise. In 2017, 40 percent of total payments were made through Internet banking systems.¹⁴⁷

Opportunities exist to further shift to digital channels to increase access and usage for consumers and lower operational costs for providers. For example, of the pensioners with deposits/savings in an account, only 6 percent have used a mobile device to make payments.¹⁴⁸ Similarly, the use of mobile channels for sending and receiving remittances stands below 10 percent, which could be further increased, as according to the 2016 National Agency for Financial Studies (NAFI) survey¹⁴⁹, only 3 percent of respondents said they had used their e-wallets in the last 12 months. Leveraging frontline agents with a “human touch” can be the missing link to encourage new users to use digital solutions.

More growth is also expected in e-commerce. E-commerce transactions using digital wallets reached 26.7 percent in 2016.¹⁵⁰ Although the size of the e-commerce market in Russia grew by 21.4 percent in 2017 and is expected to grow by 33 percent in 2018, it still only represents 3–4 percent of the total Russian retail market.¹⁵¹ The implementation of a national digital ID system would accelerate e-commerce growth.

Thus, in the broader context of the Russian digital economy, advances in FinTech help enhance financial inclusion and the development of a cashless economy. Improved financial inclusion allows for greater integration into the formal economy, making it easier to conduct day-to-day transactions, finance businesses, mitigate economic shocks, and improve welfare. A cashless economy promotes benefits in transparency, increased economic sustainability, and higher rates of growth.

146 The Central Bank of the Russian Federation, various years.

147 See [http://www.tadviser.ru/index.php/Статья:ДБО_-_Системы_дистанционного_банковского_обслуживания_\(рынок_России\)](http://www.tadviser.ru/index.php/Статья:ДБО_-_Системы_дистанционного_банковского_обслуживания_(рынок_России)), accessed July 27, 2018.

148 NAFI and BDO UK LLP 2016.

149 Ibid, p. 117.

150 See <https://www.prnewswire.com/news-releases/the-cards-and-payments-industry-in-russia-emerging-trends-and-opportunities-to-2020-300487287.html>, accessed July 27, 2018.

151 Ibid.

BOX 5.15

ATTITUDES TOWARD FINTECH IN RUSSIA

In 2017, the Skolkovo School of Management conducted a field survey, which covered 1,500 respondents in Russia. This survey focused on retail payments and assessed perceptions toward financial innovation.

Sixty-three percent of all respondents found it difficult to answer what “financial innovations” were, 13 percent replied that this was something new in the financial sphere, and 4 percent indicated that financial innovations were about convenience and simplicity. When choosing from the list of proposed options, respondents most often considered payments by bank cards (60 percent) and e-payments via a mobile phone (52 percent) as financial innovations.

When it came to electronic financial transactions, 41 percent said that they did not use them, 27 percent indicated that they predominantly used computers, and 26 percent used mobile phones. The share of gadgets used by young people under 25 years was almost twice as high as those older than 55. Thirty-three percent of respondents indicated a reluctance to use electronic devices for banking transactions, while 23 percent said that the operations were too complex. The most common services used to make financial transactions were through mobile banking applications (64 percent). The second most popular mode was through Internet banking (57 percent). For all services, older respondents were less likely to use these services.

In terms of the urban-rural divide, 78 percent of respondents in cities with population of 500,000—1 million used mobile banking applications and the same rate was recorded for cities with 50,000–100,000 inhabitants. Among villagers, 56 percent of respondents used mobile banking and 42 percent used Internet banking.

In terms of what respondents considered to be the main advantages of financial technologies, 54 percent said it was about saving time, and 49 percent about convenience and comfort. Significantly, respondents had more confidence and trust in financial innovations developed by banks (54 percent) than other developers (40 percent).

Source: Krivosheya et al. 2017.

DIGITAL ID

The growth of FinTech offers an opportunity to create an end-to-end digital identification mechanism (including remote and digital ID) that enhances and streamlines digital payments in Russia and thus creates a national digital payments infrastructure.

Biometric solutions, for example, the biometric identification platform recently piloted by Rostelecom that enables clients to open a bank account remotely, are also useful in providing a template for strong digital customer authentication systems that are digital by default and device agnostic by design.

The FinTech Strategy of the Central Bank of Russia emphasizes remote ID legislation as a key goal. The strategy establishes the use of biometrics in the Unified Identification and Authentication System and expands the use of electronic signatures for online services. At present, credit organizations are prohibited from opening accounts and deposits remotely. In 2017, the Central Bank launched the implementation of the Unified Identification and Authentication System for the government state services portal that enables users to open an account in any bank remotely after receiving digital approval from one of Russia’s credit institutions. Further development of these solutions will simplify digital transactions over the Internet and increase the availability of financial services.

RUSSIA'S SUCCESS IN FINANCIAL INCLUSION¹⁵²

The number of adults with accounts at a financial institution stands at 67.4 percent, which is well above the average rate of 51.4 percent in the Europe and Central Asia Region. Account penetration has increased by nearly 20 percent since 2011, with increases experienced across all segments of the population, including for the poorest 40 percent and for women.¹⁵³ Access to traditional financial institutions is high with 30 branches per 100,000 adults in 2016—higher than China (9) and slightly lower than the United States (33).¹⁵⁴

Success has been enabled by a combination of targeted financial services and government-led financial education efforts.

In September 2017, the Government of Russia approved the National Financial Literacy Improvement Strategy. It has also established three federal training centers for financial literacy with a network of 13 regional training centers to train the trainers and develop user-friendly educational material. In addition, an online portal and an online kiosk platform providing guidance to consumers on their rights have been launched.¹⁵⁵

Digital finance can help address the remaining gaps in financial inclusion, such as reaching the “last mile”—those segments of the population that are difficult to reach through traditional means. Physical access to financial services remains centered in major urban areas, and account penetration drops outside of these urban centers. Low-income and elderly populations are also underserved.

Improvements in rural broadband infrastructure, targeted financial education initiatives, as well as further partnerships between e-money providers, mobile network operators, and traditional financial providers would help offer services adapted to the needs of the currently underserved market segments.

5.3.3 POLICY RECOMMENDATIONS

There are seven broad opportunities for Russia to leverage digital finance technologies:

- Develop appropriate regulatory and legal frameworks to help provide a conducive environment for the further development of FinTech in Russia in a way that ensures the stability, safety, efficiency, and integrity of the financial system.
- Apply technology (RegTech / SupTech) to enable agile regulation to maintain a balance between service innovation and the privacy and security of user data, as well as to enhance the transparency of financial products and services, guarantee customer rights, and protect financial market players from unreasonable operational risks.
- Maintain focus on cybersecurity and prepare to manage new risks.
- Strengthen Russia's financial infrastructure to accelerate the move to an increasingly cashless economy through developing an ecosystem approach among all the players in the field.
- Expand the reach of financial services to underserved customers by fostering partnerships between FinTech companies, e-money providers, banks, nonbank credit organizations and consumer credit counseling (CCC) services while also encouraging CCC services to further embrace digitization, including through the use of cloud-based solutions.

¹⁵² This section is adapted from the financial inclusion technical note produced as part of the Financial Sector Assessment Program in Russia in 2016.

¹⁵³ World Bank. 2014.

¹⁵⁴ IMF 2014.

¹⁵⁵ World Bank Financial Education and Financial Literacy Project, 2018 Implementation Status and Results Report.

- Encourage banks to adopt FinTech-based approaches to expand access to finance for SMEs, including through the use of lending platforms for loans.
- Encourage the development of full-fledged digital ID capabilities and enable end-to-end digitization of customer onboarding, customer service, and compliance-related processes.
- Leverage distributed ledger technologies in financial services for improving operational efficiency, increasing transparency and customer satisfaction.

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GLOBAL BEST PRACTICE FOR BOOSTING DIGITAL INNOVATION AND ENTREPRENEURSHIP IN RUSSIA

Digital entrepreneurship is a critical area for future innovation breakthroughs. In Russia, it is supported by a number of government initiatives, yet weaknesses in the innovation ecosystem as well as a historical lack of an open innovation culture that respects entrepreneurs and encourages risk-taking have led to stagnation in this space. VC investments have plateaued and the number of successful exits has declined in recent years. Improving the coordination between different policy instruments, incentivizing SoEs to accelerate digital transformation and drive demand for innovation, ensuring the predictability of the business environment, and internationalizing the Russian start-up ecosystem are necessary.

6.1 Global Trends in Digital Entrepreneurship

Digital technology is transforming and disrupting traditional brick-and-mortar sectors as the boundaries that once protected them disappear. Manual and cognitive human labor is being augmented and displaced by technology, creating new efficiencies, but affecting labor markets in both developing and developed countries in uncertain ways. Value creation is more and more driven by scalable businesses that embrace new digital business models and markets. Evidence shows that digital data flows have increased exponentially in the last 12 years, while the value of trade of goods in the global economy has been stagnating or declining for the last 5 years.¹⁵⁶

The exponential pace of technological development is reducing both the cost.¹⁵⁷ and the barriers of access to markets and resources for technology start-ups. Digitization has thus led to radically lower barriers for innovation, which is no longer only driven by scientific breakthroughs that are commercialized in large companies but increasingly by agile, fast-growing start-ups. In the words of one private investor, if in the 1990s an entrepreneur needed US\$2 million and months of work to develop a minimum viable prototype, today s/he would need less than US\$50,000 and six weeks of work.¹⁵⁸ Technology start-ups have driven innovation and economic transformation faster than any other type of entrepreneurship in the past. According to the World Bank's WDR 2016,¹⁵⁹ countries in transition should pay special attention to the competition and disruption that new agile entrants can bring to previously protected or uncompetitive markets as a way of introducing new type of dynamism into the economy.

¹⁵⁶ McKinsey Global Institute 2016.

¹⁵⁷ See <http://blogs.worldbank.org/ic4d/fostering-cities-technology-innovation-ecosystems-big-opportunity-developing-countries>, accessed July 27, 2018.

¹⁵⁸ Center for an Urban Future 2012.

¹⁵⁹ World Bank. 2016.

Systematic support for knowledge transfer, PPPs and science–technology–industry collaboration, often with the state in a facilitation role



As innovation shifts from large R&D facilities to ecosystems where collaboration, cumulative inventions, rapid prototyping, adoption, and entrepreneurial activity are the norm, supporting and facilitating start-up entrepreneurship is fast becoming central to public innovation policies.¹⁶⁰ Recognizing that new modes of knowledge production and innovation largely take place outside the direct influence of government agencies,¹⁶¹ innovation policy makers have started to experiment with a more versatile mix of funding and other policy instruments that encourage innovation from both supply and demand sides. These include proactive regulation, support for experimentation, innovative procurement mechanisms, and ecosystem facilitation.¹⁶²

Global competition for talent and resources will intensify



Significant increases in investments in science and technology, particularly in China, but also in other emerging markets, have shifted the global distribution of knowledge and innovation resources in favor of Asia. Whereas innovation used to flow mostly in one direction, from highly developed to emerging economies, these flows are becoming increasingly two-way.¹⁶³ The OECD¹⁶⁴ predicts that while global production and diffusion of new knowledge will intensify, so will competition for talent and resources between countries and regions.

The centrality of technology start-ups in the digital economy presents an opportunity for developing countries. India hosts major start-up ecosystems in New Delhi and Bangalore, which have raised US\$1.5 billion in funding in 2016,¹⁶⁵ respectively. São Paulo ranks among the top 20 start-up ecosystems with more than 1,500 active start-ups, closely followed in the region by Santiago and Buenos Aires.¹⁶⁶ Bangkok has been adding over 3,000 jobs a year to its ICT industry.¹⁶⁷ Unicorns, those start-ups that raise more than US\$1 billion, are no longer just a U.S. or European phenomenon. Indian, Chinese, and Indonesian start-ups, such as Lu.com, Flipkart, or Go-Jek, have reached this valuation, and African Internet Group from Nigeria is poised to be the first African unicorn.¹⁶⁸

Beyond the direct impacts start-ups have on organizations and people associated with them, their economic and societal impact is also realized through creating and exploiting new knowledge, products, services, and business models. Local entrepreneurs develop new business solutions that address domestic demands. Start-ups can stimulate competition and efficiency in the markets and expand the total amount of knowledge in the ecosystem, strengthening the basis for new innovations and ideas to emerge. Even if the companies themselves fail, they can create lasting societal impact and spillovers, although the latter require a well-functioning, supportive ecosystem to be realized.¹⁶⁹

The innovation systems approach to developing national innovation capabilities has influenced policies and funding agencies around the world, especially in Northern Europe in countries such as Sweden and Finland. Key elements of this have been systematic support for knowledge transfer, PPPs and support for science-technology-industry collaboration, often with the state in a facilitation role through triple-helix models or competence-centers.¹⁷⁰ While the basic tenets of these type of approaches still hold, globalization and the changing nature of innovation processes challenge traditional PPP models.¹⁷¹

¹⁶⁰ Autio 2017.

¹⁶¹ Kuhlmann and Rip. 2014.

¹⁶² Kuhlman and Rip 2014.

¹⁶³ McKinsey Global Institute 2016.

¹⁶⁴ OECD 2016.

¹⁶⁵ See <https://blog.tracxn.com/2016/06/24/delhi-ncr-bangalore-mumbai-pune-and-hyderabad-are-indias-top-5-startup-cities-for-2016/>, accessed April 16, 2018.

¹⁶⁶ See <http://blog.compass.co/the-2015-global-startup-ecosystem-ranking-is-live/>, accessed April 16, 2018.

¹⁶⁷ National Statistical Office of Thailand, various years.

¹⁶⁸ See <https://www.cbinsights.com/research-unicorn-companies>, accessed April 16, 2018.

¹⁶⁹ Business Finland 2018.

¹⁷⁰ Palmberg and Serger 2017.

¹⁷¹ TAFTIE Task Force 2016.

BOX 6.1

ASSESSING THE EFFECTIVENESS OF GOVERNMENT INNOVATION POLICIES

Governments can improve a country's science, technology, and innovation (STI) performance by correcting for the uncertainties inherent in the process of innovation. However, few governments can answer with confidence, basic questions of how much is being spent, by whom, for what purpose, and with what results, and especially whether public policy is generating expected results and impact on social and economic development. In innovation policy, it is common for governments to act on the assumption that providing more money will automatically boost innovation. Governments also underestimate the complexity of innovation policy development process and the multiple factors that influence policy results and affect policy impact.

The World Bank Public Expenditure Review (PER) framework helps governments assess the impact of STI public spending on economic and social development. Resulting recommendations propose program and policy reforms to help increase the operational efficiency and effectiveness of public spending.^a

a. Correa 2014.

INGREDIENTS FOR SUCCESSFUL START-UP ECOSYSTEMS

The OECD predicts that as global production and diffusion of new knowledge intensifies, so will competition for talent and resources between countries, regions, and cities, and their start-up ecosystems.

A start-up ecosystem consists of people, tech start-ups at various stages of development, and other stakeholders and organizations supporting or connecting these start-ups, interacting in multiple dimensions to create and scale new start-up ventures.¹⁷²

Whereas traditional business clusters have been characterized by a pattern of horizontal competition between companies in similar value-chain positions, start-up, or entrepreneurial ecosystems are often marked by horizontal cooperation and networking but vertical competition against industry incumbents located outside the cluster. There is often a strong sense of community between start-ups, which assists in creating conditions for P2P learning, for example, in business skills development and scaling up of radical business models.¹⁷³

From an innovation policy perspective, the public sector can support ecosystem-level organization in several ways. It can provide accelerators and co-working spaces, facilitate interaction dynamics between the ecosystem participants, encourage business model experimentation and spillovers of experiences, and generate momentum around new digital platforms. Creation of regulatory sandboxes has been explored in many countries to create spaces for experimentation outside existing regulations. Encouraging private finance in the form of business angel funding or VCs has a key role in ecosystem development, in addition to public R&D funding.

To build thriving innovation and entrepreneurship ecosystems, many key factors need to be in place. A World Bank working paper¹⁷⁴ identified four general categories of ingredients needed for these ecosystems to succeed. These elements can be used to assess the maturity of each ecosystem.

- **Supporting infrastructure.** The quantity and quality of support programs and resources for start-ups to succeed. Tech start-up infrastructure can be characterized as the institutions, programs, and networks that support entrepreneurs and their teams. Supporting

¹⁷² World Bank 2017.

¹⁷³ Autio 2017.

¹⁷⁴ Mulas, Mingos, and Applebaum 2015a.

infrastructure encompasses accelerators and business incubators, mentors, events, and other ecosystem and/or skills building resources. Accelerators are support programs for entrepreneurs and start-ups typically in the early stages of development. Incubators are spaces that support start-ups by providing an office space and administrative support services.

- **Skills.** The availability of human capital and the educational and work experience that start-up founders have. It is crucial that the education system can provide skills to respond to demand from the digitalizing economy and new ventures. The role of universities in supporting student-led entrepreneurship movements and academic or research-based entrepreneurship has been important in many countries. Bootcamps, accelerators, and mentors should be leveraged to produce future skills and jobs. The OECD¹⁷⁵ predicts that while global production and diffusion of new knowledge will intensify, so will competition for talent and resources between countries and regions, and their start-up ecosystems.
- **Finance.** The availability of capital critical to the success of a tech start-up ecosystem. This includes all organizations that invest in high-growth start-ups: public agencies and funds, VC firms, angel investors, and other individuals. New developments such as crowdfunding platforms can also help the development of microentrepreneurs and provide access to seed financing as equity investments are being developed.
- **Community.** The maturity of the ecosystem as a network of stakeholders that support each other (directly or indirectly) for the successful outcome of start-ups. The tighter and more connected an ecosystem, the more efficient are knowledge spillovers and access to resources. Social connectivity matters because the success of start-ups is affected

175 OECD 2016.

BOX 6.2

ISRAEL, THE START-UP NATION: SUCCESS FACTORS

- Government's strategic positioning of Israel as a 'start-up nation' at the core of the global knowledge economy.
- Government taking the lead by laying the foundations for private industry to support innovation, and through heavy investment into human capital through the public higher-education system, resulting in a highly skilled workforce (further enhanced by highly skilled immigrants arriving from Russia in the 1990s).
- Spillover effects from government investments into military and defense technology.
- An effective ICT ecosystem in Tel Aviv and Haifa, close to leading public academic institutes: Technion - Israel Institute of Technology and Tel Aviv University.
- Government policies to attract large multinational corporations in search of new technologies to buy small start-ups and establish local R&D centers. Today there are 298 multinational companies in Israel with local R&D centers, for example, IBM, Intel, Apple, Cisco, Motorola, and Microsoft, to name a few.
- Export orientation of ICT companies enabled by moving marketing and headquarters out of Israel close to U.S. and European customers while keeping R&D in Israel.
- Focus on software and cybersecurity. About 200 Israeli companies specialize in cybersecurity, one-quarter of the world's VC-funded cybersecurity start-ups are Israeli. A comprehensive cybersecurity development complex is built in Beersheba.
- Promoting an innovation culture that encourages young people to take risks, a supportive business environment, a vibrant start-up community, and access to capital.
- Attracting experienced Israelis living abroad back into the country.
- Academic institutions' dedication to engineering, emphasis on world class education, excellence in math a foundation for educating engineers.
- A superior infrastructure to support the growth of the high-tech industry.

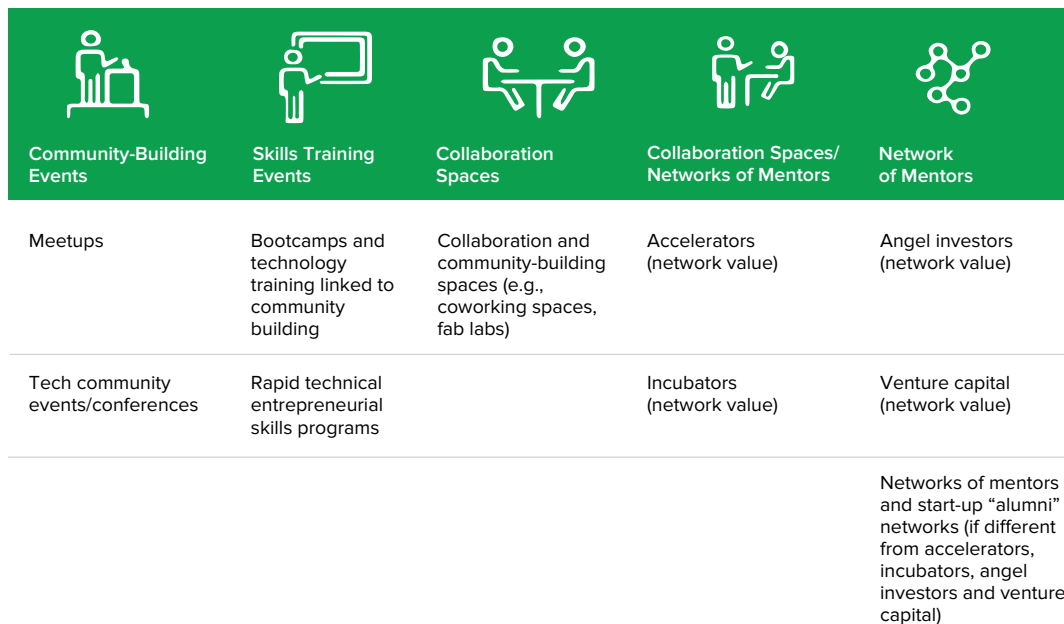
by their network and access to other ecosystem stakeholders and their networks. The success of start-ups is closely linked to the maturity, health, and sustainability of the community.

Previous World Bank research¹⁷⁶ shows that centrality—the number of ecosystem stakeholders to which a founder is directly or indirectly connected—is critical for start-up success. This finding is also consistent with research from Endeavor Insight that showed that access to mentors increases the probability of start-up success. In this environment, the supporting infrastructure acts both as a skills and network provider and is critical for ecosystem sustainability. The ecosystem’s supportive infrastructure mainly comprises networking assets. (Figure 6.1) Interactions and collisions among people are critical in creating and maintaining entrepreneurial ecosystems.¹⁷⁷ Interaction can be facilitated by various events and spaces: meetups, competitions, hackathons, co-working spaces, accelerators, and boot camps. These networking assets are central to the connections among entrepreneurs and the sustainability of the start-up communities.

Successful start-up ecosystems rely primarily on the availability of private capital, as well as investment from publicly owned or supported VC funds or public R&D and innovation funding targeting local start-ups.¹⁷⁸ Evidence from public sector involvement through public VCs is mixed, but it seems that a modest amount of public finance and an active but relatively small role of the state improves the performance of ventures in relation to ventures supported by purely private venture capitalists.¹⁷⁹ For example, in China, government R&D support policies and instruments have a positive effect on SME growth but only in so far as the companies supported are privately owned.¹⁸⁰ A recent evaluation of the role of Tekes, the Finnish Funding Agency for Innovation, on start-up growth and performance came to the

Networking assets are central to the connections among entrepreneurs and the sustainability of the start-up communities

FIGURE 6.1 Networking Assets (Ecosystem’s Support Infrastructure)



Source: Mulas, Minges, and Applebaum 2015b.

176 Mulas, Minges, and Applebaum 2015b.

177 See <http://blogs.worldbank.org/ic4d/does-social-dimension-beat-geographic-clustering-creating-tech-innovation-ecosystems-cities>, accessed July 27, 2018.

178 Cirera and Maloney 2017.

179 Brander, Du, and Hellmann 2010.

180 Peng and Yu 2013.

conclusion that Tekes funding, which mostly comes in the form of R&D grants and loans, has had a positive impact on start-up growth, ability to take risks, potential for internationalization, and capacity to raise private capital, complementing private VC funding.¹⁸¹

BOX 6.3 START-UP COMMUNITY BUILDING IN FINLAND

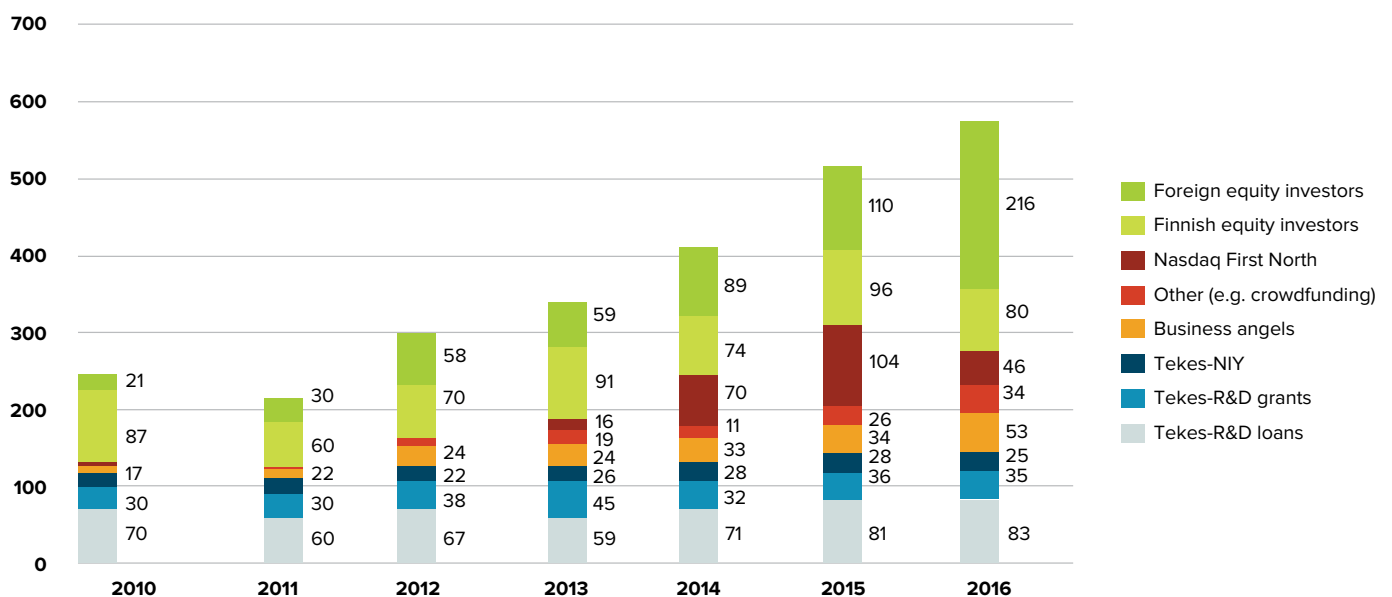
The success of the Finnish start-up community has its origins in a student-led entrepreneurship movement that began about 10 years ago. Through a collective, community-based approach, key initiatives such as the Start-up Sauna accelerator and the Slush start-up event were developed by student-led management teams supported by a network of experienced mentors and the Startup Foundation established in 2012. The movement's initiatives continue to prosper. The Aalto Entrepreneurship Society, created by Aalto University students, has now become the largest community for university entrepreneurship in Europe. Start-up Sauna accelerator now attracts around 1,500 global applications per year, with acceptance rates of less than 2 percent, and Slush has become one of the world's biggest start-up events, expanding into Asia. The 2018 Startup Genome Global Ecosystem Report ranked Helsinki #1 for local connectedness, demonstrating the strong connections within the community.

The hallmark of this movement has been a kind of “think big, act small” approach and a pay-it-forward culture, in

which successful entrepreneurs repay their debt to the community in many ways. The state has provided ample support for the grassroots movement, but has never dictated what the community should do or where it should focus. Finland's start-up community has excelled in integrating investors deeply into start-up ecosystems, sometimes getting investors to volunteer as start-up coaches. Given the limited size of the Finnish market, small companies and start-up ecosystem actors need to internationalize rapidly, which has been helped by experienced mentors' international contacts.

Helsinki hosts the Slush conference for young innovative companies, that in 2017 attracted close to 20,000 visitors from 130 countries. The national innovation funding agency Tekes has been a substantial early-stage investor in start-ups, providing 33 percent of early-stage funding in 2016. The significant decline since 2011, when Tekes provided 55 percent of early-stage investment, is a sign of the growing role of private VCs and angels and the success of the community (Figure 6.2).

FIGURE 6.2 Funding for Finnish Early Stage Growth Companies in 2010–2016



Source: See www.aaltoes.com, www.slush.org, accessed July 27, 2018; OECD 2017a; Business Finland 2018; Startup Genome 2018.

ASSESSING THE MATURITY OF A START-UP ECOSYSTEM

Based on the above elements, it is possible to assess the maturity of a start-up ecosystem.¹⁸² The assessment introduces three stages of ecosystem maturity: nascent, advancing, and mature. A **nascent** start-up ecosystem is typically characterized by a limited number of start-ups, most of which are at an early stage, with a low density of connections between founders, investors, and other stakeholders. Business acumen and experience among founders is limited, the number of serial entrepreneurs who can enrich ecosystem's skills base is very small, and substantial start-up exits are nonexistent. Mentors are scarce and inexperienced, and the ecosystem does not have international linkages.

In an **advancing** ecosystem, more start-ups emerge within the ecosystem: most of them are still in early stage but there are some successful examples of scale-ups. Several strong concentrated clusters emerge, increasing the density of connections within the ecosystem. While business acumen is still in short supply, successful start-up exits and serial entrepreneurs begin to appear, as well as mentors with practical experience in the field. Financial pipeline is established and effective, though some gaps still exist. Private early stage investments are available, and international linkages begin to strengthen.

A **mature** start-up ecosystem consists of a large number of start-ups at all stages. The ecosystem comprises highly dense clusters that are connected to each other. Founders, investors, and mentors with business acumen and practical experience are plentiful within the ecosystem, and start-ups successfully exit. International players are aware of the ecosystem and interested in developing stronger linkages with founders, investors, and mentors. Private early-stage financing is readily available and sustainable.

Findings from a recent World Bank report on Beirut's start-up ecosystem¹⁸³ illustrate this assessment approach. Beirut has an early-to-middle stage start-up ecosystem that has passed its nascent growth phase but is still far from maturity. The key strengths of the ecosystem are highly educated start-up founders with sufficient relevant experience, and the availability of funding for early-stage start-ups. The supporting infrastructure and the community is still maturing; like-minded individuals do not connect easily with one another to form clusters, suggesting a silo approach among ventures from different networks.

¹⁸² World Bank 2017.

¹⁸³ World Bank 2017.

BOX 6.4

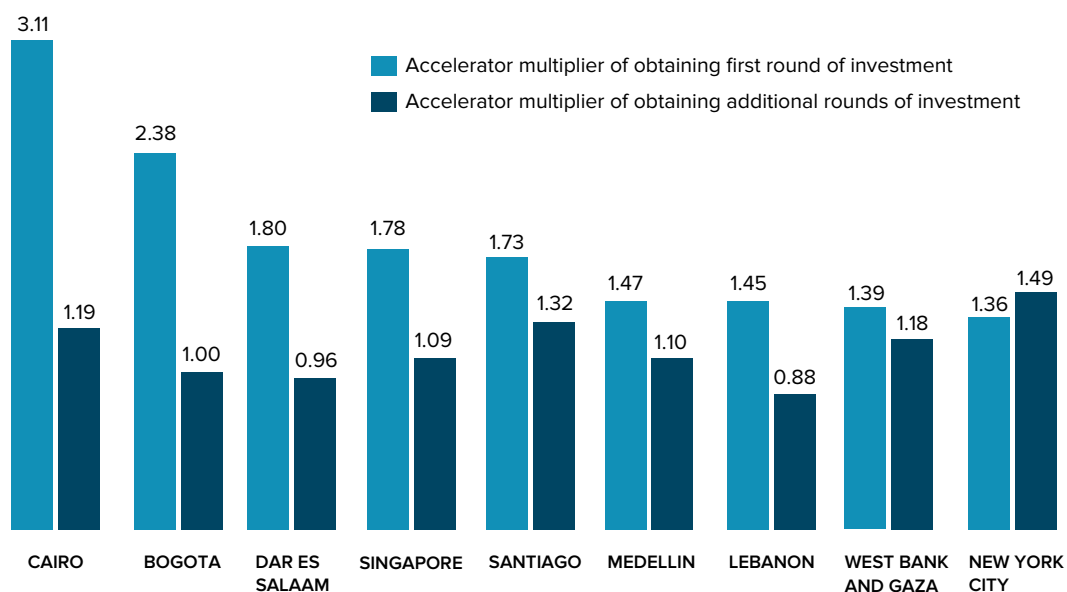
START-UP SUPPORT INFRASTRUCTURE MATTERS

A recent study^a conducted by the World Bank evaluated early-stage technology companies from New York City, Cairo, Medellín, Bogotá, Singapore, Santiago, Beirut, Dar es Salaam, and West Bank and Gaza to estimate and rank the effects of support programs, founder characteristics, and business environments on funding outcomes. The study included 2,887 unique start-ups, 68 accelerators, 247 incubators, and other support programs, 717 individual investors ("angels"), and 869 institutional investors ("VC firms") gathered through surveys of over 3,000 entrepreneurs between 2013 and 2017. The study confirmed that start-up participation in support programs (supporting infrastructure) has the greatest effect on its ability to attract funding compared to other factors such as founder skills or the regional business environment. Furthermore, the study found that support programs such as mentorship may be just as effective as improvements in business environment or founder skills.^b

a. Mulas, Qian, and Henry 2017.

b. Qian et al.

FIGURE 6.3 Accelerator Multipliers in Different Cities Worldwide



Source: Mulas et al. 2018.

The performance of accelerators varies between ecosystems, and accelerator programs do not always add value to participating start-ups and the ecosystem. The study¹⁸⁴ also demonstrated that only ecosystems with more advanced and sophisticated international accelerators, such as New York and Santiago, have a substantial positive impact on sustainable start-ups beyond the first round of funding.

IMPACT OF START-UPS ON EXISTING INDUSTRIES

Existing companies are struggling to adapt to the rapid pace of digital transformation and the resulting changes in the competitive environment. This causes transformative changes in core sectors of the economy, from hospitality to retail and urban transportation. Established companies tend to have good structures for marketing, distribution, processes, and scaling up products but are often weaker in generating and rapidly applying creativity to develop new products and services. Traditional innovation models to create products and services are ill-suited to match the pace and agility of competitive disruption from tech actors, whether large technology platforms with unbeatable access to data and capital, such as Google or Amazon, or small and agile local start-ups. Thus, a new corporate innovation model, “Corporate Innovation 2.0,” is emerging.

Through it, traditional businesses are trying to address their weaknesses by adopting open innovation practices, where multiple players interact and reinforce each other through collaboration and cumulative inventions. Existing companies are increasingly trying to absorb innovations and technology developed by start-ups. This is demonstrated by the growing interest by large corporations in scouting, nurturing, and growing start-ups in maturing ecosystems. A recent survey of almost 3,000 firms with revenues over US\$250 million in the United States and Europe found that almost 80 percent of them are using some kind of open innovation methods and practices.¹⁸⁵ Some companies are integrating tech shops into their facilities to develop open innovation and rapid prototyping. Most of these practices are internal and are more prevalent in large companies and technology-driven sectors.

¹⁸⁴ Qian et al.

¹⁸⁵ Ernst & Young 2017.

Governments can help foster an environment for open collaboration through spaces such as industry innovation labs that bring together companies, academia, entrepreneurs, users, and government to build networks, share knowledge, and produce shared inventions. A good example is the digital manufacturing lab in Chicago, which comprises a network of universities, companies, and government with an open innovation approach in manufacturing. In Europe, there is a network of living labs that are evolving organically toward a more connected ecosystem structure with universities, companies, government, and civil society.

THE INNOVATION ECOSYSTEM DRIVES NEW JOBS CREATION

The majority of new jobs associated with innovation and start-ups are not in the start-ups themselves but in traditional industries that have incorporated new knowledge and technology in their processes due to competitive pressures from new business models generated by start-ups, or innovation absorption from the start-up ecosystem. In New York City (Box 6.5), traditional industries generated three times more of these new jobs than start-ups themselves, serving as multipliers of new jobs catalyzed by the start-ups. Interestingly, these new jobs include both low – and high-skilled tech workers in similar proportions,¹⁸⁶ allowing for equal-opportunity growth.

In maturing start-up ecosystems, large corporations often become actively involved in scouting, nurturing and growing start-ups co-developing solutions that benefit the corporations. Three main approaches are used to identify and nurture such relationships and solutions:

- **Corporate accelerators.** This approach consists of creating corporate accelerators in areas linked to the corporation's market. The goal is to link with new business ideas and ultimately invest or absorb these ventures as they grow. This is the approach followed by Telefonica with Wayra¹⁸⁷ accelerator and Barclays Bank with its program of FinTech accelerators.¹⁸⁸ Softbank in Japan has taken this approach further, operating as one of the largest VC funds in new technology ventures.
- **Competitions to generate new products and services.** Corporations apply this mechanism to generate business ideas for new products and services. The result of a competition such as BBVA's annual open talent¹⁸⁹ is a minimum viable prototype from the start-up, which is then acquired by the corporation. As in the previous case, the challenge is absorption of the product and, more broadly, the absorption and sustainability of the process itself by the corporation. These competitions have been managed directly by corporations but also increasingly by accelerators and other intermediaries such as Startup500¹⁹⁰ and Nest¹⁹¹ with access to a global reach of innovative start-ups.
- **Co-creation of new products and services.** This approach takes the competition process a step further, significantly increasing the likelihood of innovation absorption by the corporation. Innovative ideas are sourced from start-ups through challenges. Once a short list of these ideas is selected, start-ups work with the corporation's development team to jointly co-create a new product or service. This co-creation process is essential, because it enables the corporation's direct absorption of the new product or service while also transforming the corporate innovation culture and process. In Europe, a network of living labs is evolving organically toward a more connected ecosystem with universities, companies, government, and civil society. This network has introduced collaborative common approaches, providing a platform to build connected innovation ecosystems.

186 See <http://blogs.worldbank.org/psd/how-are-future-blue-collar-skills-being-created>, accessed July 27, 2018.

187 See <https://www.openfuture.org/en/spaces/wayra>, accessed July 27, 2018.

188 See <http://www.barclaysaccelerator.com/#/>, accessed July 27, 2018.

189 BBVA's annual Open Talent, <https://www.centrodeinnovacionbbva.com/en/opentalent>, accessed April 16, 2018.

190 Startup500, <https://500.co/>, accessed April 16, 2018.

191 Nest, <https://nest.vc/>, accessed April 16, 2018.

BOX 6.5

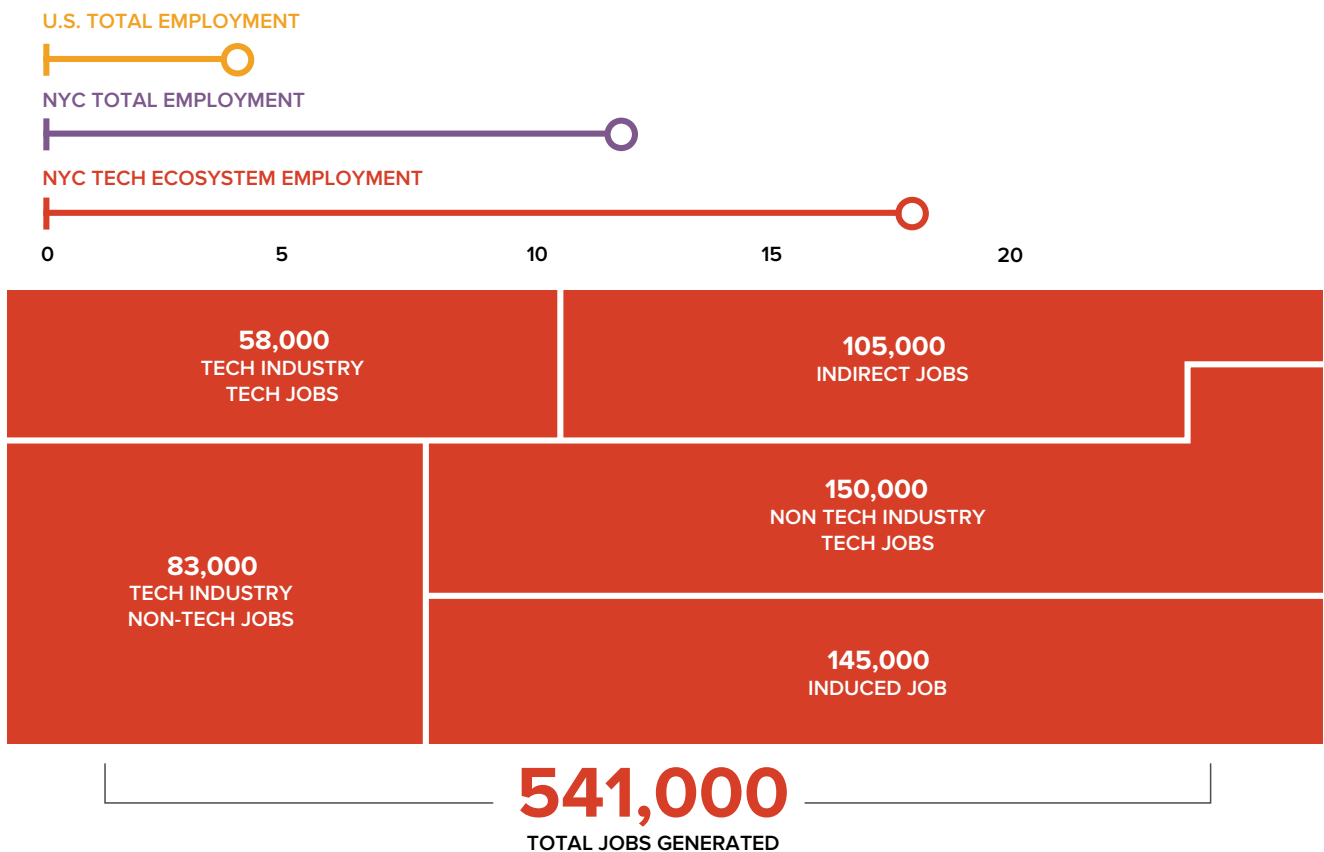
NEW YORK TECH START-UPS

In response to massive layoffs in the wake of the 2008–2009 financial crisis, New York City, a city heavy on traditional industries such as finance, fashion, media, and health care, adopted a range of policies to support the rapid development of the start-up ecosystem in the city to help retain the workforce in New York and productively absorb new talent. New York City government rapidly introduced a number of mentorship programs, accelerators, incubators, co-working spaces, events, skills training programs, and other supporting services. The boom in New York’s urban tech start-up ecosystem followed, creating new jobs and new markets, as well as increasing competitiveness of traditional New York City industries through digitization. Jobs in the city’s technology sector have increased faster than in other sectors and accounted for 12 percent of city tax revenue.^a From 2006 to 2013, the technology innovation ecosystem in New York City created over 500,000 new jobs.

Not only have New York City tech start-ups introduced technology to the city’s local industries, but they have also created new market categories. Figure 6.4 provides examples of new market categories and business models created by the tech start-up ecosystem. As the ecosystem matured, it attracted R&D, innovation, and product development functions from leading tech companies outside the city such as Google, Facebook, and IBM, further diversifying the local economy and providing another source of competitiveness.

a. HR & A Advisors 2014.

FIGURE 6.4 Employment Generated in New York City by the Tech Start-Up Ecosystem (2003–2013)



Source: HR&A Advisors 2014.

6.2 Digital Entrepreneurship and Innovation in Russia

LANDSCAPE OF INNOVATION AND DIGITAL ENTREPRENEURSHIP IN RUSSIA

Overall gross domestic spending on R&D in Russia is still low at 1.1 percent of GDP in 2016, compared to 2.7 percent in the United States, 2.1 percent in China, and 4.3 percent in Israel.¹⁹² Key weaknesses are the low business contribution to gross domestic R&D expenditure amounting only to 26.5 percent in Russia, comparing to 74.4 percent in China, 64.2 percent in the United States, 48.4 percent in the United Kingdom,¹⁹³ and the low level of R&D and innovation activity within Russian firms. Russian manufacturing companies demonstrate a very low-level engagement in innovation compared to high-income and most low – and middle-income countries. For example, only 8 percent of manufacturing companies in Russia in 2015 stated that they engaged in product innovation, compared with 43.8 percent in Germany, 28.4 percent in the United Kingdom, 16.8 percent in South Africa, and 26.1 percent in China.¹⁹⁴ Russian patent applications constitute around 1.5 percent of global applications and domestic patent applications have declined in recent years (8.6 per cent from 2015 to 2016).¹⁹⁵ Labor and capital productivity have been in decline since 2014.

In terms of its overall innovation landscape, Russia's progress is still noticeable. In the quality of its business environment, Russia ranks 35 in the 2018 World Bank Doing Business Indicator, up from 123 in 2011, now close to Japan (34) and France (31), and ahead of Israel (54), Belgium (52) and all the BRICS countries.¹⁹⁶

It is 45th in the 2017 Global Innovation Index,¹⁹⁷ up from 53rd in 2014, and 38th in the 2017 Global Competitiveness Index.¹⁹⁸ In high-tech exports, Russia ranked 30 of 132 countries with exports of digital goods and services constituting 0.5 percent of GDP, compared to India at 2.9 percent and China at 5.8 percent. Exports of software, mainly offshore software development, was the fastest growing export service niche with an average growth rate of 15 percent.¹⁹⁹

Whereas overall spending on R&D is still relatively low, government support for private sector R&D in Russia, including both direct funding and indirect instruments such as tax incentives, a share of GDP is high by international comparison, well above OECD countries such as France, Japan, or the United States.²⁰⁰ This implies both commitment from the Russian government to invest in private sector R&D and innovation and a possible over-reliance on government funding.

In recent years, Russia has prioritized supporting domestic technology development, creating local technology start-ups, and encouraging innovation within SoEs. Moreover, the government has strongly promoted cooperation between academia, the private and public sectors in the context of the Russian Digital Economy Program, the NTI, and the National Champions Initiative. Both initiatives encourage the development of national high-tech companies to become international leaders of the future. The May 2018 Presidential Decree highlights technology innovation as key to achieving the 2024 national development goals

192 See OECD data, <https://data.oecd.org/russian-federation.htm#profile-innovationandtechnology>, accessed April 16, 2018.

193 Cornell University, INSEAD, and WIPO 2017.

194 UNESCO Institute of Statistics 2017.

195 WIPO 2017.

196 See World Bank Doing Business database, various years, <http://www.doingbusiness.org/>.

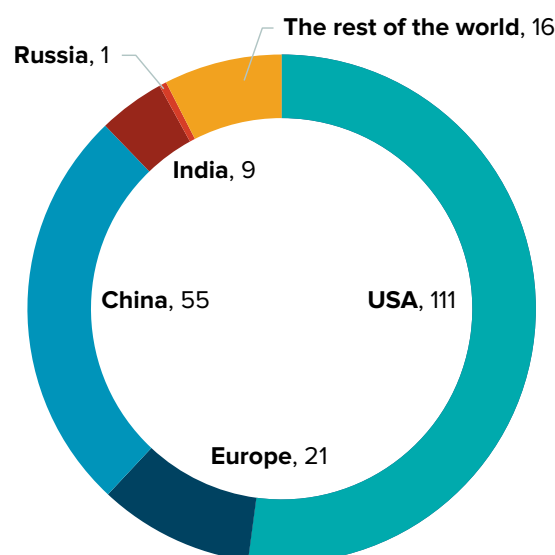
197 Cornell University, INSEAD, and WIPO 2017.

198 See Global Competitiveness Index data for Russia (2016), <http://reports.weforum.org/global-competitiveness-index-2017-2018/countryeconomy-profiles/#economy=RUS>, accessed July 18, 2018.

199 RUSSOFT 2017.

200 OECD 2017b.

FIGURE 6.5 Number of 'Unicorn' Companies



Source: Digital McKinsey 2017.

and sets the target for 50 percent of all Russian organizations to be actively engaged in technology innovation.

Some commercial success is visible, although not attributable to recent government initiatives, as Russian companies lead in several consumer segments. Russian social networks VKontakte and Odnoklassniki have nearly 160 million active users and operate as digital platforms. Yandex, a popular search engine with a diverse digital product portfolio, is one of the 25 largest internet companies in the world.²⁰¹

Compared to global peers, however, the international outreach of Russia's technology companies is limited, so is their rate of growth. There is only one Unicorn (Avito) (Figure 6.5)—a sign of structural weaknesses in the start-up and innovation ecosystem.

ASSESSING THE MATURITY OF THE RUSSIAN ECOSYSTEM

An analysis of the Russian start-up ecosystem (the case of Moscow) based on data from the Global Startup Ecosystem Report 2017 by Startup Genome reveals strength in supporting infrastructure and skills and weakness in community development and investment.

Overall status of the Russian ecosystem – Ascending (Figure 6.6).

SUPPORTING INFRASTRUCTURE STRENGTH

Strong Government Support

The role of the state is significant in supporting the Russian start-up ecosystem. The Government Resolution 218 on cooperation between research institutions and organizations sets forth subsidies distributed competitively to enterprises to fund complex high-tech projects in cooperation with universities. These funds, however, are mostly used to support existing projects rather than for investment in new innovative and potentially risky initiatives.

²⁰¹ The 25 largest internet companies in the world. See <https://www.worldatlas.com/articles/the-25-largest-internet-companies-in-the-world.html>, accessed July 27, 2018.

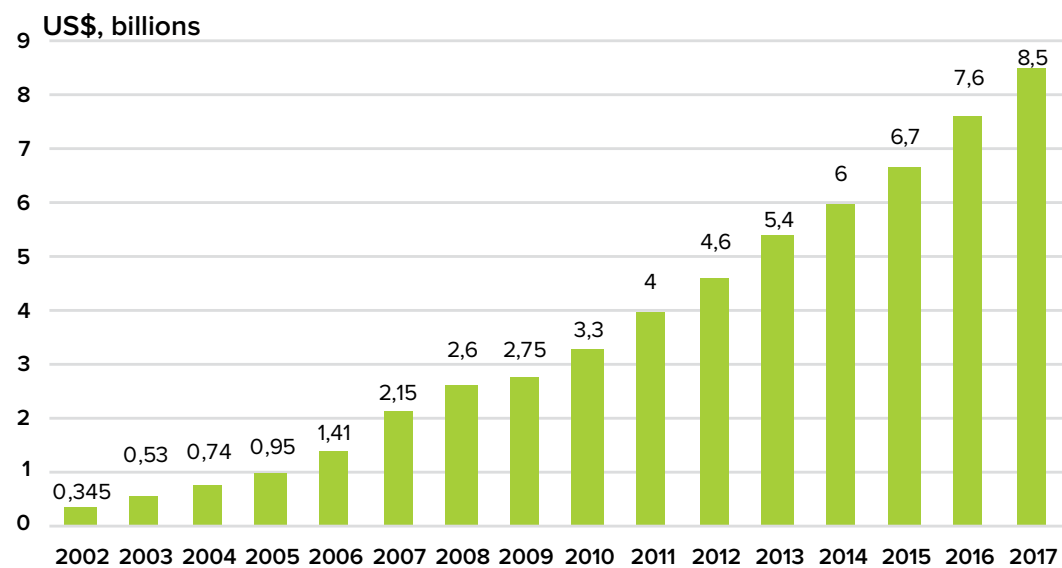
FIGURE 6.6 Maturity of BRICS Countries Ecosystems

Ecosystem Element	Brazil Sao Paulo			Russia Moscow			India Bangalore			China Beijing			South Africa Cape Town			
	N	A	M	N	A	M	N	A	M	N	A	M	N	A	M	
Community	○			○				○					○	○		
Skills	○				○			○					○	○		
Supporting Infrastructure		○				○			○	○					○	
Investment	○			○				○					○	○		
Overall	●				●				●				●	●		

Source: Startup Genome 2017.

Note: N=Nascent; A=Advancing; M=Mature.

FIGURE 6.7 Russia IT Exports 2002–2017



Source: RUSSOFT 2017.

The key state agencies driving start-up entrepreneurship are the Agency for Strategic Initiatives, the Innovation Promotion Fund, the SME Corporation, Skolkovo Innovation center, the IIDF, the RVC, and Russian Corporation for Nanotechnologies (RUSNANO).

In the last few years the government implemented a number of programs to support technology exports. In 2015, the Russian Export Center was established to serve as the primary point of contact to help technological companies boost exports, working together with EXAIR, the export credit and investment agency, and ROSEXIMBANK. And technology exports have been growing steadily (Figure 6.7).

The focus on implementing locally developed digital solutions in growing Russia's digital economy, emphasized in the May 2018 Presidential Decree, should help stimulate domestic demand for technology innovation and further boost the growth of the Russian ICT sector.

WEAKNESSES IN THE START-UP ECOSYSTEM

While the key players of the start-up ecosystem are in place in Russia, ecosystem performance is negatively affected by the weak links and coordination among key players.

Several government organizations specialize in ICT R&D in Russia, but they are not integrated into a single ecosystem with the ICT sector, which leads to a poor understanding of business needs and a poor ability of developing the right products for the right customer.

Weaknesses in the ecosystem links negatively affect cooperation between Russian academia and business. The share of industrial enterprises in joint research projects has decreased by 9 percent since 2015. Universities have an average of just 4.3 agreements with technology companies per 100 researchers.²⁰² This is partly caused by the preference of large corporate players to procure tried and tested solutions from established local and global players, on the one hand, and their frustration with the perceived lack of ability of local research institutions to understand corporate needs, generate the products and services to address them and commercialize and market those solutions to potential customers, on the other hand.

Government support for innovation in the regions through regional technoparks and innovation clusters has not yielded expected results. Most technology parks do not adequately address the infrastructure and ecosystem requirements of potential tenants.²⁰³

Efforts for stimulating commercialization of research results and creation of innovative businesses in universities, as postulated by Federal Law 217 are hampered by weak links between universities and research organizations, where innovation is supposed to be taking place, and business customers that generate demand for innovation. A lack of understanding of market needs and innovation commercialization strategies leaves isolated islands of innovation in the academic world that do not deliver broader value to the economy.

LOW INNOVATION DEMAND FROM SoEs

Innovation development programs for SoEs have not stimulated them to increase investments in innovations, and enterprises have not leveraged innovation to implement structural changes. The 2016 National Report of Innovations in Russia by the RVC discussed in length the experiences and opportunities for supporting innovation within large corporations in Russia, noting that state efforts so far have had very limited impact in increasing their R&D investments and innovativeness. The RVC sees opportunities for innovation especially in the oil and gas, automotive, aircraft and agriculture sectors, but lack of competition, high entry barriers, and low innovativeness within value chains remain obstacles.²⁰⁴

Given the high degree of consolidation in the Russian economy where SoEs account for a large share of the economy, enterprises do not feel the competitive pressure to invest in innovation on par with global corporate leaders.

²⁰² RVC and ITMO University 2016.

²⁰³ Volkonitskaia 2015.

²⁰⁴ Ministry of Economic Development of the Russian Federation, Open Government, and RVC. 2016.

A high degree of verticalization in the management structure of those enterprises, a traditional centralized top-down approach to decision making and risk aversion inherent in traditional corporate cultures, especially in SoEs, stifles innovation internally and makes it difficult for smaller, often more innovative solution vendors to win tenders and build long-term relationships with large players. Thus, the largest contributors to GDP growth do not create the demand for innovative solutions.

UNPREDICTABILITY OF THE BUSINESS ENVIRONMENT

Russian incubators and accelerators have difficulties in attracting private investors and have fewer private partners than incubators and accelerators in developed markets. This is largely due to weaknesses in the Russian business climate and what investors refer to as a high level of market unpredictability driven by local and geopolitical factors that heighten the perceived risks of investment in local ventures.

INVESTORS ARE CAUTIOUS

According to the RVC Annual Report,²⁰⁵ the Russian venture market has in recent years been characterized by a growing caution of investors, who are moving away from early-stage investing to more mature companies, as well as a diversification of investment portfolios in favor of an increase in the number of transactions and a decrease in the average volume of investments (Figure 6.8). The most significant sector of investment was ICT which altogether accounted for 90 percent of the transaction volume.

The growth of the VC market is hindered by a lack of exits for VCs in Russia and a modest international interest in the country's markets.²⁰⁶ After a continuous decline since 2013, the market demonstrated 8 percent growth in venture funds capital at the end of 2017 and reached US\$4 billion. The total number of venture funds grew by 10 percent and amounted to 194 funds.²⁰⁷ The number of exits in 2017 was quite limited because of the decrease of investments in 2013–2014. Russian Venture Capital Association (RVCA) reported 20 exits worth a total of US\$52 million.²⁰⁸

The significant capital outflow since 2013 had a major impact on investors' strategies, making them invest more cautiously, with smaller investments in more mature stages. Thus, in 2012 and 2013, the average transaction volume was US\$2.7 and US\$1.5 million, respectively. As of 2014, it has decreased even further and fluctuates at the level of US\$0.6–0.8 million.²⁰⁹

In 2017, the ICT sector remained the most preferred sector for investments at 58 percent of the total, followed by industrial technologies (22 percent) and biotechnology (7 percent). The same year, a total of US\$125 million was invested in 178 companies, which is comparable to the figures for 2016 (US\$125 million and 204 companies).²¹⁰

In 2017, the state continued to play an active role, providing almost a third of the VC for the entire market and supporting 4 out of 22 newly opened venture funds. For start-ups outside the ICT sector, venture funds with state participation were the primary source of investments.

PUBLIC SUPPORT TOOLS NEED FURTHER REFINEMENT

Thus, there is no lack of public support for innovation and technology entrepreneurship in Russia, but there are signs that the existing instruments may not be designed or targeted

205 RVC 2016.

206 VimpelCom, and ATKearney 2016.

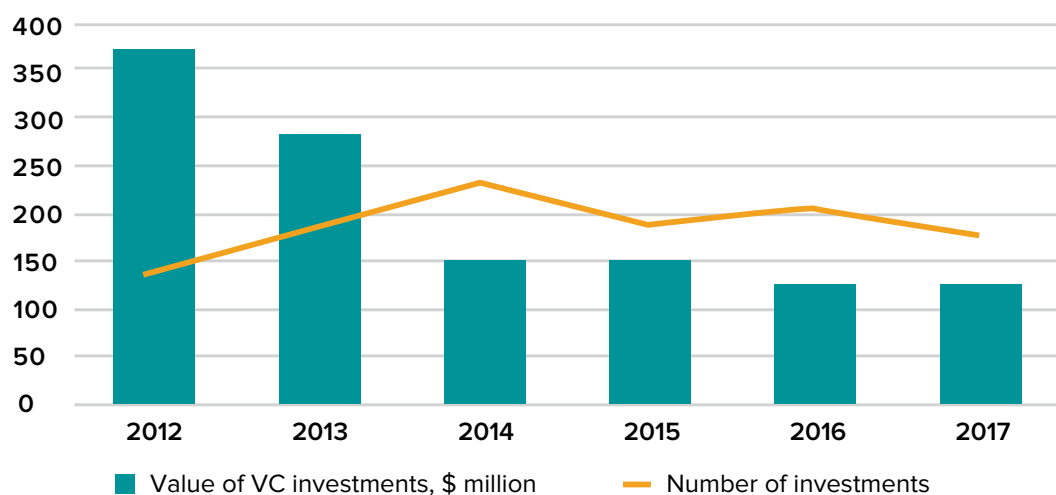
207 RVCA 2017.

208 Ibid.

209 RVCA 2017.

210 Ibid.

FIGURE 6.8 VC Investments



Source: RVCA 2017.

optimally, and there is a lack of alignment and coordination. There may have been too much focus on developing direct funding instruments, resulting in individual actors becoming too dependent on state funding and the public sector crowding out private finance. Horizontal connections are weak, as is a cooperation between key players, and flexible instruments and programs expected to address the lack of cooperation and encourage PPPs have not worked so far.²¹¹

PRIVATE AND CORPORATE INVESTOR INTEREST IS LACKING

In 2017, there were 17 corporate venture funds with US\$535 million of VC (13 percent of total VC market) and the total amount of VC investments into ICT projects reached just US\$7 million.²¹² The number of deals closed by corporate venture funds has not exceeded 5 per year for the last three years, accounting for 2 percent of overall venture deals in the market. The global share, by contrast, is 17 percent and growing.

As explained earlier, the limited number of corporate venture funds is partly a result of low demand for new technologies and innovation from large corporations, especially SoEs. The appetite for launching corporate venture funds is also low, as large corporations are reluctant to invest in high-risk ventures.

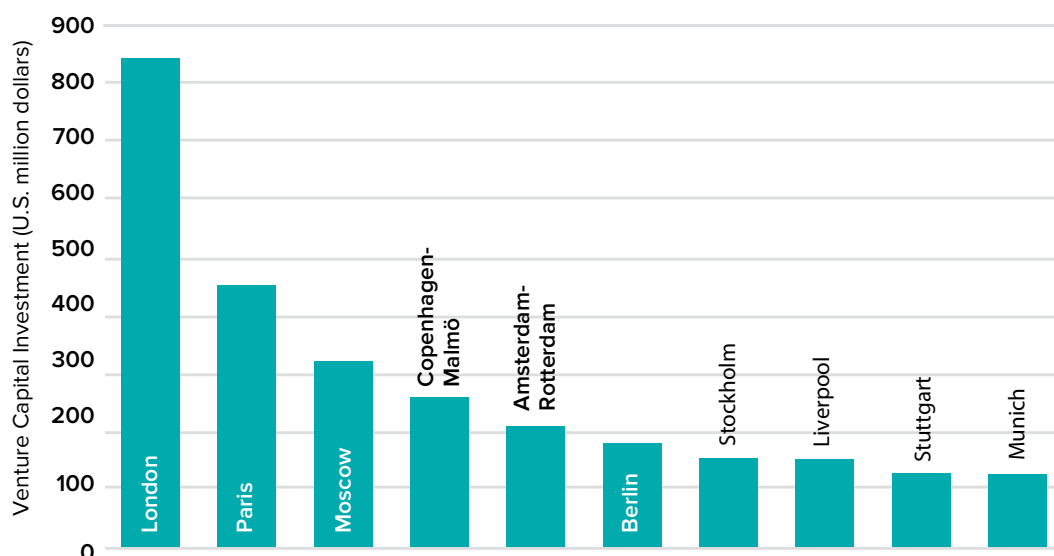
INNOVATION IS HIGHLY CONCENTRATED IN URBAN AREAS WITH MOSCOW IN THE LEAD

According to a report from the Martin Prosperity Institute, VC investment across the world amounted to US\$42 billion in 2012 but was quite concentrated. The top 10 metros account for approximately 52 percent, the top 20 metros account for almost two-thirds, and the top 50 for more than 90 percent of the total global venture investment. Ultimately, global venture investment is highly uneven and spiky—concentrated in a small number of large cities and metros around the world, and the same is true for Russia.

²¹¹ <https://vgmu.hse.ru/data/2017/08/21/1174216913/Dezhinapercent205-2017.pdf>.

²¹² See http://www.tadviser.ru/index.php/Статья:Венчурные_инвестиции_в_ИТ-сектор_России#2017, accessed July 27, 2018.

FIGURE 6.9 Comparison of Moscow to Top-10 Metros in Europe



Source: Venture Capital Investment.

Russian venture financing is centered largely in Moscow, where all major venture funds and most active accelerator programs, such as the accelerator of IIDF, GenerationS, GVA Launch Gurus, Skolkovo accelerator, VC Club, and private venture funds, are based. In 2017, 52 percent in investment volume and 79 percent of all deals were closed in the Central Federal District, which is in line with the global trend. In Europe, for example, London is first with US\$842 million or 14.8 percent of the European total, followed by Paris (US\$449 million, 7.9 percent), and Moscow (US\$318 million, 5.6 percent). Together, these three metro areas make up more than a quarter (28 percent) of the total European venture capital.²¹³ While VC investment in the Moscow area is adequate by international standards (Figure 6.9), investment in the rest of the country has slowed down. A weak start-up ecosystem produced very few exits in recent years, thus forcing many start-ups to look for opportunities in foreign markets.

ANGELS ARE FEW

The market for angel investments in Russia is still emerging, fragmented, segmented, and opaque, and reliable data is hard to come by. According to the Russian Angel Monitor,²¹⁴ in 2016, there were just 92 transactions registered and official sources recognize only 25 individuals as serial business angels. In reality, both the numbers of business angels and transactions are likely to be greater. As with VC, angel investment activities are concentrated in Moscow. Angel investors cite Russian law and the inconvenience of conducting transactions as an obstacle. The legal status and regulations of crowdfunding are not clear in Russia, an issue that is currently being addressed.²¹⁵

²¹³ Florida and King 2016, p.24.

²¹⁴ NABA, RVC, and Firrma 2016.

²¹⁵ See https://www.debevoise.com/~media/files/insights/publications/2018/02/20180226%20cryptocurrency_and_crowdfunding_bills_in_russia.pdf, accessed July 29, 2018.

BOX 6.6

CROWDFUNDING IN RUSSIA

In the last 5 years, over US\$16 million was raised through the largest Russian crowdfunding platforms. While the average amount spent on supporting one project in 2012–2013 was US\$8–9, in 2016–2017, it grew to US\$24.^a The largest crowdfunding platforms—Planeta.ru with over 700 thousand younger users interested in creative and charity projects and Boomstarter focusing on business and technology projects—raised over US\$13 million^b and US\$5 million^c during 2012–2018, respectively. In 2016, Planeta.ru raised a record US\$180,000 in Russia through crowdfunding while Boomstarter raised over US\$110,000.

a. See https://www.rbc.ru/own_business/15/06/2017/594006559a794715c9d5819c, accessed July 29, 2018.

b. See <https://planeta.ru/about>, accessed July 29, 2018.

c. See <https://boomstarter.ru>, accessed July 29, 2018.

DIGITAL SKILLS ARE LACKING

In 2016, Russia ranked a relatively high 28th (out of 130 countries) in the WEF Index of Human Capital. Russia's strengths are in the level of education in different age groups and in participation in higher education among those ages 15–24 (14th place). On the other hand, according to a WEF survey of business managers of the educational system's compliance with the tasks of ensuring the competitiveness of the economy, Russia occupies 69th place out of 138 countries (3.7 on a seven-point scale). The leaders for this indicator are Switzerland, Singapore, and Finland.²¹⁶ In the PISA in reading, mathematics, and science, Russia occupies 26th place out of 71, with an index value of 491.8, well behind the leaders, Singapore and Hong Kong SAR, China.²¹⁷ In an assessment of the quality of science education, Russia stands below the OECD average while in math it is slightly above it, having shown significant improvement in the last six years. These rankings may surprise those who frequently point to Russia's historical strength in the sciences.

216 World Economic Forum 2016.

217 Cornell University, INSEAD, and WIPO 2017a

BOX 6.7

POLICY RESPONSES TO DIGITAL SKILLS DEVELOPMENT

Most policy responses to the skills shortage in the digital economy have focused on science, technology, engineering, and mathematics (STEM) education and hard technical skills. A Talent for Europe Report takes a more holistic view, making the following policy recommendations:

- **Continuous national and local skills diagnostics** of supply and demand of high-tech talent, benchmarking policies, best practices sharing, and improving of measurement and forecasting methodologies”
- The establishment of agile, just-in-time “**software universities**” and **industry-relevant digital talent development**
- **A platform-based ecosystem of digital services for skills self-assessment** using existing tools such as the European Classification of Skills/Competencies (ESCO) and the European e-Competence Framework (e-CF)
- **Government use of incentives for lifelong learning** and tools such as pre-commercial procurement of innovation, to position the state as an effective supporter of long-term innovation
- **Launch joint training programs in partnership with the industry and academia** for leadership skills education to create a pool of high-tech and innovation leaders, such as those at CERN and Airbus

BOX 6.8

UNIVERSITY 20.35

University 20.35 is a new education format, providing “networked” tailored personalized education by offering the best courses from a variety of educational institutions on a single platform. A digital competencies profile will replace a diploma. Education will be targeted at business owners, C-level managers, marketing managers, and researchers. The first educational track will be launched in July 2018 in the Far Eastern Federal University for 1,000 students in six areas. The budget for 2017–2018 exceeds US\$26 million.

A recent report from McKinsey on digital skills in Russia.²¹⁸ reinforces this point. Even though Lomonosov Moscow State University and the St. Petersburg National Research University of information technologies, mechanics, and optics (ITMO) are ranked among the 100 best universities of the world in computer science, and Russian teams perform well in math and natural science Olympics, overall the Russian education system is not producing enough skilled personnel for the digital economy. As a result, Russia lags behind the leading countries in terms of employment in high-tech and knowledge-intensive industries.

As elsewhere, the future of work in Russia will be affected by global trends in automation, robotization, and AI. Apart from eliminating certain types of jobs, these technologies will also enable policy makers to address certain Russia-specific challenges, such as its vast territory and regional disparities. Already second-tier cities, for example, Omsk, have started to lead in providing services over digital platforms. New digital-driven initiatives are appearing in many regions of Russia, for example, Kaluga and Ulyanovsk. Broadband connectivity and the gig economy will create new opportunities for talent in small cities and remote areas of the country, potentially slowing down the pace of urbanization and breathing new life into small towns and rural areas. Policy makers should proactively adopt regulation to manage gig economy labor issues such as worker protection, arbitration, dispute resolution, income security measures, and so on. A broad program of retraining and reskilling with a focus on both technical and soft skills is also a must.

The Agency of Strategic Initiatives (ASI) names several barriers for the development of new skilled labor for the digital economy:

- The Russian education system does not recognize the needs of organizations as future employers. Current internships and apprenticeships do not create young professionals with necessary skills and experience.
- The education system is not flexible and does not allow fast adoption of new standards and methods. The standard implementation cycle usually takes up to seven years.
- The lack of cooperation between enterprises and educational institutions leads to a limited number of joint trainings and educational programs.
- Most colleges and universities do not have the latest technologies and equipment.²¹⁹

To overcome the gap, the ASI and other government institutions and universities launched several programs such as WorldSkills Hi-Tech, AgroSkills, and DigitalSkills championships, and NTI Olympics for high school students. Moreover, the agency published the atlas of new professions and leads the establishment of University 20.35.

Lifelong learning, flexibility of educational trajectories, modularity of educational courses, interpersonal skills, and “interdisciplinary” problem-solving are key to success in the digital age.

²¹⁸ Digital McKinsey 2017.

²¹⁹ See <https://asi.ru/eng/staffing/>, accessed July 29, 2018.

BOX 6.9

DIGITAL SKILLS IN THE TULA OBLAST

A modern training and education cluster based on a partnership between schools, universities, professional training centers, government organizations, and large enterprises has been created in the Tula Oblast. The parties have signed an agreement to enhance the quality of physics and math training in the region. The regional government, the leading Rostech corporation, and the WorldSkills Russia development agency have agreed to launch the first higher technical school in the country at the local Oktava plant to train highly qualified specialists that are most in demand.

The regional government has also initiated the Composite Valley Project aimed at the creation of an industrial innovation cluster in the region at the Tula State University in partnership with the Lomonosov Moscow State University and other leading national universities. Students will also be offered opportunities to apply their knowledge at the Uzlovaya special economic zone.^a

a. See https://tularegion.ru/presscenter/press-release/?ELEMENT_ID=76385, accessed July 29, 2018.

Skills and education development is a major part of the Russian Digital Economy Program that aims for 40 percent of the population to possess digital skills by 2024.²²⁰

The importance of a broad skill set has been highlighted by a recent investor survey²²¹ that identified the key challenges facing Russian start-ups: three out of four mentioned the lack of a coherent business model, almost 70 percent pointed to team weaknesses, and more than half identified a narrow market orientation. By far the majority of entrepreneurs have an engineering background and thus lack marketing and business skills to commercialize their offerings.

ESTABLISHING GOVERNMENT-LED REGIONAL INNOVATION CENTERS

Another way of facilitating innovation and fostering digital entrepreneurship at the regional level is to establish a network of government-led regional innovation centers by encouraging

²²⁰ See <https://data-economy.ru/education#rec36240063>, accessed July 29, 2018.

²²¹ During the research for the Russian Angel Monitor 2016 (See NABA, RVC, and Firma 2016), 55 business angels from all over the country, including 15 leaders of official and informal communities and groups, were interviewed.

BOX 6.10

DRIVING REGIONAL INNOVATION IN KOREA

The Korean government is establishing Centers for Creative Economy and Innovation (CCEIs) across the country to drive focused regional innovation through PPPs. Each region of Korea has been assigned with developing a distinct set of competencies; for example, Seoul focuses on SME exports and cooperation with China. Kyonggi region drives FinTech, gaming, and IoT, while Sejong region focuses on agribusiness and smart agriculture. Regional specialization has been at the heart of the government's national competitiveness vision.

The centers focus on establishing regional innovation ecosystems. As of July 2015, 18 centers have been established. They act as start-up hubs that promote SME innovation and drive new business creation and new job opportunities. Anyone with creative ideas can visit CCEIs and receive one-stop support including product development, financing, legal and technology support, marketing, and business development. The centers encourage collaboration with innovation agencies, universities, and companies to support regional flagship industries and match start-ups with new graduates in the regions. As of late 2016, CCEIs have supported 3,870 start-ups.

large SoEs to work closely with individual entrepreneurs and university-housed research institutions with appropriate stimulation mechanisms; large corporations can play a significant role in building digital entrepreneurship ecosystems. These centers in close collaboration with academic institutions could also provide tailored education for business owners. A similar model based on private-public sector partnership has been rolled out in Korea (Box 6.10).

6.3 Policy Recommendations

To boost the Russian entrepreneurship and innovation ecosystem, **first of all**, it is critical to continue to improve the local business climate and launch specific initiatives aimed at building private sector and investor confidence in the transparency, stability, and predictability of the local market dynamics.

- Review existing regulation and public programs and policies governing entrepreneurship and innovation in Russia and ensure its international competitiveness compared to the world's leading centers of innovation, so as to make it attractive for local start-ups to grow locally rather than relocate abroad, and to support domestic and attract international investment.

Second, it is crucial to strengthen the innovation ecosystem by launching specific initiatives to boost links between the government, the private sector, and the scientific community. Specific initiatives include the following:

- Prioritize digital entrepreneurship in implementing the Russia Digital Economy Program. Develop a coordinated vision and road map for ecosystem enhancement through engaging a wide array of start-up ecosystem stakeholders and by drawing on an accurate analysis of the state of innovation and entrepreneurship in Russia.
- Improve horizontal links between different sectors, especially through creating cross-sector innovation-oriented teams tasked with interpreting the value of new technologies for different verticals of the economy.
- Encourage universities, research institutions, and the scientific community to work closely with the private sector to understand market needs. Engage marketing and sales experts as active ecosystem participants to link products and solutions to private sector demand by driving commercialization and go-to-market strategies.
- Develop mechanisms to attract professional mediators, independent financial consultants, and financial and technological brokers to support investors in different deal stages.

Third, it is necessary to review the role of the public sector in start-up ecosystem development and facilitation. Assess the effectiveness of government involvement in start-up support and funding to understand which support mechanisms are the most effective and which are less so. A system of regular assessment of existing support tools in line with innovation objectives and key performance indicators (KPIs) and an agile mechanism of funds reallocation is key to the distribution of government support. A variety of support mechanisms should be continuously explored, including the role of government in crowding in private funding and targeted support to address market failures.

Fourth, coordination across government agencies and government programs needs improvement. Today there is a lack of a coordinated approach to the management of innovation policy instruments across sectors, and existing policies governing industry, science and technology, and education innovation development lack alignment. Several initiatives exist in Russia for improving the targeting of public funding, strengthening horizontal and cross-sectoral cooperation, and supporting joint projects between research institutes, universities, and companies. Most of the initiatives operate based on short-term time frames, when longer-term commitments are needed. Rather than launching new funding instruments and programs, it is recommended to focus on coordinating and improving existing ones

through feedback and evaluation. Special attention should be given to investigating barriers for cooperation, such as Intellectual Property in Russia (IPR) legislation, poor capability to manage IPR in joint projects, or regulatory obstacles. The national strategy of venture market development must be updated to reflect the priorities of the digital economy.

Fifth, it is necessary to accelerate the digital transformation initiatives of large SoEs to create demand for innovation locally and encourage them to increase open innovation activities through corporate accelerators and venture funds. SoEs have resources that can significantly benefit the start-up ecosystem, but they also need to be able to work through modern, agile models of cooperation. Special targeted and regularly reviewed tax benefits or co-investments could be used by the government as incentives. Qualitative innovation KPIs at SoEs should also be enforced.

Sixth, establish links with the global and regional entrepreneurial ecosystem.

- Develop partnerships with key players in the global VC market and attract experienced venture fund managers who can mentor investors. Setting up an ongoing training program for venture investors and specifically for corporate venture funds management is also recommended.
- Strengthen the Russian start-up community by engaging internationally experienced Russian entrepreneurs as mentors and champions.
- Leverage existing relationships beyond Moscow to support regional start-up communities. Build dedicated incentives to attract Russian scientists and entrepreneurs back to Russia. Engaging the Russian community abroad can help network and grow the Russian start-up ecosystem globally.
- Consider setting up regional innovation centers to encourage regional collaboration between innovation agencies, universities, and companies to support regional flagship industries and start-ups.

Seventh, develop and promote a culture of innovation.

- Review and analyze international best practice to select mechanisms for promoting a culture of open innovation that can work well in the Russian environment.
- Create innovation sandboxes for start-ups to implement new and promising innovations without fear of whether they meet legal or regulatory guidelines. Establish reasonable safeguards to limit the consequences of failure and maintain the stability of the technology-enabled systems.
- Develop public relations strategies to improve the perception of entrepreneurs and the value of innovation in the eyes of the Russian public. Promote innovation success stories, encourage innovation evangelists, and promote high-profile successful entrepreneurs.

Last but not least, develop and nurture innovation talent at all stages of the education process.

- Develop digital education skill-set requirements appropriate for different educational levels: primary, secondary, and tertiary.
- Engage the private sector in formulating requirements for digital innovation and establish joint education programs with the private sector.
- Improve education for digital entrepreneurship at universities through multidisciplinary programs and through collaborative efforts between business and academia.
- Pay special attention to the growing needs of digital economy start-ups to employ talent from sectors beyond science and technology, such as business, design, and marketing as well as soft interpersonal skills.
- Develop multidisciplinary learning modules for use by incubators and accelerators in their training programs.

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CONCLUSION

There are several overarching takeaways from this study. Consistently and continuously addressing these five areas is fundamental to the success of the digital transformation process. These apply at the national, regional and municipal levels of the country, as well as at the sectoral level.

First of all, to prepare for digital disruption and to uncover opportunities for digital creation, policy makers around the world and in Russia need to **strengthen the non-digital foundations** of their economies by maintaining leadership focus on the role of digital transformation in achieving national performance objectives; ensure agility in revising regulation to address the rapidly changing needs of the new digital economy; and empower an ecosystem of decision makers, institutions, and organizations responsible for stimulating digital transformation and managing digital disruption.

Effective project management is also of the essence. Detailed road maps need to be developed and implemented in line with key strategy objectives, project portfolios prioritized to identify quick wins as well as longer-term strategic initiatives. New governance mechanisms that engage all the key stakeholders in the decision-making and governance process should be introduced to accelerate the pace of transformation in line with stated goals. Budgets and financing mechanisms need to be firmly in place.

The dividends of building a competitive digital economy are high, and a high-level leadership focus on tightly targeted policies and flawless execution is required to accelerate the pace of this transformation.

Second, the government needs to continue to **strengthen the digital foundations** by preemptively investing into a scalable intelligent secure infrastructure capable of anticipating the exploding demand for the digital economy.

Third, it is about **strengthening the digital transformation ecosystem** both horizontally—across all sectors of the economy at the national, regional, and municipal levels—as well as vertically, throughout the sectors and subsectors of government, industry, and services.

Weak links between the government, private sector, research organizations, and academic institutions negatively affect the pace of digital transformation, the implementation of key government programs, the adoption of new technologies and business models, proactive responses to technological and economic disruptions and crises, and the speed of innovation. A strong and effective operational ecosystem is the foundation of the technological breakthrough envisioned by the Russian leadership.

Fourth, it is about **boosting digital skills**, as any technological breakthrough requires a **highly-trained workforce**. In spite of its traditional strength in fundamental science, the Russian education system is not sufficiently agile to respond to the digital transformation requirements in all economic spheres. Strengthening the training and education ecosystem, starting at the level of kindergarten and all the way up to higher education, including coordination between enterprises and educational institutions in higher education and R&D is a must. So are investments into educational platforms for the rapid development of digital economy skills across the country, and training and upskilling the existing workforce with a focus on learner-centric lifelong educational models. Policy makers should also focus on reversing brain drain and attracting and retaining talent, as well as attracting the best and brightest back into the country.

And finally, it is about **cultural transformation**. As digital transformation breaks down barriers between sectors, regions, organizations, and individuals, it challenges traditional centralized hierarchical governance structures and requires a new culture of ongoing innovation. Key elements of this culture include open communication and knowledge sharing, horizontal cross-team collaboration and co-creation, proactive experimentation and problem solving, risk taking, and the ability to translate failure into opportunity. Specific initiatives aimed at promoting a culture of open innovation should become a priority for Russian policy makers.

In terms of priorities, first, it is key to **maintain the high-level government focus** and strategic prioritization of the national digital transformation so as not to lose the existing momentum and concentrate on addressing the objectives outlined in the May 2018 Presidential Decree and effectively reaching the 2025 goals set out in the Russia Digital Economy Program, the EAEU Digital Agenda, and other relevant policy documents.

Second, there is a need to **accelerate the pace of the digital transformation of the traditional-industry** sector where the application of ICT and new digital technologies can yield significant dividends across all parts of the value chain, thus improving the competitiveness of key industry sectors. Engaging the private sector in digital transformation partnerships, sharing best practice from the national leaders in this space, fostering connections with the scientific and R&D community, and creating favorable taxation regulation to incentivize investments into digital technologies and R&D are all mechanisms that need to be leveraged. Current industrial policy should be closely aligned with the digital economy policies and programs. It is also critical to invest in back-end digital transformation and organizational restructuring in private sector companies and especially the large SoEs.

Third, **boosting R&D into new technologies** and understanding their potential to transform traditional industries and create new ones should be high on the government and private sector agendas. Understanding the impact of emerging technologies on existing business models is key to gaining competitive advantage. A high level of coordination is required between industrial development objectives and digital transformation goals, so it can accelerate the creation of clusters of innovative companies and new drivers of economic growth.

Fourth, specific policies should be implemented to **encourage innovation and entrepreneurship** in the digital transformation context. Sustainable innovation requires close coordination between the government, the private sector, and the academic community. Public sector should not only support fundamental research and drive the development of world class R&D units in Russia but also implement policies to encourage the commercialization of R&D outputs, while the private sector should focus on go-to-market strategies and new business-model development. An efficient regulatory system encouraging innovation should be further developed, with a special focus on intellectual property rights protection and patent regulation.

Fifth, the government needs to focus on ways to **leverage digital technologies to alleviate disparities in the development of Russia's regions and municipalities** and to enable the less-advanced regions to take advantage and effectively localize the implementation of the national digital economy program. Policies should focus on demand creation by large regional SoEs, local digital skills development, management training, local PPPs, and regional innovation cluster-building, local market development and funding mechanisms. Special attention should be given to developing digital infrastructure in remote and rural areas and educating rural populations about the benefits of digital services.

And finally, policies should be aimed at the **development of a receptive domestic market that values the processes and outputs of digital transformation**. These include a focused top-down approach to the digital transformation of large industrial enterprises and especially SoEs where technology adoption can be managed throughout the existing

strong vertically integrated industry structures to boost demand for digital technologies, as well as specific steps aimed at improving the business climate, focused market-development initiatives to boost local demand, public sector technology procurement preferences, and incentives for market players to procure locally. Initiatives aimed at building the public's trust in the digital economy are also important.

In summary, the ongoing Russian government commitment to digital transformation as a national priority, if complemented by effective policies across key economic sectors and a results-oriented focus on implementation, will enable the country to join the world's digital transformation leaders and position it for a technological breakthrough and the achievement of the economic and social benefits it implies.

