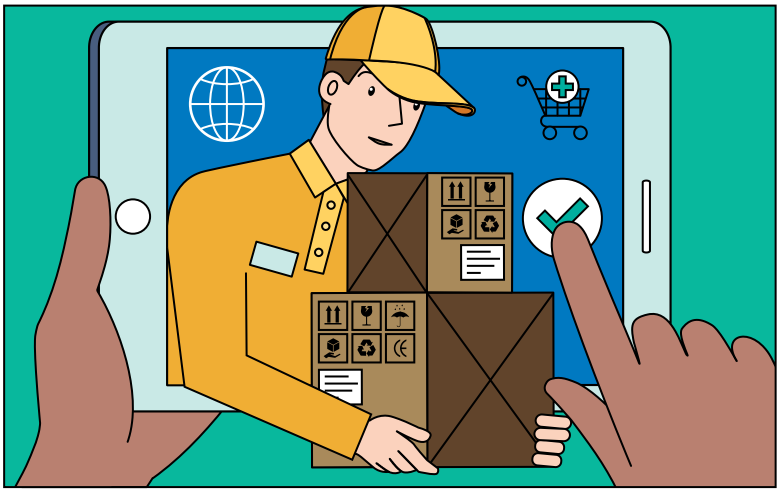

DIGITAL DIVIDES
3G
3G
ABSOLUTE BEGINNERS
HOW-TO GUIDE
COMPUTER SKILLS
USER GUIDE
LIBRARY
in



This chapter introduces a new index of digitalisation and provides an overview of digital divides in the EBRD regions, both across and within economies. While countries with medium levels of digitalisation have been catching up with advanced economies, the countries with the lowest levels have been falling further behind. Low levels of digital skills are the key constraint holding back digitalisation in many economies in the EBRD regions. Within economies, while individuals with medium levels of education and income and the middle-aged have been catching up with the most digitally literate, older individuals and those with lower levels of education and income are increasingly being left behind. Digital technologies are also contributing to increased divergence in the performance of firms, which is being amplified by the Covid-19 crisis.

Introduction

The Covid-19 crisis has boosted digitalisation in many economies, changing the role that technology plays in the way that we learn, work and live. Overall, this is a welcome development. Investment in digital technologies can increase growth and improve productivity through greater efficiency in the allocation of resources across industries and by allowing capital and labour to be combined more efficiently within individual sectors. Such structural shifts underpinning growth in total factor productivity (TFP) have been the leading source of growth over the last decade, in the EBRD regions and advanced economies alike (see Box 1.1). A number of studies have documented a positive correlation between digitalisation and productivity growth in the medium term, both within firms and across economies.[1]

At the same time, the crisis has also exposed growing digital divides, both across and within economies. While the better off and those living in cities and more advanced economies have been more able to order goods and services online, do their banking via the internet and even work from home, large parts of the population remain excluded from such benefits of digitalisation. Similarly, while some firms have taken advantage of the new opportunities provided by digitalisation, others have fallen further behind. Against that background, this chapter provides an overview of digitalisation in the EBRD regions and a few select comparator economies (both emerging markets and advanced economies), looking at developments both across and within countries.

The first part of the chapter introduces a new index of digitalisation and looks at how countries in the EBRD regions and comparator economies compare in terms of the preconditions for digitalisation ("digital enablers") and the use of digital technologies by individuals and firms ("digital outcomes"). It also looks at the evolution of those differences over time.

That analysis documents large digital divides across countries, with the gap between the EBRD regions and advanced economies being especially pronounced for more advanced digital technologies (such as digital tools used in production management). Some digital divides have narrowed over the last five years: economies with medium levels of digitalisation – such as those in eastern Europe and south eastern Europe (SEE) – have made large gains and

[1] See Hernandez et al. (2016) for a review. See also Niebel (2018), Aly (2020), Solomon and Van Klyton (2020) and Brynjolfsson et al. (2017).

closed some of the gap relative to advanced economies. However, other economies – such as those of Central Asia and the southern and eastern Mediterranean (SEMED) – have seen only limited improvements in the area of digitalisation, despite starting from a low base, and are thus falling further behind.

The digitalisation index also highlights the constraints that appear to be impeding digitalisation the most, which vary from economy to economy. Most of the EBRD regions have seen significant improvements in infrastructure over the last five years (although in some economies, such as those of Central Asia, investment in digital infrastructure remains a priority). Many economies in the EBRD regions have also made large gains in terms of the digital provision of government services. Getting regulation right may become more challenging as digitalisation increases, since more advanced digital technologies require more complex regulatory and legal frameworks.

Insufficient digital skills are the key constraint holding back digitalisation in many economies in the EBRD regions. Indeed, returns to investment in digital-intensive capital are found to be significantly higher in economies with strong skills relative to economies where human capital is weak. Thus far, the EBRD regions have benefited from high levels of human capital – in some cases, on a par with advanced economies and above the levels observed in other emerging markets. However, the quality of schooling (as assessed using standardised international tests) appears to be falling, and the EBRD regions are lagging behind in terms of digital skills (for instance, when it comes to finding information online, sending emails, shopping online, using a word processor or updating software).

While workers in the EBRD regions appear to be just as likely to access free online courses and other independent training in the area of digital skills as their counterparts in advanced economies, the amount of training provided by employers is considerably lower than in advanced economies. Furthermore, many economies in the EBRD regions are experiencing significant "brain drain", with people with strong digital skills moving abroad.

The resulting low levels of digital skills are already holding back people's use of digital technologies, even where the relevant digital infrastructure and services are available. This is likely to become even more of a constraint in the future, as the structure of production is shifting towards more digital-intensive industries. Moreover, the importance of digital skills *within* individual industries is also increasing – even in industries far removed from the information and communication technology (ICT) sector.

The second part of the chapter focuses on digital divides *within* countries, looking at how the use of digital technologies varies across individuals and firms with different characteristics. It shows the existence of significant digital divides within countries, which typically coincide with deep socio-economic disparities.

While some digital divides within economies have narrowed, others have widened. Individuals with medium levels of education and income and the middle-aged have been catching up with the most digitally literate groups (those with high levels of education and income and the young). However, people aged 55 or over, people with only lower-secondary education and people in the poorest income quartile have made only limited gains in terms of digital proficiency, despite starting from a low base. Those groups are at risk of falling further behind, since their non-digital skills may quickly become obsolete as digital skills gain in importance in sectors not traditionally thought of as digital-intensive.

Digital divides may also contribute to increased divergence in the performance of firms, with larger, better managed and more innovative firms being more likely to take advantage of digitalisation. Such firms are also more likely to have increased their use of digital technologies during the Covid-19 crisis, suggesting that digital gaps between firms may widen in the future. That increased dispersion in the productivity of firms could, in turn, weigh on average productivity in the economy.[2]

THE INDEX AGGREGATES
22
DIFFERENT MEASURES OF DIGITALISATION

[2] See, for instance, Berlingieri et al. (2020) and Gal et al. (2019).

An index of digitalisation

A country's level of digitalisation consists of various different aspects, such as the infrastructure that allows access to the internet, the regulation that governs the provision and use of digital solutions, and the use of digital technologies by firms and individuals.

This first section of the chapter introduces a new digitalisation index looking at economies in the EBRD regions and a number of comparator economies (see Annex 1.2 in the online version of this report for more details). The index, which compares the situation in 2015 and 2020, is informed by a number of existing indices with different areas of focus and differing coverage in terms of countries: EIB (2019) focuses on firms; European Commission (2020c) focuses on households; and World Bank (2016) focuses on the supply of digital technologies.[3]

Digital enablers

The index described in this chapter aggregates 22 different measures, capturing both (i) preconditions for the use of digital technologies (enablers) and (ii) the use of digital technologies by individuals and firms (outcomes). The enabler pillars of the index cover key areas that facilitate the application of digital technologies by households and firms: infrastructure, skills, regulation and digital provision of government services.

The infrastructure pillar captures the availability, quality and affordability of mobile and broadband internet using indicators such as coverage of mobile networks supporting internet (3G or above), fixed and mobile phone subscriptions, download speeds and the cost of devices (see Chapter 2 for more detailed analysis of internet access infrastructure).

The skills pillar looks at the quality of education in general (quality-adjusted years of schooling), as well as digital skills specifically, and internet access in schools.

The regulation pillar covers legislation relating to the provision of ICT services (mostly focusing on operators), legal and technical measures relating to cybersecurity, and the adaptability of legal frameworks to digital business (capturing, for instance, the legal framework governing e-commerce; see also Box 1.2 for examples of different approaches to digital regulation and Annex 1.1 on investors' perceptions of regulatory frameworks for ICT).

The last pillar of the enabler part of the index tracks the provision of digital services by governments. A measure of e-government looks at whether the public sector provides information on laws or public spending initiatives online and whether the public are able to access services via the internet (for instance, whether they can make appointments or pay taxes online; see also Box 1.3 on e-government services and digital identification). A measure of e-participation looks at information sharing online, including consultation with stakeholders in the context of new initiatives or construction projects.

Digital outcomes

On the outcome side, the index assesses the use of digital technologies by (i) individuals (looking at the percentage of the population that use the internet, shop online or make/receive payments online) and (ii) firms (looking at the percentage of firms that have a website, as well as the number of secure servers relative to the size of the population – a commonly used measure of firms' use of digital technologies).[4] Within all pillars, the various indicators are weighted equally.

For each pillar, scores are expressed on a scale of 0 to 100, where 100 corresponds to the frontier (which represents the highest-scoring economy across the two years covered by the index). For infrastructure and regulation, for instance, the frontier is the United States of America in 2020; for skills, it is Sweden in 2015 (with skill levels having deteriorated in recent years, as discussed later in the chapter); and for the digital provision of government services, it is Estonia in 2020. Similarly, individuals' use of digital technologies is expressed relative to the situation in Canada in 2020, and firms' use of digital technologies is relative to the situation in Germany in 2020. Thus, the overall index, which averages scores across the six subcomponents, represents the distance to a hypothetical frontier that aggregates the strongest enablers and outcomes across all economies, with no economy in the sample currently standing at that frontier.

Many of the observations that were used to construct the index date back to 2019, which means that the index mainly captures the level of digitalisation prior to the Covid-19 crisis. Indicators were selected with a view to ensuring broad coverage of the economies in the EBRD regions, and the choice of emerging market comparators was also driven by the availability of data. Data gaps were filled using interpolation (see Annex 1.2 in the online version of the report for details). A total of about 5 per cent of observations were imputed. In the case of Kosovo, the majority of its values had to be imputed, so it has been omitted from this analysis.

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[3] See also World Economic Forum (2016, 2020) and World Wide Web Foundation (2014).

[4] See, for instance, Coppel (2000).

TABLE 1.1. Digital enablers

Economy	Enablers in 2020					Enablers in 2015				
	Overall	Infrastructure	Skills	Regulation	Government services	Overall	Infrastructure	Skills	Regulation	Government services
United States of America	95.4	100.0	84.3	100.0	97.5	91.9	89.1	94.6	90.9	92.9
Estonia	94.7	88.4	93.9	96.3	100.0	80.7	74.8	92.2	81.0	74.7
Sweden	92.1	97.0	96.7	90.0	84.8	83.1	91.6	100.0	78.8	62.0
United Kingdom	91.6	85.5	85.9	98.1	96.8	86.6	84.6	87.0	82.4	92.6
Canada	89.2	93.6	89.3	85.4	88.4	84.2	79.9	92.9	78.5	85.6
France	87.4	97.9	72.5	90.4	88.6	82.8	90.1	71.8	71.1	98.1
Japan	86.1	94.5	78.4	77.0	94.6	79.0	80.9	77.4	62.5	95.1
Lithuania	86.0	87.8	81.9	96.8	77.6	74.7	77.8	85.3	68.7	67.2
Germany	84.3	89.8	79.1	96.3	71.9	79.1	82.2	84.0	84.1	65.9
Slovenia	81.0	75.7	81.0	83.0	84.3	61.3	72.6	85.2	52.4	35.0
Spain	80.4	93.6	65.2	77.4	85.5	73.6	85.3	61.5	62.4	85.1
Poland	79.5	80.5	69.2	77.8	90.7	63.0	72.7	71.2	61.2	46.9
Cyprus	77.5	73.2	70.8	75.3	90.7	54.8	61.1	76.3	48.8	33.1
Italy	76.6	80.1	58.4	87.0	81.0	69.6	74.0	62.4	67.2	74.6
Czech Republic	75.0	81.6	78.5	69.9	70.0	58.4	62.4	87.7	59.2	24.2
Russia	74.6	71.5	76.1	67.6	83.1	63.9	67.5	79.4	41.7	66.9
Slovak Republic	72.7	81.0	64.4	77.0	68.3	62.9	65.7	72.1	62.1	51.7
Hungary	72.5	89.8	50.9	80.6	68.5	60.7	71.3	58.4	67.8	45.5
Turkey	71.3	67.6	43.4	87.6	86.7	54.4	56.9	42.6	70.5	47.7
Kazakhstan	71.1	67.7	60.7	66.5	89.5	60.6	60.2	75.3	33.6	73.5
Romania	70.9	85.1	46.5	77.4	74.7	58.1	79.3	52.4	60.6	40.3
Latvia	70.2	72.6	76.5	77.4	54.3	68.9	71.0	79.0	58.1	67.6
Bulgaria	68.2	65.2	53.4	72.3	81.9	47.9	58.1	59.0	57.6	17.1
Croatia	68.1	67.8	48.1	75.7	81.0	51.2	58.3	58.2	54.3	33.8
Serbia	68.0	59.9	50.5	82.5	79.1	49.0	52.7	61.4	47.7	34.4
Greece	67.3	74.4	49.8	72.8	72.4	56.6	66.0	53.0	39.2	68.1
Albania	65.4	55.6	55.8	67.2	83.0	46.1	44.1	55.7	40.6	44.1
Belarus	64.2	70.3	72.0	44.0	70.4	47.8	63.7	76.7	23.6	27.3
Azerbaijan	63.9	56.9	58.4	73.3	67.0	49.6	46.6	58.0	56.1	37.6
Moldova	63.8	63.6	48.0	70.2	73.6	50.4	49.1	48.5	50.2	53.8
India	63.3	41.9	41.4	85.4	84.3	42.6	23.0	27.5	65.3	54.7
Mexico	62.5	51.6	41.5	76.4	80.7	48.5	40.1	40.5	53.3	59.9
Brazil	62.4	56.8	26.8	77.9	88.0	52.5	55.2	28.2	64.3	62.1
Ukraine	61.3	51.8	62.5	58.4	72.5	45.9	49.7	67.5	37.4	28.8
North Macedonia	59.3	52.2	36.5	71.7	77.0	33.6	45.3	36.1	37.9	15.3
Georgia	58.8	57.8	38.6	80.8	58.0	53.3	51.0	45.1	61.8	55.4
Montenegro	58.5	68.0	49.0	66.9	50.0	52.8	57.4	44.6	57.7	51.6
Armenia	58.5	54.1	45.9	63.9	70.0	46.4	44.2	43.5	45.1	52.9
Uzbekistan	52.6	36.1	51.9	44.5	77.8	35.0	22.7	57.8	19.0	40.7
South Africa	52.3	51.2	17.5	67.7	72.6	35.2	52.3	14.3	44.6	29.5
Egypt	50.4	45.2	28.3	78.6	49.6	41.1	43.2	15.7	52.8	52.8
Tunisia	49.8	46.1	26.9	63.7	62.6	43.3	40.8	26.0	45.7	60.9
Morocco	48.4	52.3	21.0	73.4	47.1	47.0	31.8	21.0	62.3	72.7
Jordan	47.7	35.7	48.7	78.1	28.1	45.8	43.5	47.4	47.6	44.5
Kyrgyz Republic	47.1	36.2	38.2	48.7	65.2	30.8	24.7	40.7	29.6	28.1
Mongolia	46.5	44.8	50.5	37.9	52.8	47.9	40.1	52.2	37.5	61.8
Bosnia and Herzegovina	45.2	51.3	33.6	42.9	53.1	35.2	46.4	40.9	34.9	18.5
West Bank and Gaza	37.7	35.1	41.9	30.0	43.7	34.3	25.5	35.8	24.4	51.3
Lebanon	35.4	47.3	37.6	25.4	31.2	30.0	37.7	41.1	15.6	25.6
Tajikistan	29.7	31.0	39.0	22.4	26.6	21.4	21.0	44.3	20.3	0.0
Turkmenistan	23.7	31.4	34.3	18.4	10.9	22.1	31.5	40.5	15.0	1.3

Source: Enterprise Surveys, Global Findex Database, GSMA Mobile Connectivity Index, ITU-D ICT Statistics and Global Cybersecurity Index Reports, Ookla Speedtest Open Data, World Bank Netcraft and World Development Indicators, WEF Global Competitiveness Index, UN E-Government Development Index and Knowledgebase, UNCTAD and authors' calculations.
Note: Data relate to 2020 (or the latest year available) and 2015 (or the closest year available), with a score of 100 representing the frontier. See Annex 1.2 in the online version of the report for details. Economies are ranked on the basis of the overall enabler score for 2020, which is an average of the four enabler pillars. The lowest scores in each year are highlighted.

TABLE 1.2. Digital outcomes

Economy	Outcomes in 2020			Outcomes in 2015		
	Overall	Individuals	Firms	Overall	Individuals	Firms
Sweden	97.3	99.2	95.4	88.5	95.5	81.6
Canada	96.3	100.0	92.5	81.7	90.9	72.6
Germany	92.3	84.6	100.0	81.1	82.9	79.3
United Kingdom	90.2	88.9	91.5	82.1	88.9	75.3
United States of America	89.9	86.2	93.7	76.1	75.6	76.5
Estonia	89.7	90.2	89.3	80.8	89.2	72.4
Japan	84.4	73.1	95.7	70.6	67.5	73.7
Slovenia	84.3	73.4	95.1	69.8	65.1	74.4
Czech Republic	84.0	71.3	96.6	72.7	67.3	78.1
Spain	83.3	79.6	87.0	66.4	72.2	60.5
Slovak Republic	80.0	70.8	89.2	69.6	65.3	74.0
France	77.8	72.6	83.1	64.2	69.7	58.8
Latvia	77.7	77.9	77.5	60.2	73.0	47.3
Lithuania	76.9	65.4	88.5	57.1	56.0	58.2
Italy	74.1	66.1	82.1	53.4	51.0	55.8
Croatia	73.8	65.4	82.1	56.5	56.2	56.7
Poland	73.4	72.5	74.3	61.4	53.7	69.0
Cyprus	70.1	59.8	80.5	56.4	47.9	64.9
Hungary	69.8	54.9	84.7	52.0	49.4	54.6
Belarus	69.2	64.1	74.3	43.1	45.6	40.5
Russia	62.8	58.2	67.5	46.7	45.0	48.4
Greece	62.8	45.4	80.2	44.1	28.2	60.0
Serbia	60.8	42.0	79.6	41.2	34.4	47.9
Turkey	58.6	49.8	67.5	44.8	38.4	51.2
Ukraine	54.1	39.5	68.8	33.3	29.2	37.3
Brazil	53.0	38.7	67.2	40.3	32.7	47.9
Bulgaria	50.7	34.7	66.6	39.3	29.5	49.0
Moldova	49.9	45.1	54.8	32.3	29.0	35.5
Romania	49.7	33.3	66.1	38.8	25.4	52.2
Kazakhstan	48.3	43.5	53.1	26.9	31.9	21.9
North Macedonia	47.7	41.6	53.8	36.3	34.7	37.8
Bosnia and Herzegovina	47.5	29.9	65.1	29.6	20.2	38.9
South Africa	46.2	28.8	63.6	35.3	32.5	38.1
Lebanon	43.1	39.7	46.5	33.5	27.5	39.5
Mongolia	42.1	44.1	40.1	30.2	26.3	34.1
Georgia	41.9	29.7	54.1	24.5	16.5	32.5
Armenia	39.7	32.1	47.2	31.5	17.2	45.8
Mexico	39.5	26.8	52.2	31.9	23.1	40.7
Azerbaijan	39.0	29.0	49.0	17.9	23.6	12.2
Jordan	38.0	24.4	51.7	18.6	14.6	22.7
Montenegro	36.9	36.3	37.6	23.3	27.2	19.4
Albania	35.9	20.4	51.4	24.7	17.1	32.3
Tunisia	32.3	21.7	42.9	22.4	13.0	31.9
Kyrgyz Republic	32.2	19.4	44.9	17.5	8.0	27.1
Morocco	32.0	20.0	43.9	21.7	12.5	30.9
India	25.1	9.7	40.5	11.9	7.2	16.7
Uzbekistan	24.5	24.9	24.1	11.1	22.2	0.0
West Bank and Gaza	23.5	19.2	27.7	13.1	14.2	11.9
Tajikistan	17.7	20.1	15.2	6.7	5.5	7.9
Egypt	16.6	12.7	20.5	7.2	7.2	7.2
Turkmenistan	8.4	7.1	9.7	0.9	1.8	0.0

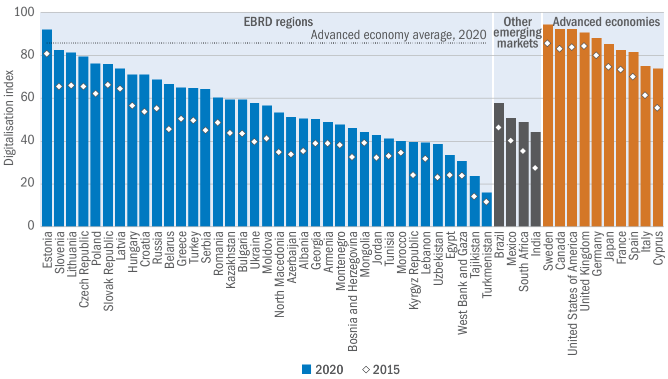
Source: Enterprise Surveys, Global Findex Database, GSMA Mobile Connectivity Index, ITU-D ICT Statistics and Global Cybersecurity Index Reports, Ookla Speedtest Open Data, World Bank Netcraft and World Development Indicators, WEF Global Competitiveness Index, UN E-Government Development Index and Knowledgebase, UNCTAD and authors' calculations.
Note: Data relate to 2020 (or the latest year available) and 2015 (or the closest year available), with a score of 100 representing the frontier. See Annex 1.2 in the online version of the report for details. Economies are ranked on the basis of the overall outcome score for 2020, which is an average of the two outcome pillars.

Digital divides across economies

This digitalisation index points to large digital divides across economies in the EBRD regions (see Chart 1.1, which presents scores averaged across digital enablers and digital outcomes; divides look similar when considering enablers and outcomes separately, as Tables 1.1 and 1.2 show). The economies with the highest levels of digitalisation are Estonia, Lithuania and Slovenia, while those with the lowest levels are Tajikistan, Turkmenistan and the West Bank and Gaza. These rankings would remain broadly unchanged if alternative indicators were used to construct the index or the indicators were weighted differently. Most economies in the EBRD regions lag far behind the average level of digitalisation seen in advanced economies, and a number of economies lag behind emerging market comparators such as Brazil, India, Mexico or South Africa.

As one might expect, countries' levels of digitalisation are closely correlated with their overall levels of development. For instance, while 89 per cent of people living in advanced economies used the internet in 2019, the equivalent figure for the EBRD regions is only around 76 per cent. Differences in countries' gross domestic product (GDP) per capita (measured in US dollars at market exchange rates) explain around 80 per cent of the cross-country differences in digitalisation that are observed for 2020.

CHART 1.1. There are large digital divides across economies

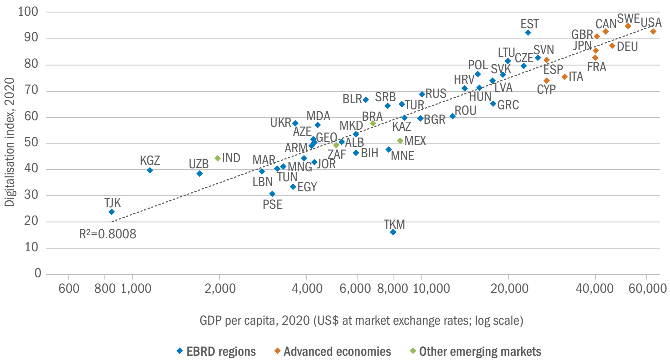


Source: Enterprise Surveys, Global Findex Database, GSMA Mobile Connectivity Index, International Telecommunication Union (ITU-D ICT Statistics and Global Cybersecurity Index Reports), Ookla Speedtest Open Data, World Bank Netcraft and World Development Indicators, World Economic Forum (WEF) Global Competitiveness Index, United Nations (UN) E-Government Development Index and Knowledgebase, UN Conference on Trade and Development (UNCTAD) and authors' calculations.
Note: Data relate to 2020 (or the latest year available) and 2015 (or the closest year available), with a score of 100 representing the frontier. See Annex 1.2 in the online version of the report for details. Advanced economies are based on the classification used by the International Monetary Fund (IMF).

Nonetheless, that correlation is not perfect. For instance, Estonia, Belarus, the Kyrgyz Republic and Ukraine stand out as having a high level of digitalisation relative to their overall level of development, while some economies in the SEMED region have levels of digitalisation that are lower than one would expect on the basis of their GDP per capita (see Chart 1.2).

Additional analysis reveals that economies with stronger administrative and fiscal capacity (as captured by an index presented in the *Transition Report 2020-21*)[5] tend to have better digital enablers, even taking into account their overall level of development. Similarly, economies with higher-quality economic and political institutions in 2015 (measured using the Worldwide Governance Indicators assessing voice and accountability, political stability and the absence of violence, government effectiveness, regulatory quality, the rule of law and control of corruption) are characterised by stronger digital enablers in 2020, taking into account their overall level of development, with government effectiveness and the rule of law having the largest impact. Geographical differences also play a role, with enablers tending to be weaker in countries with more mountainous terrain, where the provision of infrastructure may be costlier.

CHART 1.2. Countries' levels of digitalisation are closely correlated with their overall levels of development



Source: Enterprise Surveys, Global Findex Database, GSMA Mobile Connectivity Index, IMF, ITU-D ICT Statistics and Global Cybersecurity Index Reports, Ookla Speedtest Open Data, World Bank Netcraft and World Development Indicators, WEF Global Competitiveness Index, UN E-Government Development Index and Knowledgebase, UNCTAD and authors' calculations.
Note: Data relate to 2020 or the latest year available.

Digital divides are starker for more advanced technologies

Digital divides across countries are more pronounced for more advanced digital technologies. For example, 89 per cent of adult residents of advanced economies have made or received payments online in the last year, compared with just 44 per cent in the EBRD regions (see Chapter 4 for a detailed discussion of digital finance). Similarly, while 52 per cent of adults in advanced economies make purchases online, the equivalent figure for the EBRD regions is only around 21 per cent.[6]

ONLY AROUND
21%
OF ADULTS IN THE EBRD REGIONS MAKE PURCHASES ONLINE, COMPARED WITH
52%
IN ADVANCED ECONOMIES

Similar patterns can be observed for firms. For instance, 94 per cent of firms in the EBRD regions use the internet and 71 per cent have a website – similar to the levels observed in advanced economies (98 and 78 per cent respectively). However, the percentage of firms using enterprise resource planning (ERP) technology (software which allows integrated digital management of a firm's main business processes in real time) for production management is much lower. Strikingly, while three-quarters of firms in Hungary have a website (similar to the level seen in Spain), only 14 per cent use ERP technology (compared with 43 per cent in Spain). Overall, 29 per cent of firms in the EBRD regions use digital business management tools, compared with 36 per cent in advanced economies.[7]

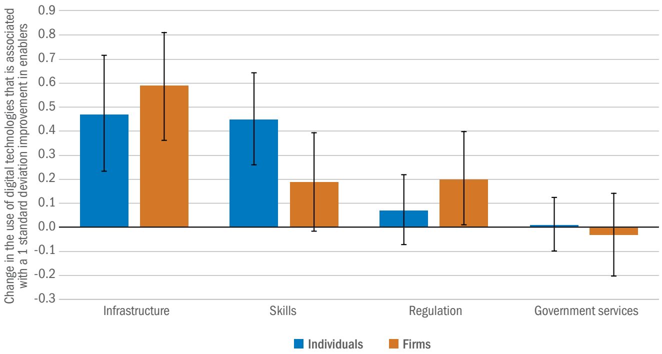
Digital enablers affect the use of digital technologies by individuals and firms

More than three-quarters of all cross-country differences in the use of digital technologies by individuals and firms in 2020 can be explained by differences in conditions that are supportive of digitalisation – differences in infrastructure, skills, regulation and government services.

Where basic digital infrastructure is in place, skills appear to be especially important for individuals' use of digital technologies, while the quality of regulation matters for firms' adoption of digital technologies. A 1 standard deviation improvement in digital skills (which roughly corresponds to the difference between Kazakhstan and Slovenia in 2020) increases households' use of digital technologies by 0.45 of a standard deviation, taking into account the

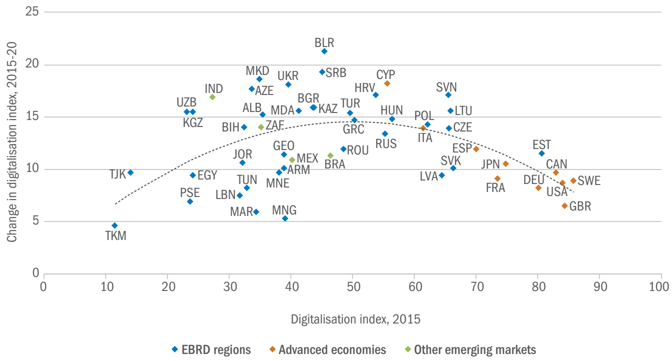
[5] See EBRD (2020a).
[6] Based on data for 2017 in the Global Findex Database and data for 2019 in the ITU-D ICT Statistics dataset. These figures are simple averages across 38 economies in the EBRD regions and 10 advanced economies.
[7] Based on information from the 2019/20 round of Enterprise Surveys, Eurostat and UNCTAD. These figures are simple averages across 14 economies in the EBRD regions and 7 advanced economies. See also EBRD (2022).

CHART 1.3. Skills and regulation have a large impact on the use of digital technologies by individuals and firms respectively



Source: Enterprise Surveys, Global Findex Database, GSMA Mobile Connectivity Index, ITU-D ICT Statistics and Global Cybersecurity Index Reports, Ookla Speedtest Open Data, World Bank Netcraft and World Development Indicators, WEF Global Competitiveness Index, UN E-Government Development Index and Knowledgebase, UNCTAD and authors' calculations.
Note: Bars denote the coefficients derived from regressing individuals' and firms' use of digital technologies on the four enablers (pooled across 2015 and 2020; all expressed as z-scores – that is to say, standardised deviations from the mean). 95 per cent confidence intervals are shown.

CHART 1.4. The largest gains have been seen in economies with medium levels of digitalisation



Source: Enterprise Surveys, Global Findex Database, GSMA Mobile Connectivity Index, ITU-D ICT Statistics and Global Cybersecurity Index Reports, Ookla Speedtest Open Data, World Bank Netcraft and World Development Indicators, WEF Global Competitiveness Index, UN E-Government Development Index and Knowledgebase, UNCTAD and authors' calculations.
Note: Data relate to 2020 (or the latest year available) and 2015 (or the closest year available), with a score of 100 representing the frontier. See Annex 1.2 in the online version of the report for details.

94% OF FIRMS IN THE EBRD REGIONS USE THE INTERNET AND **71%** HAVE A WEBSITE

quality of infrastructure and digital government services (see Chart 1.3). This corresponds to almost 40 per cent of the difference observed between households' use of digital technologies in Kazakhstan and Slovenia.

Similarly, a 1 standard deviation improvement in the quality of regulation (which roughly corresponds to the difference between Croatia and Estonia) increases firms' use of digital technologies by 0.2 of a standard deviation (equivalent to two-thirds of the actual difference between firms' levels of digitalisation in those two economies). Indeed, improvements in the quality of regulation can explain more than half of the total increase seen in firms' use of digital technologies in the EBRD regions between 2015 and 2020 (based on regressing the change in firms' level of digitalisation on changes in the four enabler scores).

Some digital divides have narrowed over time

Chart 1.4 compares changes in the digitalisation index between 2015 and 2020 with the levels recorded in 2015. Its inverted-U shape indicates that the sharpest improvements were seen in economies that had medium levels of digitalisation in 2015. Belarus, North Macedonia, Serbia and Ukraine saw the biggest gains, driven by large improvements in regulation and government services and associated increases in firms' use of digital technologies. Gains were more limited in economies that already had high levels of digitalisation in 2015, such as Estonia, Latvia, the Slovak Republic and most advanced economies.

But other economies are falling further behind

At the same time, however, many economies that had low levels of digitalisation in 2015 have made little progress since then and are thus at risk of falling further behind. In Egypt, Lebanon, Mongolia, Morocco, Tajikistan, Tunisia, Turkmenistan and the West Bank and Gaza, for instance, gains have been smaller than those seen in advanced economies, despite starting from a low base. For those economies, therefore, the digital divide has widened.

Broad-based improvements in the quality of digital infrastructure

Digital infrastructure improved in almost all economies in the EBRD regions between 2015 and 2020 (see Chart 1.5; see also Chapter 2). Gains mostly reflected improvements in the quality and affordability of digital infrastructure. Similar improvements were seen in the digital infrastructure underpinning financial markets during this period (see Chapter 5).

Large gains in terms of the quality of digital government services and regulation

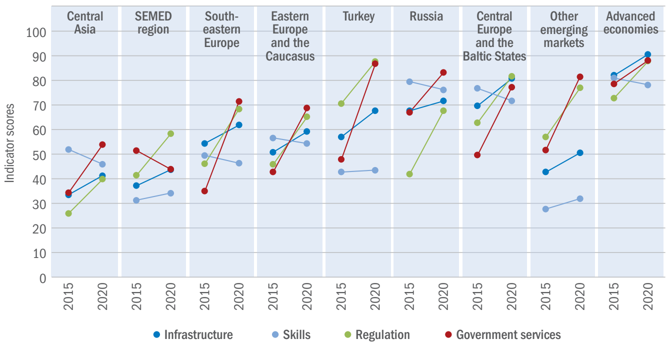
Many economies have also seen significant improvements in the quality of digital government services and the regulatory framework governing digitalisation (see Chart 1.5; see also the Structural Reform section for examples of recent digitalisation initiatives in the context of the Covid-19 crisis). The largest improvements in regulation have been seen in Greece, North Macedonia, Russia and Serbia, largely owing to perceived improvements in cybersecurity. Government services have also improved in many economies in the EBRD regions and other emerging markets.

Skill levels are a key constraint

As documented in previous *Transition Reports*, a number of economies in the EBRD regions – such as those of central Europe and the Baltic states (CEB), as well as Russia – have high levels of human capital relative to other emerging markets.[8] Nevertheless, the average gap relative to advanced economies is sizeable. The EBRD regions are only one year behind advanced economies in terms of the average number of years of schooling; however, when adjusted for the quality of schooling (based on standardised international tests administered to recent cohorts of students), the gap is more than two years (see Chart 1.6).[9]

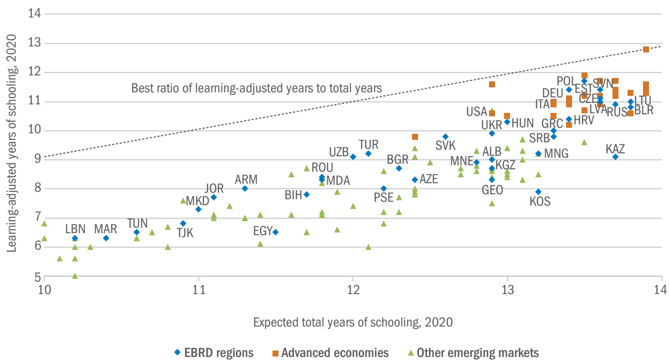
Strikingly, in 55 per cent of economies in the EBRD regions, as well as some advanced economies (including Germany, Italy and the United States of America), quality-adjusted years of schooling declined between 2017 and 2020. For instance, in Bulgaria, Kazakhstan, Russia and Serbia, quality adjusted years of schooling fell by over a year

CHART 1.5. Regulation and government services have improved most, while skills have worsened



Source: Enterprise Surveys, Global Findex Database, GSMA Mobile Connectivity Index, ITU-D ICT Statistics and Global Cybersecurity Index Reports, Ookla Speedtest Open Data, World Bank Netcraft and World Development Indicators, WEF Global Competitiveness Index, UN E-Government Development Index and Knowledgebase, UNCTAD and authors' calculations.
Note: Data relate to 2020 (or the latest year available) and 2015 (or the closest year available), with a score of 100 representing the frontier. See Annex 1.2 in the online version of the report for details. Data for comparator economies are simple averages across 4 emerging markets and 10 advanced economies.

CHART 1.6. The EBRD regions compare less favourably with advanced economies when years of schooling are adjusted for quality



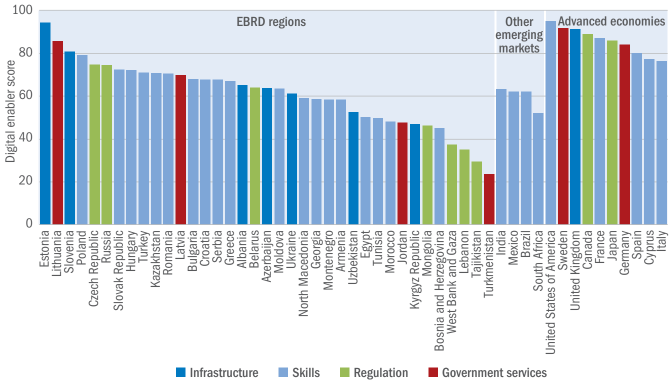
Source: World Bank and authors' calculations.

THE EBRD REGIONS ARE ONLY
1 YEAR
BEHIND ADVANCED ECONOMIES IN TERMS OF THE AVERAGE NUMBER OF YEARS OF SCHOOLING

[8] See, for example, EBRD (2018).
[9] Learning-adjusted years of schooling are derived by adjusting a country's average years of schooling on the basis of its test performance relative to a global high-performance benchmark (see Filmer et al., 2018).

IN 55% OF ECONOMIES IN THE EBRD REGIONS, QUALITY-ADJUSTED YEARS OF SCHOOLING DECLINED BETWEEN 2017 AND 2020

CHART 1.7. In the EBRD regions, skills are most likely to be the key constraint impeding digitalisation



Source: Enterprise Surveys, Global Findex Database, GSMA Mobile Connectivity Index, ITU-D ICT Statistics and Global Cybersecurity Index Reports, Ookla Speedtest Open Data, World Bank Netcraft and World Development Indicators, WEF Global Competitiveness Index, UN E-Government Development Index and Knowledgebase, UNCTAD and authors' calculations.
Note: The bars indicate the overall enabler score for each economy (with economies ranked on that basis). However, the colour of an economy's bar indicates its key constraint. For each economy, the key constraint is the enabler with the score that is furthest from the frontier. Although, in practice, some economies have more than one constraint, only the enabler with the lowest score is indicated here.

between 2017 and 2020, largely owing to growing dispersion of test scores within those countries (with total years of schooling remaining broadly unchanged).[10]

This indicator may overstate the downward trend in terms of an economy's overall stock of human capital (which also includes people who were educated in the past) to the extent that estimates are based on a sample of recent secondary-school leavers. However, it is a warning that economies' comparative advantages in terms of the strength of their skill base are at risk of being eroded.

However, there have been some gains, too. Within the EBRD regions, skills have improved most in Egypt (albeit from a low base), with improvements in terms of total years of schooling, quality adjusted years of schooling, digital skills and access to internet in schools. In 2017, Egypt introduced a set of educational reforms entitled "Education 2.0", which involved updates to curriculums, changes to teaching methods and student assessments, enhanced teacher training and greater emphasis on digital technology.[11]

Identifying policy priorities in terms of supporting digitalisation

Although the relationship between the four enablers is strong, priorities in terms of improving the conditions for digitalisation vary across economies. The key constraint for each economy is assumed to be the one where its digital enabler score is furthest from the frontier. By construction, this analysis identifies a key constraint for each economy, regardless of its level of digitalisation. For instance, while Estonia is close to the frontier for all of its enablers (and was the top performer for government services in 2020), its digital infrastructure is assessed as being furthest from the frontier (see Table 1.1 and Chart 1.7).

Infrastructure is often a key constraint in lower-income economies with lower scores for digital enablers (such as the Kyrgyz Republic and Uzbekistan). However, it is also a key constraint in some economies with high levels of digitalisation, such as Estonia, Slovenia and the United Kingdom. (A similar pattern can be observed for infrastructure supporting the development of financial markets, as discussed in Chapter 5.)

Regulation tends to be a key constraint in economies where the quality of digital enablers is lower than one would expect on the basis of the overall level of development, such as Lebanon, Mongolia, Tajikistan and the West Bank and Gaza. Moreover, it remains the key constraint in Russia, despite significant improvements in the last five years (including the simplification of requirements for some electronic transactions and new regulations facilitating digital contracts). It is also a key constraint in some economies with higher levels of digitalisation (including

[10] See OECD (2019b).
[11] See also Saavedra (2019).

THE NUMBER OF ICT PROFESSIONALS AND TECHNICIANS WORKING IN THE EBRD REGIONS IS AROUND HALF OF THE LEVEL SEEN IN ADVANCED ECONOMIES AS A PERCENTAGE OF TOTAL EMPLOYMENT

Canada, the Czech Republic and Japan), as more advanced digital technologies require a more complex regulatory and legal framework to govern them.

If we compare the data for 2020 with the equivalent figures for 2015, there has been a significant decline in the number of economies in the EBRD regions where government services are the key constraint, reflecting the progress made in that area.

Skills are often a key constraint in the EBRD regions

In the EBRD regions, skills are often the key constraint impeding digitalisation, especially in economies with medium levels of digitalisation, such as those in central, eastern and south-eastern Europe. The number of economies where skills are the key constraint has increased in recent years as infrastructure, the quality of regulation and the availability of government services have improved. Skills are also the key constraint in a number of emerging market comparators. As the analysis in Box 1.1 shows, economies with high skill levels enjoy significantly greater returns to investment in digital-intensive capital than economies with low skill levels.

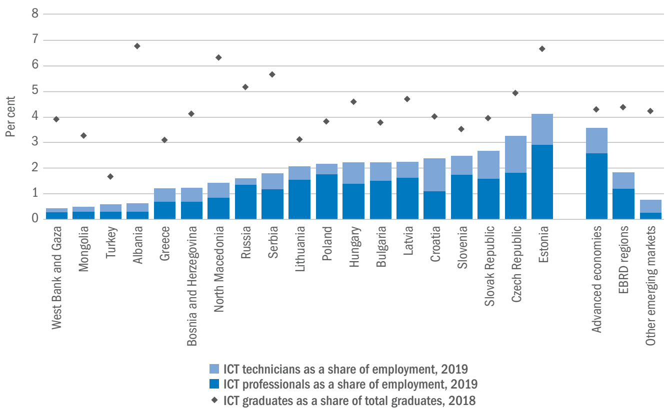
The skill gap discussed in the context of average quality-adjusted years of schooling is also present in the digital sphere. While around two-thirds of people living in advanced European economies have at least basic digital skills (which is defined as being able, for instance, to find information online, send emails, shop online, use a word processor or update software), this is true of less than a quarter of people living in most economies in the SEE region, based on data from Eurostat.

Digital brain drain

The lack of digital skills in the working-age populations of economies in the EBRD regions is being exacerbated by a brain drain – the outward migration of people with higher levels of education and, in particular, better digital skills. While the EBRD regions are similar to advanced economies in terms of ICT graduates as a percentage of total graduates (with both averaging around 4.5 per cent), the number of ICT professionals and technicians working in the EBRD regions (as a percentage of total employment) is around half of the level seen in advanced economies (see Chart 1.8). In other words, many ICT graduates in the EBRD regions end up migrating to advanced economies or working in different fields (differences may also reflect a time lag). The differences between education and employment patterns are somewhat more pronounced for ICT specialists than for other highly skilled professionals (such as lawyers or teachers), whose qualifications are less likely to be recognised abroad (or less transferable to other sectors). Similar patterns can be observed in other emerging markets.

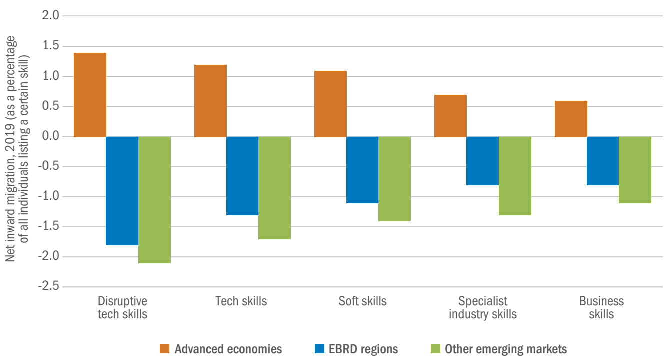
In order to examine that digital brain drain in greater detail, this section draws on a unique LinkedIn-World Bank

CHART 1.8. Many economies in the EBRD regions are training ICT specialists but not retaining them



Source: International Labour Organization (ILO), United Nations Educational, Scientific and Cultural Organization (UNESCO) UIS database and authors' calculations.
Note: Data for comparator economies are simple averages across 15 advanced economies and 6 emerging markets.

CHART 1.9. The EBRD regions are experiencing a digital brain drain



Source: LinkedIn-World Bank database and authors' calculations.
Note: Data are simple averages across 30 economies in the EBRD regions, 41 advanced economies and 48 other emerging markets. See Zhu et al. (2018) for descriptions of skill groups.

database, which uses information from members' profiles on LinkedIn, a leading social network connecting professionals and employers.[12] It looks at how skills listed on members' profiles are linked to their international moves, as well as the changing skill needs of various industries. While the database is unlikely to be representative of blue-collar occupations, for digital-intensive sectors and occupations it is a good approximation of data from labour surveys and administrative sources (such as the ILO).

The analysis in this section provides further evidence of a digital brain drain in the EBRD regions and other emerging markets (see Chart 1.9). Each LinkedIn profile indicates the skills of the member in question, as well as the location of their job. Using that information, cross-border job changes can be translated into net gains (or losses) in terms of members with a given skill working in a given economy.[13] Those net gains (or losses) are then divided by the total number of LinkedIn members with that skill in the country in question. The analysis in this section focuses on general technological skills (such as web development, data storage, graphic design and technical support, as well as general digital literacy) and disruptive technological skills (such as artificial intelligence (AI), data science, nanotechnology and robotics; see also Box 1.4 on the opportunities and risks presented by AI).

While advanced economies experience net inward migration across a range of skills, the net gains are strongest for disruptive technology and other technological skills, mirrored by significant net outward migration of professionals with technological skills in the EBRD regions and other emerging markets. On average, 1.5 per cent of people in the EBRD regions who listed some technological skills on their profile moved abroad in 2019. That brain drain was especially pronounced in economies in the SEMED region (particularly Lebanon, Morocco and Tunisia) and the Western Balkans (particularly Albania and Bosnia and Herzegovina). Although demand for such skills can be strong in emerging and developing economies, firms in advanced economies may offer significantly higher wages.[14]

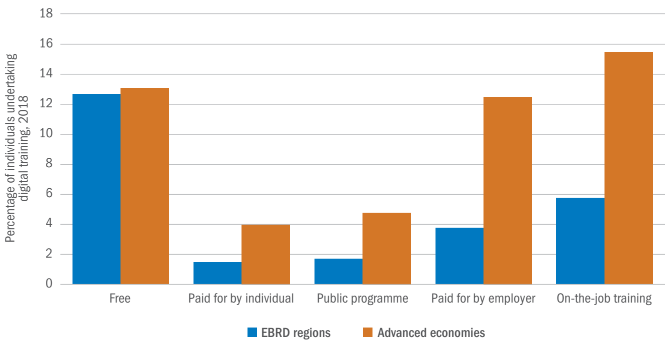
Limited digital training provided by employers

Economies in the EBRD regions also lag behind advanced economies in terms of digital training (see Chart 1.10). Survey data from Eurostat suggest that the EBRD regions are similar to advanced European economies in terms of the percentage of people undertaking free, independent training on the use of computers, software or applications (such as free online courses). However, differences are much more pronounced when looking at training that individuals have to pay for themselves or is provided free of charge by the public sector. Moreover, they are particularly large when it comes to training provided by employers and on-the-job training. For instance, while 12 per cent of survey respondents in advanced economies report having received training provided by their employer, that is true of just 4 per cent of respondents in the EBRD regions. Thus, there is a risk of a vicious cycle whereby brain drain discourages employers from investing in people's digital skills, and people with some digital skills then move abroad in search of better opportunities. Differences in the percentage of individuals who have received on-the-job digital training can explain about 60 per cent of total variation in the outward migration of people with technological skills.[15]

While digital training is somewhat less common in economies where manufacturing accounts for a larger percentage of employment, the EBRD regions continue to lag some way behind advanced economies even after differences in the structure of employment have been taken into account.

WHILE 12% OF SURVEY RESPONDENTS IN ADVANCED ECONOMIES REPORT HAVING RECEIVED TRAINING PROVIDED BY THEIR EMPLOYER, THAT IS TRUE OF JUST 4% OF RESPONDENTS IN THE EBRD REGIONS

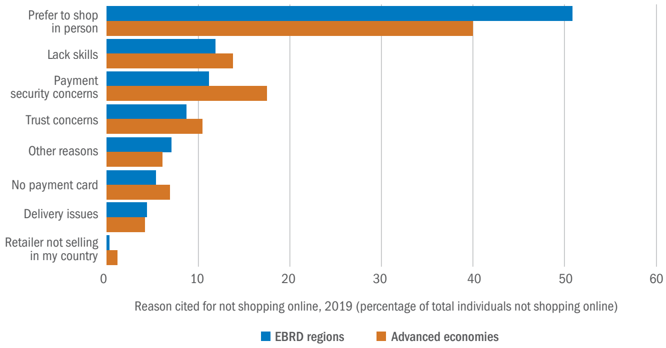
CHART 1.10. There is less digital training in the EBRD regions than in advanced economies



Source: Eurostat and authors' calculations.
Note: Data are simple averages across 19 economies in the EBRD regions (central and south-eastern Europe, plus Turkey) and 17 advanced European economies.

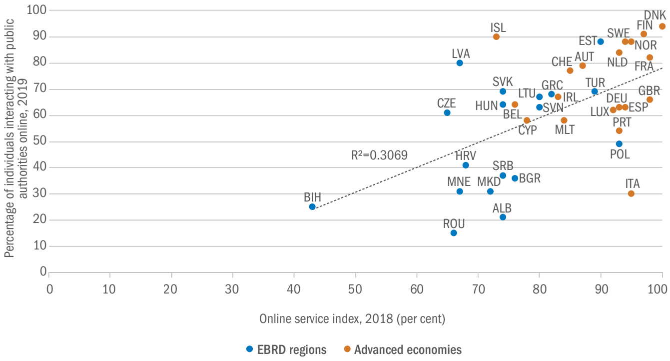
[12] See Zhu et al. (2018).
[13] International moves are identified on the basis of self-reported changes in location on LinkedIn profiles.
[14] See World Bank (2021a).
[15] Based on a sample of 17 economies in the EBRD regions.

CHART 1.11. In the EBRD regions, a lack of skills is the second most common reason for not shopping online



Source: Eurostat and authors' calculations.
Note: Data are simple averages across 18 economies in the EBRD regions (central and south-eastern Europe, plus Turkey) and 3 advanced economies (Germany, the Netherlands and Sweden).

CHART 1.12. Low levels of digital skills are impeding the use of e-government services



Source: Eurostat, UN and authors' calculations.

Finland, Iceland and Norway stand out as having high levels of employer-funded training, whereas in the Western Balkans such training is particularly scarce. For instance, the percentage of people receiving training paid for by their employer or on-the-job training is about six times higher in Norway than it is in Montenegro, despite the two economies having similar percentages of people undertaking free training.

Weak digital skills constrain people's use of digital technologies

Low levels of digital skills appear to be impeding people's use of digital technologies. A recent survey conducted by Eurostat asked those with no experience of ordering goods or services online in the past year why they did not do so. A lack of skills was the second most common reason, after a preference for shopping in person (see Chart 1.11). In advanced economy comparators, by contrast, concerns about payment security were the second most common reason, highlighting the importance of digital regulation and cybersecurity when rolling out digital services.

More generally, differences in digital skills can explain almost 80 per cent of the cross-country variation observed in households' use of digital technologies. A similar correlation is observed between ICT specialists' share of total employment and firms' use of digital technologies.

Low levels of digital skills appear to be impeding the use of digital technologies even where supporting infrastructure and digital government services are available (see Chart 1.12). For instance, while the Czech Republic and Romania are comparable in terms of the availability of e-government services (plotted on the horizontal axis), the percentage of individuals using them is around 46 percentage points

DIFFERENCES IN DIGITAL SKILLS CAN EXPLAIN ALMOST
80%
OF CROSS-COUNTRY VARIATION IN HOUSEHOLDS' USE OF DIGITAL TECHNOLOGIES

higher in the Czech Republic. More generally, differences in the availability of government services only explain around 30 per cent of the cross-country variation observed in their use, and the remainder is not meaningfully explained by differences in internet infrastructure.

However, there is a close correlation between the percentage of the population that use e-government services and the percentage of the population that have at least basic digital skills (see Chart 1.13), with differences in digital skills accounting for almost 70 per cent of the variation observed in households' use of digital technologies. For instance, the percentage of individuals with at least basic digital skills is about 31 percentage points higher in the Czech Republic than it is in Romania. More formally, a cross-country regression indicates that digital skills have a large and statistically significant effect on the number of people using e-government services (as a percentage of total internet users), even after controlling for the availability of e-government services.

Economies are shifting towards more digital-intensive sectors

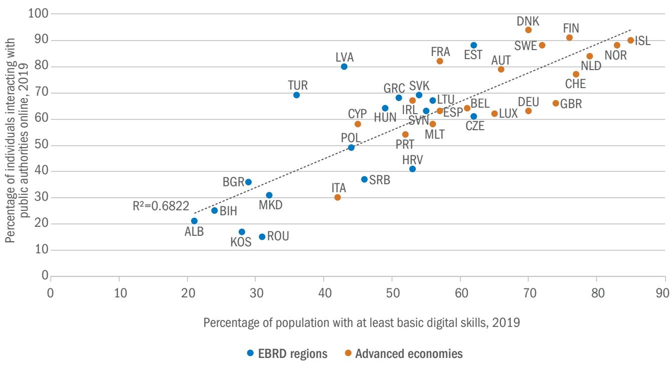
Low levels of digital skills are likely to become even more of a constraint in the future, as production structures are shifting towards more digital-intensive sectors. The analysis below draws on a rich ILO database and groups sectors together on the basis of their digital intensity using the classification in Calvino et al. (2018).[16] For example, sectors with low digital intensity include agriculture, construction, food products, and hotels and restaurants; medium-low sectors include textiles, basic metals and healthcare; medium-high sectors include machinery and equipment, wood and paper products and furniture, and public administration; and sectors with high digital intensity include information technology and telecommunications, as well as transport equipment, finance and insurance, and professional services.

Countries differ substantially in terms of the role played by digital-intensive sectors, with such sectors typically accounting for a larger share of employment in higher-income economies. In the CEB region, for example, sectors with high and medium-high digital intensity account for almost half of total employment. In Albania and Egypt, by contrast, sectors with low and medium-low digital intensity dominate, accounting for around 70 per cent of employment in 2019.

In the EBRD regions, employment in sectors with high and medium-high digital intensity grew three times faster than employment in less digital-intensive sectors in the period 2011-19 (see Chart 1.14). In some economies, such as Armenia, Bosnia and Herzegovina, Croatia and Romania, employment in less digital-intensive sectors shrank. Such structural shifts are increasing the digital intensity of overall employment, as more digital-intensive sectors are becoming more important employers.

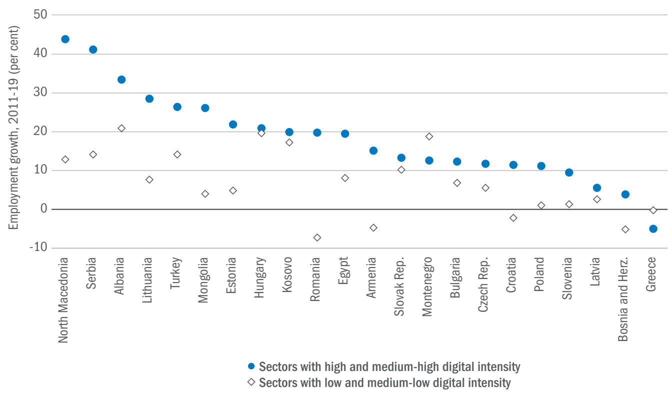
Similarly, employment in more digital-intensive occupations (defined as all occupations which involve the use of software – not just specialist ICT occupations) grew about twice as fast as employment in less digital-intensive occupations between 2011 and 2019 in the EBRD regions.

CHART 1.13. There is a close correlation between the percentage of the population that use e-government services and the percentage of the population that have at least basic digital skills



Source: Eurostat, UN and authors' calculations.

CHART 1.14. More digital-intensive sectors have seen stronger employment growth



Source: ILO, Organisation for Economic Co-operation and Development (OECD) and authors' calculations.
Note: Digital intensity is defined in accordance with ISIC Rev. 4 following the taxonomy in Calvino et al. (2018). Data for Armenia relate to the period 2011-17; data for Bosnia and Herzegovina and Kosovo cover the period 2012-19; and data for Albania relate to the period 2014-19.

[16] Sectors are classified on the basis of their digital intensity ("high", "medium-high", "medium-low" or "low") using a number of different factors (ICT investment and ICT intermediates; use of robots; online sales; and ICT specialists) and then grouped together by quartile.

Digital skills are becoming more important within sectors

Not only are economies shifting towards more digital-intensive sectors, but even *within* sectors, technological skills are becoming more important. The following analysis draws on the aforementioned LinkedIn-World Bank database, examining the skills that are most common in a given sector based on the skills listed in LinkedIn members' profiles and looking at how the skill needs of industries have changed over time. In this analysis, the importance of each group of skills is measured by the group's share of the top 30 skills associated with a given industry or occupation.

The importance of technological skills increased in almost three-quarters of industries globally between 2015 and 2019, including industries far removed from the ICT sector (such as food production, paper products and textiles). As production becomes increasingly automated, many repetitive tasks will be carried out by advanced robotic systems, with human involvement switching to the maintenance and supervision of machines.[17]

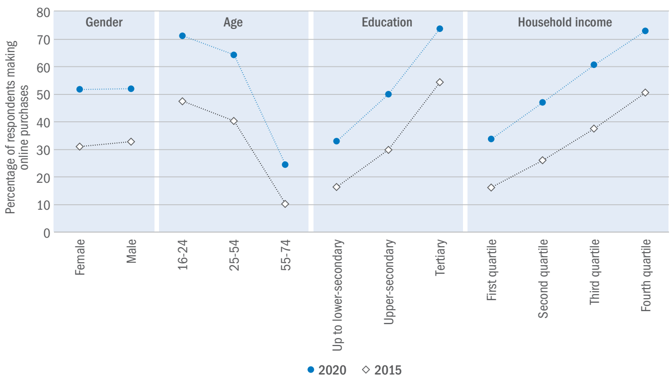
A similar picture can be observed for disruptive technological skills. While they remain less common than general technological skills, their prevalence has increased in 92 per cent of industries (including sectors as diverse as industrial automation and financial services).

More generally, the largest increases in the importance of technological skills have been seen in industries which in 2015 still had relatively low levels of digital intensity (such as the automotive sector, banking, chemicals, mining and metals, oil and energy, paper products and textiles). In contrast, their relative importance has declined in some industries which were already highly digital-intensive in 2015 (such as animation and graphic design).

With economies shifting towards more digital-intensive sectors and digital skills becoming more important within individual sectors, raising digital skill levels will become a greater policy priority in terms of maintaining and improving an economy's competitiveness.

THE IMPORTANCE OF TECHNOLOGICAL SKILLS INCREASED IN
ALMOST THREE-QUARTERS
OF INDUSTRIES GLOBALLY BETWEEN 2015 AND 2019

CHART 1.15. Younger, more educated and richer individuals are more likely to take advantage of digital technologies



Source: Eurostat and authors' calculations.
Note: Data are simple averages for Turkey and 13 economies in the EU and the Western Balkans.

Digital divides within economies

This section focuses on digital divides *within* economies, looking first at individuals and then at firms. Digital divides between urban and rural areas of countries are discussed in Box 1.5.

Younger, more educated and richer individuals are more likely to use digital technologies

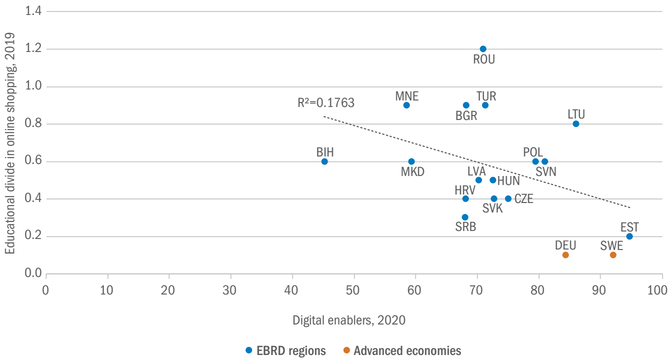
The results of a Eurostat survey of economies in the European Union (EU), the Western Balkans and Turkey suggest that younger, more educated and richer individuals are more likely to take advantage of digital technologies, with roughly equal uptake of digital technologies by men and women. This is true of the EBRD regions and advanced European economies alike and holds across a range of indicators: younger, better-educated and wealthier individuals are more likely to shop online (see Chart 1.15), more likely to use online banking (see Chapter 4) or e-government services, and more likely to have strong digital skills.

Digital divides are greater in economies with lower levels of digitalisation

Differences on the basis of age, education or income are typically larger in economies where digitalisation is less advanced (see Chart 1.16). In all economies, university-educated people are more likely to shop online, but economies with weaker digital enablers tend to have larger gaps between the shares of individuals with tertiary and upper-secondary education (with an even stronger correlation being observed for digital outcomes).

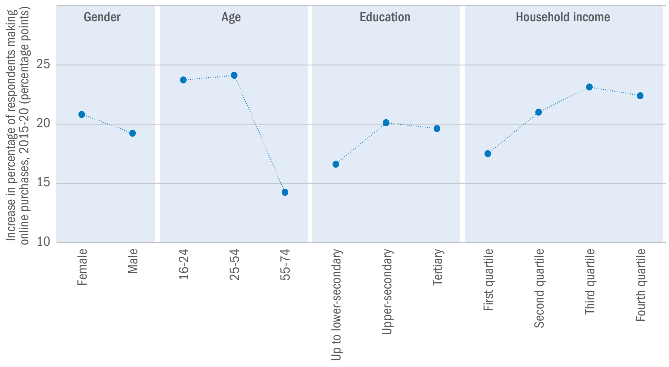
[17] See Akyazi et al. (2020).

CHART 1.16. Digital divides are greater in economies with lower levels of digitalisation



Source: Eurostat and authors' calculations.
Note: The educational divide in online shopping is calculated as the difference between the percentage of tertiary-educated respondents shopping online and the percentage of upper-secondary-educated respondents shopping online, divided by the percentage of total respondents shopping online.

CHART 1.17. People aged 25-54 and people with medium levels of education and income were most likely to start shopping online between 2015 and 2020



Source: Eurostat and authors' calculations.
Note: Data are simple averages for Turkey and 13 economies in the EU and the Western Balkans.

Some digital divides have narrowed, but other groups are falling behind

Some digital divides within economies appear to have narrowed between 2015 and 2020. As in the case of digital divides between countries, individuals making moderate use of digital technologies saw the largest gains. For instance, those aged 25-54, those with upper-secondary education and those with household income between the median and the 75th percentile were most likely to start shopping online between 2015 and 2020 (see Chart 1.17). Those aged 55 or over, those with lower secondary education or below and those in the bottom quartile for income saw the smallest gains in terms of the uptake of digital technologies, even as moderate users were catching up with the highest users.

There is a risk that those groups will fall further behind, entering a vicious cycle whereby digital divides amplify existing socio-economic divides, and then income inequality and inequality of opportunity, in turn, exacerbate digital divides.[18]

Digital divides are greater among older individuals

Next, this analysis looks at digital divides among individuals who are of similar age, but have differing levels of educational attainment. Digital divides among older cohorts (individuals aged 55-74) are stark, and more so in the EBRD regions than in advanced European economies. In this age group, around half of all tertiary-educated individuals in the EBRD regions have at least basic digital skills, compared with just 2 per cent of people who are only educated up to lower-secondary level. Reassuringly, economies in the EBRD

AMONG PEOPLE AGED 55-74, AROUND
HALF
OF TERTIARY-EDUCATED INDIVIDUALS IN THE EBRD REGIONS HAVE AT LEAST BASIC DIGITAL SKILLS, COMPARED WITH
JUST 2%
OF PEOPLE EDUCATED UP TO LOWER-SECONDARY LEVEL

[18] See also Duarte (2021) and World Bank (2021b).

regions look much more similar to advanced economies when it comes to the young, with between 72 and 91 per cent of 16-24 year olds having at least basic digital skills (see Chart 1.18).

Larger, better-managed and innovative firms are more likely to use digital technologies

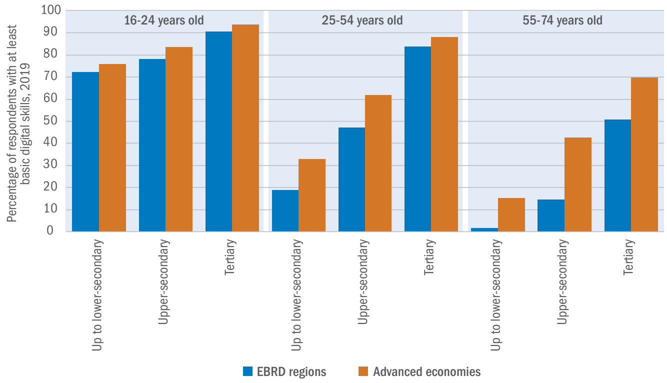
This section examines digital divides across firms, drawing on the results of the Enterprise Surveys – large representative face-to-face surveys of firms with at least five employees which have been conducted globally since 2006 by the World Bank in cooperation with the EBRD and the European Investment Bank (EIB). All survey respondents are either senior managers or owners of the firms in question.

The last standard survey round was carried out shortly before the onset of the Covid-19 crisis. However, some of those respondent firms have since been approached again with a special questionnaire looking at their experiences during the pandemic. Firm-level regression analysis based on these data looks at firm characteristics that are associated with a greater likelihood of (i) having a website (as a measure of the use of digital technologies before the Covid-19 crisis) and (ii) introducing or increasing remote working during the pandemic.

Analysis reveals that larger, better-managed and innovative firms and those with international links through trade or ownership were more likely to have a website in 2019 (see Chart 1.19). Those differences are sizeable and statistically significant. For instance, large firms (defined as firms with 100 employees or more) were about 1.5 times more likely to have a website than small firms (defined as firms with between 5 and 19 employees). Global value chain (GVC) participants were more than twice as likely to have a website as firms that do not actively trade across borders (with GVC participants being defined as firms that both (i) import and (ii) have exports accounting for at least 10 per cent of sales). Better-managed firms and those that reported having introduced a new product or process in the past three years were also more likely to have a website.

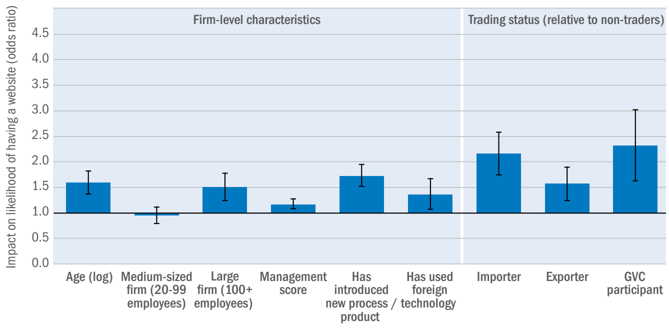
LARGE FIRMS IN THE EBRD REGIONS ARE ABOUT
1.5
TIMES MORE LIKELY
TO HAVE A WEBSITE THAN SMALL FIRMS

CHART 1.18. Within age-based cohorts, digital divides by level of education are smaller among the young than among the old



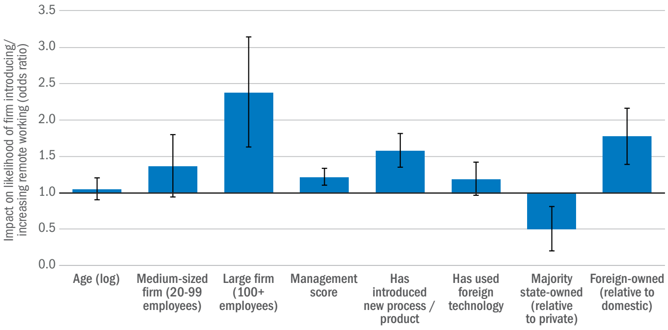
Source: Eurostat and authors' calculations.
Note: Data are simple averages across 13 economies in the EBRD regions (central and south-eastern Europe, plus Turkey) and 11 advanced economies in Europe.

CHART 1.19. Larger, better-managed and innovative firms and firms trading across borders are more likely to take advantage of digital technologies



Source: Enterprise Surveys and authors' calculations
Note: This chart shows coefficients derived from a logit model regressing a variable capturing the existence of a website on various firm-level characteristics for economies in the EBRD regions. Bars denote odds ratios, with a ratio higher than 1 indicating that a firm-level characteristic has a positive impact on the likelihood of having a website. The base group is made up of small firms (5-19 employees). Regressions control for average sales growth over the previous two years (log-difference), as well as sector and country fixed effects. The 95 per cent confidence intervals shown are based on standard errors clustered at country level.

CHART 1.20. Use of digital technologies is more likely to rise at larger, better-managed, innovative and foreign-owned firms



Source: Enterprise Surveys and authors' calculations.
Note: This chart shows coefficients derived from a logit model regressing a variable capturing the introduction of or increases in remote working during the Covid-19 crisis on various firm-level characteristics for economies in the EBRD regions. Bars denote odds ratios, with a ratio higher than 1 indicating that a firm-level characteristic has a positive impact on the likelihood of the firm introducing or increasing remote working. The base group is made up of small firms (5-19 employees). Regressions control for average sales growth over the previous two years (log-difference), participation in international trade, and sector and country fixed effects. The 95 per cent confidence intervals shown are based on standard errors clustered at country level.

ICT'S SHARE IN GREENFIELD FDI PROJECTS IN THE EBRD REGIONS ALMOST DOUBLED BETWEEN 2011 AND 2018, REACHING
8.4%

Firm-level digital divides may widen further

Moreover, larger, better-managed, innovative and foreign-owned firms are more likely to have *increased* their use of digital technologies during the Covid-19 crisis (see Chart 1.20) on the basis of similar regression analysis looking at the firm-level characteristics associated with the introduction of or increases in remote working during the Covid-19 crisis. Chapter 3 analyses these patterns in greater detail.

This analysis points to a widening of digital gaps between firms over time. While firms that take advantage of digital technologies expand their horizons further and benefit from access to larger markets and improved availability of finance (see Chapters 2 and 4), small, less well-managed, less innovative and domestically owned (particularly state-owned) firms risk missing out on the benefits of digitalisation.

Recent OECD research also points to a widening of digital divides between firms, reinforcing the idea of a winner-takes-all dynamic. For instance, industry concentration, mark-ups, and mergers and acquisitions have all increased more strongly in more digital-intensive sectors and sectors that are more reliant on the use of intangible assets (such as patents).[19] The productivity gap between the most productive firms globally and the rest has been widening, notably in digital-intensive sectors.[20] In turn, business dynamism (as captured by rates of entry for new firms) has declined more sharply in digital-intensive sectors.[21]

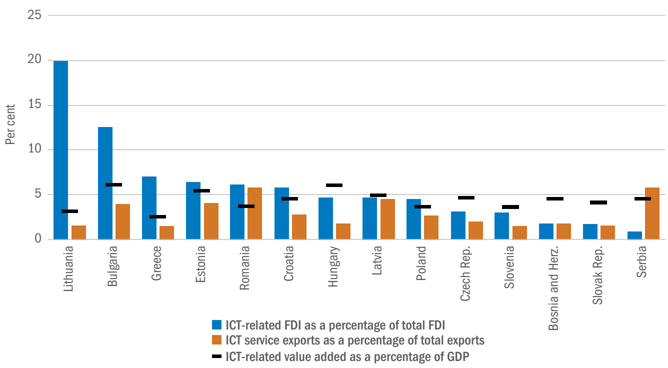
Even economies with low levels of digitalisation have the potential to develop digital niches

Motivated by the impact that trade and foreign ownership have on firms' use of digital technologies, this section looks at whether less digitally advanced economies may be able to develop pockets of digital excellence – for instance, by benefiting from foreign investment in digital-intensive sectors or developing export-oriented digital industries. This analysis looks at the structure of capital expenditure for foreign direct investment (FDI) projects, as reported in the Financial Times fDi Markets database, and compares it with the structure of production (GDP) and exports for each economy. The analysis is based on the total expected expenditure for each project, regardless of the degree of ownership by foreign investors.

A number of economies in the EBRD regions (such as Bulgaria, Greece and Lithuania) have seen substantial greenfield FDI inflows in ICT sectors, even where those sectors make a relatively modest contribution to overall value added in the domestic economy (see Chart 1.21). In Lithuania, for instance, ICT accounted for over a fifth of the total expenditure of greenfield FDI projects over the period 2009-18, while the sector's value added accounted for less than 3 per cent of GDP. ICT's share in greenfield FDI projects in the EBRD regions almost doubled between 2011 and 2018, reaching 8.4 per cent, with particularly sharp increases being seen in the Baltic states, Poland and Romania. More generally, the relative importance of the ICT sector in FDI inflows increased faster in countries with better digital skills.

[19] See Bajgar et al. (2021) and Calligaris et al. (2018).
[20] See Andrews et al. (2016).
[21] See Calvino and Criscuolo (2019).

CHART 1.21. Even in less digitally advanced economies, ICT-related FDI and exports of ICT services can sometimes be substantial



Source: Eurostat, Financial Times fDi Markets database, IMF, ITC Trade Map and authors' calculations.
Note: ICT-related FDI as a percentage of total FDI is based on the capital expenditure of greenfield FDI projects announced in the period 2009-18 (including announced, opened and completed projects). ICT service exports as a percentage of total exports of goods and services refer to 2019. ICT-related value added as a percentage of GDP refers to 2018 (with the exception of Bosnia and Herzegovina, for which data relate to 2016).

As a result, some economies (such as Belarus, Estonia, Serbia and Ukraine) have established strongly outward-oriented ICT sectors, with exports of ICT services accounting for around 3 per cent or more of GDP. Indeed, the average value of ICT service exports in the EBRD regions has increased in recent years, rising from 0.7 per cent of GDP in 2011 to 1.4 per cent in 2019, reflecting strong export growth in economies in eastern Europe and the Caucasus (EEC) and central and south-eastern Europe.[22] Export-orientation often supports the development of a broader ICT ecosystem and start-up scene, leveraging the economies of scale that the international market for ICT services can offer.[23]

Estonia, for example, is well known for its digital start-ups. Seven ICT unicorns (privately held companies with a valuation in excess of US$ 1 billion) have an Estonian connection (an Estonian founder, Estonian headquarters or a significant amount of research and development (R&D) operations in Estonia). Indeed, according to Startup Estonia, a government agency supporting young technology companies, Estonia leads the world in terms of unicorns per capita. Meanwhile, Estonia's virtual e-residency scheme (a government-run digital initiative which allows e-resident entrepreneurs from all over the world to set up an EU-based company and manage their business from anywhere, entirely online) aims to attract other businesses to the country.

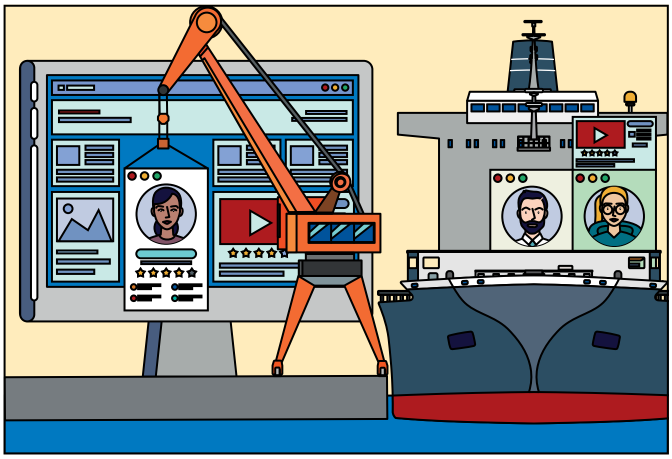
Serbia's ICT sector benefits from relatively low wages and a highly qualified workforce, as well as investment incentives of up to €10,000 per employee under a government-sponsored scheme. As well as being home to a number of fast-growing local start-ups, foreign firms such as Huawei, Kaspersky and Microsoft also have offices there.

Ukraine has about 200,000 ICT engineers who are capable of producing high-end solutions (such as software for mobile phone platforms, gaming, financial technology, healthcare programmes, artificial intelligence and e-commerce), making it the world's seventh-largest supplier of qualified freelance ICT specialists.[24] Ukraine is currently home to more than 110 R&D centres run by multinational companies (including centres belonging to the likes of Apple, Boeing, Google, Huawei, Samsung and Siemens, as well as Ubisoft – a French game developer).

Belarus, meanwhile, has a high-tech park hosting more than 1,000 technology companies (concentrated in business computer services, gaming and software development), which employ more than 70,000 workers.

Thus, ICT-specific foreign investment can support countries' structural and digital transformation. ICT's share of GDP has been increasing over time in the EBRD regions, somewhat faster than in advanced economies. In 2011, ICT-related manufacturing and services accounted for about 3.8 per cent of GDP in both the EBRD regions and advanced economies; by 2018, they accounted for 4.3 per cent in the EBRD regions and 4 per cent in advanced economies.

THE AVERAGE VALUE OF ICT SERVICE EXPORTS IN THE EBRD REGIONS STOOD AT 1.4% OF GDP IN 2019, UP FROM 0.7% IN 2011



[22] Based on ITC Trade Map data, with figures representing simple averages across 31 economies in the EBRD regions.
[23] See also EBRD (2022).
[24] See UNIT.City and Western NIS Enterprise Fund (2019).

Conclusions and policy implications

As this chapter has shown, there are large digital divides both across and within countries. While many economies in the EBRD regions (particularly those with medium levels of digitalisation) have made significant progress in recent years in terms of closing the digital gap relative to advanced economies, many economies with low levels of digitalisation have been falling further behind.

For economies with low levels of digitalisation (particularly in Central Asia and the SEMED region), investing in internet and other digital infrastructure remains a key policy priority. In a number of economies (including Russia and parts of Central Asia and the SEMED region), regulatory frameworks have been identified as a key constraint impeding the use of digital technologies, in some cases notwithstanding the large gains seen in recent years.

Many other economies have seen substantial improvements in terms of the quality and affordability of infrastructure and the provision of e-government services, and low levels of digital skills are now the key constraint impeding people's use of digital technologies in those countries. In such economies (particularly in central and south-eastern Europe), policies should focus on investment in digital skills. This could, for example, involve adapting school curriculums in line with changing skill requirements, providing digital training to teachers and introducing incentives to encourage more digital training by employers.

Investment in digital skills will become even more important over time. While many economies in the EBRD regions have so far relied on the comparative advantages afforded by the strength of their human capital, the quality of their education has showed signs of declining in recent years, and many graduates with strong digital skills are finding employment in advanced economies. Such weakening of economies' skill bases is particularly worrying in a context where digital skills are becoming more important as economies shift towards more digital-intensive sectors and the importance of digital skills is increasing in sectors that are not traditionally thought of as digital-intensive (such as food processing or paper and textiles).

At the same time, however, examples from across the EBRD regions confirm that even less digitally advanced economies have the potential to develop ICT hubs around export-oriented digital industries. Improved employment opportunities at home could also help to mitigate some of the digital brain drain that is being observed in emerging markets, with qualified ICT specialists moving abroad.

The Covid-19 crisis has exacerbated the issue of digital divides within countries. Such gaps, which are especially pronounced in less digitally advanced economies, risk amplifying pre-existing socio-economic divides, potentially triggering a vicious cycle that deepens inequality and worsens social tensions. For example, poor digital skills in people aged 55 or over may result in those workers being pushed out of the labour force as a consequence of increasing digitalisation, thereby aggravating labour market pressures (particularly in ageing societies).

Against that background, broad-based provision of digital infrastructure and digital training is crucial in order to prevent human capital from being wasted, as the skills of groups that make little use of digital technologies have the potential to become obsolete. Policies aimed at addressing such digital divides could, for example, include digital literacy programmes provided through public libraries (particularly in rural areas), support for reskilling, and programmes targeting older workers or the unemployed.

Individuals may sometimes require a nudge when it comes to increasing their use of digital technologies. For example, in order to receive support during the Covid-19 crisis, individuals may have needed to register or fill in forms online or provide bank details for digital payments. More generally, linking digital technologies to the provision of other services can increase uptake of digital tools. For instance, digital signature tools should ideally be provided to the general population as part of the roll-out of smart cards (cards with machine-readable chips that are used to confirm a person's digital identity). The use of digital signatures can also be boosted through cooperation with banks, telecommunication companies and utility providers (see Box 1.3).

Firms can be incentivised to invest in productivity-enhancing digital technologies via grants or tax credits for investing in certain digital products (such as enterprise resource planning, big data or cloud services) or, more generally, through support for R&D or training.[25] Tailored business advice and technology awareness campaigns can also target firms in specific sectors, or firms of a specific size or age (with smaller firms and state-owned enterprises arguably having particular scope to benefit from such programmes). More generally, facilitating access to finance can support investment in cutting edge digital technologies that are perceived to be high-risk. Thus, government interventions supporting digitalisation will be crucial in terms of boosting future growth.

[25] See OECD (2020).

BOX 1.1.

Growth accounting revisited: digital transition and sources of growth

This box updates the discussion on sources of growth in the *Transition Report 2017-18*. Following a growth accounting approach, this analysis links economic growth to changes in capital, labour and the residual, total factor productivity (which indicates the efficiency with which factors of production are combined, and can often be enhanced by the use of digital technologies).

This update draws on the latest, most detailed data, distinguishing between the quantity of labour and the quality of human capital.[26] In order to construct a quality-based measure of human capital, it extrapolates from data on quality-adjusted years of schooling (which are typically available for 2010 and the period 2017-19) using growth rates for conventional measures of human capital, implicitly assuming a constant quality of education.

This analysis also distinguishes between (i) capital that is highly digital-intensive in nature or can be enhanced through digitalisation (such as machinery and transport equipment, computers and communication equipment, software and intellectual property products) and (ii) other types of capital (such as residential buildings, commercial property and roads) that are less digital-intensive. That said, there is significant scope for enhancing the productivity of that second type of capital through the use of digital technologies. For instance, smart traffic light management systems can substantially increase the effective capacity of the existing stock of urban roads.

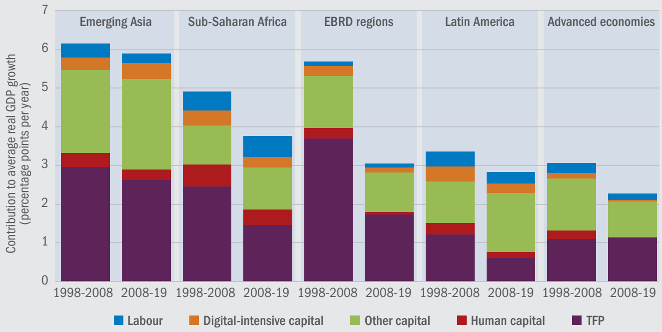
The updated data also focus on capital services, rather than the stock of capital (as used in the previous analysis). This adjustment takes account of the fact that digital-intensive capital (such as laptops) depreciates faster than buildings, implying that a greater percentage of their value is effectively utilised in production each year.[27] Following this adjustment, digital-intensive types of capital account for around 30 per cent of total capital services globally and around 28 per cent in the EBRD regions.

The analysis uses an augmented Cobb-Douglas framework, which assumes that all of these factors (the number of workers, the quality of human capital, digital-intensive capital services and other capital services) are complementary as far as the economy's total output is concerned, but can substitute for one another to some extent.

New measure of human capital underscores its role

A production function estimated for a panel of 122 economies over the period 2000-19 yields coefficients for human capital and labour that add up to around 0.55. This is consistent with earlier findings and the fact that the share of labour in national income averages around 55 per cent across major economies according to OECD data.

CHART 1.1.1. Differences in average growth rates are primarily due to differences in TFP growth



Source: Penn World Tables, IMF, World Bank and authors' calculations.
Note: Estimated by means of a Cobb-Douglas production function using log-changes, with factor coefficients of 0.35 for human capital, 0.2 for labour, 0.1 for digital-intensive capital and 0.35 for other capital.

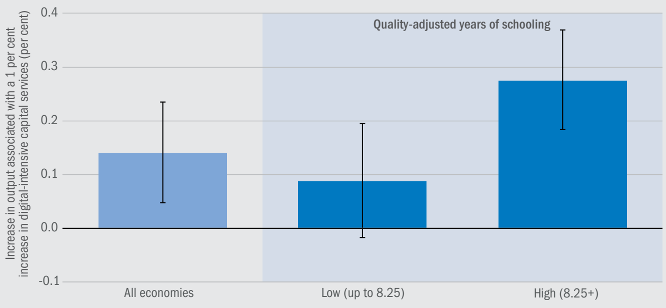
The analysis also underscores the importance of skills as a driver of growth in today's economies. Around two-thirds of labour's share in income is estimated to be attributable to human capital when a measure of quality-adjusted years of schooling is used. Traditional measures of human capital based on the quantity (rather than the quality) of schooling produce a much lower coefficient for human capital and a higher coefficient for the number of workers. The coefficients obtained in this analysis are, in turn, used to break average real GDP growth (in constant 2017 US dollars) down into components linked to changes in labour, human capital and types of physical capital (see Chart 1.1.1).

TFP making a rising contribution to growth

This analysis suggests that differences in average real GDP growth across regions and time largely reflect differences in TFP growth. TFP growth, in turn, is driven by technological progress and digitalisation, allowing more efficient use of factors of production within sectors and incentivising the relocation of resources across industries. In the EBRD regions, TFP growth was exceptionally strong in the 2000s, with market reforms enabling more efficient matching of physical and human capital (which had often been combined inefficiently under central planning). Since then, TFP growth has more than halved. However, it still accounts for more than half of all real GDP growth in the EBRD regions over the last decade, with its contribution exceeding those of capital, human capital and labour. In advanced economies, too, TFP growth has accounted for more than 50 per cent of total growth in real GDP since the 2008-09 global financial crisis, up from around a third between 1998 and 2008.

[26] See Filmer et al. (2018).
[27] See Feenstra et al. (2015) for a discussion of measures of capital in Penn World Tables.

CHART 1.1.2. Economies with stronger skills enjoy greater returns to digital capital



Source: Penn World Tables, IMF, World Bank and authors' calculations.
Note: Estimated by means of a Cobb-Douglas production function using log-changes. The cut-off value for the two subsamples represents median quality-adjusted years of schooling across all economies on the basis of the latest available data. The 95 per cent confidence intervals shown are based on standard errors clustered at country level.

Looking beyond TFP growth, strong capital accumulation has continued to make a marked contribution to growth in emerging Asia, while in advanced economies capital accumulation has slowed markedly. Labour force growth has decelerated across the board, and its contribution to growth has been downgraded as better data on the quality of human capital have become available. Lastly, while returns to human capital are high, few economies have recently managed to achieve significant improvements in levels of human capital, resulting in a modest contribution to overall growth.

Returns to digital capital are higher in economies with strong skills

The analysis also suggests that returns to digital-intensive capital tend to be significantly higher in economies with a strong skill base. In particular, in a subsample with above-median quality-adjusted years of schooling (which includes economies such as Estonia and Poland), a 1 per cent increase in digital-intensive capital is associated with a 0.28 per cent increase in output. In contrast, in a subsample with human capital below the median level (which includes, for instance, the Kyrgyz Republic and Morocco), the corresponding increase in output falls to 0.09 per cent (see Chart 1.1.2).

This implies that countries with greater stocks of human capital are better able to harness their investment in digital-intensive capital, which requires higher levels of skill to operate. When a single production function is used for all economies (as in Chart 1.1.1), the synergies between digital-intensive capital and skills manifest themselves as stronger growth in TFP.

BOX 1.2.

Digital regulation in the EBRD regions

In the past, governments often provided digital infrastructure directly (for example, by building fixed-line telecommunication networks and acting as their owners and operators). Increasingly, however, they are now playing more of an arm's-length role – acting as a regulator, establishing an environment that is supportive of private-sector investment while ensuring universal access to infrastructure.[28] At the same time, however, government intervention – whether through direct ownership or subsidies underpinning universal service obligations – remains crucial in order to ensure universal access to digital infrastructure. In 2016, the EBRD established the Accelerating Broadband Connectivity Initiative (referred to as the "ABC Initiative") to help design technical and financial models that would underpin the roll-out of digital network infrastructure in rural areas. Such areas would otherwise be at risk of being underserved, given the high cost of providing internet access in sparsely populated areas (see also Box 1.5).

In addition to public investment in digital infrastructure, government policies and regulation also play a crucial role in shaping the digital economy. For example, legal frameworks need to provide clarity and certainty as regards digital alternatives to paper documents/contracts and wet-ink signatures. Legal and regulatory frameworks need to adapt in order to allow firms to take advantage of new digital technologies (for instance, by digitalising dispute resolution mechanisms and broadening the use of digital technologies in the judicial system). In general, countries tend to pursue different approaches to developing legal frameworks for digitalisation, with no agreed best practices.

In order to take stock of the latest developments in terms of regulatory risk in the area of digital infrastructure, a group of more than a dozen multilateral and bilateral development banks and international organisations recently established the Digital Infrastructure Regulatory Risk Forum. That forum, which is chaired by the Asian Infrastructure Investment Bank, aims to support the convergence of standards and practices, making it easier for investors to deal with regulations. It allows technical experts to share non-confidential information on regulations at country level and facilitates exchanges of views on how to manage risks. It also helps to identify high-level principles underpinning regulatory frameworks for digital infrastructure and related institutions.

[28] See World Bank (2016).

BOX 1.3.

E-government services in the EBRD regions

Information and communication technologies can help to enhance the provision of public services to individuals and businesses. For instance, e-government services can simplify interaction between governments and citizens by allowing online access to government forms and processes, eliminating trips to government offices and reducing waiting times. Businesses can also register, obtain licences and pay taxes digitally, thereby benefiting from significantly reduced processing times and costs. The cost of wasting time can be significant.[29] Indeed, Estonia is estimated to have saved the equivalent of 2 per cent of its GDP by introducing digital signatures.[30]

Many governments in the EBRD regions have made increased digitalisation an explicit policy goal, establishing digitalisation strategies and setting up dedicated agencies. The challenges posed by the Covid-19 crisis have accelerated trends towards increased digitalisation in order to facilitate fast, secure and stable digital access to public services. For instance, the EBRD has helped to assess the degree of digitalisation for investment and business services in Tunisia (in collaboration with Estonia's e-Governance Academy) and Montenegro, paving the way for the development of e-payments and e-registration and the electronic delivery of legal acts from authorities to businesses and citizens.

Digital identification and digital signatures

A key building block in the provision of digital services is digital identification. In the physical world, a person's identity is usually confirmed using a document such as a passport. In the virtual world, however, digital identification is required in order to confirm someone's identity, allow online access or verify virtual transactions (such as government service requests, bank transactions or internet purchases). Smart cards with machine-readable chips are the most common way of confirming a person's digital identity. In addition to having visual information (such as a person's photo, name or date of birth) stamped on the card, the chip also contains a digital identity – a set of data and software that is protected by encryption and can be accessed using a card reader by entering a personal identification number (PIN). Mobile ID is an alternative solution, whereby mobile phones carry a digital identity, with an encrypted set of data and software (similar to that used in smart cards) being contained in the phone's SIM card. In that case, the phone's keyboard is used to enter the PIN number, which activates the digital transaction and identifies the user.[31]

Digital signatures are another key element of e-government. These are most likely to be used where there is a need to verify a transaction (for example, when approving a bank payment or signing a contract) and keep a record of it for the future (ensuring that a contract is signed by both parties, for instance). Unlike an electronic signature, which is simply a name entered in an electronic document, digital signatures are trusted by the government and protected by encryption. However, they are not limited to transactions with the government. In countries that use digital signatures, they are most commonly used for business-to-business transactions (signing contracts or delivery documents) or business to consumer transactions (sales or service contracts).[32]

Ideally, digital signature tools should be provided to the general population as part of the roll-out of smart cards. That way, everyone has access to a digital signature, but they have a choice as to whether or not they use it. If people have to apply separately for a digital signature, the additional financial and bureaucratic barriers may mitigate its advantages. The use of digital signatures can also be boosted through cooperation with banks, telecommunication companies and utility providers, as these entities have large client bases and considerable scope for using digital signatures, increasing their attractiveness as an alternative to wet-ink signatures.[33]

Thus, a legal framework that recognises digital identities on the basis of digital signatures and electronic systems that are capable of identifying individuals are both prerequisites for the effective provision of electronic services. Recently, for example, the Kyrgyz Republic and Uzbekistan developed remote identification systems for their banking sectors, with a strong focus on risk mitigation, protection of personal data and cryptographic security.

Secure management of digital data is crucial for the electronic provision of services. Governments use digital databases for various different purposes (such as maintaining an overview of the population, issuing identity documents, registering, taxing and monitoring business activities, and organising land and property ownership). Thus, the implementation of e-government is highly dependent on the quality of such digital databases.

When information is sent digitally, both the sender and the receiver need to ensure that it is properly dispatched and securely delivered. Against this background, Serbia has recently started to provide e-delivery services and electronic confirmation of receipt, allowing electronic delivery of acts and other documents between government agencies, businesses and citizens. In 2020, for example, a new service was introduced allowing e-delivery to be used in the registration of property rights. As a result, the use of e-services has increased substantially, with 117 cities and municipalities registering on electronic portals.

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[29] See Deacon and Sonstelie (1985), Aguiar and Hurst (2007), Allon et al. (2011) and Garrido and Gutiérrez (2019).
[30] See Vassil (2016).
[31] See e-Governance Academy (2017).
[32] See e-Governance Academy (2017).
[33] See e-Governance Academy (2017).

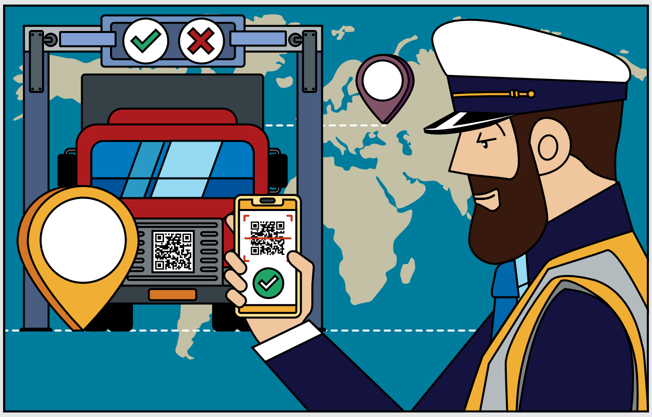
Publicly available databases

Digitalisation can also help to make information more accessible. Until recently, for instance, it was difficult for businesses in Montenegro to monitor changes to public levies and fees, as the country did not have a publicly available digital database containing such information. With assistance from the EBRD, an up-to-date public database of all public levies has been established, enabling users to access online information on fee types, required payment amounts and payment methods. Similarly, both the Kyrgyz Republic and Mongolia have recently developed national geoscience databases. Previously, valuable geoscientific information (such as geological data on metal and mineral resources) used to be fractured and spread across a number of different paper-based and digital databases. Now, however, comprehensive geoscience databases map all existing structures, bringing them together in a single coherent system to ensure that all information is accessible and consistent, which is a key step towards attracting investment.

More generally, digital solutions can facilitate more efficient interaction between firms and governments. To this end, a regional business registry portal (BIFIDEX) has recently been established in the Western Balkans. This system brings together business registration data (such as financial and statutory data) from all official business registries in Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia and Serbia, covering 1.6 million business entities and 2.2 million natural persons. It offers comparative financial performance data and other services relating to businesses' performance at regional level. It also enables users to identify firms on the basis of financial criteria. Meanwhile, Serbia has digitalised its business inspection process by creating a digital information system called the "e-Inspector", while the Kyrgyz Republic has introduced e-licences for small and medium-sized enterprises (SMEs), e-registration of businesses and electronic notary services.

Digital solutions for customs

Digital solutions can support trade by streamlining customs processes, reducing processing times and costs, and facilitating digital access to certificates of origin for exporters. Moldova, for example, recently introduced an electronic customs clearance process that issues electronic certificates of preferential origin and ATA carnets (international customs documents that allow temporary entry of goods on a duty-free and tax-free basis). Such e-commerce solutions can simplify control procedures for certificates of origin, thus helping to reduce the time that is needed for re-verification. Similarly, Armenia now issues digital certificates of origin to exporters. An online one-stop shop now enables exporters to submit all relevant documents via a single online portal and receive their certificate of origin via that same portal within one working day. This removes all direct interaction between the applicant and the expert assessing the request. Meanwhile, with the EBRD's support, Georgia is exploring options for full digitalisation of the maritime transport chain to reduce congestion in its seaports. This electronic platform will connect various port management systems, facilitating the exchange of information between seaport stakeholders (both public and private) and improving the management of port logistics.



Other digital solutions

Digitalisation efforts often target SMEs. Albania, for example, has recently established a full digital inventory of financing schemes for SMEs, while Montenegro now has a single access point for information on all financial and non-financial support available to SMEs.

Digitalisation also provides an opportunity to simplify cumbersome processes and increase transparency, particularly as regards access to public services and projects involving public-private partnerships (PPPs) and concessions. For instance, e-procurement systems can substantially reduce the risk of corruption. Belarus, Jordan, Kazakhstan, Moldova, the Kyrgyz Republic, Tunisia and Ukraine have all been developing platforms for e-procurement, e-monitoring and e-reporting, in many cases with the EBRD's support. Such initiatives can have a significant impact. Indeed, the implementation of the Prozorro project in Ukraine is estimated to have saved US$ 3.8 billion in public funds in 2015-19 alone.

Digitalisation can also support the shift towards faster decarbonisation of the energy sector and accelerate the transition to a green economy (for instance, through the use of digital solutions in renewable power auctions, green digital procurement, the deployment of smart meters and e-mobility).

BOX 1.4.

Artificial intelligence

Over the last ten years, artificial intelligence has really entered the public consciousness. AI is defined as a "machine-based system that is capable of influencing the environment by making recommendations, predictions or decisions for a given set of objectives".[34] Broadly speaking, it refers to the aim of creating intelligent machines that emulate the full range of human cognition and can eventually exceed it. Increased digital connectivity, coupled with a rise in computing power and the ability to store a rapidly growing amount of data and use it to train algorithms, has given AI fresh impetus.

AI's potential applications include mitigating climate change, safeguarding biodiversity, making cities more resilient, automating business processes and facilitating personalised medicine and drug discovery.[35] According to some estimates, activities involving AI could account for as much as 14 per cent of global GDP by 2030.[36]

Thus far, large-scale investment in AI has been concentrated in the United States of America (which dominates the AI landscape in terms of research output, talent, investment and infrastructure) and China, with those two economies estimated to receive about 70 per cent of global gains from AI.[37] However, other economies are looking to catch up. The EU, for example, recently declared a desire to create, by 2030, a "single European data space"[38] – a single market for data, allowing information to flow freely across sectors within the EU while adhering to EU regulatory standards (including privacy and data protection rules). Meanwhile, a number of economies in the EBRD regions have recently adopted AI strategies (including Bulgaria, the Czech Republic, Egypt, Estonia, Latvia, Lithuania and Serbia). National AI strategies are also being developed in Croatia, Greece, Romania, Slovenia, Tunisia and Turkey.

At the same time, AI does involve certain risks. The fact that it is trained on the basis of past practices means that it can potentially perpetuate existing inequalities through bias in decision making algorithms (as regards recruitment, credit scoring and criminal justice, for instance). It can also raise privacy and safety concerns, for example when it comes to the use of facial recognition technology, which is currently allowed in about half of the world's economies.[39]

The increasing use of AI needs to be accompanied by new and evolving regulatory frameworks. Governing principles for AI have been put forward by a number of multilateral and industry organisations, with examples including the OECD Principles on Artificial Intelligence (which stipulate, for instance, that users of AI should (i) include appropriate safeguards – for example, enabling human intervention where necessary – to ensure a fair and just society and (ii) provide transparency and responsible disclosure around AI systems to ensure that people understand AI-based outcomes and can challenge them), a proposal for a European Artificial Intelligence Act (which seeks to establish a comprehensive regulatory framework for AI in the European Union) and proposals by the Global Partnership on Artificial Intelligence (GPAI).[40] Industry-wide initiatives such as IEEE's Global Initiative on Ethics of Autonomous and Intelligent Systems and efforts by the International Organization for Standardization (ISO) aim to further inform emerging regulatory frameworks at national level.

Thus, investment in AI is often accompanied by changes in cybersecurity and data governance (including as regards data-sharing infrastructure, data privacy and data portability). Member states of the European Union, for instance, are expected to be bound by the EU's proposed Artificial Intelligence Act, which will require "high-risk" systems (such as medical devices and recruitment applications) to be more heavily regulated (which will involve, for instance, human oversight). That category of systems will also be subject to specific transparency requirements (for example, as regards the labelling of "deep fakes"). The proposed legislation will also prohibit some AI systems, such as AI-based social scoring or biometric identification systems.

[34] See OECD (2019a).
[35] See Zhou et al. (2020) and Santosh (2020).
[36] See PwC (2018).
[37] See PwC (2020).
[38] See European Commission (2020a).
[39] See Benaich and Hogarth (2020).
[40] See OECD (2019a), European Commission (2021) and gpai.com.

BOX 1.5.

The urban-rural digital divide in the EBRD regions

Households in the EBRD regions have experienced significant improvements in the availability and quality of internet access over the last decade. However, rural and remote communities remain underserved compared with urban households.

As the provision of broadband internet is often expensive in sparsely populated and isolated areas, private providers may not enter these markets at all, or they may charge high fees for access in remote areas, resulting in only a few individuals being willing to pay for that service. Governments may then intervene, either arranging for services to be provided directly by the state, compensating service providers for any public service obligations that are imposed on them, or asking service providers to average the cost of provision across all consumers, thus cross-subsidising some users at the expense of others.[41]

In the EBRD regions, divides are particularly stark when comparing capital cities with the rest of the country. For instance, while 90 per cent of households in Belgrade have internet access at home, this compares with just 80 per cent for Serbia as a whole (with much lower shares in some areas).

More generally, the percentage of households with internet access is, on average, 13 percentage points higher in urban areas than it is in rural areas. For instance, while in Poland's urban centres of Warsaw, Lódz, Poznań and Trójmiasto over 90 per cent of households have access to fixed broadband, in rural areas such as the south-eastern Sandomiersko-jędrzejowski region fixed broadband coverage still remains below 70 per cent.[42]

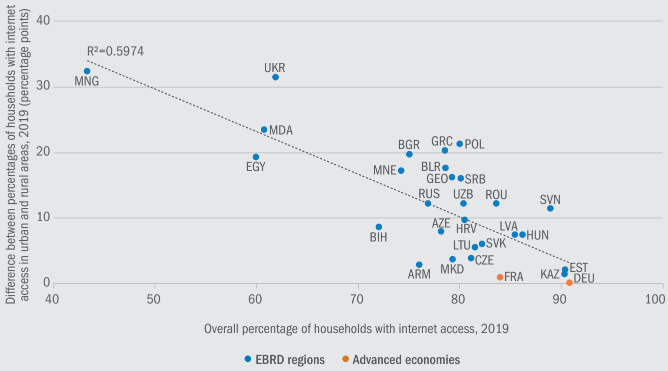
These unequal opportunities to participate in the digital economy exacerbate pre-existing inequalities. As documented elsewhere in this chapter, people living in rural areas are less likely to shop online or use e-government services and have worse digital skills than those living in urban areas.

Moreover, without adequate high-speed internet infrastructure, rural schools and their students risk falling behind their peers in urban areas.[43] Targeted interventions can be used to improve rural schools' access to broadband. In Serbia, for example, a recent EBRD-backed initiative connected around 600 rural schools to the country's broadband network, thereby increasing the proportion of schools with internet access to 32 per cent (an increase of 13 percentage points).

The digital divide between urban and rural areas is particularly pronounced in economies with lower overall internet penetration (see Chart 1.5.1). Strikingly, 58 per cent of Mongolia's urban population has internet access, compared with just 25 per cent of its rural population. Similarly, differences between a country's best-performing and worst-performing regions (normalised on the basis of the national average) are also larger in economies with less internet penetration.

However, such differences between best and worst-performing regions have declined in most economies. In some countries (such as the Czech Republic, Hungary and Serbia) they have fallen sharply, albeit from high levels. A similar pattern can be observed for urban-rural divides: these, too, have narrowed over time in most economies.

CHART 1.5.1. Digital divides are larger in economies with less internet penetration



Source: EBRD, European Commission, OECD, ITU and authors' calculations.
Note: Data for North Macedonia and Ukraine relate to 2018.

[41] See also EBRD (2020a).
[42] See European Commission (2020b).
[43] See EBRD (2021).

Annex 1.1. ICT in the EBRD regions: investors' perceptions

Introduction

In the past, the EBRD's Legal Transition Team (LTT) carried out regular assessments looking at the information and communication technology sectors of the economies where the EBRD invests. Those assessments considered the key characteristics of each market in terms of output metrics (looking, for example, at broadband penetration and world rankings for e-government and e-commerce), as well as comparing economies' legal and regulatory frameworks with best practices for the sector.

More recently, however, the LTT has adopted a new approach. Over the last two years, it has conducted a survey assessing investors' views on the factors in each country which contribute most to decisions on whether or not to invest. The results of that survey identify the countries that have the most attractive markets and the best policies fostering investment, particularly as regards digital infrastructure and broadband connectivity. The objective of the survey is to inform investors, policymakers and regulators, so that they can make decisions that will increase the impact and effectiveness of investment in the ICT sector, thereby improving the coverage, quality and capacity of digital infrastructure and broadband connectivity.

That 2020/21 survey covered selected economies in the EBRD regions – specifically, Egypt, Jordan, Lebanon, Morocco and Tunisia in the SEMED region, Albania, Bosnia and Herzegovina, Croatia,[44] Kosovo, Montenegro, North Macedonia and Serbia in the SEE region, and Armenia, Georgia, Moldova and Ukraine in the EEC region. The Central Asia region will be covered in a future survey round.

Methodology

In order to prepare for the survey, more than 50 face-to-face meetings were held with stakeholders regarded as having a direct interest in digital infrastructure and broadband connectivity, including government policymakers, sectoral regulators, network operators and service providers, financial institutions, representative bodies and consultants. Participants in the survey included operators of telecommunication infrastructure (both fixed and mobile networks) and providers of services (both retail and wholesale) delivered over those networks (voice, internet, data, media and broadband services) – both private and state-owned actors alike. The survey covered a number of different areas:

- The attractiveness of the market
- Risk factors for investment – including sectoral policies, legal and regulatory frameworks (as regards both the ICT sector and the economy as a whole), cooperation between the public and private sectors, the availability and quality of input resources (including spectrum, labour and rights of way), taxation, trade policies and political stability
- Potential in terms of best practices – that is to say, the level of confidence that investors have in the country adopting best practices for the sector.

The conclusions and recommendations derived from the survey results have been reported in detail on the EBRD's website in full survey reports, both at the level of individual countries and for the three regional groupings. This annex provides a summary of the conclusions and recommendations for the three regions.

Results for the SEMED region

Egypt, which is the SEMED region's largest market by population, is also forecast to be the fastest growing market for broadband services (albeit from the lowest base), according to Fitch Solutions (see Table A.1.1.1). Morocco, which is the second-largest market by population, is expected to see the second-fastest growth (also from a low base). All five countries have relatively low positions in the overall world rankings for ICT development, although Jordan and Lebanon appear to have made some progress in terms of improving their rankings.

Jordan and Lebanon are smaller markets, but perform fairly well in terms of internet usage. Jordan already has a high level of mobile broadband penetration, while its relatively expensive fixed broadband prices are contributing to relatively low fixed broadband penetration. Jordan's forecast for broadband growth is the lowest of the five countries. Relatively low speeds are recorded by fixed broadband subscribers in Tunisia and Lebanon.

Based on respondents' views, Egypt has the most attractive broadband market in the SEMED region and Lebanon has the least attractive. For this component, survey participants were asked to rate economies only in terms of pure market potential, disregarding any investment risk factors (which were subsequently taken into account in separate analysis, also based on the views expressed by survey respondents).

Jordan appears to be the fastest at adopting best practices aimed at lowering barriers to investment. Its legal and regulatory framework has followed the main

[44] Exceptionally, Croatia is regarded as part of the SEE region (rather than the CEB region) for the purposes of this survey.

TABLE A.1.1.1. Survey findings for the SEMED region

	Egypt	Jordan	Lebanon	Morocco	Tunisia
Survey results					
Broadband Market Attractiveness Index (0-100)	53.2	61.9	56.7	53.5	48.9
Best Practice Index (0-100)	66.7	56.7	53.3	52.0	43.3
Overall Broadband Investment Index (0-100)	43.3	66.7	60.0	53.3	53.3
Attractiveness of market					
Overall size of the market in population terms and relative spending power	Green	Orange	Red	Red	Orange
Growth potential of the market in terms of demand for broadband services	Green	Orange	Orange	Green	Orange
Efficiency of the market in terms of fair competition	Red	Green	Red	Orange	Orange
Existence of a clear national ICT strategy with stated ambitions and goals	Red	Green	Red	Green	Orange
Market headlines					
Penetration of fixed broadband (per 100 people)	5.4	4.7	21.0	3.9	8.8
Penetration of mobile broadband (per 100 people)	50.0	104.0	57.0	58.0	81.0
Percentage of population using the internet	45.0	67.0	78.0	65.0	64.0
Average download speed per fixed broadband user (Mbps)	26.5	50.5	8.1	18.5	9.1
Average download speed per mobile broadband user (Mbps)	16.9	17.7	46.7	33.6	25.3
Forecast overall broadband market growth up to 2024 (% per year)	17.0	3.4	5.8	13.0	6.0
Investment risk factors					
Legal and regulatory framework for broadband	Red	Orange	Red	Orange	Orange
Certainty as regards construction permits or wayleaves	Red	Green	Green	Red	Orange
Country's overall legal system, predictability and processes	Orange	Green	Red	Orange	Orange
State participation in the sector	Red	Green	Red	Green	Orange
Access to spectrum resources	Red	Red	Orange	Orange	Orange
Taxation (both in general and for the ICT sector specifically)	Orange	Red	Orange	Red	Red
State assistance and funding schemes	Red	Green	Red	Green	Orange
Trade barriers	Orange	Green	Green	Green	Red

Source: EBRD, United Nations, ITU, Speedtest Global Index, Fitch Solutions.
Note: As regards the attractiveness of the market, green means good, orange means medium, and red means poor. In the case of investment risk factors, red means high priority, orange means medium priority, and green means low priority. In terms of the indices, a score of 0 indicates a perception that the broadband market has no attraction whatsoever, whereas a score of 100 indicates a perception that the market is perfect.

liberalising steps adopted by the EU. Examples of steps taken include the privatisation of state telecommunication assets, the liberalisation of licensing and the provision of state support for rural broadband development. Jordan is continuing to align itself with the EU's investor-friendly laws and regulations. Morocco and Tunisia have the same overall alignment goals, but are slower to implement the required measures. Lebanon, meanwhile, is currently deadlocked by policy and regulatory inaction. Egypt is the country where respondents have the least confidence in best practices being adopted for the ICT sector.

The results of the survey are summarised by the Overall Broadband Investment Index, which is a composite index reflecting (i) the perceived attractiveness of the market, (ii) investment risk factors and (iii) confidence in the adoption of best practices. In all SEMED economies, conditions are still a long way short of what respondents would ideally wish for (see Table A.1.1.1).

(Continued on page 38)

Results for the SEE region

Serbia is the largest market in the SEE region in population terms, but is also forecast to be the slowest growing market for broadband services. Croatia,[45] which is the second-largest market by population, is also expected to see only weak growth. The highest expected growth rates are in Albania and Kosovo. Croatia has the highest global ranking for ICT development in the SEE region, benefiting from its membership of the EU. Kosovo, Montenegro and North Macedonia are relatively small markets, but perform fairly well in terms of internet usage, as well as having some potential to grow their broadband markets.

Based on respondents' views, Montenegro has the most attractive broadband market in the SEE region and Bosnia and Herzegovina has the least attractive. All of the SEE markets surveyed have problems when it comes to the adoption of best practices (being characterised, for example, by time delays and inconsistent application of procedures), creating significant barriers to investment. The most common problem across the region is the difficulty that investors have in obtaining the relevant permits for civil infrastructure projects (which affects, for example, the building of mobile transmission towers, the laying of cables and ducts, the accessing of public and private properties, and the installation of specialist equipment). In many of those markets, there are bureaucratic delays, multiple levels of decision-making and inconsistent application of rules.

Ideally, it should be possible to submit all necessary applications online via a one-stop shop, with all layers of

TABLE A.1.1.2. Survey findings for the SEE region

	Albania	Bosnia and Herzegovina	Croatia	Kosovo	Montenegro	North Macedonia	Serbia
Survey results							
Broadband Market Attractiveness Index (0-100)	59.3	46.9	63.6	57.4	69.9	59.3	52.4
Best Practice Index (0-100)	73.3	53.3	56.7	44.3	75.0	66.7	66.7
Overall Broadband Investment Index (0-100)	50.0	33.3	83.3	66.7	66.7	50.0	33.3
Attractiveness of market							
Overall size of the market in population terms and relative spending power	Orange	Orange	Orange	Red	Red	Red	Green
Growth potential of the market in terms of demand for broadband services	Green	Orange	Red	Green	Green	Red	Red
Efficiency of the market in terms of fair competition	Orange	Orange	Orange	Orange	Green	Green	Red
Existence of a clear national ICT strategy with stated ambitions and goals	Orange	Red	Green	Orange	Orange	Orange	Orange
Market headlines							
Penetration of fixed broadband (per 100 people)	16.0	22.0	34.0	38.0	25.0	22.0	26.0
Penetration of mobile broadband (per 100 people)	45.0	51.0	90.0	72.0	55.0	63.0	91.0
Percentage of population using the internet	72.0	70.0	73.0	77.0	72.0	79.0	73.0
Average download speed per fixed broadband user (Mbps)	33.2	32.1	35.7	46.2	30.3	46.4	50.0
Average download speed per mobile broadband user (Mbps)	49.6	33.6	61.5	28.8	49.3	41.3	43.4
Forecast overall broadband market growth up to 2024 (% per year)	6.2	1.5	0.9	6.8	2.6	1.1	0.8
Investment risk factors							
Legal and regulatory framework for broadband	Orange	Red	Green	Green	Green	Green	Red
Certainty as regards construction permits or wayleaves	Red	Red	Red	Green	Red	Red	Red
Country's overall legal system, predictability and processes	Orange	Orange	Red	Red	Green	Green	Green
State participation in the sector	Red	Orange	Orange	Red	Green	Orange	Red
Access to spectrum resources	Green	Orange	Green	Red	Green	Red	Green
Taxation (both in general and for the ICT sector specifically)	Red	Orange	Orange	Green	Red	Red	Green
State assistance and funding schemes	Orange	Orange	Red	Green	Green	Red	Green

Source: EBRD, United Nations, ITU, Speedtest Global Index, Fitch Solutions.
Note: As regards the attractiveness of the market, green means good, orange means medium, and red means poor. In the case of investment risk factors, red means high priority, orange means medium priority, and green means low priority. In terms of the indices, a score of 0 indicates a perception that the broadband market has no attraction whatsoever, whereas a score of 100 indicates a perception that the market is perfect.

[45] See footnote 44.

approval following the same effective procedures and timescales. However, even in Albania, Croatia, North Macedonia and Serbia, where new approval procedures have been introduced, network operators are still experiencing significant problems.

Croatia is the market where there is the most confidence that best practices will be adopted in terms of policies, legislation and regulatory practices. This stems from its membership of the EU. In the other markets, levels of confidence vary, especially in terms of the way in which different municipalities apply the various legally defined procedures. The lowest levels of confidence can be found in Serbia, where private investors feel particularly disadvantaged when competing against the state-owned incumbent operator (see Box A.1.1.1 for further details of the situation in Serbia). In all of the SEE markets, investment conditions fall short of what respondents would ideally wish for (see Table A.1.1.2).

Results for the EEC region

Of the countries surveyed in the EEC region (see Table A.1.1.3), Ukraine is the largest market and is also forecast to be the fastest-growing market (mainly as a result of mobile broadband, having made a late start in launching 3G and 4G services). The slowest growth is expected to be seen in Moldova, where the mobile broadband market is saturating and fixed broadband growth remains sluggish.

(Continued on page 40)

TABLE A.1.1.3. Survey findings for the EEC region

	Armenia	Georgia	Moldova	Ukraine
Survey results				
Broadband Market Attractiveness Index (0-100)	62	53	50	52
Best Practice Index (0-100)	62	60	50	50
Overall Broadband Investment Index (0-100)	62	57	50	52
Attractiveness of market				
Overall size of the market in population terms and relative spending power	Orange	Orange	Orange	Green
Growth potential of the market in terms of demand for broadband services	Green	Green	Orange	Green
Efficiency of the market in terms of fair competition	Green	Orange	Orange	Red
Existence of a clear national ICT strategy with stated ambitions and goals	Red	Orange	Orange	Orange
Market headlines				
Penetration of fixed broadband (per 100 people)	13	24	17	16
Penetration of mobile broadband (per 100 people)	83	80	59	47
Percentage of population using the internet	68	69	76	63
Average download speed per fixed broadband user (Mbps)	35	27	123	70
Average download speed per mobile broadband user (Mbps)	31	38	40	30
Forecast overall broadband market growth up to 2024 (% per year)	6.5	5.3	3.9	7.3
Investment risk factors				
Legal and regulatory framework for broadband	Green	Red	Red	Red
Certainty as regards construction permits or wayleaves	Green	Red	Red	Orange
Country's overall legal system, predictability and processes	Green	Green	Red	Red
State participation in the sector	Green	Orange	Red	Orange
Access to spectrum resources	Orange	Green	Orange	Red
Taxation (both in general and for the ICT sector specifically)	Green	Green	Orange	Red
State assistance and funding schemes	Orange	Green	Orange	Orange
Political stability, security, criminality and terrorism	Red	Green	Red	Red
Availability of labour (especially as regards digital skills)	Green	Orange	Red	Green
Corruption (both in general and in the ICT sector specifically)	Green	Green	Red	Orange
Overall infrastructure	Green	Green	Orange	Orange
Quality of databases and access to information	Orange	Orange	Orange	Green

Source: EBRD, United Nations, ITU, Speedtest Global Index, Fitch Solutions.
Note: As regards the attractiveness of the market, green means good, orange means medium, and red means poor. In the case of investment risk factors, red means high priority, orange means medium priority, and green means low priority. In terms of the indices, a score of 0 indicates a perception that the broadband market has no attraction whatsoever, whereas a score of 100 indicates a perception that the market is perfect.

(Continued from page 39)

Overall, respondents reported that markets in the EEC region had good potential, with strong consumer demand for high-speed broadband services. Markets are seeing continued investment in high-quality optical fibre for backbone and fixed access, plus more gradual introduction of higher quality 3G and 4G-based mobile broadband services.

Although a small market in population terms, Armenia has the highest overall index score, taking into account its market potential and the investment risks involved. Meanwhile, in Georgia (which is the closest economy to the EU in terms of its approach to market regulation) there are considerable risks associated with taxation and the granting of permission to install infrastructure. In Moldova and Ukraine, there are significant risks associated with political and legal uncertainty. Respondents also expressed the view that the full benefits of ICT markets were not currently being reaped in the region. In their view, the policies and regulatory frameworks in those markets do not reflect best practices.

Investment in the latest 5G-based broadband infrastructure has been weaker than that seen in more developed markets. Traditional networks and service operators have not yet explored the possibility of embarking on new, more cooperative ventures in partnership with a larger number of players. The precise nature of future business models remains unclear, with little coordinated consultation on joint investment at national level.

Respondents also highlighted a number of examples of separately owned infrastructure (ducting, fibre backbone networks and transmission masts, for example) where cost-saving joint investment or infrastructure-sharing opportunities had not yet been exploited. The main players in the EEC region's broadband markets do not yet appear to have found the optimal balance between competitive advantage on the one hand and cost efficiency on the other. Given the need for greater network reach and greater affordability, best practice cost-reduction measures (notably, infrastructure and spectrum sharing) should become a more prominent feature of future investment in broadband infrastructure.

Respondents in the EEC region concluded that a more collaborative approach – both within the sector and between network operators and other sectors – was the only way to ensure that the transformative economic and social impact of new 5G and fibre-based technologies was achieved.

Recommendations

Taken together, the views expressed by survey respondents point to a number of broad policy priorities when it comes to the development of the ICT sector.

First, they highlight the importance of having a business environment that incentivises private investment. Experience in other markets clearly shows that private participation in broadband infrastructure programmes makes any public funds go significantly further. Private involvement also helps to ensure that infrastructure is commercially sustainable in the long term and does not rely on large and sustained subsidies from the taxpayer.

The state's main task is to establish a clear policy framework for broadband infrastructure that boosts investors' confidence. It is worth noting, in this regard, that the development of e-government services for businesses and households and support for the development of e-commerce can, in turn, strengthen demand for broadband infrastructure.

Government intervention in the market may be required in order to ensure universal access to broadband in all geographical areas at affordable rates. Additional state funding may be provided where the private sector is not planning to invest in particular geographical areas within a reasonable timescale. At the same time, however, it is important to minimise any market distortion that is associated with using subsidies to foster universal coverage. The European Union, for instance, has specific state aid rules for broadband markets which provide that such state funding must not have an unwarranted distortionary effect on the broadband market.[46]

Governments need to address any excessive barriers to investment in broadband, including high charges for access to spectrum frequencies and other public resources. Tax policy needs to balance the twin objectives of raising revenue and leveraging private-sector participation in the provision of ICT infrastructure.

Investors often incur additional costs as a result of delays and uncertainty that they experience in obtaining construction permits and access to rights of way. The survey also points to significant wasted network expenditure on separate civil structures (primarily ducts and transmission masts). More cooperative models involving the sharing of networks and infrastructure, joint ventures and greater cooperation on civil works could be introduced in order to ensure that investment in broadband infrastructure maximises the effectiveness of the market, producing greater economic and social benefits.[47]

[46] See https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:025:0001:0026:EN:PDF (last accessed on 13 September 2021).
[47] For more details, see EBRD (2020b).

Developments during the Covid-19 crisis

Some of the analysis for this survey took place before the onset of the Covid-19 crisis, so accounting for the impact of the pandemic is difficult. The forecasts for fixed and mobile broadband growth are based on 2019 data and are likely to prove conservative, given the increase in demand for social and business-related networking during the Covid-19 crisis. Although the precise impact of Covid-19 is likely to vary from market to market, the differences between the various growth rates should remain broadly unchanged.

Broadband speeds appear to have changed during the Covid-19 crisis. In Albania, for example, average mobile broadband download speeds have fallen by 9 per cent, while fixed broadband speeds have increased by 1 per cent.[48] Similarly, fixed broadband speeds have increased markedly in Armenia, Jordan, Tunisia and Ukraine, while mobile broadband speeds have declined in Moldova, Morocco and Tunisia. While it is difficult to draw firm conclusions from these data, it is clear that the inconsistency of these changes adds further uncertainty to the investment climate.

Several SEMED countries have adopted specific measures in order to cope with the increasing demand for communication services during the Covid-19 crisis. In Egypt and Tunisia, for example, the government asked operators to provide free internet packages and offer free access to e-learning and healthcare platforms. In Egypt, the cost of the additional data packages and free browsing was covered by the state. In Jordan, meanwhile, the country's regulator gave telecoms operators temporary access to additional spectrum in order to increase network capacity.

The detailed recommendations in this annex are based on analysis of the views expressed by respondents before the onset of the Covid-19 crisis. However, it is clear that the case for further investment in broadband infrastructure has increased in the meantime, with an even greater need for more reliable and universal broadband services. At a policy and regulatory level, there also needs to be a greater focus on collaboration between public and private-sector investment. This is particularly relevant when it comes to policy consultation, the use of public funds, the achievement of universal broadband coverage, and the need for greater investment efficiency to achieve cost reductions and make networks more resilient.

BOX A.1.1.1.

Serbia's national broadband programme

A recent initiative in Serbia has allowed it to successfully address the absence of investment in broadband with a view to extending connectivity beyond urban centres to less-populated rural and semi-rural areas. The country's national broadband programme, which is supported by the EBRD, involves a PPP-type collaborative approach whereby the state installs telecommunication infrastructure to connect schools and municipal centres to existing operators' networks. Those operators can then bid for the right to use that new network free of charge, provided they commit to covering the cost of operating and maintaining it and construct, at their own expense, a "last-mile" network that connects the new network with unconnected rural households. This project allows the government to pursue its socio-economic objective of universal digital connectivity in a cost-effective way through a competitive bidding process, while at the same time increasing competition in the sector by requiring that competing operators have open access to the network.

[48] See www.speedtest.net/insights/blog/tracking-covid-19-impact-global-internet-performance/#/ (last accessed on 13 September 2021).

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