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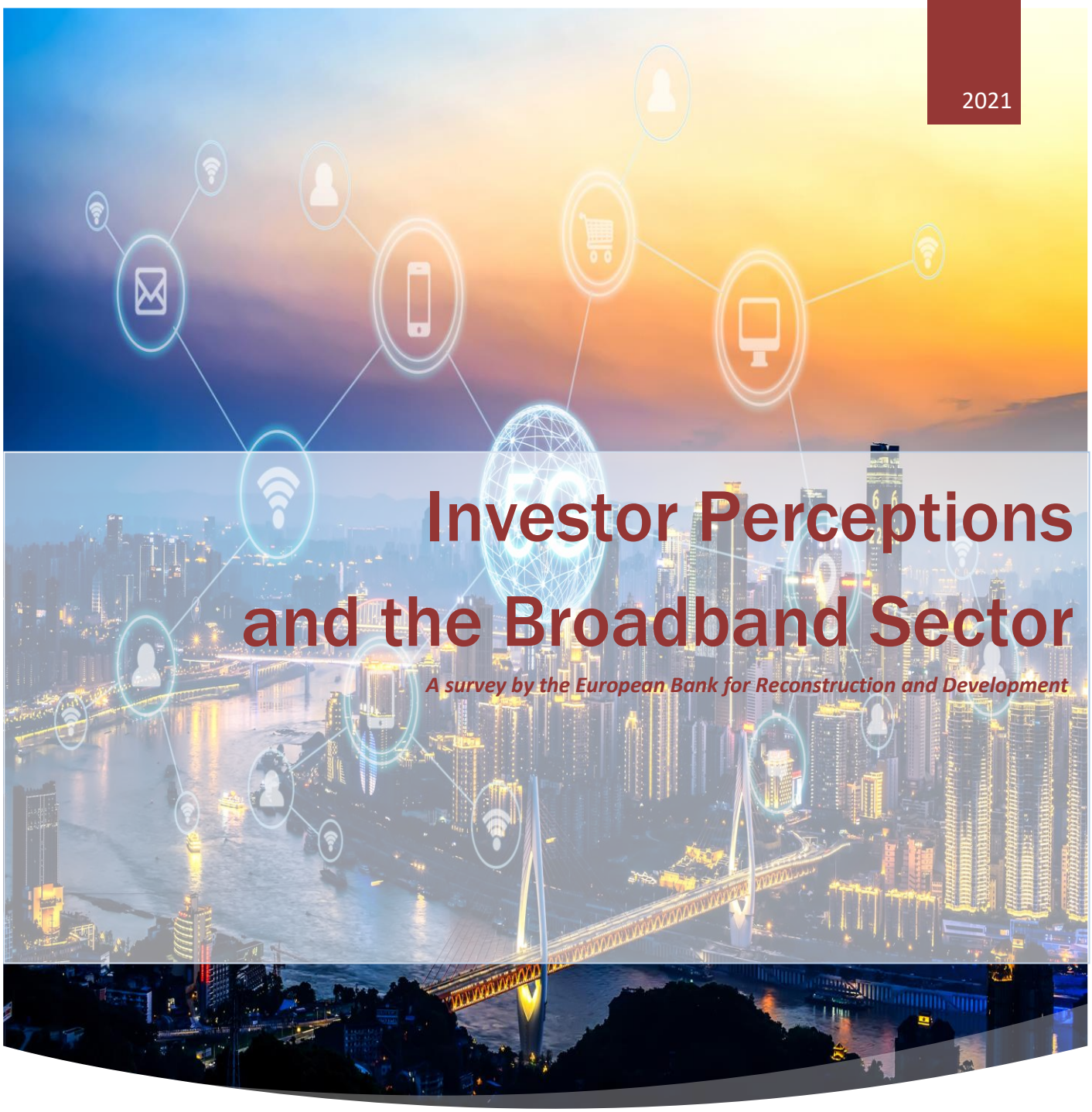


Investor Perceptions and the Broadband Sector

A survey by the European Bank for Reconstruction and Development

Eastern Europe and the Caucasus

&

Moldova

European Bank
for Reconstruction and Development

Survey context and disclaimer

The EBRD has conducted this survey to contribute to dialogue aimed at advancing development of the sector, its regulation and governance, in particular to promote investments in broadband infrastructure by improving investment conditions.

The views expressed in this report are from the survey respondents themselves and as such are not necessarily the views of EBRD or its representatives. The summaries and recommendations in the report have also been based on conversations with respondents and analysis of the collected views.

The views of respondents were given in confidence and accordingly, in the report, specific statements are not attributed to individuals or organisations.

The respondents' views were expressed here to stimulate and inform debate with policy makers and other organisations that influence broadband markets for investment in each country.

Contents

0: EXECUTIVE SUMMARY

This report examines conditions for investment in broadband infrastructure in Armenia, Georgia, Moldova and Ukraine– collectively the Eastern European and Caucasus markets EBRD operates in ("EEC"). Previous surveys have been recently published on five countries of the Southern and Eastern Mediterranean ("SEMED") and seven in South-eastern Europe ("SEE")[1].

To prepare these reports, a survey team has held a large number of face-to-face meetings with stakeholders having a direct interest in the Information and Communications Technology (ICT) sector, including policy makers from governments, regulators of the sector, the networks and services operators, sector representative bodies and consultants. For the EEC region, meetings were conducted during the first half of 2021.

In addition, and to back-up the face-to-face meetings, an on-line questionnaire was sent to additional stakeholders in the markets surveyed. This report summarises the views expressed in both the face-to-face discussions and from the completed on-line surveys. Throughout the survey, to allow for a frank and forthright discussion, respondents were asked to express their views in strictest confidence. Their comments have been included in this survey report without attributing them to an individual or an organisation, therefore maintaining this confidentiality.

Investments in broadband infrastructure take the form of networks to support fixed and mobile broadband services, together with the necessary civil engineering structures and associated equipment. Around 70% of the survey respondents have investments in fixed or mobile physical network infrastructures and 50% or more have customer service centres and data centres. Of growing importance are investments in new business models linked to connectivity. These investments include smart cities, vertical industry sector partnerships, logistics, content, data analytics and the "Internet of Things"[2]. Only a minority of the respondents surveyed had interests in TV or satellite networks.

In this report, the views of respondents are seen very much in the context of the introduction and potential widespread growth in both fixed and mobile broadband services, including 5th Generation (5G) spectrum-based services plus increased investments in fibre access broadband services. When respondents criticise the current situation from a policy, legal or regulatory standpoint, they most often express the view that the current situation must change in order for them to be more confident in making their next investment decisions in 5G and/or fibre networks.

The regional surveys have attempted to make a comparison between the investment conditions in the individual markets covered. The main components of the respondents' perceptions are:

- Their views on pure market factors – the market size, growth and investment potential
- Their views of the investment risks – the barriers that limit or delay investments

For the second aspect, investment risk, we have identified 14 factors that contribute most to broadband investment risks, as follows:

- The country's overall legal system, predictability and process
- The legal and regulatory framework specific to electronic communications and broadband investments
- State participation in the sector, for example through ownership of one or more players in the market
- State assistance and funding schemes
- Quality of databases and access to information
- Availability of labour especially with digital skills
- Labour regulations, employment agreements, militancy, disruptions
- Access to state-controlled resources related to investment in networks and services, notably spectrum

1 https://www.ebrd.com/cs/Satellite?c=Content&pagename=EBRD%2FContent%2FContentLayout&cid=1395292756036

2 https://ec.europa.eu/digital-single-market/en/news/b-day-boosting-connectivity-investments

- Certainty in obtaining construction permits or wayleaves
- Taxation generally or targeted at the sector
- Overall infrastructure
- Trade barriers
- Political stability, security, criminality, terrorism
- Corruption generally or in any aspect of operations

These factors have been identified from previous surveys conducted by EBRD[3]. Respondents in the current survey were asked also to add any concerns regarding broadband investments that are not covered by the above list. We have found that these 14 factors listed cover the majority of risks present in broadband investment markets. Where any other concerns were made known, they were relatively minor and have been recorded in the results of this survey given later in this report.

For each of the market and risk factors, respondents were asked to state how the situation in the county affected their investment decision making. Their responses were categorised into one of the following answers for each factor considered:

- Positively encourages investment
- Does not deter investment
- Mildly deters investment
- Strongly deters investment
- No opinion.

Respondents were also asked to indicate, when they are making investment decisions, what was the relative emphasis they place on the *pure market factors* on the one hand and the *investment risk factors* on the other. The results for the Eastern Europe and Caucasus markets were:

Relative weights in broadband investment decisions (EEC markets)

Pure market factors: 63%

Investment risk factors: 37%

Finally, respondents were asked how confident they were about the country adopting best practices across the sector, in policy and law-making, in regulation and in implementation. By combining the results obtained from these opinions on market attractiveness, investment risk and best practice potential, we were able to estimate the overall perception of each market by respondents.

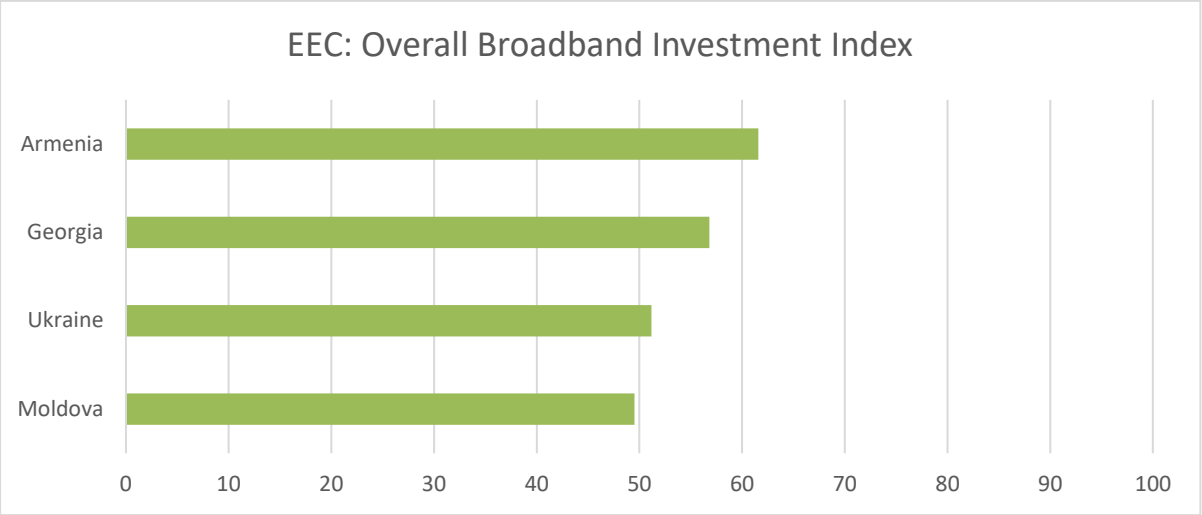
Important note about country-by-country comparisons

It is important to stress that when comparing countries together, that the results for each country reflect largely what respondents in that country say about only their own country. That is to say, for example, we are comparing what Georgian investors say about the Georgian market with what Ukrainian investors say about the Ukrainian market and so on.

In this respect the resulting ranking between countries should not be taken as strict investment benchmarks. Instead, the differences that are most valid are the level of importance attached to specific risks within each country. The same 14 risk factors have been analysed in each market, but the level of importance for some risks is far greater in some countries than in others.

The results therefore show the relative importance of each risk faced in each country when taking investment decisions. The primary purpose of this comparative analysis is to prioritise the issues for action to improve investment conditions in each country.

[3] The EBRD carried out surveys of the ICT sector in 2008, 2012 and 2016, results are available on request.



On the comparative scale, zero would indicate a perception that the investment climate is very poor. A score of 100 would indicate a perception that the overall conditions are perfect for investment. The method of calculation of the index is given in section 2 of this report.

Armenia, although a small market in population terms, came out the with the best measure, taking into account its market potential and the investment risks involved. Georgia, although already closest to the EU in its approach to market regulation, still has some risks mainly associated with regulatory intervention and the granting of permissions to install infrastructure. Ukraine is by far the largest market and still has good growth potential but has some significant investment risks associated with political, legal and regulatory uncertainty. Moldova's market has some growth potential but also has high risks associated with legal and political uncertainties.

The features of each country's market, as expressed by the respondents to the survey, are explored in more detail in this report. The overall measurement of broadband investment risks and rewards has taken place in the context of growing markets throughout the region. The average growth rate for broadband services, based on forecasts by Fitch Solutions[4], is 6.7% per annum compound up until 2024.

Overall outlook

Market growth and technology fulfilment

The overall view of respondents is one of good market potential, especially with continuing consumer demand for high-speed broadband services, The market has continuing investments in high quality optical fibre for backbone and fixed access, plus the introduction of 3G and higher quality 4G-based mobile broadband services. Investments in the latest 5G[5]-based mobile broadband technology have not started in the four EEC markets surveyed.

Further investments in broadband technologies, particularly in optical fibre and 5G, are confidently expected to support a significant expansion of the current range of ICT services, continuing the transformational impact on the development of all sectors of economic and social activity. The improved broadband speeds, quality, and reliability promised by fibre and 5G are expected to revolutionise the ICT sector, bringing increased scope for more cross-sector coordination and new business models, all bringing new revenue sources to the sector.

New investments in fixed broadband access are now dominated by fibre optic technology, both for expansion and as a replacement for existing copper-based access networks. 5G technology still faces a more uncertain rate of investment, especially in the markets studied in this survey. The respondents generally view the business cases for investment as yet to be clear, with remaining uncertainties surrounding 5G demand from both the industrial and consumer sectors. In the EEC countries, mobile company infrastructure investments are still predominately in 4G expansion, with investment returns still not certain. The decisions regarding

[4] https://store.fitchsolutions.com/telecommunications

[5] https://www.digitaltrends.com/mobile/what-is-5g/

additional spectrum purchases for 5G remain over-complex, with decisions by government and regulators on release dates and spectrum pricing still not clear.

National digital transformations

In this survey, respondents expressed the view that the full benefits of the ICT market are currently not being achieved in the EEC markets. In their view, the policies and regulatory frameworks in these markets are lagging behind best practice. The new and extended scope of markets created by 5G and fibre access technologies are likely to impact all sectors of the economy in all markets. The traditional networks and service operators have not yet explored new, more co-operative ventures in partnerships with a larger number of players. The new business models remain unclear, with little coordinated consultation at national level on joint investments.

Future discussions on broadband investments will involve many parties outside the current broadband sector players, including manufacturing, transport, utilities, agriculture, logistics, media, education, healthcare, public administration and many more.

Broadband infrastructure cost efficiencies

Respondents also expressed the opinion that there are too many examples of separately owned infrastructures (for example ducting. transmission masts, backbone and access cable networks) where cost-saving joint investments or infrastructure sharing opportunities have not yet been exploited. The main players in the EEC broadband market do not yet appear to have yet found the correct investment balance between competitive advantage on the one hand and cost efficiency on the other. With the need for greater network reach, more investment and greater affordability, best-practice cost reduction measures, (notably infrastructure and spectrum sharing) should become a more recognised and normal features of future broadband infrastructure investments.

Collaboration is key to adopting best practices

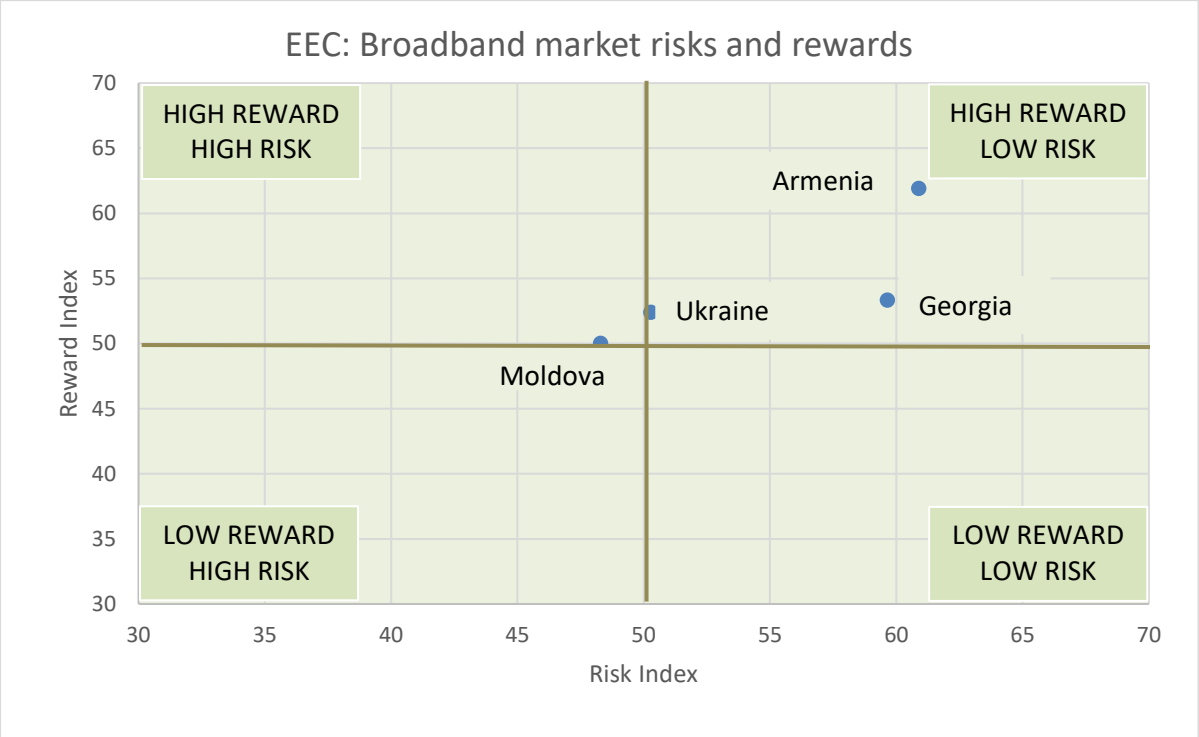
Respondents believe that only with a more collaborative approach within the sector, and between the network operators and other sectors, can the overall transformative economic and social impact of new 5G and fibre- based technologies be achieved. If these more collaborative approaches do not materialise, the risks facing investors will continue to be high and the full benefits to the investors, to wider industry and society, will not be realised.

Drawing on these views, the recommendations in this report are designed to inform priority-setting activities by policy makers and sector regulators as they move to adopt many of the best practices already being used elsewhere.

Risks and rewards

Using the results of the survey, we are able to present a picture of the relative risks and rewards associated with broadband investments in each country. In the graph below, the ‘Reward Index’ is derived from the ratings by respondents of the pure market potential in terms of market size, growth and possible returns. A value of zero represents zero market attraction and 100 represents perfect attraction. The ‘Risk Index’ is derived from a separate rating by respondents across a number of potential investment risk factors ranging from policy weaknesses, legal and regulatory bottlenecks, competitive imbalances and availability of resources. In the case of investment risk presentation, a value of zero represents absolute risk and 100 represents zero risk.

The ideal position on the chart is in the upper right-hand corner where rewards (vertical axis) are highest and risks (horizontal axis) are lowest.



On the Reward Index scale (y-axis) a value of zero represents no market attraction and 100 represents perfect attraction, On the Risk Index scale (x-axis) a value of zero represents absolute risk and 100 represents zero risk.

Based on respondent responses, Armenia exhibits the highest relative reward, with growth potential and reasonable investment risk. Georgia has a relatively lower market attraction but a reasonable risk profile. Ukraine and Moldova have similar market attraction to Georgia, but with higher risks.

Priorities for action

To analyse the factors that respondents used to make this overall assessment, the survey has examined the main risk factors, as expressed by respondents. We have used these views to prioritise the main investment risk factors for each country. For these priority issues, this report defines the key action areas to be addressed if the barriers to investment are to be reduced, making the markets more attractive in investment terms. The key action areas for each country are shown in the table below.

The reasons behind the risks, and the specific recommendations for each country to reduce their risk, are contained in the country-by country sections of this report and further developed in Section 4.

EEC markets: Priorities for action

Investment risk factors	Armenia	Georgia	Moldova	Ukraine
Legal and regulatory framework for broadband	!	!	!	!
Political stability, security, criminality, terrorism	!	!	!	!
Certainty in construction permits or wayleaves.	!	!	!	!
The country's overall legal system, predictability and process	!	!	!	!
State participation in the sector	!	!	!	!
Access to spectrum resources	!	!	!	!
Availability of labour especially with digital skills	!	!	!	!
Taxation generally or targeted at the sector.	!	!	!	!
Corruption generally or applied to the sector	!	!	!	!
State assistance and funding schemes	!	!	!	!
Quality of databases and access to information	!	!	!	!
Overall infrastructure	!	!	!	!

! - Low priority/ ! - Medium priority/ ! - High priority

The general recommendations resulting from this survey

Taking the respondents' own views, the survey offers a number of general recommendations for increasing the attractiveness and decreasing investment risks in the four markets surveyed. The recommendations are relevant to all the markets, but their relative priority for action is governed by the table above.

More detailed and specific recommendations are given in section 4 of this report. In summary, and taken together, these recommendations seek to create better conditions for broadband infrastructure investments:

- Governments should create an environment that maximises private investment. Experience from other markets clearly shows that private participation in broadband infrastructure programmes makes any public funds used go significantly further.
- Private involvement also helps to create programmes that are commercially sustainable in the long term, as opposed to ones that continually rely on state aid and other subsidy programmes.
- The key role of the state is to establish a clear policy for broadband, within which the investment strategies of market players can have greater confidence. This policy should include the support and stimulation of demand for broadband-based services such as eGovernment and eCommerce.
- A relevant renewed component of state policy is the role that governments can play in intervening in their markets in order to provide additional funding where necessary to achieve universal broadband access. The necessary conditions for additional state funding include where the private sector is not planning to invest in particular geographic areas (within the timescale required by the state policy to achieve universal broadband coverage). It is important to ensure that any such state funding does not have an unwanted distorting effect on the broadband market. State policy in this respect should therefore include relevant "state-aid" rules such as those adopted by the European Union (EU) for broadband markets[6].
- A key component of any broadband policy should be to ensure that all relevant decisions made by government and regulators are consistent with the need for investment to take place without undue barriers. Key examples of these barriers are high levels of taxation on the sector and high charges for access to government-managed resources, notably spectrum resources.
- Future investment efficiencies could be further promoted by policy and regulatory actions. At present there are significant wasted network expenditures on separate civil structures, most often ducts and transmitter masts. Additional costs are also incurred by investors in the delays and uncertainties they experience in getting construction permits and access to rights of way.
- More cooperative models involving network and infrastructure sharing, joint cost ventures and greater cooperation of civil works could be introduced to ensure that broadband infrastructure investments maximise the effectiveness of the market, bringing greater economic and social benefits.

These general recommendations, taken together, have been derived from the views of respondents during this survey. We believe that, if adopted, these recommendations should have a significant positive impact on the future investment climate in the markets surveyed.

Section 4 of this report gives nine specific recommendations arising from this survey, based on the views of respondents. Included in these recommendations are some examples of best-practice models for reducing investment barriers, risks and delays.

The impact of the COVID-19 pandemic

This analysis for this report took place in the first half of 2021 with a full recognition that the broadband market sector is experiencing the impact of the COVID-19 pandemic. The forecasts used in this analysis of fixed and mobile broadband growth up to 2024, are based on 2020 data and do not fully reflect the possible medium-term impact on broadband growth. If anything, business and consumer demand for faster and more reliable broadband services is likely to be permanently increased by rising on-line commercial activity, plus

[6] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:025:0001:0026:EN:PDF

the changes in working and domestic life arising from the pandemic. Another likely impact is one of increased demand outside the main cities (and less growth within city centres) as more people work a greater part of their time from home and also seek to spend more leisure time away from the main population centres.

Although the impact is likely to vary from market to market, the overall relative broadband growth rates should remain consistent. For example, the relatively high growth rate for broadband services in Ukraine (at +9.0% p.a.) is likely to be maintained because mobile broadband services started late and fixed broadband also began from a lower base. In contrast, Moldova will maintain a relatively low projected growth rate (at 4.4%p.a.) unless the relatively poor fundamentals of their market remain unchanged.

Broadband speeds appear to be affected differently in each country[7], for example in the first four months of the pandemic, in Armenia and Ukraine broadband download speeds increased by between 12% and 19% whereas in Georgia, overall broadband speeds remained broadly constant. In Moldova, mobile broadband speeds declined by 14%. It is difficult therefore to draw firm conclusions regarding the more longer-term impacts of changing broadband usage on broadband investments.

One aspect of national policy that has come into particular focus during the survey as a result of the COVID-19 pandemic, is that of network security and resilience. Respondents raised this issue as one that requires greater national policy discussion, in order to:

- Define clearly the country's critical network infrastructures.
- Coordinate the actions required for responses to network failures or security breaches.
- Put in place measures to protect critical network functions and services from future adverse incidents.

From the views of the survey participants and from the experiences of the wider international stakeholders in the broadband market sector, there are some lessons now emerging from the pandemic experience. A collection of views, illustrated by case studies is given in the Annex to this report.

Policy and investment-related recommendations have been reinforced by the pandemic experience

Conducting the survey during the course of the pandemic has served to underline the importance of taking account of investors' views so that the remaining barriers to broadband investment, which vary to some extent from country-to-country, can be addressed by policy makers and sector regulatory bodies in close cooperation.

This report makes both general and detailed recommendations based on the analysis of respondent views given before and during the coronavirus outbreak. These recommendations will still apply in the post-COVID situation and in many instances with their relevance brought more into more focus by the COVID experience. The case for further investment in broadband infrastructure has increased, now with even more focus on more reliable and universal broadband services.

At a policy and regulatory level there will also be greater focus on the collaboration between government investments and private sector investments. This is particularly relevant in areas such as policy consultation, the use of public funds, achieving universal broadband coverage and the need for greater investment efficiencies to achieve cost reductions and greater network resilience.

In section 4 of this report "Detailed Recommendations" we make the case, based on the views expressed by respondents during the survey, for greater investment efficiencies, notably in the following areas which are also relevant to short-term COVID-19 mitigation:

- A clear national policy for broadband, based on public and private sector investor consultations, supported by a best-practice legal and regulatory framework (Recommendations 1, and 2).

[7] https://www.speedtest.net/insights/blog/tracking-covid-19-impact-global-internet-performance/#/

- Greater broadband investment efficiency and co-operation, including making use of wholesale markets, infrastructure and network sharing plus a range of cost- reduction measures specific to broadband investments, backed up by best-practice regulations (Recommendation 3).
- Faster permission granting procedures for network construction (Recommendation 4).
- The role of the state (Recommendation 5)
- Efficient exploitation of spectrum resources, particularly in the planning and management of spectrum releases for 5G (Recommendation 6).
- The availability of digital skills (Recommendation 7)
- Taxation of the telecommunication sector with regard to a wider strategic view of the required investments in the sector (Recommendation 8).
- The use of state funding to work alongside private investment, accelerating broadband access and affordability (Recommendation 9).

The country-by-country sections of this report make reference to the specific factors that are influencing investor decisions on broadband infrastructure investments in each country. Within the context of the above general recommendations, these country-by-country analyses provide policy makers and regulatory agencies with a set of recommended priorities for action in each country that are now raised in importance by the COVID-19 experience.

1: SURVEY BACKGROUND AND OBJECTIVES

Background

Under the Legal Transition Programme of the European Bank for Reconstruction and Development (the "EBRD" or the "Bank"), the Bank's Legal Transition Team has focused part of its work on the development of detailed analytical assessments of the state of legal, policy and regulatory transition in a number of commercial and financial sectors of its countries of operation. These assessments benchmark the developments in these sectors in each country against recognised international best practices, providing analysis of the existing legislative framework, comparison of that framework with best practice and the identification of gaps and legal and regulatory reform needs.

The Bank has carried out regular (in 2008, 2012 and 2016) assessments of the telecommunications/ICT sector in its countries of operation[8]. These assessments have focused on the overall potential of the sector for reforms that could improve the broader investment climate in the sector, in particular, to improve the infrastructure for delivering modern broadband services. The previous assessment approach used by EBRD has been to study key characteristics of the market, in terms of output metrics (for example broadband penetration, eGovernment and eCommerce world rankings) alongside a comparison between the legal and regulatory framework and best practice in the sector. The methodology relied on building an accurate picture from the outputs of the sector itself alongside on the policy, legal and regulatory environment for investors, service providers and consumers.

The current 2020/21 survey report takes a different approach, one in which the informed views of investors have the most impact. The approach is based on investors' immediate concerns in terms of which factors in each country contribute most to decisions on whether to invest or not. The results have therefore identified the countries that have the most attractive markets and policies for encouraging investment, particularly for broadband infrastructure and connectivity. The survey outputs, in the form of a ranking of investment attractiveness and a listing of the key investment risk factors, are intended not only to inform investors, but also to prompt policy makers to consider reforms that would improve investment conditions in their countries.

To help with the development and conduct of the survey, EBRD retained an external consulting advisor[9]. The requirements for the survey and analysis methodology are defined in section 2 of this report, which also contains a description of the survey methodology plus the definitions of the required calculations, indexes and rankings.

Markets included in the survey

The markets intended to be included in the 2020/21 survey are:

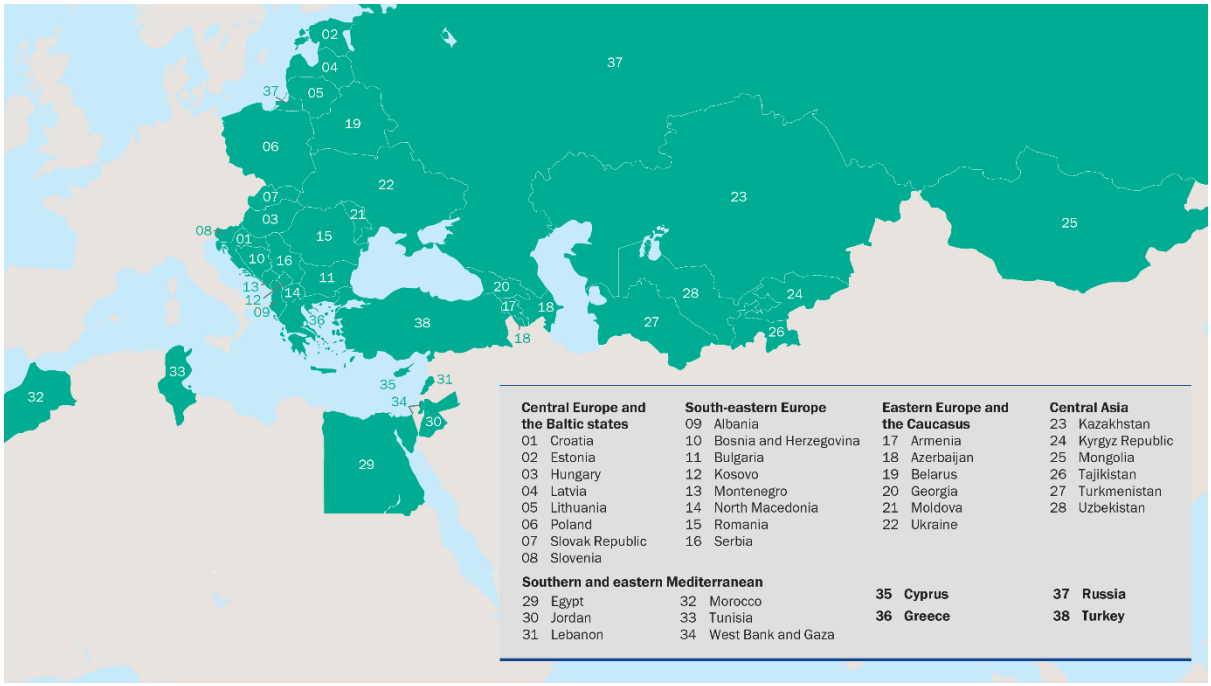
- From the Southern and eastern Mediterranean (SEMED) region: Egypt, Jordan, Lebanon, Morocco and Tunisia
- From the South-eastern European (SEE) region: Albania, Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, North Macedonia and Serbia
- From the Eastern Europe and the Caucasus (EEC) region: Armenia, Georgia, Moldova and Ukraine
- From the Central Asia region: Kazakhstan, Kyrgyz Republic, Mongolia, Uzbekistan

This report covers: Armenia, Georgia, Moldova and Ukraine.

[8] See http://www.ebrd.com/where-we-are.html

[9] Cullen International, an international and independent research organisation specialising in the ICT sector https://www.cullen-international.com/

EBRD countries of operation



Objectives of the survey

The overall objective of this survey is to inform investors, policy makers, regulatory and other influencers of investment so that they can make decisions that will increase effectiveness in sector investments and thereby improving broadband infrastructure coverage and capacity.

The survey has involved a wide range of existing and potential stakeholders in investment in broadband infrastructure and service, including finance providers, telecommunications network operators, broadband and internet service providers, analysts and other market stakeholders.

The specific objectives of this survey, analysis and assessment are:

- To produce a comparative "Broadband Investment Index" for each country plus relevant sub-indexes, that will inform policy makers and market participants, based on the perceptions of investors.
- To provide a focus on identifying the key enablers to investment in each country as a means of informing policymakers of specific impediments to sector growth. Such identification should also help EBRD focus its resources in engagement with policy makers and market participants as a means of reducing barriers and increase investment in the sector.

The main output of the survey, analysis and assessment is a ranking of markets, based on their investment attractiveness, with further explanations for each country giving the main reasons expressed by investors that have led to the index and ranking calculated.

The telecommunications/ICT sector and broadband infrastructure investment

The focus of this survey is the broadband infrastructure that enables access to fixed and mobile broadband services. This infrastructure includes electronic communications networks providing access through higher speed broadband services, plus the enabled digital services market, most notably delivered through digital media services and the internet. ICT sector investments will increasingly target new markets and business models linked to greater connectivity. This includes smart cities, vertical industry sector partnerships, logistics, content, data analytics and the "Internet of Things".

The policy, legal and regulatory frameworks for the infrastructure market providing access to broadband services have undergone significant changes since the latter part of the 20th century. These changes have been driven by the rapid development of digital technologies and the internet. The traditional telecommunications, internet and broadcast media services markets have been transformed by the influences of these technological developments.

In particular, the model of state-owned monopoly telecommunications and broadcasting infrastructure has been largely replaced by the more liberalised competitive supply of fixed and mobile services. This has responded to more sophisticated consumer demands for better quality services, mobility and the expected higher speeds of access required for a larger range of internet and media services.

The pace at which ICT-based markets have been transformed has varied from country to country. One of the significant determinants of the speed of transition from monopolistic to competitive markets has been the progress made by each country's policy and law makers in adopting the enabling legal and regulatory frameworks. To put in place modern digital network infrastructures with competitive service delivery, the legal and regulatory frameworks have to be seen as enablers, not barriers, to investment.

In addition to the attractiveness of the broadband market, investors (whether existing operators or new market entrants) require an effective legal and regulatory framework to help reduce risks and increase their confidence to invest.

The goal of universal broadband connectivity

Since the wave of privatisations across the sector from the 1980s onwards, the majority of investments in ICT sector infrastructure are now private sector investments. In recent years, a parallel role for public investment has been proposed. This additional state investment seeks to fill the gap caused by the lower private commercial investment returns resulting from a state policy to achieve universal broadband access to all citizens, including the more remote regions.

Policy makers have adopted different types of market interventions, including:

- Market demand stimulation (for example through the implementation of eGovernment services).
- Direct public subsidies that accelerate private investment into the more remote regions, including via public-private partnerships.
- Direct public investments in broadband infrastructure for delivering government services and to provide wholesale capacity for the commercial operators to exploit.

Private investors see these types of public investments as complementary to and supporting of private investments, not as competing networks. Governments should continue to create an environment that maximises private investment at the outset. Private involvement also helps to create programmes that are commercially sustainable in the long term, as opposed to ones that continually rely on state aid and other subsidy programmes.

The global Covid-19 pandemic has raised awareness of the current lack of universal broadband connectivity. This report has a separate section which records the key messages that have been expressed on planning for a post-Covid world. These messages reinforce the need for further broadband investment initiatives, using private investments alongside public intervention where necessary to achieve more connected broadband-enabled societies.

Growth drivers

Broadband market investors have faced new challenges. In the markets surveyed, competitive markets have been introduced, allowing new entrants to provide services, both by direct infrastructure investment and by exploited the existing broadband connectivity provided by incumbent operators. The new entrants include providers of "over the top" services, starting with voice services over the internet ("VoIP services"). Users can now also benefit from a wide range of "streaming" services using the internet, giving multi-media content including high-definition video.

These new services have significantly threatened the traditional revenues of the existing network operators, forcing them to find new market offerings, including "bundled" fixed and mobile broadband-enabled packages of voice, internet and video content.

Additional technology developments, particularly in mobile communications, have allowed faster and more reliable broadband connectivity. 3G and 4G mobile services are now reaching almost full population coverage. The growth in the number of users and the higher data download speeds demanded by those users have already attracted significant new investments to keep up with this new demand.

As well as the existing competition between the larger network operators, new forms of competition have developed, attracted by the growth in demand for broadband-enabled services. The continued growth in broadband services has attracted investments across a wide range of infrastructures, including:

- Fixed and mobile networks.
- Cable, terrestrial and satellite TV networks.
- Buildings, towers, physical structures, power plant and other supporting services for ICT infrastructures.
- Data centres and internet exchange points.
- Customer service centres and retail shops.
- Investments and business models linked to connectivity – for example smart cities, vertical industry sector partnerships, logistics, content, data analytics, internet of things (in the light of 5G and its potential).

The survey found respondent interest in all these types of infrastructure, from existing players and new entrants. The larger network operators continue to provide a full range of broadband services, while others emerge as specialist investors, for example tower companies, data centres and internet exchange points, focussing on one investment type.

Smarter investment strategies

Greater competition is resulting in both existing companies and new entrants seeking new ways to make investments more efficient. The lowering of unit costs in the supply in broadband services markets is needed to maintain profit margins. In the EU, policy makers and regulators have promoted specific cost reduction measures for broadband investments[10,11,12,13], including:

- The efficient use of wholesale markets in the telecommunications sector.
- The liberalisation and fairer pricing of spectrum.
- Removing sector-specific taxation.
- Greater coordination of civil works and access to multi-occupancy buildings.
- Cost and infrastructure sharing models including joint investments and public-private partnerships.

These newer policy and regulatory measures, although also being adopted by non-EU countries, have not yet had significant impact on investment efficiency outside the EU. All countries are facing the same investment needs, driven mainly by the significant growth in broadband services demand and often alongside national policy directives towards achieving universal high-speed broadband connectivity.

Policy, legal and regulatory frameworks are gradually being adapted to these new demands, in some countries faster than in others. This survey has sought to identify the main remaining obstacles to efficient investments in broadband infrastructure in each country.

[10] https://ec.europa.eu/competition/sectors/telecommunications/overview_en.html

[11] https://ec.europa.eu/digital-single-market/en/cost-reduction-measures

[12] https://ec.europa.eu/digital-single-market/en/content/eus-spectrum-policy-framework

[13] https://ec.europa.eu/taxation_customs/business/vat/telecommunications-broadcasting-electronic-services-archived_en

The important next wave of ICT infrastructure investments has already been foreseen in all the markets surveyed. Mobile services will be enhanced by 5G technologies which will include many more applications around the "Internet of Things" and other, not yet fully defined, digitally enabled business and service models. In the fixed broadband market, fibre access investments will grow to meet the faster (and more reliability dependent) data services requirements of businesses and households. Fixed access services will be enhanced by fibre-based local networks which are better suited to the higher capacity and reliability needs of broadband users.

The range of business models required for these new investments are likely to involve more collaborative approaches. Greater cooperation will not just be between the operators and service providers in the ICT sector. New ventures span different market sectors, including telecommunications with healthcare, education, agriculture, logistics, public sector management, transport, entertainment, manufacturing, supply chain and many other industrial sectors.

Smarter investment models designed for this greater collaborative investment world are continuing to emerge. In the view of the respondents, the makers of policy, laws and regulations will need to engage fully with the sector and be seen as better facilitators for these new types of smarter investments.

The way forward

The respondents to this survey appear to have reached a turning point in their approach to future infrastructure investments. Over the past twenty years investors have tended to choose strategies that build separately owned and operated infrastructures for each network operator. There is a general realisation that new investments in ICT infrastructure in the future will require new and more collaborative models to be considered in order reduce costs and maintain investment returns.

According to survey participants, the sector's collaboration experience has so far not been good, evidenced by the many examples where each operator invests in separate civil works, separate parallel network capacity and separate transmission masts. Greater cooperation would have saved investment funds that could have been used to expand and improve connectivity. Fierce competitive pressures appear to have prevailed over the economic good sense of cost reduction. Collaboration between operators has not yet become normalised.

The collaboration experience between policy makers and the sector players has also not been good. Governments still expect to receive high fees for spectrum resources, diverting investment funds away from achieving the policy aims of better infrastructure and a more universal access. In some markets, taxation schemes targeting the sector still seek to extract maximum payments from telecommunications and internet providers, further limiting their capacity to make investments in ICT infrastructure. In addition, there are still inconsistent and time-consuming administrative procedures for obtaining network construction permits and access to rights of way.

Structural influences from the next wave of investments

"Digitisation is also fostering cross-industry interaction; telecommunication operators should be the landmarks in enabling other industries along their digitisation journeys.

"New high-speed networks and next-generation quality of services features are increasingly becoming the main drivers for digital growth, but still the business equation is not yet solved to unlock wide roll-out of fibre-to-the-premise and upcoming 5G development."

"Beyond the evolving roles for established players, a multitude of start-ups are leveraging the Internet of Things (IoT) to create a new business model and domain for business.

"Most successful IoT use cases would not be implemented by single players alone, but with agreed roles together in partner ecosystems. Right ecosystems are a major driver of IoT success".

[Source: AD Little 2019 Report "(IoT) breakthrough – Is the industry ready for commercial success?"[14]]

Recommendations are made in this report, based on our survey of investor perceptions. These recommendations aim to reduce the most important barriers facing investors in broadband infrastructure. Most of the recommendations are based on best practices already in place in other markets, notably in the EU. In some of the markets surveyed, these best practices are already being implemented but implementation has so far been relatively slow. The survey respondents have expressed the view strongly that best practice adoption for the governance of the sector need to be accelerated before their investment decisions on 5G and fibre access can be made more confidently.

The recommendations in this report are therefore designed to inform priority-setting activities by policy makers and ICT sector regulators in readiness for the next wave of ICT infrastructure investments driven by rapidly growing and extending markets for broadband services.

[14] https://www.adlittle.com/en/who-dares-wins

2: SURVEY METHODOLOGY

Taking an investor's view

The previous (2008, 2012 and 2016) EBRD assessments studied the legal and regulatory conditions applying to the electronic communications sector in a wide variety of national markets. Investors take into account many factors before they decide whether to invest or not.

For the 2020/21 survey, we have directly recorded the views of a wide range of existing and potential stakeholders in investment in broadband infrastructure and service, including, telecommunications network and service operators, broadband and internet service providers, analysts and other market stakeholders. "Broadband investment" embraces telecommunications infrastructure and connectivity (fixed and mobile networks) and the services (both retail and wholesale) that are delivered over these networks (voice, internet, data, media and broadband services). This definition is used within the context of the key purpose of this survey – to promote broadband infrastructure investments.

In addition, the survey team has researched and held wider discussions regarding the overall policy, legal and regulatory conditions used by the relevant authorities in each country. In this way, we have attempted to match the effectiveness of the relevant conditions in each country to investor needs.

Stakeholders generally use benchmarks to compare the conditions in their country alongside the conditions achieved in neighbouring markets and regions, notably the EU. The EU is generally perceived to be an open and effective marketplace for ICT investments. The EU's current legal and regulatory framework ("The European Electronic Communications Code"[15]) is viewed by investors as an enabler to overcome the most commonly faced problems in the competitive ICT markets.

Other factors are used in our surveys that could be useful to investors in deciding on which countries to focus on now and in the future. The most important of these other factors are the relative broadband market sizes and growth potential. Where we have included this information in the report, the source of the data has been given.

Respondents' views of the policy, legal and regulatory enablers for broadband infrastructure investment have led us to identify the gaps in policy implementation. The action areas required for each country are shown in the results Section 3 of this report.

What are the components of the survey?

The main purpose of the survey is to use the results to inform investors, policy makers, regulatory and other influencers of sector investment to increase effectiveness in telecommunications sector investments and in particular to improve broadband infrastructure coverage, capacity and connectivity.

Confidentiality

To allow for candid and forthright responses, the answers provided and views expressed by the respondents to this survey are treated in strictest confidence by the Bank. The overall results, or any part of the results are not attributed to any organisation, group of organisations or individuals. The Bank will publish the main results to benefit investors, policy makers, regulators and other sector players, making it clear where actions need to be taken to improve the climate for sector investments.

This will be done without breaching the confidentiality of the persons and organisations that expressed their opinions during the survey.

[15] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L1972&from=EN

Respondents were asked to make a separate response for each country where they are familiar. Their knowledge of the country could be either by their existing presence, or by their having studied the market for possible investment in the sector in that country. The markets being analysed include the following: Albania, Armenia, Bosnia and Herzegovina, Croatia, Egypt, North Macedonia, Georgia, Jordan, Kazakhstan, Kosovo, Kyrgyz Republic, Lebanon, Moldova, Mongolia, Montenegro, Morocco, Serbia, Tunisia, Ukraine and Uzbekistan. This report covers four markets of the EEC region: Armenia, Georgia, Moldova and Ukraine.

The survey sought opinions on the market for broadband investment from several overall viewpoints:

- Market attractiveness - what is perceived about the market size, potential and attractiveness for investments?
- Investment risk factors - including sector policies, the general and specific legal and regulatory frameworks, public and private sector cooperation, availability and quality of input resources including spectrum, labour and rights of way, taxation, trade policies and political stability.
- Best practice potential – what level of confidence do investors have in the country moving towards best practices for the sector?
- The following sections define these various factors and how they are used and reported in the survey.

Market attractiveness and investment risk factors

Respondents were asked to indicate, when they are making investment decisions, what was the relative emphasis they place on the pure market factors on the one hand and the investment risk factors on the other. The results for the SEE markets were; pure market factors; 57% and investment risk factors; 43%.

Additionally, a number of factors relevant to investments in the ICT sector are included in the survey. Each factor and its components and weightings are described in the table below.

Survey factor	Components	Weightings
Perception of market attractiveness	Respondents are asked, for the types of investment that they are involved in, -what is their view, for each country, of the overall market potential, regardless of the investment conditions and risks there? Respondents are asked to add comments to support their views.	63%
Investment conditions, risks and related factors	In this part, 14 potential risk factors are listed. Each could influence investment decisions in each country. Respondents were asked to give their view separately for each listed factor and for each country. Respondents are asked to add comments to support their views. These comments could be on any of the listed topics or other areas of the situation, ranging from "examples of best practice" right through to "examples of any key inhibitors and barriers to investments".	37%
The list of 14 potential risk factors identified for the broadband market		
1. **The country's overall legal system, predictability and process** This factor covers the overall national legal system and its enforcement, the effectiveness of public authorities, the risk of overlaps, duplications and inconsistencies. 2. **Legal and regulatory framework specific to electronic communications and broadband investments** This includes the existing overall legal and regulatory framework (primary and secondary legislation/ by-laws) relating specifically to the electronic communications networks and services sector, your confidence in the effective application of those laws and the transparency of the procedures used by-law makers and regulatory bodies in supervising those laws. The types of laws and regulations for the sector are typically related to the rights and obligations of market participants, interconnection and access, sector competition, conditions for the provision of services, technical standards and any specific rules for promoting investments. 3. **State participation in the sector** This includes the level of state ownership of networks and service operators and the possible implications for competition, for example the possible bias that could result in applying policies, laws and regulations. 4. **State assistance and funding schemes**		

This includes any funds that are available to investors for assisting electronic communications networks and services expansion or for ensuring universal service (for example rural development funds, digital society/ information society development funds, broadband infrastructure funding) and the related rules and procedures applying to such funding with relation to the related conditions for state participation, open access, distortion of competition etc. 5. **Quality of databases and access to information** This includes the existence and reliability of relevant information sources for population distribution and other relevant national statistics as well as specific databases for licence-holders in the sector, interconnection offers, network infrastructure atlas, index of relevant laws and regulations. 6. **Availability of labour especially with digital skills** This includes the labour and skills required for network construction and operations, customer service and business management. 7. **Labour regulations, employment agreements, militancy, disruptions** This relates to the national or sector specific conditions for employing labour in support of investment and operations, including the risk of strikes or other disruptions outside the control of the investor, for example through organised labour campaigns generally or directed at the sector specifically. 8. **Access to state-controlled resources related to investment in networks and services** This includes the access to, and the procedures used in frequency spectrum, numbering ranges or any other types of networks or services licences or authorisations required before launching new services or growing existing services. 9. **Certainty in construction permits or wayleaves** This includes any required approvals for physical construction or civil engineering works and the placing of plant on public or private land (including masts, towers, poles, overhead wires, ducts, manholes, operational or other buildings, street furniture etc.). 10. **Taxation generally or targeted at the sector** This includes the general taxation applied to businesses and individuals plus any specific taxes or additional financial burdens placed on trading in the electronic communications sector, the collection of services revenues or on the outlay of investment or operating costs. 11. **Overall infrastructure** This relates to the national and local infrastructures for road transport, electric power distribution, and other utilities essential to the normal operation of electronic communications networks and services. 12. **Trade barriers** This includes any trade barriers or specific trade tariffs (generally or related to the sector), ownership restrictions, profit repatriation, currency risks. 13. **Political stability, security, criminality, terrorism** This relates to any aspect that threatens your overall presence in the country from danger to life and personal safety or the overall climate of adherence to rule-of-law and the general level of criminal threats against businesses, residents and visitors. 14. **Corruption generally or in any aspect of operations** This relates to the likelihood of corruption affecting investments or operations, either through the taking of bribes in return for specific assistance or through systemic corruption applied generally in contravention of relevant laws and regulations. **Any other aspects that are not mentioned above** A section where the respondent can add any other investment related risk factor not covered above, including a view that one of the above factors is overriding in their decision whether or not to invest.	
For each factor (market attractiveness plus the 14 potential risk factors), a rating is given by choosing one of the following categories: • Positively encourages investment • Does not deter investment • Mildly deters investment • Strongly deters investment • No opinion.	100% Total weighting

Progress towards the adoption of best practice

An additional part of the survey concerns the levels of confidence that respondents have regarding the country's movement towards the adoption of best practices for the sector.

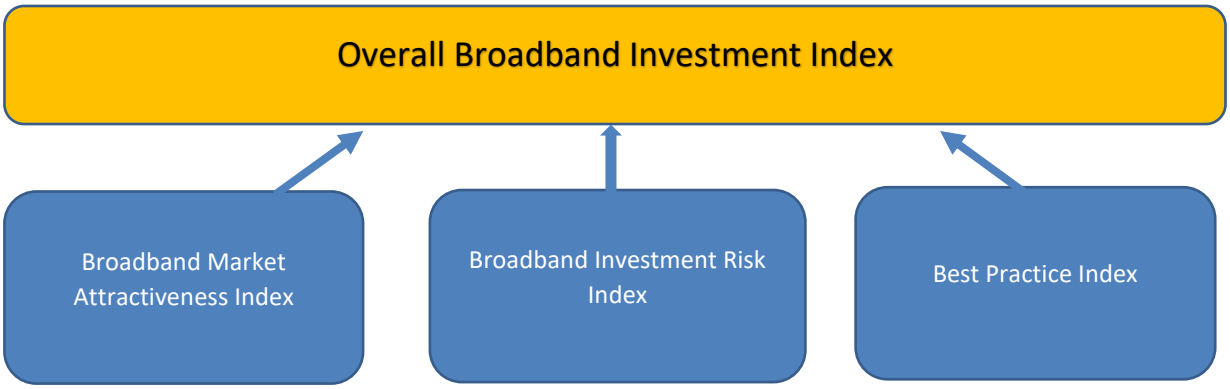
Survey factor	Components
Confidence in moving towards best practice	Respondents are asked to rate the confidence that they place on the country's policy makers/regulators etc. being motivated and able to improve towards implementing best practice conditions for investors.

The level of confidence is measured by choosing one of the following categories:

- Very confident
- It could happen within reasonable time
- Some doubts that it will happen at all
- Strong doubts / Unlikely ever to happen
- No opinion

The methodology for calculating the overall Broadband Investment Risk index

The main index proposed for the overall comparison of markets is the Overall Broadband Investment Index. Its calculation combines the results of three sub-indexes, the Broadband Market Attractiveness Index, the Broadband Investment Risk Index and the Best Practice Index.



The Overall Broadband Investment Index therefore seeks to measure factors associated with the attractiveness of the market, the perceived barriers to investing in that market and the potential for the country to improve the investment climate by removing the barriers.

The resulting Index is normalised so that the maximum possible value is 100 and the minimum value is zero. The ranking of markets according to their Overall Broadband Investment Index will therefore show which markets are perceived more positively or less positively by respondents.

Component Index 1: Calculating the Broadband Market Attractiveness Index for each country

The Broadband Market Attractiveness Index for each country is calculated from the average of responses to a specific question: *"For the types of investment that you are involved in - what is your view, for each country, of the overall market potential, regardless of the investment conditions there?"*

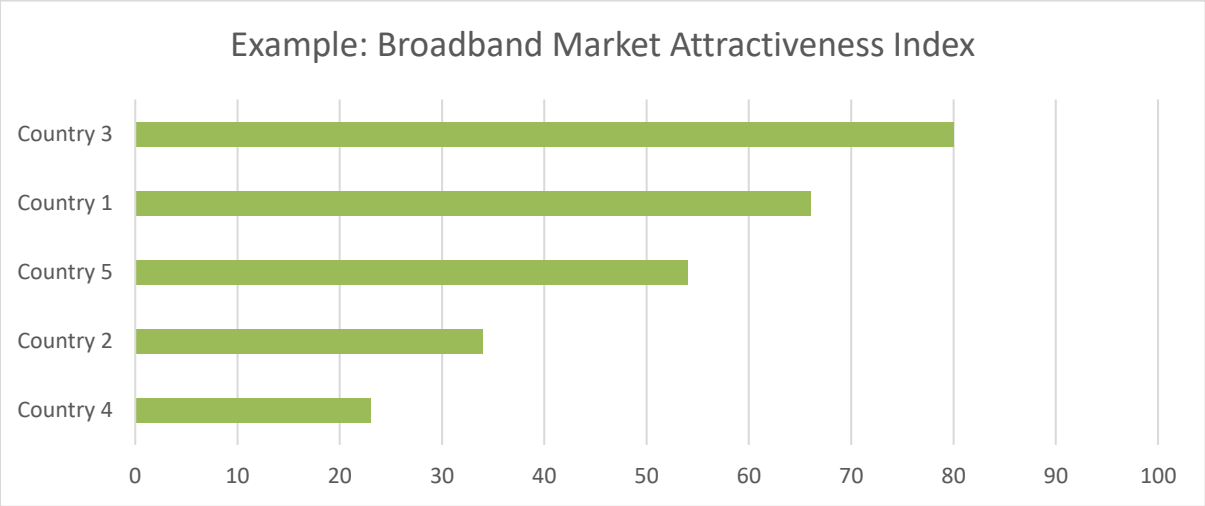
The responses are placed into one of five possible categories:

- Positively encourages investment
- Does not deter investment
- Mildly deters investment

- Strongly deters investment
- No opinion.

The average result for each country is calculated by adding the total scores from all responses for that country and dividing by the number of responses.

The resulting Index is normalised so that the maximum possible value is 100 and the minimum value is zero. The ranking of markets according to their Broadband Market Attractiveness Index will therefore show which markets are perceived by respondents to have the most intrinsically attractive markets and which are less attractive.



On the comparative scale, zero would indicate a perception that the broadband market has no attraction. A score of 100 would indicate a perception that the market potential is perfect.

Component Index 2: Calculating the Broadband Investment Risk Index for each country

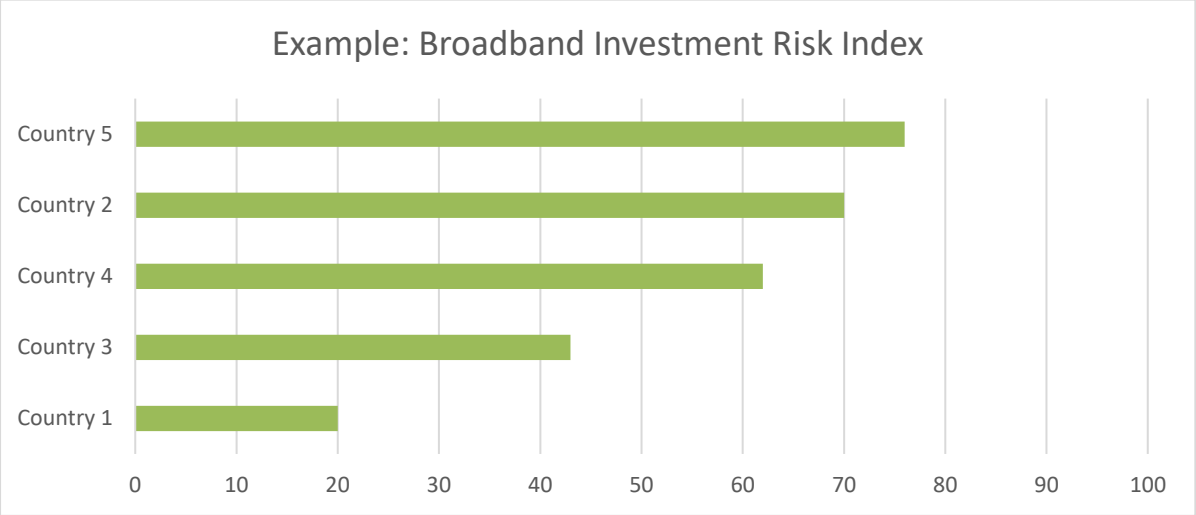
The Broadband Investment Risk Index for each country is calculated from the average of responses to a section of the questionnaire which lists 14 relevant investment risk factors. For each factor in turn, the respondent is asked *"In this part, we go through a list of 14 factors, which could influence investment decisions in each country. Please give your view separately for each listed factor and for each country."*

The responses are placed, for each of the 14 factors in turn, into one of five possible categories:

- Positively encourages investment
- Does not deter investment
- Mildly deters investment
- Strongly deters investment
- No opinion.

The average result for each country is calculated by adding the total scores from all responses from all 14 questions for that country and dividing by the number of responses to all questions.

The resulting Index is normalised so that the maximum possible value is 100 and the minimum value is zero. The ranking of markets according to their Broadband Investment Risk Index will therefore show which markets are perceived by respondents to be the least intrinsically risky and which markets have most risk.



On the comparative scale, zero would indicate a perception that the broadband market has no enabling policy or has other absolute barriers and risks to investment. A score of 100 would indicate a perception that the full implementation of policies, legal and regulatory frameworks and other enabling conditions are already in place leaving no barriers or risks to investment.

Component Index 3: Calculation of the Best Practice Index for each country

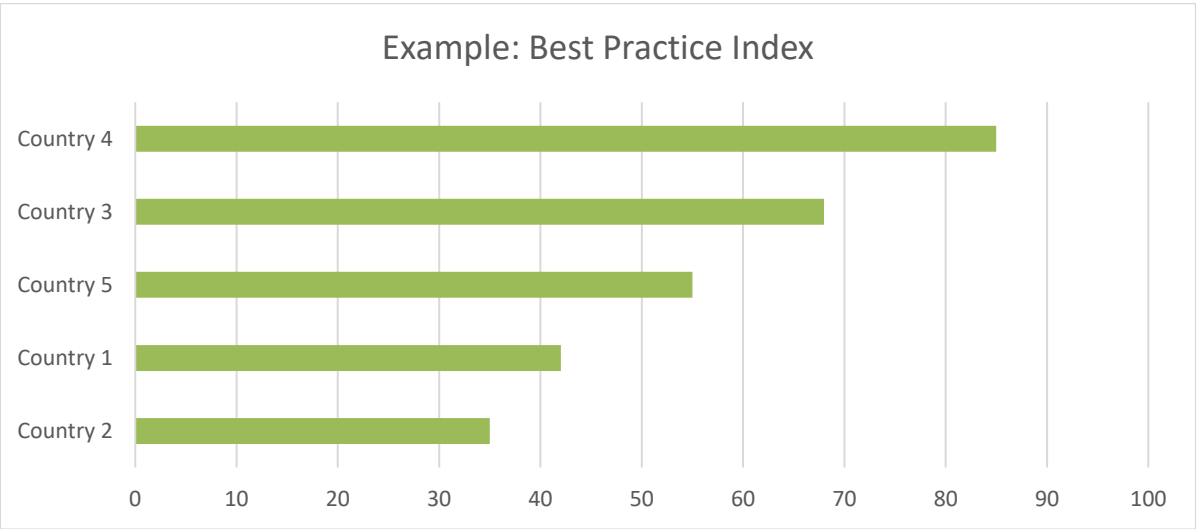
The Best Practice Index is calculated by using the responses to the specific question: *"Please rate the confidence that you place on the country's policy makers/regulators etc. being motivated and able to improve towards implementing best practice conditions for investors."*

The responses are placed into one of five possible categories:

- Strong doubts / unlikely ever to happen
- Some doubts that it will happen at all
- It could happen within reasonable time
- Very confident
- No opinion

The average result for each country is calculated by adding the total scores from all responses and dividing by the number of responses to all questions.

The resulting Index is normalised so that the maximum possible value is 100 and the minimum value is zero. The ranking of markets according to their Best Practice Risk Index will therefore show which markets are perceived by respondents to be more likely to move towards better conditions and which are less likely.



A value of zero would indicate that the country has no best practices relating to broadband investment conditions. A score of 100 would indicate that the country has already adopted all relevant best practices.

Calculation of the Overall Broadband Investment Index for each country

The Overall Broadband Investment Index (BII)c for a country is a composite index that combines the Broadband Market Attractiveness Index (MAI)c, the Broadband Investment Risk Index (IRI)c and the Best Practice Index (BPI)c for the country, according to the formula:

(BII)c = 0.67 x [Wm x (MAI)c + Wr x (IRI)c] + 0.33 x BPIc

Where,

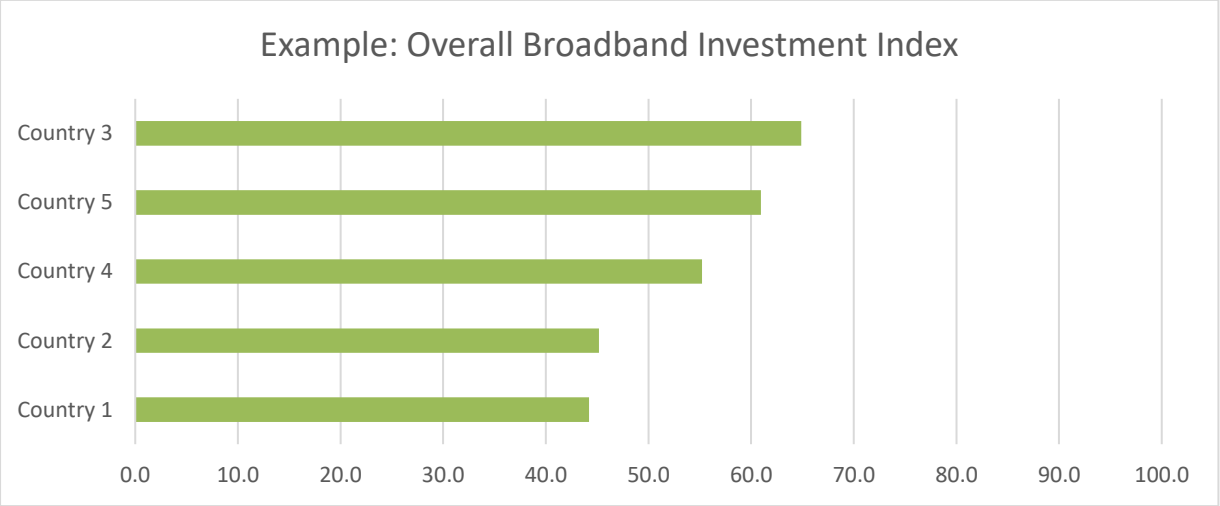
Wm= weighting applied to the Broadband Market Attractiveness Index (MAI)c for the country

Wr= weighting applied to the Broadband Investment Risk Index (IRI)c for the country

BPIc = Best Practice Index for the country

And Wm + Wr = 1

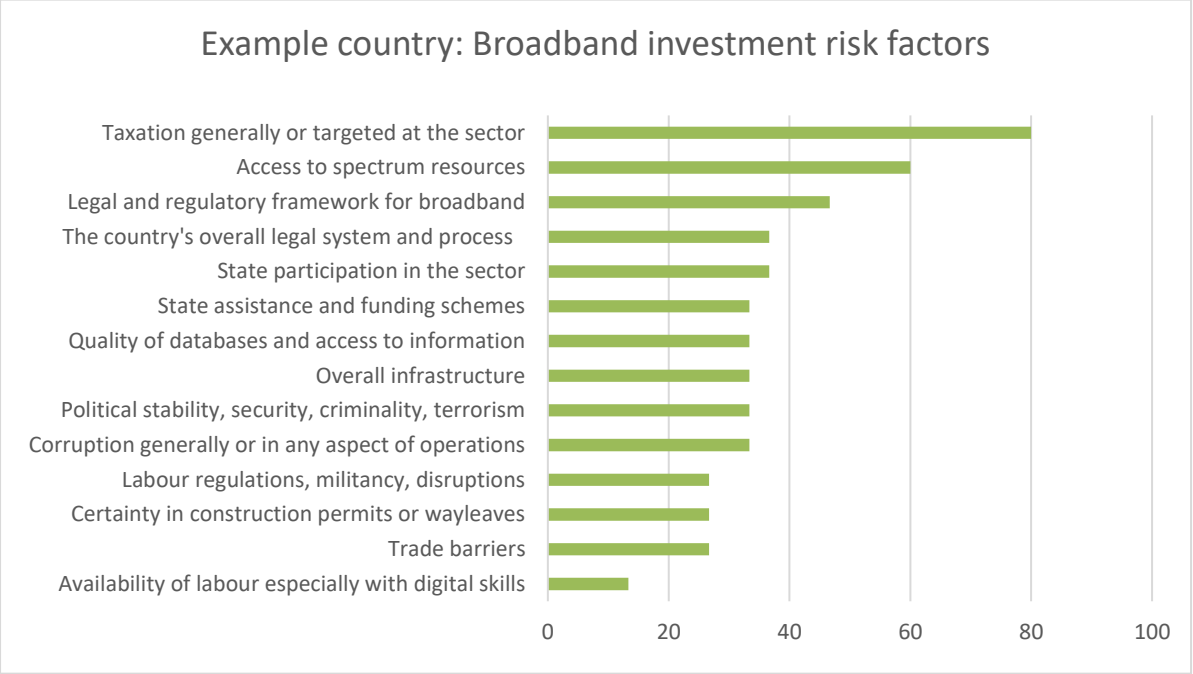
The values of Wm and Wr are derived directly from the aggregated results (average of all respondents for all markets) to a specific question in the survey. Respondents are asked to judge how much relative weight that they place on pure market attractiveness factors on the one hand and investment risk factors on the other hand. For the EEC markets, Wm has a calculated value of 63% and Wr is 37%.



On the comparative scale, zero would indicate a perception that the investment climate is very poor. A score of 100 would indicate a perception that the overall conditions are perfect for investment.

The above example results show that Country 3 has the best conditions for broadband infrastructure investment, despite there being relatively worse perception of the risks involved for Country 3. Country 5, despite being perceived as less attractive in pure market terms, has the best risk profile and reasonable potential to adopt best practices. Country 4 has the lowest market attractiveness but there is good confidence that it will soon adopt best practices. Countries 1 and 2 are relatively unattractive.

The next step is to reveal the factors that most significantly influence the investment risk in each country and therefore to indicate the key areas of policy that need to be tackled in order to improve investment conditions. This important result as obtained by ranking the responses to the 14 factors that make up the Broadband Investment Risk Index.



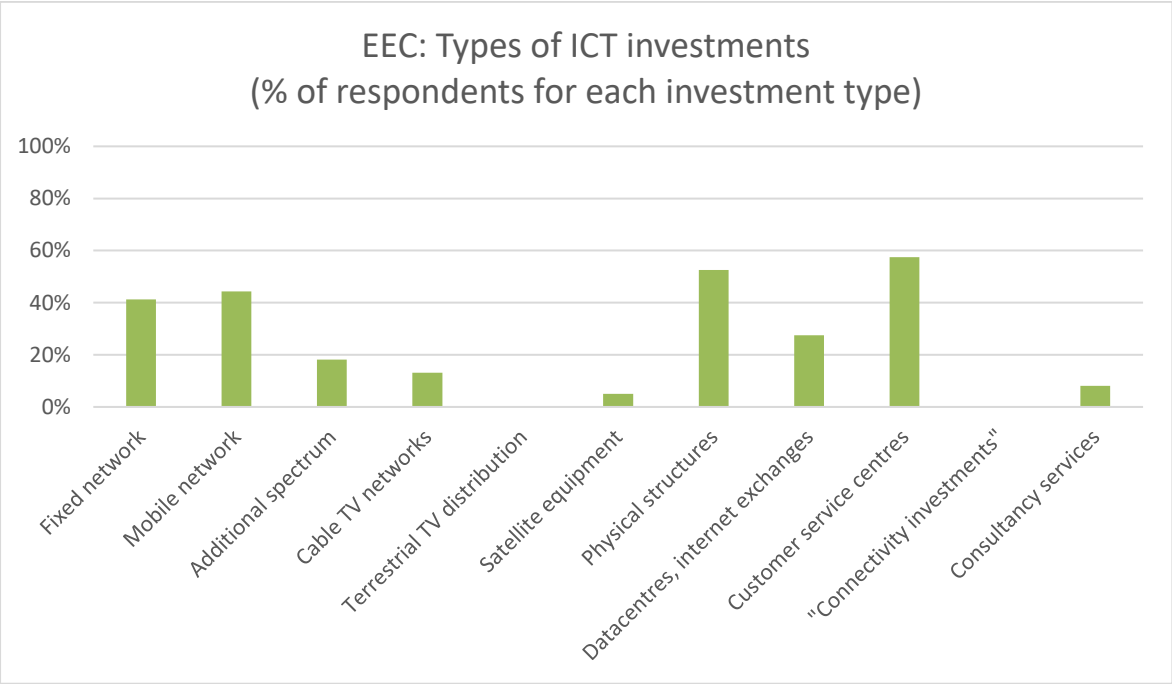
A score of zero for any factor would indicate that the factor has no influence at all on investment decisions, a maximum score of 100 would indicate that the risk associated with the factor is so high that it completely puts off any investment.

In this example, the three priority factors that most hinder investments are high taxation on the sector, poor spectrum access and limitations in the legal and regulatory framework. The remaining factors, although contributing to the overall investment conditions, are less important in the eyes of the respondents.

3: SURVEY RESULTS

Types of investments

The respondents to the survey covered a range of investment types in the ICT market, from fixed and mobile networks through to customer services centres and consultancy services.



Most respondents are involved in operating either fixed or mobile networks including basic voice, internet, and broadband services. An increasing number of operators are now offering both fixed and mobile broadband services.

The main broadband market demand over the last ten years has been skewed toward mobile rather than fixed network services. On average, the take-up of mobile broadband in the four EEC markets outnumber fixed broadband by over three to one. In the EEC region, fixed broadband market is forecast to grow in the medium term at less than half the rate of mobile broadband growth.

Infrastructure assets include the sector specific cabling and switching equipment, almost all of which is imported to the markets surveyed, plus the physical infrastructures - mainly buildings, ducts and towers plus customer service centres (including retail shops). The specific investments in TV networks, including cable and terrestrial distribution plus satellite communications equipment, have become limited to specialist players.

Most major network players still prefer owning their own fixed and mobile infrastructures, rather than renting capacity from other infrastructure owners, or sharing infrastructures with their competitors. The extent of infrastructure sharing, or joint investments, is still very limited even though these forms of collaboration would lead to significant cost reductions. Investors in the region have in the past followed the prevailing opinion in many telecommunications markets that the pursuit of market share (favouring own-network investments) outweighs cost reduction (favouring joint investments and infrastructure sharing). However, some collaborative cost sharing initiatives have appeared, mostly amongst the more established operators. There appears to be a more positive attitude towards infrastructure and network sharing in the lead up to future investment decisions regarding 5G.

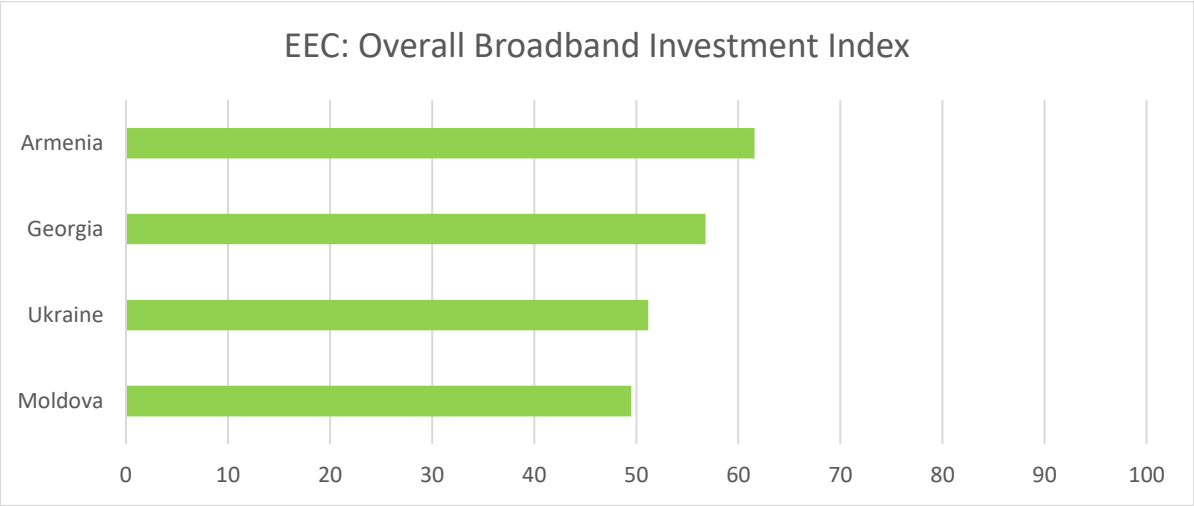
Of growing importance in a market now dominated by broadband services are investments in data centres, which include storage capacity for the fast-growing use of “cloud” services. Data services growth has risen very sharply in all markets, as the number of internet users (ranging from 59% of the population in Ukraine

to 76% in Moldova) increases. Consumer appetite for higher broadband speeds continues to develop as 4G mobile services are being deployed and fixed broadband infrastructures grow.

There is interest in additional spectrum investments, although still mostly limited to 4G growth. The investment appetite remains low for the expected future demand for a range of new business models linked to 5G connectivity – for example smart cities, vertical industry sector partnerships, logistics, content, data analytics and the "Internet of Things". Mobile service providers in the EEC markets are currently mainly concerned with achieving returns from their existing investments in 3G and 4G infrastructures. Commercial 5G-based services are expected to be launched only in 2022 or 2023.

Overall respondent perception

The overall Broadband Investment Index result for the EEC markets is shown below.



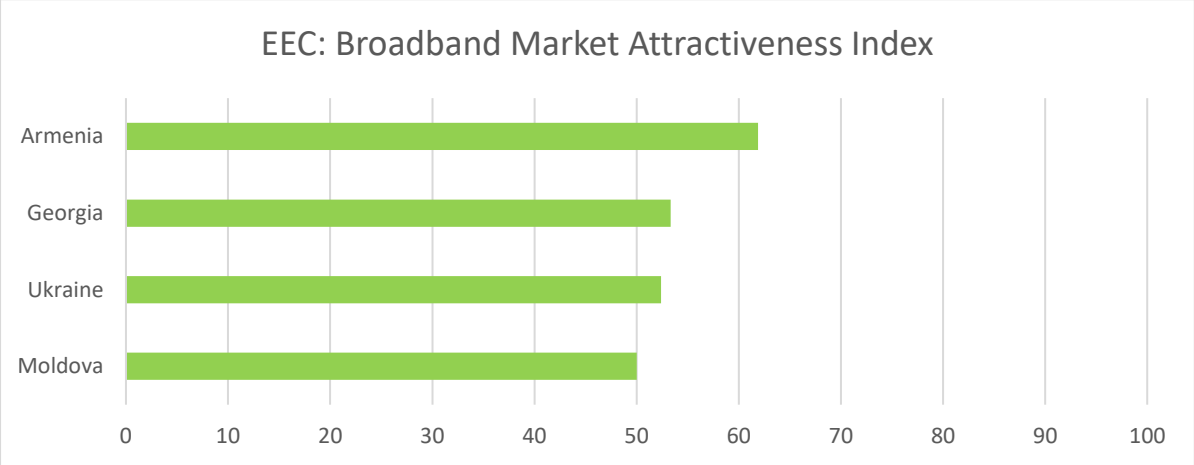
On the comparative scale, zero would indicate a perception that the investment climate is very poor. A score of 100 would indicate a perception that the overall conditions are perfect for investment.

The chart shows that in the EEC markets, the investment conditions are less than what respondents would ideally wish for. To examine the reasons, the following paragraphs highlight the factors that contribute most to the overall results.

The Overall Broadband Investment Index has been calculated from several components; market attractiveness, investment risk and confidence towards adopting best practices. The full list of component factors and the calculation methodology for each index are detailed in section 2 of this report.

Market attractiveness

The Market Attractiveness Index result for the SEE markets surveyed is shown below.



On the comparative scale, zero would indicate a perception that the broadband market has no attraction. A score of 100 would indicate a perception that the market potential is perfect.

Based on the respondents' views, Armenia is the most attractive of the EEC broadband markets and Moldova is the least attractive. For this component of the survey, participants were asked to rate only the pure market potential, disregarding initially any investment risk factors, which are subsequently taken into account in a separate analysis that is also based on the views expressed. Both the market attractiveness and the risk factors are combined to calculate the overall Broadband Investment Index.

The main benchmark indicators of the ICT markets in the four EEC countries are shown below.

EEC market headlines

	Armenia	Georgia	Moldova	Ukraine
Population	3.0m	4.0m	4.0m	42m
Penetration of fixed broadband/100 population	13	24	17	16
Penetration of mobile broadband/100 population	83	80	59	47
% of population using the internet	68%	69%	76%	63%
Average download speed per fixed broadband user (Mbps): The global average is 105.2Mbps	34.6	26.8	123	70.1
Average download speed per mobile broadband user (Mbps): The global average is 54.5Mbps	30.5	38.3	40.4	30.3
Forecast overall broadband market growth up to 2024 (% compound growth p.a.)	6.5%	5.3%	3.9%	7.3%

[Sources: UN, ITU, Speedtest Global Index, Fitch Solutions]

Ukraine is the largest market in population terms and is also forecast to be the fastest growing market mainly from mobile broadband services, having made a late start in launching 3G and 4G services. Armenia and Georgia also have reasonable fixed and mobile broadband market growth rates. The lowest forecast growth rate is in Moldova, where the mobile broadband market is saturating, and fixed broadband growth remains sluggish.

The main features of each market are:

- **Armenia** is the smallest market in population terms and has the highest mobile broadband penetration alongside the lowest fixed broadband penetration. Forecast growth is 6.7% per annum up to 2024 for mobile broadband and 4.3% for fixed broadband. Average download speeds are still relatively low.
- **Georgia** is a relatively small market in population terms but already has a relatively high penetration of fixed and mobile broadband. Mobile broadband is expected to grow at 5.6% per annum and fixed broadband at 4.2% per annum. Average broadband download speeds are still relatively low.
- **Moldova** is a relatively small market with relatively low fixed and mobile broadband penetration. Mobile broadband is forecast to grow at 4.1% per annum up to 2024 and fixed broadband at only 3.2%. Internet usage is well established and download speeds are the highest in the region, particularly for fixed broadband.
- **Ukraine** is the largest market but the lowest broadband penetration. It has the highest forecast for overall broadband growth estimated at 7.3% per annum up to 2024. Mobile broadband is expected to grow strongly at 8.7% per annum, but fixed broadband growth will remain low (estimated at 3.2% per annum) until the legal and regulatory framework is improved. The relatively high fixed broadband download speeds reflect the high percentage of fibre now being deployed to replace copper cabling of poor quality.

EEC markets: Market attractiveness factors

Market attractiveness factors	Armenia	Georgia	Moldova	Ukraine
Overall size of the market, in population terms and relative spending power	👎	👎	👎	👎
Growth potential of the market, in terms of demand for broadband-services	👍	👍	👎	👍
Efficiency of the markets in terms of fair competitive conditions	👍	👎	👎	👎
A clear national ICT market strategy for the country with stated ambitions and goals, for example targets for broadband coverage and take-up	👎	👎	👎	👎

👍 - Good / 👎 - Medium / 👎 - Poor

Investment risk factors

The survey sought views on a number of factors relating to sector investment risks. These factors ranged from the general and specific policy, legal and regulatory frameworks that apply to sector investments, public sector participation, the availability of digital labour skills, the procedures for granting construction and rights of way permits, overall supporting infrastructures, overall political stability and levels of corruption. A more detailed description of these risk factors is given in section 2 of this report.

Respondents were asked how important these risk factors were in their investment decision making, alongside the pull of market attractiveness. The results across a wide range of respondents gave an average relative weighting:

Balance of factors in deciding investment in a country

Respondents were asked to assess the relative weighting that market and risk factors hold when deciding to invest in a country. The results were:

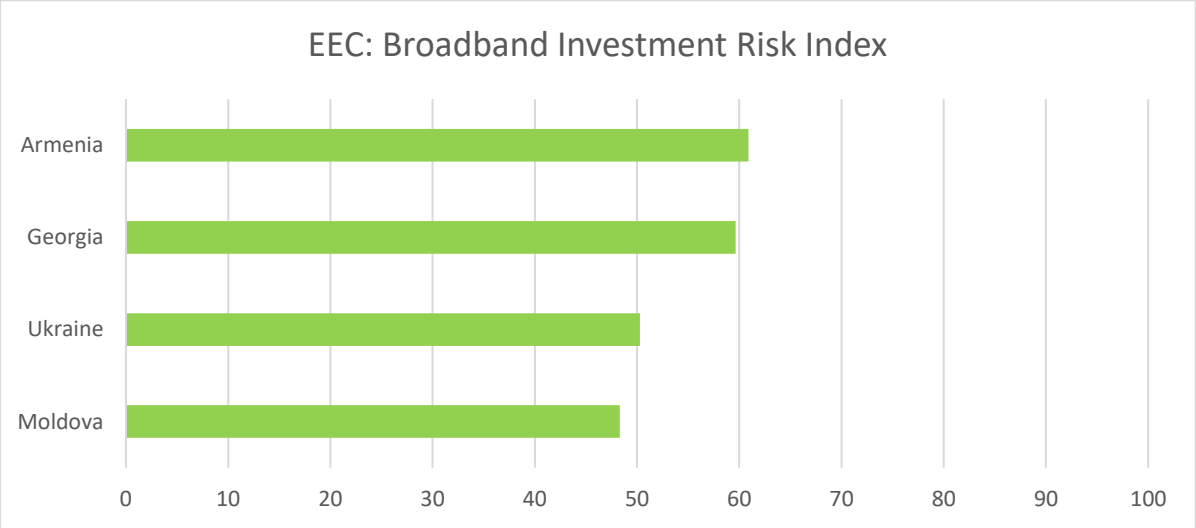
***Pure market potential**: Average response 63%*

***Investment-related risk factors**: Average response 37%*

Taken together, the various investment-related risk factors are therefore a key element (37%) in the decision making of respondents in broadband markets. The country-by-country results are given later in this section, leading to the identification of the most important risks facing respondents in each country.

Actions to reduce these investment-related risks are largely in the hands of policy and lawmakers in each market, alongside the regulatory and other agencies charged with implementation of the policy and legal frameworks. The findings of the survey have enabled the measurement of the perceived risk faced by respondents, leading to an identification of the key policy and improvement challenges that need to be worked on to remove the obstacles that create the investment risks.

The measurement of these perceived risks has led to the calculation of a Broadband Investment Risk Index for each market.



On the comparative scale, zero would indicate a perception that the broadband market has no enabling policy or has other absolute barriers or risks to investment. A score of 100 would indicate a perception that the full implementation of policies, legal and regulatory frameworks and other enabling conditions are already in place leaving no barriers or risks to investment.

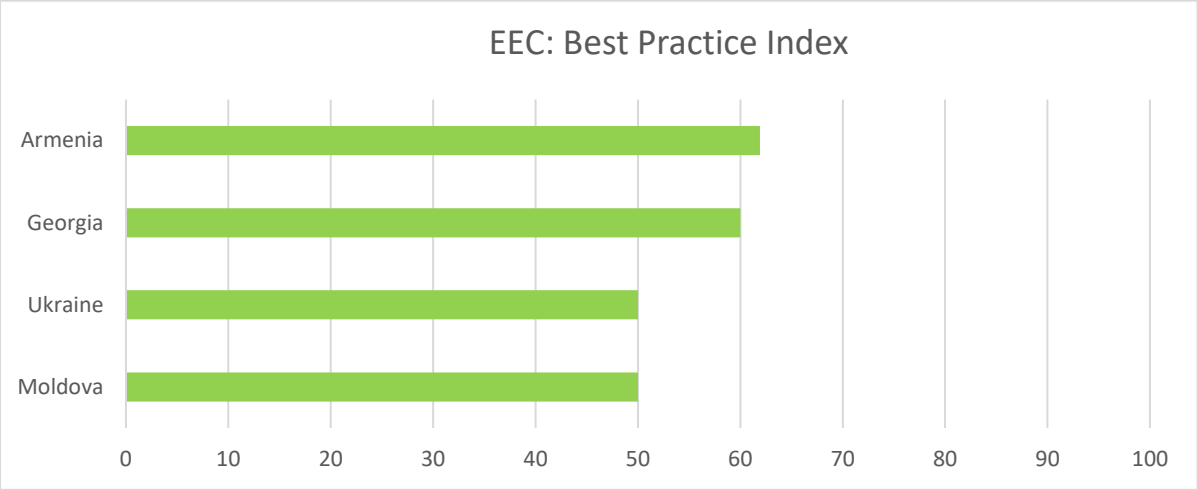
All the four EEC markets surveyed fall short of implementing polices, legal and regulatory frameworks that would facilitate investments without barriers. The main obstacles are explored country-by-country later in this section. Armenia was perceived by respondents as having the fewest barriers overall, followed closely by Georgia. Ukraine and Moldova and have sought to adopt best practices in their policy, legal and regulatory frameworks, but implementation has been slower and significant investment uncertainties remain.

The investment risks present in each market, as perceived by the survey respondents, are analysed in more detail in the country-by-country results later in this section.

Confidence in adopting best practices

The survey has measured the perceived risks associated with broadband investments, in the view of the respondents. These risks exist today but could be reduced significantly given action by policy and law makers together with the sector regulatory agencies.

The survey asked respondents how confident they were about whether best practices will be adopted to reduce investment barriers within a reasonable timescale. The range of concerns regarding best practices for the sector is wide, from perceptions of slow progress on market liberalisation and privatisation, through to comments regarding specific procedures that can delay individual investment decisions. For example, the survey participants were generally aware that there are a set of best practices regarding broadband cost reduction that are now legally defined and apply across EU member states. These measures include a range of procedures for joint construction, infrastructure sharing, access to multi-occupancy buildings and rights of way over public and private property. These best practices are especially important to broadband infrastructure investors because they can reduce costs and remove significant procedural barriers.



A value of zero would indicate that the country has no best practices relating to broadband investment conditions. A score of 100 would indicate that the country has already adopted all relevant best practices.

All the EEC markets surveyed have problems in the adoption of best practices, creating significant barriers to investments including time delays and inconsistently applied procedures. The most common concerns expressed in the survey involve the updating of the legal and regulatory frameworks to take account of new technologies, new competitive market conditions and applying the rule of law. Specific cases include the need to move quickly towards a more liberalised and transparent approach for releasing new spectrum capacity, greater opportunities for infrastructure access and network sharing, protection against unfair competition and the creation of more effective and less time-consuming procedures.

A specific set of procedural issues are frequently mentioned by the survey participants, particularly in Georgia, Moldova and Ukraine. These concern the problems experienced by investors in obtaining permissions for constructing civil infrastructures. Generally, permission is required before building mobile transmission towers, laying cables and ducts, getting access to public and private properties and for installing specialist equipment. In many cases there are bureaucratic delays, multiple levels of decision making and inconsistently applied rules.

Best practice would be in place if the necessary applications could be made on-line via a one-stop-shop procedure, with all the layers of permission granting following the same effective procedures and timescales.

Another factor that impinges on investor perception of best practice is the emergence in all four countries of small local internet service providers. Many of these are less likely to adhere to the rules set out in the legal and regulatory framework, for example in relation to quality standards and in relation to general cooperation on infrastructure access. Many respondents consider these small local entities as unfair competition, especially when the overall legal and regulatory processes are themselves not sufficiently backed up by effective legal enforcement and dispute resolution procedures.

The findings of the survey reflect a common experience over the passage towards a more liberalised and competitive era for telecommunications and internet services. Both incumbents and new network providers have invested heavily in response to significant increases in demand, especially for broadband services. Investment strategies have generally resulted in the construction and expansion of separate infrastructures,

with each fixed and mobile operator seeking to roll-out networks under their own control to gain competitive advantage.

Where options for infrastructure sharing, wholesale access and joint construction may have been considered in the past, they are normally not followed, either because the regulatory conditions are insufficiently clear or enforced, or because the investors wish to retain full control of their planning and asset management. In addition to the extra costs involved, these separate infrastructures appear as duplicated structures, for example separate masts in the same locations, multiple duct laying disruptions, and unsightly aerial cabling.

From the latest survey responses, it appears that there is now a general realisation amongst investors that new models of investment requiring more collaboration should now be considered, in order to reduce unit costs and protect investment returns. There is a parallel view that the sector's legal and regulatory frameworks will need to adapt in the expectation of this trend, especially in the lead up to investment decisions based on 5G technology and the increasing roll-out of optical fibre connectivity.

Overall, Armenia and Georgia are the markets where there is most confidence that best practice policies, legislation and regulatory practices will be applied to the sector. In Moldova and Ukraine, although the general direction of policy, legislation and regulation remains towards better practice, the relatively slow progress with implementation has led to a lower level of investor confidence.

The following country-by-country sections examine the main investment barriers across the EEC region, leading to the recommendations provided in section 4 of this report.

MOLDOVA

At a glance

Headline market statistics - Moldova	2016 survey	current
Population (millions)	4.1	4.0
Fixed broadband penetration per 100 population	16	17
Mobile broadband penetration per 100 population	52	59
Internet usage (% of population)	50%	76%
Forecast overall broadband market growth up to 2024 (% compound growth per annum)	3.9%	

[Sources: UN, ITU, Fitch Solutions]

Moldova has a relatively small and declining population. Growth in the market is forecast at 4.1% per annum up until 2024 for mobile broadband and only 3.2% for fixed broadband, both are below the average for the EEC region. Geographical areas outside the three main population centres remain relatively underserved, particularly with fixed broadband connectivity.

Survey results

Moldova	Rating	EEC average	EEC Ranking
Broadband Market Attractiveness Index/100	50	54	4th
Broadband Investment Risk Index/100	48	55	4th
Best Practice Index/100	50	55	4th
Overall Broadband Investment Index/100	50	55	4th

In general, an index above 50/100 indicates a relatively a good market for broadband investments.

The survey results show that Moldova is perceived overall to be the least attractive broadband investment market of the four EEC countries surveyed. The three component indexes for market attractiveness, investment risk and best practice all show below average conditions.

What respondents are saying about the market

Market size and potential

"The market in Moldova is already saturated with operators and with a declining population."

"Demographic changes mean that it's difficult to make investment decisions."

"There is little untapped potential in the rural areas to justify investments there."

"There is little private sector justification to push the infrastructure into rural areas."

"Operators are not too interested to invest in rural areas."

"Investment in ICT Business parks with some public money is a better model."

"Moldova has a reduced salary tax structure in place for employees of ICT companies. This has been a major incentive for the development of the sector.

"The state has indirectly supported development of ICT parks and similar initiatives for a digital society."

"There is little prospect of a viable 5G business model yet. The operators still have to make money on 4G."

"Optical fibre backbones are present all round, with little scope for further investments."

"The investment opportunities in Moldova are in value-added services as opposed to infrastructure."

"Moldova's growing ICT sector needs to expand into higher margin services."

Current market conditions

"Moldova has comparatively advanced levels of broadband services and internet speeds."

"Consolidation is the most significant factor in the last four years, and we could see further acquisitions."

"There is an ongoing struggle to continue developing the sector."

"There is huge population shift to urban areas, people are leaving rural areas."

"Many of our rural sites are a burden now, they are not profitable, but they have to be there because of our licence obligations."

"The main factor driving investment decisions is the relatively poor overall economic level of the country."

"Mobile 4G investments have not yet seen a return on investments."

"Broadband services are a really good price deal for consumers."

"The pre-existing networks inherited by today's entities were demanding for operators."

"A new entrant to the market would have to 'steal' subscribers from an existing operator."

"Network expansion by an existing operator would also encounter existing operator(s) in any geographic expansion."

"The market is segmented – there is competition in urban areas so the focus should now be on rural expansion."

"There is already a map available showing where the mobile operators are – this should be developed to include more on the quality and price of services for consumers."

"There is fierce competition so now the operators are looking for convergent services covering fixed and mobile broadband."

"The fixed broadband market is very strong, but the last mile cost is very high."

"New investment is shifting to fixed broadband but there are some low cost and low quality 'roof to roof' methods of provision, rather than good quality investments."

"'Roof-to-roof' fixed broadband distribution suffers in bad weather and heavy snow – the trees come down and the service is lost."

The overall strategy for the sector

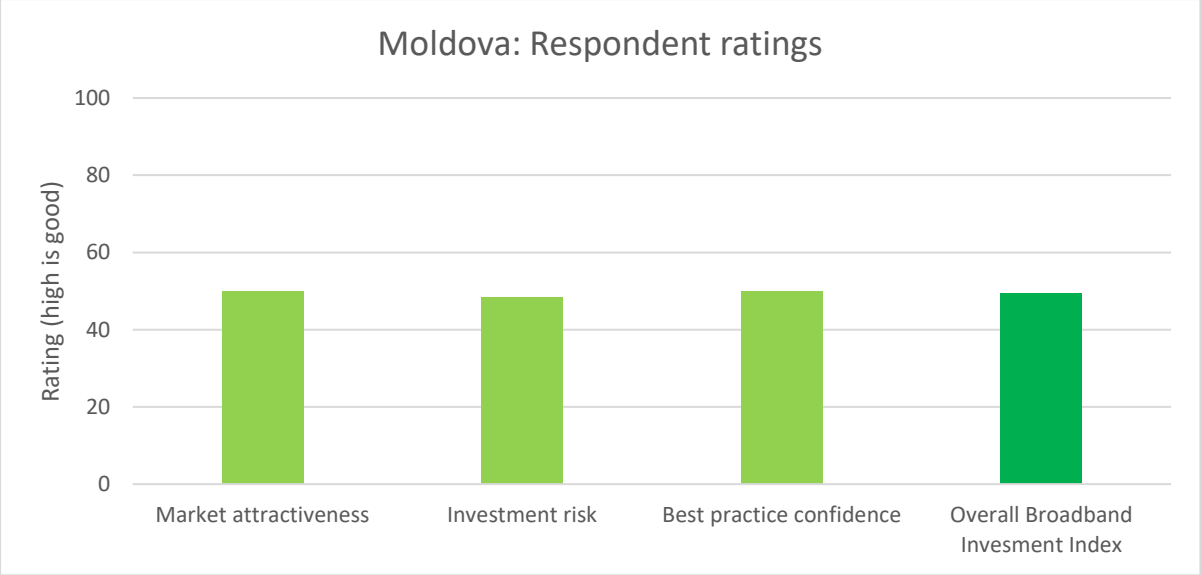
"Moldova has actively encouraged the development of the ICT sector with regulatory development, investment attraction and support for industry initiatives."

"Government programmes have been quite successful and have resulted in significant growth in the ICT sector."

"The digital TV switchover never happened, there were too many competing interests."

"There is a draft law intended to impose some ownership restrictions on critical infrastructure, which includes broadband infrastructure. The restrictions are generally intended to ensure trust in the investors acquiring pieces of critical infrastructure in Moldova."

"The Digital Roadmap in response to COVID-19 was pushed by the ICT sector, focussing on digitisation, eCommerce and solving issues."



The overall Broadband Investment Index (right hand pillar) is calculated from the three indexes represented by the first three pillars. The full calculation methodology is given in section 2 of this report. For each pillar, the higher the score, the better the conditions are.

Moldova has only a medium score for market attractiveness and best practice confidence. Investment risk is considered medium, as measured by the broadband investment risk index. The top concerns are political stability and corruption, legal and regulatory issues, the role of the state in the sector and insufficient digital skills. Other investment risks are relatively low in Moldova, including trade barriers and labour regulations.

The overall index of broadband investment Index rates Moldova as the least-best investment climate of the four EEC countries surveyed.

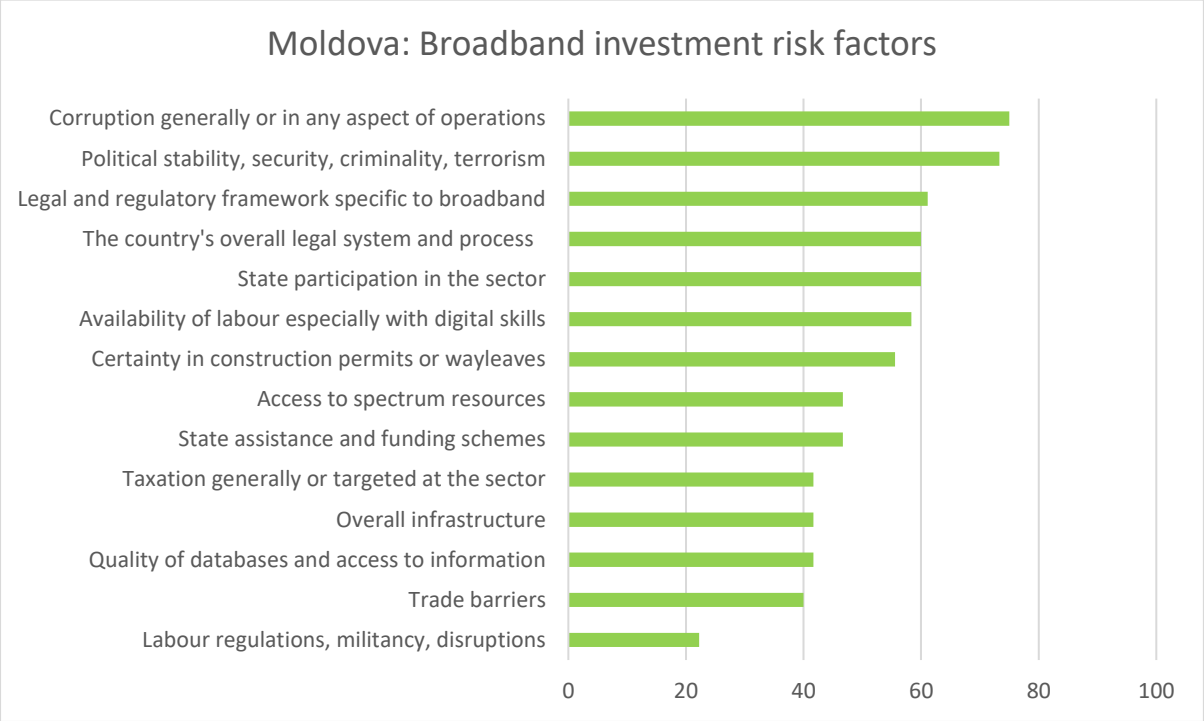
More detail regarding the main investor concerns is given in their comments below.

Respondent views

The survey considered 14 factors related to investment in ICT infrastructure. A description of these factors is given in section 2 of this report. Respondents were asked to express their view on whether the conditions for investment are affected by each factor in any of the following ways:

- Positively encourages investment
- Does not deter investment
- Mildly deters investment
- Strongly deters investment
- No opinion.

By assigning relative scores normalised to a scale of zero to 100, each factor has been ranked in terms of how much it contributes to investment risk.



A score of zero would indicate that the factor has no influence at all on investment decisions, a maximum score of 100 would indicate that the risk associated with the factor is so high that it completely puts off any investment.

Respondents perceive that issues related to political stability and corruption contribute the most risk to broadband investments. The associated legal and regulatory risks generally and as applied to the sector, also contribute significantly to the risks faced by investors. Parallel concerns are the perceived power of state-owned Moldtelecom to distort competition, the difficulties in recruiting staff with digital skills and the inconsistencies with obtaining permission to install infrastructure.

Other factors, including spectrum granting and taxation contribute less to investment risks.

The following comments give more details of the specific concerns of investors.

Political stability and corruption

How respondents expressed views about political stability and corruption in Moldova

"Moldova's greatest deterrent is the corrupt or non-independent judiciary. Investors are rightly concerned that their businesses and investments will not be protected."

"Access to inter-urban infrastructure, such as alongside the railroad, is not regulated and is a point for corruption."

"Moldova's political instability generally affects investments as well as the trust in the justice system."

"There are challenges for the business climate related to bribes and corruption, involving state authorities."

"Political instability continues to be a problem for Moldova and a deterrent to investment."

"Moldova's business environment is one of the most challenging in the eastern European region and is undermined by pervasive public sector corruption, political instability and a burdensome regulatory environment."

"The main sectors affected by corruption are healthcare, procurement, the judiciary, law enforcement and customs."

"The telecommunications sector is more protected from acts of corruption."

"Ministry changes mean that every time there is a new team, there has to be a new dialogue."

"The political environment and its changes are a risk; we have to be careful with our investments and we need more stability."

"The ICT sector has one of the strongest voices with government in Moldova, but not all ministries see its importance."

"Because it is so small, Moldova has the potential to change course and develop rapidly. Slovakia, Slovenia and Georgia continue to be examples of what Moldova could achieve."

"Unfortunately, a political will currently does not exist to take the decisions and implement the measures that would be necessary to achieve economic successes."

Political instability and corruption issues were expressed as the top inhibitors to investments in the sector. Although these issues are raised by the sector players with the responsible ministries and the sector regulator, the frequent changes (there have been seven ministers responsible for the sector in the last ten years) are seen as adding greatly to the overall unpredictability and risk in making new investments in broadband infrastructure.

These significant concerns could be to some extent allayed by a more positive public stance generally toward the need for broadband investments to improve the overall growth of the economy, requiring a clear national strategy for digital connectivity and access to modern digital services.

Recommendations for improvement of digital awareness and investment promotion are given in Recommendations 1 and 2 in section 4 of this report.

The legal and regulatory framework for broadband

How respondents expressed their views on the legal and regulatory framework for broadband in Moldova

"For smaller operators we do not have symmetric regulations."

"The mobile companies have licence obligations to cover territory and major highways. But they did not comply and were found out."

"The regulations say that the number portability fee should be cost-based but in fact, the amount charged by is much higher than in other countries."

Critical infrastructure has been raised in government, to protect personal data, educational entities and companies doing government activities."

Infrastructure access

"The Ministry are preparing a 2021 - 2025 programme of legal changes including to improve the regulatory framework for sharing infrastructure including telecommunications and other utilities."

"There is always space for better sharing of infrastructure."

"There is now an agreement among the three mobile operators to share backbone national infrastructure, in order to avoid duplication."

"The mobile operators have now agreed mutually beneficial conditions for sharing infrastructure."

"We can get ducts and wholesale broadband bitstream access but the wholesale prices expected by Moldtelecom are very high and have not been revised for several years so there is not enough margin."

"Recent road improvements were done without planning for telecommunications cables and without underground conduits for fibre."

"We use the existing ducts for our backbone network and for distribution we use aerial cable on electricity and tram poles."

"Access to urban and inter-urban infrastructure is not regulated and this is a major impediment to investment in fixed infrastructure."

"For the backbone network, using our own fibre is the best solution."

"We rent fibre infrastructure to our competitors and we also buy from competitors. Infrastructure sharing works well in Moldova."

"Tower sharing is expensive and there is a risk - what you gain on cost you lose on revenue."

"Duct rental prices are still not regulated. You don't want to rent from Moldtelecom because that gives you a low margin and they could raise the price more."

During 2020, the Ministry of Economy and Infrastructure carried out a "gap analysis" to identify the actions necessary to bring Moldovan laws into line with the EU practices[16] with particular reference to the cost efficiency of broadband infrastructure. A number of ways to improve the legal and regulatory framework for broadband investments in Moldova[17] were recommended, including:

- Improving the sector regulator's enforcement powers
- A single information point
- Dispute settlement procedures
- Clear rights, procedures and prices of access to properties
- Access to the infrastructure of electronic communications network operators
- Coordination of civil works
- Streamlining authorisations and permits
- Improving in-building infrastructure and access

Further details of the EU's practices in ensuring that the legal and regulatory frameworks fully support broadband infrastructure investments are included in Recommendation 3 and 4 in section 4 of this report.

The overall legal system

How respondents expressed views about the overall legal system in Moldova

"The weak and non-independent judicial system continues to be the biggest deterrent to investment and poses a threat to Moldova's long-term potential for development across all sectors."

"The Ministry are planning to develop the law and to improve investments."

"Future mergers and acquisitions should be validated by the competition agency and also a special agency for critical infrastructure."

16 See https://ec.europa.eu/digital-single-market/en/cost-reduction-measures

17 See report "Gap Analysis MD Law 28 & Directive 2014/61/EU Analysis and Recommendations on Alignment" prepared by World Bank Group and the European Commission (June 2020)

"Moldova has joined several international investment protection agreements, but these tend to protect only foreign investors and are often cost-prohibitive for investments on the scale appropriate for Moldova."

"There is a law that gives free access for infrastructure on government buildings, but the building occupiers ask for money."

"With commercial laws in Moldova are still in need of modernisation, inadequacy of the legislative framework is one of the major factors contributing to the low quality of court judgments."

"Lack of a well-developed system of judicial education combined with judges' lack of experience with commercial law and practice is another major factor affecting the quality of judgments."

Investors in broadband infrastructure do not feel that the overall legal system sufficiently encourages or protects their investments. The existing measures are seen as too general and do not recognise the growing importance of the ICT sector to the economic development of the country. General consideration regarding overall commitment to the sector and the specific investment-enabling legal and regulatory framework for broadband are given in Recommendations 1 and 3 in section 4 of this report. Regarding the need for a special agency for critical infrastructures, network and cyber security aspects are further considered the Annex to this report.

State participation in the sector

How respondents expressed views about state participation in the ICT sector of Moldova

"The government wants to protect Moldtelecom, so they put barriers to new entrants, like raising the cost of duct access."

"A national wholesale network would have to be a separated entity from Moldtelecom to make it work - but this is a pipe dream."

"Historically, refusal to allow access to infrastructure has been one of Moldtelecom's strongest tools for anticompetitive activity."

The views expressed relate to the remaining state ownership of the incumbent telecommunications operator Moldtelecom. These views reflect that the objective for a fair and competitive market has not been fully achieved alongside the presence of a state-owned dominant market player.

The role of the state in its ownership of Moldtelecom is seen as an inhibitor to investment by the newer broadband providers. In the opinion of its competitors, Moldtelecom uses its market power to limit the growth of other networks and services. This is a general issue across all countries where the sector has typically developed from a single state-owned entity into a more liberalised competitive market. The protection of a state-owned telecommunications operator against privately-owned entrants into a competitive market could have a number of motives, including the need to protect public sector jobs and state revenues. In the European Union, only a few member states still retain some of ownership of telecommunications operators, but competitive markets have grown, along with overall sector jobs, new services and revenues[18]. The role of the state as an enabler to competition and investments under these conditions is examined further in Recommendation 5 in section 4 of this report.

[18] See https://link.springer.com/article/10.1007/s11151-019-09686-6

For a fully efficient investment market, a clear framework of sector policy is required, backed up by a modern legislative and regulatory framework for the sector. The components of the policy, legal and regulatory frameworks are further explored in Recommendations 1, 2 and 3 in section 4 of this report.

Skill shortages

How respondents expressed views about obtaining skilled staff in Moldova

"Overall, there is a shortage of qualified ICT professionals in Moldova - recruiting and retaining good people is a challenge."

"Moldova has high technical capability, but the problem is the loss of these skills due to emigration."

"Recruiting is a challenge, so we hire very fresh graduates and train them ourselves."

"We increased the pay to try to match European salaries."

"For the IT park project, the government have introduced salary advantages to the people who work there."

"The 'no salary tax' for ICT employees is a major encouragement for investment in the sector and has contributed to the overall development of the sector."

"The population that is skilled has already moved to the capital Chisinau, so the problem is mainly in the regions."

"Moldovan policy is towards a cheaper labour force to attract high tech companies, but salaries are not that small."

"In trying to reduce the brain drain, the effect is that the skilled people who remain start their own businesses, or the big multinationals cherry pick the best ones."

"Customer service and business management skills are generally available."

"The labour and skills required for network construction and operations are more challenging."

"The private sector tends to train and invest in the development of their own teams."

Although the government has introduced measures to improve the availability of skills for the ICT sector, the main problems as expressed by respondents appears to be the migration of workers with these skills towards higher salaries or other benefits from large companies with offices in the Moldova's capital city or to work abroad.

In 2017, the government introduced tax incentives for companies that locate in IT parks[19] including:

- A unified tax of 7% on income from sales (with the tax to include corporate income tax, personal income tax, social security, and health care contributions payable by both employers and employees, local taxes, property tax, and road fees).
- An exemption from customs duties and value-added tax for imported IT hardware needed to conduct business activities.

As a result, companies in the telecommunications sector (which do not benefit from these special tax concessions) find it difficult to attract employees with good ICT skills. The responses of the telecommunications sector have been to raise salaries to attract experienced staff and also to recruit inexperienced staff with potential and then provide in-house ICT skills training.

19 For details see also: https://www.roedl.com/insights/moldova-common-tax-it-sector

Other issues

How respondents express their views on other issues in Moldova

Obtaining permissions and wayleaves

"In the city most towers are on government buildings and access should be free according to the law. But the building occupiers ask for money."

"The municipality chiefs sometimes block access to buildings because it remains on local discretion."

"We have to get permissions from a number of institutions, including ministries, local government and householders. The process should be coordinated to encourage us to invest."

"The process of obtaining the necessary approvals for construction of infrastructure, is challenging when public institutions are involved."

"Simplified procedures governing modifications to existing infrastructure are being requested by the telecommunications operators."

"Other required approvals for physical construction or civil engineering works and the placing of plant on private land is generally accessible. There are challenges due to lack of cooperation in sharing infrastructure.

State assistance and funding schemes

"There is no effective instrument from the state budget. The universal service mechanism is not used to satisfy the real needs."

Access to spectrum and other government-controlled resources

"The arrangements to obtain spectrum and other state-controlled aspects are generally helpful to investments."

"There are general procedures used in frequency spectrum, numbering or any other types of networks and services licences or authorisations."

"Spectrum access is transparently done; the price is set and there is sector consultation."

"Spectrum prices have been high compared with revenues – we realise that the government needs the money."

"Mobile operators complained that pricing for new spectrum was not economically justifiable and that the pricing was not tied to market economics. However, both private mobile operators eventually bought 4G spectrum."

"The consultation has yet to happen on 5G but the question of high price for spectrum will be raised."

"5G in the future could be a good substitution product instead of fixed broadband."

"Spectrum is no problem."

"5G will be more complex and there is a risk that the government will push for high prices as they did with 4G, together with licence obligations."

"4G spectrum was overcharged immensely, given the expected low returns. The operators paid to stay in the market and not to upset the government."

"The prospect of the government making 5G spectrum available cheaply is not there. This is because there is a lack of strategic thinking."

"There is a budgetary shortfall, so any new spectrum will be at a high price."

"Low prices on spectrum might be seen as corruption."

Taxation and trade issues

"Taxation is the top issue we raise with the Economic Council.".

"There is a 2.5% tax on total mobile services turnover (a so-called "luxury tax" introduced in 2000 and paid into the Population Social Fund) plus a universal service contribution, portability fees and spectrum fees. These taxes total 30% of revenues."

"Mobile services are subject to a luxury tax, but today mobile services are not a luxury anymore; instead of investing in improvement of their operations, mobile operators are suffocated by irrelevant taxes."

"The copyright levy is 5% on ICT sector revenues, but this is based on vague laws and none of the money ever goes to the copyright holders."

"Internet service providers are not charged the copyright tax, so this is not fair on the other operators who are charged."

"Copyright tax has to be sorted."

"For imported equipment there is a large black market with no tax – for example smartphones at half the price, making it difficult to compete."

Access to information

"Much of the population statistics, disposable income etc. are either non-existent, out-dated or inaccurate."

"We have to rely on our own staff to collect information because the available statistical data is unreliable."

"The sector bears the costs related to the national statistics and in addition studies are funded by the companies when needed."

Labour regulations

"Labour unions are uncommon in Moldova's ICT sector and this is not a major consideration for investors."

"There have been several initiatives in recent years to reform the labour code with significant participation from the private sector."

The difficulties in obtaining permissions for placing infrastructure on government land and buildings appears to be a general concern. This could be improved by a strengthening of the legal basis and the streamlining of procedures for obtaining permits (see also Recommendation 4 in section 4 of this report).

If Moldova is to take full advantage of the expected transformational benefits of 5G and its related applications, then the procedures for awarding 5G spectrum need to be improved using a more liberalised, fair and transparent approach, taking account of the needs of the market (see also Recommendation 6 in section 4 of this report).

Tax issues are examined in Recommendation 8 in section 4 of this report.

Recommendations

The detailed recommendations in this report are given in section 4. There are two types of recommendations, the first type to improve the overall attractiveness of markets and the second type to reduce investment risks.

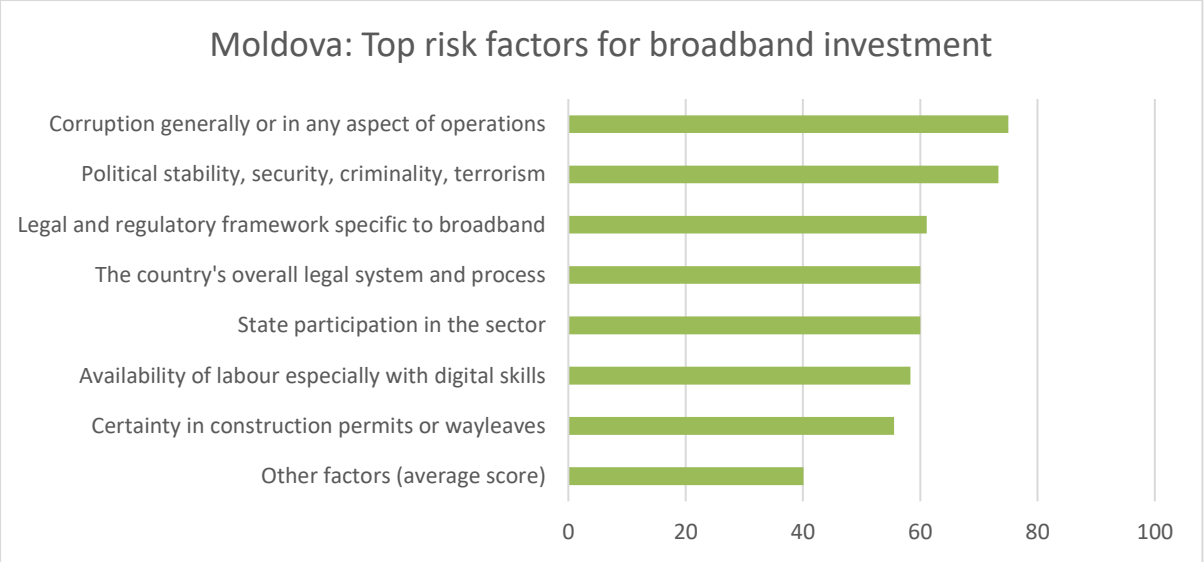
Survey results – Moldova

For Moldova, the respondent views regarding market attractiveness are summarised below, together with the relevant recommendations for improving the overall attractiveness of the market.

Market attractiveness factors	Moldova	Recommendations for improving the overall attractiveness of the market (See section 4)
Overall size of the market, in population terms and relative spending power		Recommendation 1
Growth potential of the market, in terms of demand for broadband-services		
Efficiency of the markets in terms of fair competitive conditions		Recommendations 1 and 3
A clear national ICT market strategy for the country with stated ambitions and goals, for example targets for broadband coverage and take-up		Recommendation 2

- Good / - Medium / - Poor

The issues raised by respondents that most contribute to broadband investment risk in Moldova are shown below.



A score of zero would indicate that the factor has no influence at all on investment decisions, a maximum score of 100 would indicate that the risk associated with the factor is so high that it completely puts off any investment.

The priorities for investors are summarised below, together with references to the relevant recommendations for reducing broadband investment risks given in section 4 of this report.

Investment risk factors	Moldova	Recommendations for reducing broadband investment risks (See section 4)
Corruption generally or in any aspect of operations.	⚠	

Political stability.		Recommendations 1 and 2
.Legal and regulatory framework specific to electronic communications and broadband		Recommendation 3
The country's overall legal system, predictability and process.		Recommendation 1
State participation in the sector.		Recommendation 5
Availability of labour especially with digital skills		Recommendation 7
Certainty in construction permits and wayleaves.		Recommendation 4
Access to spectrum resources		Recommendation 6
State assistance and funding schemes		Recommendation 9
Taxation generally or targeted at the sector.		Recommendation 8
Overall infrastructure		
Quality of databases and access to information		

 - Medium priority/  - High priority

4. DETAILED RECOMMENDATIONS

The comments made by respondents regarding the attractiveness of each of the four EEC markets surveyed (Armenia, Georgia, Moldova and Ukraine) and their concerns about the investment risks involved are given in section 3 of this report. The analysis in section 3 has also resulted in a set of priorities for actions in each market to improve investment conditions.

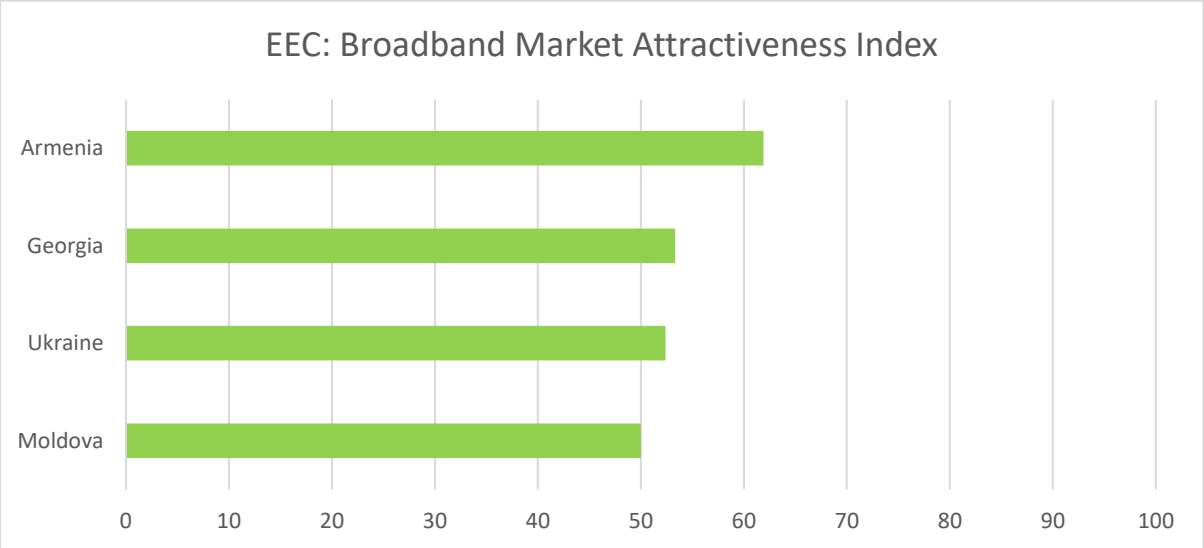
Some general recommendations are given in the executive summary (section 0) of this report under the heading "The general recommendations resulting from this survey".

This section gives a set of more detailed recommendations to improve the investment conditions in the broadband markets of the EEC countries. These detailed recommendations focus on the priorities for action resulting from the survey, with the key recommendations for each market being determined by the specific priorities for action, country-by-country.

The general recommendations in section 0 should be taken together with the detailed recommendations in this section dealing with the specific priorities for action identified in section 3 for each country. The main purpose of these recommendations, in accordance with the survey's overall objectives stated in section 1, is "*to inform investors, policy makers, regulatory and other influencers of investment so that they can make decisions that will increase effectiveness in sector investments and thereby improving broadband infrastructure coverage and capacity".*

Recommendations on improving the overall attractiveness of the market

The market attractiveness, in terms of the pure market potential regardless of the investment risks involved, was rated by respondents as follows:



On the comparative scale, zero would indicate a perception that the broadband market has no attraction. A score of 100 would indicate a perception that the market potential is perfect.

From the comments received from respondents in each market, the general factors that make a market more or less attractive can be summarised as follows:

- The overall size of the market, in population terms and consumers' relative spending power.
- The growth potential of the market, in terms of demand for broadband-enabled services.
- The efficiency of the markets in terms of fair competitive conditions.
- A clear national ICT market strategy for the country with stated ambitions and goals, for example targets for broadband coverage and take-up.

The following table summarises the views of respondents for each country:

EEC markets: Market attractiveness factors

Market attractiveness factors	Armenia	Georgia	Moldova	Ukraine
Overall size of the market, in population terms and relative spending power				
Growth potential of the market, in terms of demand for broadband-services				
Efficiency of the markets in terms of fair competitive conditions				
A clear national ICT market strategy for the country with stated ambitions and goals, for example targets for broadband coverage and take-up				

 - Good /  - Medium /  - Poor

Market size and spending power

In terms of market size, Ukraine has the highest population at 42m. The other three markets have relatively small populations of 4.0m (Georgia and Moldova) and 3.0m (Armenia). The populations of Ukraine and Moldova are declining.

In all markets, broadband growth arises from a combination of new subscriber take-up, network expansion into new geographical areas, and most significantly from consumer demand for higher data speeds. New demand is being taken up by both fixed and mobile broadband offerings. The respondents recognise that in the future, significantly more investments in fixed (mainly fibre-based) broadband infrastructure will be necessary, as business and consumer demand embrace more digital services. Mobile broadband services have more universal geographical coverage in all four markets, with fixed broadband infrastructure lagging behind, particularly in rural areas. In Armenia, mobile broadband users outnumber fixed broadband users by over seven to one. This compares to a figure of around three to one on average in the EU. In Georgia, Moldova and Ukraine, the ratio is around four to one.

Low levels of broadband service usage and relative spending power are often cited by respondents as reasons for a relatively unattractive market.

Broadband affordability	Armenia	Georgia	Moldova	Ukraine	European average
Fixed broadband price as % of GNI per capita	3.2%	2.8%	2.3%	1.8%	1.2%
Mobile broadband price as % of GNI per capita	1.0%	0.6%	0.5%	1.5%	0.5%

[Source: ITU]

In terms of pricing, fixed broadband is most affordable (relative to Gross National Income per capita) in Moldova and Ukraine and most expensive in Armenia. Mobile broadband is most affordable in Georgia and

Moldova and most expensive in Ukraine. All four countries are more expensive overall relative to income per capita than the average tariffs within the EU[20].

Market growth potential

The potential for broadband growth is still good, with mobile broadband forecast to grow strongest in Ukraine and Armenia (at 8.7% and 6.7% per annum up to 2024 respectively). Mobile broadband growth is less strong in Georgia and Moldova (at 5.6% and 4.1% per annum). Fixed broadband growth will remain restricted by the relative lack of infrastructure outside the main population centres. The fastest growth forecasts for fixed broadband are in Armenia and Georgia (at 4.3% and 4.2% per annum respectively) with Ukraine and Moldova both lagging at 3.2% per annum growth up to 2024).

The respondents' views of market potential are affected by uncertainties in the market at a time of continuing and costly investments, currently including fibre network and 4G broadband rollouts. There are also added risks in the mobile broadband market, especially with the lack of clarity on future spectrum release dates and the current uncertainties of a mobile operator-based business case for 5G investments. There is also no clear indication yet in the four countries that other significant players will enter future markets to exploit the added potential 5G-enabled "Internet of Things" markets.

Market efficiency

Another factor creating market uncertainty is the lack of confidence by respondents regarding the development of their legal and regulatory frameworks for the more liberalised market conditions. In Ukraine and Moldova particularly, the competitive market conditions have been the slowest to adapt, with investors expressing uncertainties about progress towards greater liberalisation and the adoption of best-practices. Analysis of the responses from all four markets has indicated the priority areas for market reforms, as detailed in section 3 of this report.

A national broadband strategy

Of general further concern to respondents is the lack of an agreed national policy-led approach to sector development, acknowledging broadband's increasing role in creating a more efficient digital economy. The participants in the survey expressed the general need for a comprehensive national plan for broadband incorporating clear targets for coverage and take-up, backed up by sector-wide policy, regulatory and financing frameworks.

It follows that, in order to increase the overall attractiveness of the markets for broadband infrastructure investments, a good perception of a country's policy and regulation towards more effective markets is needed. The first two recommendations below seek to increase investor confidence, even in those markets that are already reasonably attractive in pure market size and growth terms.

The remaining recommendations (3 to 9) seek to reduce the specific investment barriers and risks highlighted by respondents and prioritised in the survey on a country-by-country basis.

Recommendation 1: Demonstrating a clear commitment to the effective implementation of an investor-friendly legal and regulatory framework for the broadband market

Although the four countries surveyed have moved to more competitive markets, the transition to fully liberalised, investor-friendly legal and regulatory conditions has not yet been achieved. For example, in Moldova, respondents believe that the remaining state ownership of network operators still has a detrimental influence on competitive market conditions. In Ukraine, where many thousands of small local internet service providers have entered the market to fill the gaps left unfilled by the more established market players, the ability of the legal and regulatory framework to ensure fair competitive market conditions has been severely exposed. In Armenia and Georgia, there remain some structural and competitive market

[20] See https://www.itu.int/en/ITU-D/Statistics/Documents/publications/prices2020/ITU_A4AI_Price_Briefing_2020.pdf

barriers, including uncertainties regarding spectrum availability and the lack of effective procedures for obtaining permissions to expand broadband infrastructure.

The nature of these market distortions in each country, as perceived by the survey participants, is examined more closely in section 3 of this report.

In all four markets, respondents still perceive a strong preference for operators to construct and operate their own separate networks. Looking to the future, as markets expand into more rural geographical areas, relative costs will rise alongside declining average revenues and investment returns. There is a clear realisation amongst the survey participants that more collaborative models for joint investments and infrastructure sharing will have to be developed. The traditional regulatory approaches, mainly based on allowing new operators wholesale access to the incumbent's established infrastructure, have largely failed in all four countries.

In the survey, the most often cited model for promoting more effective broadband infrastructure investments is the EU's legal and regulatory framework for electronic communications[21]. As well as clear rules on universal services and quality, consumer protection, fair competition, regulatory oversight and enforcement, the EU regulatory framework includes the "Directive on measures to reduce the cost of deploying high-speed electronic communications networks"[22] which has been applied in all EU countries since 2016. These measures have led to better coordinated investments between the public and private sectors, in particular to promote more infrastructure investments and increase connectivity in rural areas.

The commitment to broadband investment enablers is part of the EU's overall policy towards a better-connected society. All four EEC countries surveyed have similar "digital society" aspirations and respondents generally recognise the EU approach to broadband investments as being best practice for the sector. The general message from the survey is that unless the legal and regulatory frameworks in the four countries are updated explicitly to support broadband investment efficiency, then the markets will continue to operate in a relatively uncoordinated way. Failure to adopt best practices will lead to far slower progress in achieving the universal high-speed broadband coverage required for better overall economic and societal development.

It is recommended that the EEC markets continue on a path to faster adoption of best practice broadband market regulation, backed up by a fully effective sector regulatory body with the powers to enforce the relevant competitive market safeguards and investment-promoting measures. The remainder of these detailed recommendations (below) include more details of the required policy, legal and regulatory best-practices aimed at broadband markets and investments.

Recommendation 2: Agreeing a clear national broadband strategy with stated ambitions and goals, including targets for broadband coverage and take-up

In the opinion of respondents, national government policy makers need to demonstrate a strong commitment to the sector and in particular, emphasising the increased role of broadband infrastructure investments for promoting economic growth and better living standards. Clear targets should be set at national level for broadband connectivity to allow businesses and households full access to internet services of high speed and quality at affordable prices. The results of this survey show a lack of clarity and national coordination of overall development of the ICT sector. Generally, respondents expressed their willingness to participate in their national debates and to contribute towards the development of national plans and new investment opportunities.

Experience in preparing and implementing policies across a number of countries[23], has highlighted the key characteristics of effective national broadband plans:

[21] https://digital-strategy.ec.europa.eu/en/policies/electronic-communications-laws

[22] https://ec.europa.eu/digital-single-market/en/cost-reduction-measures

[23] https://www.cullen-international.com/studies/2014/Benchmarking-15-national-broadband-plans.html

Survey recommendations

- National broadband plans should have a local context, in terms of both the current stage of ICT development and the political aims of the plans.
- Markets in the earlier stages of ICT development have a greater focus on supply-side initiatives, building network infrastructures and encouraging widespread internet usage. Markets in later stages of ICT development focus more on demand-side measures and embedding ICT into the national society and economy.
- Supply-side targets (for example stated levels of broadband coverage and penetration) lend themselves more readily to being expressed in specific, measurable terms.
- Effective government actions often focus on the stimulation of private funding and commercial activities. However, governments always play an important role in the central coordination of initiatives, in monitoring progress, and in ensuring the plan's goals are achieved.

In three of the EEC countries surveyed, state funding for broadband expansion is being employed in different ways:

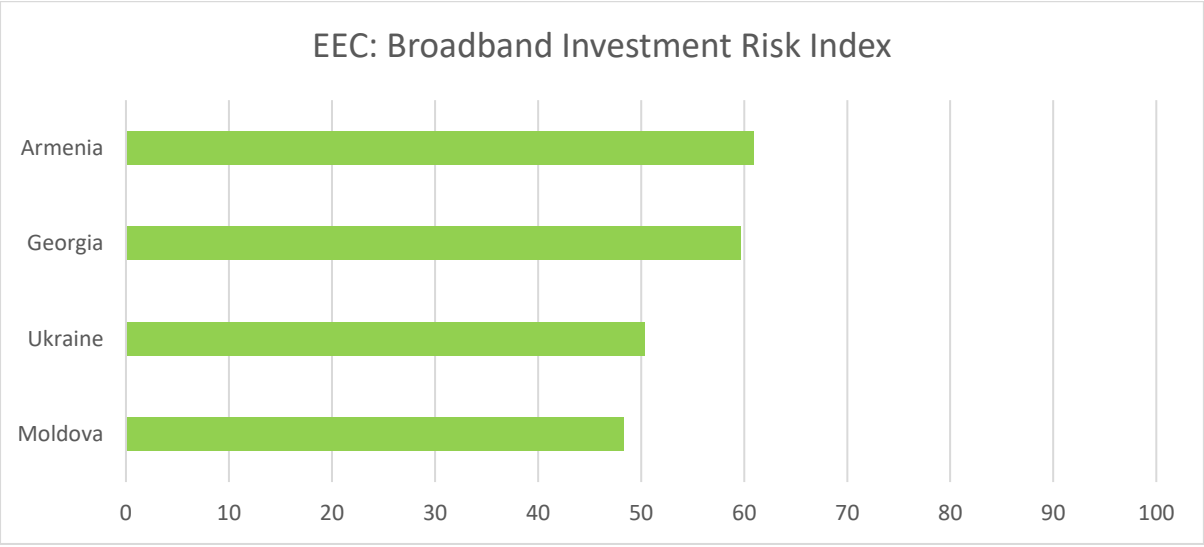
- In Georgia, a separate state-owned and operated network (Open Net) is being established to provide wholesale broadband infrastructure to connect rural areas. The capacity will be available to broadband providers for offering retail services to customers.
- In Moldova, the incumbent operator remains state owned and provides both fixed and mobile retail broadband services but there are no special funds available for connecting the more remote areas.
- In Ukraine, state funding is being transferred to local government entities, allowing them to select private sector offers for building new connecting infrastructure and operating broadband services in small villages.

In Armenia, only private investments are used for broadband infrastructure expansion.

Further recommendations regarding the role of the state and the use of state funding subsidies in promoting broadband investments in areas that remain unattractive to private investors, are further considered in recommendations 5 and 9 below.

Recommendations on reducing the overall investment risks

In addition to the factors related to market attractiveness, this survey has examined the opinions of respondents regarding investment risks – including a list of 14 potential barriers to investment. These opinions are summarised in section 3 of this report.



On the comparative scale, zero would indicate a perception that the broadband market has no enabling policy or has other absolute barriers and risks to investment. A score of 100 would indicate a perception that the full implementation of policies, legal and regulatory frameworks and other enabling conditions are already in place leaving no barriers or risks to investment.

The results show that, taking all 14 risk factors into consideration, Armenia has the least investment risk for broadband infrastructure, closely followed by Georgia. Moldova has the most risk.

Survey recommendations

The risks for each factor varied from market to market, as shown in the table below. Of the 14 factors, 12 have medium to high risk in at least one market:

- The legal and regulatory framework specific to electronic communications and broadband investments.
- Political stability, security, criminality, terrorism.
- Certainty in construction permits or wayleaves.
- The country's overall legal system, predictability and process.
- State participation in the sector.
- Access to state-controlled resources, particularly spectrum.
- Availability of labour especially with digital skills.
- Taxation generally or targeted at the sector.
- Corruption generally or in any aspect of operations.
- State assistance and funding schemes.
- Quality of databases and access to information.
- Overall infrastructure.

The following two remaining factors presented only low risk in all markets:

- Labour regulations, employment agreements, militancy, disruptions.
- Trade barriers.

EEC markets: Priorities for action

Investment risk factors	Armenia	Georgia	Moldova	Ukraine
Legal and regulatory framework for broadband	!	!	!	!
Political stability, security, criminality, terrorism	!	!	!	!
Certainty in construction permits or wayleaves.	!	!	!	!
The country's overall legal system, predictability and process	!	!	!	!
State participation in the sector	!	!	!	!
Access to spectrum resources	!	!	!	!
Availability of labour especially with digital skills	!	!	!	!
Taxation generally or targeted at the sector.	!	!	!	!
Corruption generally or applied to the sector	!	!	!	!
State assistance and funding schemes	!	!	!	!
Quality of databases and access to information	!	!	!	!
Overall infrastructure	!	!	!	!

Labour regulations	!	!	!	!
Trade barriers	!	!	!	!

! - Low priority/ ! - Medium priority/ ! - High priority

The following recommendations aim to reduce overall investment risks for broadband markets across the EEC markets, with the priorities for each country taken from the above table.

Recommendation 3: Ensuring that the legal and regulatory framework fully supports broadband infrastructure investments

1) The importance of effective wholesale markets

Across most countries, specific legal and regulatory conditions have been applied to the electronic communications sector in order to facilitate the significant technological and institutional changes that have taken place in the sector. These frameworks have resulted in more competitive markets by allowing greater consumer choice and by implementing specific competitive safeguards that apply to new entrants in order to limit the market power of a previous monopoly incumbent.

The capital-intensive nature of telecommunications infrastructure means that a new entrant cannot simply replicate the main components of a network in order to compete fully with an incumbent operator that has previously enjoyed a monopoly position. A faster transition to more competitive market conditions can be achieved by the creation of an effective wholesale market for infrastructure. Regulators have therefore sought to impose obligations on an incumbent operator to open up its network so that capacity can be rented out to other operators on fair terms.

This means that in going for market growth, a more recent market entrant has two options to expand its reach:

- The new entrant could invest in its own infrastructure or,
- if it is not ready to invest, it could rent capacity from the incumbent.

Where using the wholesale option is clearly more cost-effective, retail competition can grow to meet market demands quicker, because the infrastructure to provide service is already in place.

The regulators in the markets surveyed have created rules that oblige incumbent operators to open up (or "unbundle") their networks. Typically, the respondents to this survey have expressed dissatisfaction that this obligation has not been properly enforced or has not operated fairly. Typically, the incumbent fixed line operator has not made it routinely possible for the newer market entrants to use their network on the terms specified by the regulator. The result of this wholesale market barrier is that the fixed broadband retail market has grown more slowly in comparison to other markets. The average fixed broadband penetration in the four CEE markets is 16.5 per 100 population, which is less than half the average penetration rate for fixed broadband in the EU, where wholesale market regulations have been applied more effectively.

The wholesale market barriers typically used by incumbents fall into several categories:

- Procedural barriers – the incumbent operator will typically give preference to its own needs rather than releasing capacity for the use of other operators. This often leads to long delays (respondents have claimed wholesale requests can take up to two years to fulfil).
- Lack of capacity – the incumbent operator claims that there is no capacity available for renting, for example that a duct is already full or that a cable has no spare capacity. In an effective wholesale market, the capacity planned and implemented by the supplier should take account of the additional demands of all types of retail and wholesale users, but this is rarely the case in practice.
- "Price squeezing" or "margin squeezing" – the incumbent typically calculates the wholesale charge at a rate deliberately designed to ensure that a competitor cannot match the incumbent's offerings in the downstream retail market on price. The solution is for the regulator to use a cost

modelling approach that assumes the most efficient technology use in the network and imposes a fair "cost plus rate of return" wholesale price. (In the absence of a cost model, the regulator could impose a "retail minus" charge with sufficient margin to attract users into the wholesale market.)

In most cases, where an operator seeking wholesale access is denied, there are no effective dispute resolution procedures in operation to enforce the regulations. In the most extreme cases, where wholesale access regulations do exist, they are simply ignored.

It is therefore recommended that the conditions for effective wholesale markets are fully implemented by sector regulators and if necessary, backed up by legally binding dispute resolution and enforcement measures. Unless best practices in wholesale access regulations are implemented effectively in the four EEC markets surveyed, fixed broadband markets in particular will develop more slowly than would normally be expected and consumer demands will not be fully satisfied.

2) Cost reduction measures for broadband investments

The roll-out of broadband infrastructure requires substantial investments. The civil engineering component of these investments, such as the digging-up of roads, the building of towers, manholes and other specialist street works, can account for up to 80% of the overall cost of deploying high-speed networks[24].

EU rules on broadband cost-reduction

"To help achieve its "Connectivity for a Gigabit European Society"[25] targets, the European Union has sought to incentivise as much broadband infrastructure investment as possible in the EU member states. Focusing on the high civil works component of the necessary investments, the "Directive on measures to reduce the cost of deploying high-speed electronic communications networks" (2014/61/EU)[26], aims to facilitate and incentivise the deployment of high-speed electronic communications networks by reducing its cost.

"The Directive includes measures, such as the sharing and re-use of existing physical infrastructure, which can create conditions for a more cost-efficient network deployment. It will help create a digital economy that delivers sustainable economic and social benefits based on modern online services and fast internet connections.

"The measures of the Directive focus on four main areas:

- *Access to existing physical infrastructure (e.g. ducts, poles or masts) including those belonging to energy and other utilities, for operators willing to deploy high speed broadband networks.*
- *Efficient coordination of civil works.*
- *Faster, simpler and more transparent permit-granting procedures.*
- *Equipping new buildings and major renovations with high-speed physical infrastructures (e.g. mini-ducts, access point) and access to in-building infrastructure.*

"Member States had to transpose the EU Directive into national legislation and since 1 July 2016, they have applied these measures."

Extract from "EU rules to reduce the cost of high-speed broadband deployment" https://ec.europa.eu/digital-single-market/en/cost-reduction-measures

Respondents in all four markets surveyed expressed views that their existing conditions for all the above topics (access to ducts, poles and masts, coordination of civil works, the granting of permits and for

[24] https://www.nic.org.uk/wp-content/uploads/Cost-analysis.pdf

[25] https://ec.europa.eu/digital-single-market/en/policies/improving-connectivity-and-access

[26] https://ec.europa.eu/digital-single-market/en/cost-reduction-measures

equipping buildings for broadband) were unnecessarily slow, inconsistent and in many cases unfair. There is also a clear recognition that the EU measures represent sector best practice.

It is recommended that regulators and government bodies (both at state and municipal level) should examine the scope of the specific regulatory provisions described above for the EU and incorporate these into their legal and regulatory frameworks. If these best-practice measures are implemented in the EEC markets and properly enforced by the regulator, then the investment conditions for broadband infrastructures would improve significantly.

Further consideration is given in Recommendation 4 to the procedures for faster, simpler granting of permits.

3. Network sharing will be a key lever to reduce cost and make 5G deployments feasible

Network sharing should become a standard part of the operating model for mobile operators, and this awareness is accelerating as decisions on investing in 5G networks approach. The business cases for 5G investments are still uncertain in all four EEC markets surveyed. It remains unlikely that commercial 5G services will be launched before 2023 in these markets.

Until now, the imperative for gaining market share has been the predominant justification for mobile operators to invest. This still applies to the current roll-out of 4G services in the four EEC countries surveyed, where network coverage is still seen a one of the key competitive differentiators. The more established mobile operators have been generally reluctant to share their infrastructure with newer entrants that are still rolling out their networks. The drive for market share has resulted in mobile operators investing largely in their own separate infrastructures in the knowledge that trying to coordinate with a competitor would delay investments at the expense of market share gains. Investment returns on the current 4G markets are still not guaranteed in the short term. There is also some uncertainty about the availability, timing and cost levels of additional spectrum resources in each country.

Respondents have expressed the view that during the lead-up to the decisions for 5G investment, that is between now and 2023, the sector stakeholders should seek more collaborative ways to achieve further mobile services development in the 5G and 'Internet of Things' era. If cooperation can be agreed, then significant cost reduction opportunities can be achieved across the sector, leading to more confident investment conditions and faster roll-out of new services.

Network sharing and 5G: A turning point for lone riders

"Operators in some countries have been able to reduce the total cost of ownership by up to 30% while improving network quality through sharing a variety of both active and passive equipment. 5G will be no exception, with operators eyeing new ways of accelerating the deployment of an otherwise daunting investment.

"The cost savings potential for network sharing is even stronger with 5G, as greenfield deployment is better suited for sharing because it avoids the cost of network consolidation. For example, the cost of small-cell deployment can be reduced by up to 50 percent if three players share the same network. But the rationale for sharing extends beyond cost, as it could solve many practical roadblocks of 5G deployment in urban areas, such as the potential for urban disruption and visual pollution from the installation of excessive equipment and fibre.

"Given these arguments for network sharing, operators will need to have strong commercial rationale to justify stand-alone deployment of 5G, rather than sharing a common 5G network. Although such cases may exist for certain operators in particular markets, for many operators, sharing will be a necessity and requires preparation now."

[Source: https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/network-sharing-and-5g-a-turning-point-for-lone-riders]

Network sharing is widely seen as a means to accelerate 5G deployment, and to minimise disturbances from construction work and visual pollution. Given that 5G thinking is still in its infancy in the EEC markets,

operators have the opportunity to participate in regulatory dialogue on alternative development paths and positive conditions for deployment.

There are a range of network sharing options available, which can be analysed in the context of network providers' different needs:

- Sharing infrastructure at different network levels, from microcells up to whole network 'Internet of Things' (for example industry sector-specific) macro layers.
- Different sharing models in urban and rural markets, where cost structures and coverage areas differ.
- The number of players sharing could depend on the level of cost savings that are required to attract investment participation – in the most extreme case, a single network could be built on which all players in the market gain wholesale access.

In some countries, market players have already started work on network sharing as a separate business model. Tower companies, for example, which have already proved attractive in rural areas, are predicting diversification into urban areas by securing access to lampposts and rights of way for investing in fibre infrastructures.[27]

It is recommended that network sharing should become a standard part of the operating model for broadband operators in order to improve the commercial case for many of the expected investments for the future, particularly for 5G. Regulators should engage in sector-wide consultation and if necessary, prepare statutory rules for facilitating network sharing.

Recommendation 4: Construction permits and rights of way

For the civil works typically associated with broadband infrastructure investments (including buildings, manholes, ducts, masts, towers, poles and street cabinets), companies normally have to seek certain permissions before construction work can begin. These permissions can include access to public or private rights of way, approval of construction details and permissions to carry out civil works.

Typical problems arise in:

- Negotiating wayleaves for access to land and buildings (particularly in the situation of absentee landlords or where there are multi-tenancy buildings).
- Negotiating with local authorities regarding street access and works coordination.
- Accessing existing infrastructure to reduce overall costs.

The survey respondents generally ask for faster, simpler, more transparent and fairer permit-granting procedures. This is true in all markets surveyed.

In some cases, newer market entrants find it more difficult than incumbent operators to obtain permits. This tends to prolong an incumbent's competitive advantage in the market and also disincentivises alternative operators from investing in their own networks where this would be otherwise profitable for them.

In Georgia and Moldova, the survey participants view this aspect as a major contributor to overall investment risks. In Armenia and Ukraine, the issue is seen to be of lesser importance, but respondents generally agree that procedures should be more transparent and more consistently applied. Charges should be set in relation only to administrative cost and any disputes should be settled by the sector regulator using legally binding resolution and enforcement procedures. In the case of greenfield developments, the right of broadband providers to install infrastructure is generally permitted without additional procedures or delay.

The recommended best practices, in the form of relevant powers, obligations, procedures and coordination are described below.

[27] McKinsey & Company "Network Sharing and 5G: A turning point for lone riders" https://www.mckinsey.com/~/media/McKinsey/Industries/Technology%20Media%20and%20Telecommunications/Telecommunications/Our%20Insights/Network%20sharing%20and%205G%20A%20turning%20point%20for%20lone%20riders/Network-sharing-and-5G-A-turning-point-for-lone-riders.ashx

The UK's Digital Connectivity Portal provides practical guidance and resources about building digital infrastructure

In 2018 the UK government established, after public consultation, a "Digital Connectivity Portal https://www.gov.uk/guidance/digital-connectivity-portal *that provides resources and advice for local authorities and commercial providers to facilitate deployment of digital infrastructure (full-fibre and mobile networks).*

Under the Electronic Communications Code (the UK regulatory framework) operators can be granted "code rights" by Ofcom, the sector regulator. This grants the operator the rights to install, operate, maintain and upgrade electronic communications infrastructure (such as fibre broadband cables) on private and public land. Ofcom publishes a register of operators with code rights.

The code has provisions for calculating the rent to be paid to landowners for hosting equipment. Rent is now calculated based on the value of the land to the landowner rather than the value to the telecommunications company.

It provides a framework for what landowners and network operators should expect from each other when negotiating wayleave agreements and suggests best practice to facilitate positive and productive engagement between all parties, including some practical examples.

If such an agreement cannot be agreed consensually, the operator can apply to the Court to impose an agreement to confer the code rights.

[Extract from the UK government Digital Connectivity Portal

https://www.gov.uk/guidance/digital-connectivity-portal]

The coordination of civil works in the EU

The "Directive on measures to reduce the cost of deploying high-speed electronic communications networks" (2014/61/EU)[28]*, enables any network operator to negotiate agreements with other infrastructure providers for coordinating civil works with a view to deploying high-speed electronic communication networks. It also enables a better coordination of civil works in support of efficient infrastructure.*

Additional obligations apply to network operators fully or partly financed by public means; these operators have to meet any reasonable request for coordination of works, provided that it does not entail any additional costs and does not impede control over the coordination of the works.

In order to facilitate coordination, any network operator should make available, upon specific request or via a Single Information Point, the following minimum information related to its on-going or planned civil works:

-the location and type of works

-the network elements involved

-the estimated starting date and duration of works, and

-a contact point.

[Extract from Digital Single Market policy "Coordination of Civil Works
https://ec.europa.eu/digital-single-market/en/coordination-civil-works*]*

[28] https://ec.europa.eu/digital-single-market/en/cost-reduction-measures

Survey recommendations

It is recommended that governments and regulatory agencies implement best practice legislation, procedures and on-line capabilities (such as those described above) that will significantly ease the problems associated with providers seeking permissions to install broadband infrastructures.

Recommendation 5: The role of the state

Respondents in the four EEC markets expressed a number of opinions regarding the proper role of the state in the broadband investment sector. The state's role can be summarised into the following categories:

- The need for clear state policy for the ICT sector with national targets for broadband (see also recommendation 2).
- The level of taxation, spectrum charges and other payments to the state should be consistent with the state's overall ICT policy, with regard to the need for sufficient investments by market players to achieve the policy objectives (see also recommendations 6 and 8).
- A clear legal and regulatory framework needs to be in place for the sector, enforced by an independent regulator. This legal and regulatory framework should be applied fairly, without bias towards operators that are fully or partly state-owned (see also recommendations 1 and 3).
- Effective state-aid mechanisms need to be in place, for example rural development funding or other support measures offered by the state to private investors in order to achieve policy objectives where these objectives cannot be met by commercial investments alone. (See also Recommendation 9).
- Where state investments are used to create national infrastructures, there is a clear danger that the state investments will "crowd out" further private investments. This will weaken competition and could result in an over-dependence on a single infrastructure with the resulting losses in consumer choice and quality of services.

The overall view of respondents is that when government decisions are made that significantly impact the ICT sector (especially sector policy, law and regulation, taxation and spectrum payments), these issues should be discussed with the sector participants so that they can express their views, especially regarding their forward investment planning.

In most markets surveyed there is still a high level of reliance on the existing backbone and copper access networks. Any significant new state investments in new national fibre-based networks, (for example the new Open Net national wholesale broadband network in Georgia), could "crowd out" further investments by private operators.

The key role of the state is to establish a clear policy for the ICT sector, within which the investment strategies of market players can have greater confidence. This recommended consultation is particularly important for the broadband sector because any adverse impact on infrastructure investments also spills over onto all other sectors of the economy that rely on ICT services for their development.

It is recommended that governments should involve the private sector in consultations aimed at creating an investment environment that encourages all investments and maximises private incentives. Experience from other countries clearly shows that private participation in broadband infrastructure programmes makes any state ICT policies and public funds used go significantly further. Private involvement also helps to create programmes that are commercially sustainable in the long term, as opposed to ones that continually rely on state aid and other subsidy programmes.

Recommendation 6: Ensuring that spectrum resources are used effectively

The survey has supported a general view that restrictive spectrum management policies are in conflict with sector investment needs and in a wider context, to be against the future interests of national economic development.

Respondents in all four countries surveyed expressed the view that operators have paid relatively high sums for new spectrum awards and in addition, have to pay high yearly spectrum fees. In all the markets surveyed, the respondents feel strongly that the investment case for 5G services will be difficult to make, unless there is more certainty about spectrum management policy, especially in the timing and pricing levels of new spectrum releases.

GSMA position on spectrum pricing

"To deliver affordable, high quality mobile broadband services, operators require fair access to sufficient radio spectrum. As a result, governments and regulators carefully manage mobile spectrum, which in turn supports a vibrant digital economy. Sometimes this includes charging a price for access to spectrum to encourage efficient use. However, evidence shows that when prices are too high, consumers can suffer from slower mobile data speeds, worse coverage and slower rollouts."

1. *High spectrum prices can harm consumers through lower quality mobile broadband services*
2. *Governments should prioritise improved mobile broadband services – above revenue maximisation – when awarding spectrum*
3. *Avoid limiting the supply of mobile spectrum (for example through set-asides), publish long-term spectrum award plans and hold open consultations*
4. *Set modest reserve prices and annual fees, and rely on the market to determine spectrum prices*
5. *Avoid creating unnecessary risks that put operators' current or future services in jeopardy*
6. *Consult with industry on licence terms and conditions and take them into account when setting prices*
7. *Auctions must be well designed and implemented to be an effective award mechanism*
8. *There is no single best approach to estimating the value of spectrum and international benchmarks should be used with caution*
9. *Spectrum pricing decisions should be made by an independent regulator in consultation with industry*
10. *The rise in the total cost of spectrum is a threat to mobile broadband growth – especially 5G*

Extract from GSMA Public Policy Position on Spectrum Pricing May 2021
https://www.gsma.com/spectrum/wp-content/uploads/2021/05/Spectrum-Pricing-Positions.pdf

There is a widespread view in the markets surveyed that the spectrum management strategies adopted by governments and regulatory agencies should be better harmonised within the overall context of a wider ICT strategy[29]. More specifically, modern spectrum management strategies should promote investments in a more liberalised telecommunications market. Broadband infrastructure providers should be able to access spectrum resources in order to facilitate geographical universality, to meet the growth of existing services and to support the expected 5G market transformation.

In planning the release of new spectrum, governments and regulators should recognise that investors need more certainty, for example by ensuring technological neutrality, extending licence periods and by aligning new spectrum release dates.

The charges raised for spectrum should be based on market needs as well as on the need to reflect any remaining spectrum scarcity. Open market consultations, well in advance of spectrum releases, should be used to find the right balance in spectrum charges, recognising the cost pressures faced by operators in meeting national ICT objectives. Similarly, any quality or coverage obligations faced by spectrum holders should be subject to consultation. The general view of survey participants is that service quality and coverage

[29] For example, see https://londoneconomics.co.uk/wp-content/uploads/2011/09/56-Economic-Impacts-of-Increased-Flexibility-and-Liberalisation-in-European-Spectrum-Management.pdf

Also https://www.sciencedirect.com/science/article/pii/S030859611730126X

are already subject to, and are best left to, competitive market forces. These competitive pressures are likely to increase when a wider range of 5G-based services become available, so regulatory obligations should be set only at the level required to achieve good investment conditions.

It is likely that in the future, 5G and 'Internet of Things'-based market presence will being considered not only by the traditional network operators, but also by a potentially large number of application-driven, commercial and industrial sector-driven interests.

The potential scope of 5G

"5G is expected to support significantly faster mobile broadband speeds and lower latencies than previous generations while also enabling the full potential of the 'Internet of Things'.

"From autonomous vehicles to smart cities, 5G will be at the heart of the future of communications. 5G is also essential for preserving the future of today's most popular mobile applications – like on-demand video – by ensuring that growing uptake and usage can be sustained.

"5G goes beyond meeting evolving consumer mobile demands by also delivering carefully designed capabilities that will transform industry vertical sectors. 5G introduces a new level of flexibility and agility so the network can deliver customisable services to meet the needs of a huge variety of users and connection types.

"Features like network slicing means industrial sectors can rely on the network delivering precisely what they need – ranging from speed, latency and quality of service to security."

Extract from "5G Spectrum GSMA Public Policy Position July 2019"
https://www.gsma.com/spectrum/wp-content/uploads/2019/09/5G-Spectrum-Positions.pdf

Expected technology development horizons:

5G and the Internet of Things connectivity

Enablers:

Advances in cloud and edge computing will increase demand for 5G by driving data-hungry applications including the proliferation of connected devices (around 42Bn connected IoT devices by 2025), increasingly complex devices driving exponential growth of generated data and the demand for real-time analysis, decision-making, and adjustments, for example connected cars/ drones.

Core technologies have become increasingly affordable over the past years (sensors -44% price drop, storage -72% and computing power -57%). This will make several connectivity-driven use cases financially viable.

Barriers:

Inconsistencies in legislative process and content across geographies are likely to create significant barriers to the deployment of 5G.

Lack of demonstrable cost efficiency and return on investment, further complicated by connectivity not being part of R&D plans for manufacturing companies.

Concerns around incompatibility and interoperability of mobile networks when it comes to integrating with existing industrial systems.

Cultural barriers to working with companies in different sectors including telecommunications, as well as start-ups.

Extract from McKinsey analysis "Technology deep dive, industrial Internet of Things"
https://www.mckinsey.com/~/media/mckinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/The%20top%20trends%20in%20tech%20final/Tech%20Trends%20slides%202%203%204

What will 5G be used for?

The ITU has outlined specific criteria ….which will support the following use cases:

1. Enhanced mobile broadband, including peak download speeds of at least 20Gbps and a reliable 100Mbps user experience data rate in urban areas. This will better support increased consumption of video as well as emerging services like virtual and augmented reality.

2. Ultra-reliable and low latency communications: Including 1msec latency and very high availability, reliability and security to support services such as autonomous vehicles and mobile healthcare.

3. Massive machine-type communications: Including the ability to support at least one million Internet-of-Things connections per square kilometre with very long battery life and wide coverage including inside buildings.

4. Fixed wireless access: Including the ability to offer fibre type speeds to homes and businesses in both developed and developing markets using new wider frequency bands, massive Multiple-Input-Multiple-Output and 3D beamforming technologies.

Extract from: GSMA report: 'Fixed Wireless Access: Economic Potential and Best Practices' (2018)] https://www.gsma.com/futurenetworks/wp-content/uploads/2018/08/Fixed-Wireless-Access-economic-potential-and-best-practices.pdf

The views of respondents on the required spectrum conditions to inform better investment decisions regarding 5G, lead to the following recommendations:

- Governments and regulators should avoid inflating 5G spectrum prices as this risks limiting network investment and driving up the cost of services.
- Regulators must consult potential 5G stakeholders to ensure spectrum awards and licensing approaches take account of various business models of technical and commercial deployment of 5G services.
- Governments and regulators need to adopt national spectrum policy measures to encourage long-term heavy investments in 5G networks, including long-term licences, a clear renewal process the expected timeframe for future spectrum releases.

One of the barriers to 5G adoption identified in a recent McKinsey report[30] is the problem of 'cultural barriers' to working with companies in different sectors including telecommunications, as well as start-ups. This barrier is likely to be confounded by the apparent reluctance, expressed in this survey of EEC countries, by the existing spectrum holders (notably mobile telecommunications operators) to accept the need for new market entrants to bid for and obtain future spectrum releases for 5G.

The existing operators typically state their preference for the emerging 5G markets to operate through themselves, rather than be initiated and operated within specific sectors or application areas. If this is the case, then the innovation and speed of the introduction and exploitation of 5G will be slower and opportunities will be missed. This potential barrier can be reduced if policy makers and spectrum regulators adopt a transparent, informative and open market consultation approach, as well as watching other countries' experiences, before taking decisions about the exploitation of future spectrum capacity.

This points to the need to ensure that new stakeholders are not excluded from applying for and receiving new spectrum releases. Greater participation will promote innovation and ensure that all sectors of the economy can exploit new spectrum capabilities without having to rely only on the traditional holders of spectrum for telecommunications use.

[30] https://www.mckinsey.com/~/media/mckinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/The%20top%20trends%20in%20tech%20final/Tech%20Trends%20slides%202%203%204

Recommendation 7: The availability of digital skills

Respondents in all four EEC markets surveyed reported problems in hiring and retaining staff with skills relevant to modern digital networks and services. Typically, there is a reasonable supply of people with the necessary potential, but there is a risk that they will chose to take vacancies in other IT sector companies with local offices, or they will move abroad to find better opportunities. The problem of finding sufficient digital skills in the future is not just a local problem within the broadband sector, most economies are already experiencing digital skills shortages and the demand for well qualified staff with good digital skills is expected to grow further[31].

In response to the potential digital staff shortages in the EU, The European Commission is promoting various initiatives aimed at increasing training in digital skills for the workforce and for consumers; modernising education across the EU; harnessing digital technologies for learning and for the recognition and validation of skills; and anticipating and analysing skills needs. For example, the EU has plans[32] for:

- Master's Programmes in cutting-edge digital technologies developed together with EU excellence centres.
- Short-term specialised training courses in advanced digital technologies for job seekers and employed people especially in SMEs.
- Job placements in companies or research centres where advanced digital technologies are developed or used.

It is recommended that, using the existing channels for co-operation in the telecommunications sector, that the issue of digital skills shortages is raised and plans developed for national and regional initiatives for the sector.

Recommendation 8: Aligning the taxation regime with the national objectives for ICT development

This issue is of high concern in Ukraine and medium concern in Moldova. In both cases, additional sector specific taxes are imposed on the operators.

It has been estimated[33] that in Ukraine, taxation represents 35% of total market revenue, which is significantly above the 21% average tax burden seen in Europe. Furthermore, Ukraine's mobile-specific taxes are equivalent to 14% of total mobile sector revenue, significantly above the European average of 4%. The mobile-specific burden is driven by the accumulation of regulatory fees and a special pension fund. In the view of respondents, the high tax burden makes conditions less conducive to investment, risking the achievement of increased mobile connectivity and the sector's wider impact on economic development.

Overall taxation levels, coupled with other sector specific charges such as high spectrum fees (see also recommendation 6), take cash out of the sector that would otherwise have been available for further investments in infrastructure. In this respect, at macro-economic policy level, the aims of promoting ICT are directly contrary to the policy of taking high taxes from the broadband infrastructure and services sector.

The indirect impact of telecommunications/ICT taxation: macro effects

In its 2013 report "Taxing Telecommunications/ICT services", the International Telecommunications Union stated that:

"Analytical research has demonstrated that although the telecommunication/ICT sector tax revenues play an important role in supporting national public services, this role must be

[31] https://www.weforum.org/agenda/2019/03/the-digital-skills-gap-is-widening-fast-heres-how-to-bridge-it/

[32] https://ec.europa.eu/digital-single-market/en/policies/digital-skills

[33] https://www.gsma.com/publicpolicy/wp-content/uploads/2020/11/GSMA-Mobile-taxation-in-Ukraine_EN_2020.pdf

weighed against the potentially adverse effects that taxation can bring to the growth of the sector, broadband penetration and national economic growth."

"One of the most interesting and important aspects of the debate concerns a feedback mechanism which is widely considered to be particularly important in application to telecommunications/ICT.

"The feedback works as follows. A government levies a tax on telecommunications. As a result, the roll-out of services is delayed. This has a direct effect on national income, which includes telecommunication/ICT output. However, there is also a spill-over effect. This arises because telecommunication/ICT services are used in many other sectors and can increase productivity there.

"Accordingly, the tax has a broader effect on the growth of national income, and hence on future tax revenues from other sectors."

Extract from "Taxing Telecommunications/ICT Services: An Overview" (ITU 2013) https://www.itu.int/en/ITU-D/Regulatory-Market/Documents/Publications/Taxation2%20E-BAT3.pdf

The survey results support in the following recommendations:

- Governments should consider whether the apparently low cost of collection of telecommunication taxes is a strong enough consideration to justify a special tax on the sector.
- More weight should be placed on the exceptional macro-economic benefits of investment in broadband infrastructures as sufficient grounds for not taxing them.
- Whether there a special economic development case for the application of an especially low and advantageous tax rate to facilitate greater investments in specific broadband-enabled projects.

Survey participants placed special emphasis on the second point because there was a general view that national policy makers were not sufficiently aware of the positive and wider economic benefits of broadband infrastructure investments.

Recommendation 9: State assistance and funding schemes

Regarding the state's role in state aid including universal service mechanisms, survey respondents generally welcome such support provided that the funding is administered in a fair and transparent manner and the state component of the funding supports private sector investments rather than competing with (or "crowding out") private investment.

There are various options for state support for broadband investments:

- State funding to "top up" private investments and ensure there is sufficient incentive for the private sector to invest. The fair and transparent method for the state to allocate this type of funding is by a competitive "subsidy auction", which ensures that the investor offering the most cost-effective solution is awarded the subsidy. This auction mechanism, widely used in the EU, is being launched in Ukraine for the very specific case of connecting small villages with high-speed broadband infrastructures. Respondents to the survey in Ukraine expressed some doubts about the inherent lack of competitive safeguards in the scheme, coupled with the lack of potential for economies of scale and therefore risking service affordability.
- Direct state investment in networks that connect outlying regions into a national backbone network. The concept of a state-owned national broadband network has been launched in Georgia, but survey respondents there expressed worries that this state investment would crowd out private investments and duplicate capacity where it is not needed. The proposed use of this type of state operated network is to provide wholesale capacity for use by any retail broadband service provider. The government itself will generally also be a major user of this network for example to connect its own offices and to provide a platform for eGovernment services.
- An alternative to a fully state-funded broadband infrastructure, or "top-up" funds for private investments, is some kind of public-private partnership (PPP) venture that uses both state and private investment for the specific purpose of expanding broadband connectivity to otherwise

unprofitable locations. The PPP options include a range of different ownership, funding and governance models. There are no such examples being used in the four EEC markets surveyed.

The choice of state funding mechanism from the above options should be supported by relevant laws and regulations, for example a framework and supporting procedures for obtaining construction permits and rights of way. In the Ukraine scheme, the necessary permits are granted along with the funding as part of the contracts between the government and the private operators awarded each project. There is however not sufficient clarity about the level of charges faced by the private operators for the use of public assets in constructing their networks, or whether the broadband tariffs will be capped by any universal service regulations.

A key aspect in the choice of any government injection of funds is the potential this creates for distorting competition in the market, including the danger of "crowding out" of private investments. The EU has addressed this issue with a specific set of rules in relation to "state aid for broadband"[34]. It is also recommended that the legal and regulatory framework adopts a specific set of rules regarding the relevance of state aid for any particular broadband scheme, following the examples already implemented within the EU.

Following the views expressed in the survey, it is recommended that a full range of state-funding options is considered by governments in consultation with the market before decisions are reached. The different options should be tested against full cost/ benefit criteria as well as taking into account the implications of each option on the potential impact on market efficiencies, competition and consumer choice. The chosen model should be piloted in limited geographical areas to gain experience before scaling up into a full national scheme.

[34] https://ec.europa.eu/regional_policy/sources/conferences/state-aid/broadband_rulesexplained.pdf

5. Glossary of terms used in this report

3G and 4G mobile services	These 3rd and 4th generations of mobile technology currently provide the mainstream services in most countries. See also **GSM, LTE** and **5th Generation mobile.**
5th Generation mobile (5G)	5G is the latest generation mobile technology for digital wireless networks that began deployment in 2019 and is expected to become the standard for mobile broadband access with better quality and **latency**, supporting a further range of high-speed services and applications, in particular the growing "**Internet of Things**".
ADSL	Asynchronous Digital Subscriber Line (ADSL) has been the most prominent existing infrastructure technology for providing fixed broadband access to end users over traditional copper cables in the access network. The achievable performance is dependent on the distance between the premises and the nearest network exchange node. Although in most cases it can provide reasonable quality and broadband capacity, it cannot reach the performance that can now be delivered over **Fibre access** technologies.
ARPU	Average revenue per user – the basic measure of revenue for telecommunications operators. ARPU is calculated by dividing the total revenue from a given service by the number of subscribers to that service. It is normally quoted as a monthly figure – most operators send out monthly bills for their services.
B2B	Shorthand for "business to business." It refers to the sales companies make to other businesses rather than to individual consumers. Sales to consumers are referred to as "business-to-consumer" or B2C. In the context of this report, the B2B market consists of connecting businesses to telecommunications services including leased line networks and **VPN**s.
Bandwidth	True internet speeds are measured by a combination of bandwidth and **latency**. **Bandwidth** is the amount of data transmitted per second (bps). Typical broadband rates are measured in Megabits per second (Mbps) up to Giga bits per second (Gbps).
Bitstream	A wholesale service provided by an operator as a working broadband fixed connection to customer premises which can be used by another operator to provide a competitive fixed broadband service to the customer. The handover point in the network can be at a local or more remote level. The term Bitstream now generally refers only to non-fibre broadband technologies (notably **ADSL).** The broadly equivalent term for fibre wholesale access is **VULA.**
Bluetooth	A short-range wireless technology standard that is used for exchanging high-speed data between fixed and mobile devices over short distances, normally up to around 10 meters.
Broadband services	Telecommunications, media and internet services that are delivered individually or together to consumers and businesses

	over high-speed access links. The average **bandwidth** (speed) of broadband services has been steadily increasing and are now available from around 2Mbps (2 million megabits per second) up to Gbps speeds (Gigabits per second) using different technologies.
Broadband infrastructure	Investments in broadband infrastructure take the form of networks to support fixed and mobile broadband services, together with the supporting civil engineering structures and associated equipment. National and international connectivity also includes terrestrial TV and satellite network infrastructures. Of growing importance are investments in new business models linked to connectivity. These growing investments include smart cities, vertical industry sector partnerships, logistics, content, data analytics data and the "Internet of Things".
Best Practice Index	One of the comparative indexes derived from this survey, which rates each country on a score from zero to 100 based on the respondents' confidence that the country will adopt best practices in the investment conditions for broadband within a reasonable timescale. A value of zero would indicate that the country has no best practices in the broadband sector. A score of 100 would indicate that the country has already adopted all relevant best practices.
Broadband Market Attractiveness Index:	One of the comparative indexes derived from this survey, which rates each country on a score of zero to 100 based on the respondents' perception of the pure attractiveness of a broadband market taking account of such factors as market size and growth. On the comparative scale, zero would indicate a perception that the broadband market has no attraction. A score of 100 would indicate a perception that the market potential is perfect.
Broadband Investment Index	See **Overall Broadband Investment Index**
Broadband Investment Risk Index	One of the comparative indexes derived from this survey, this rates each country on a score of zero to 100 based on the respondents' perceived barriers to investment. On the comparative scale, zero would indicate a perception that the broadband market has no enabling policy or has other absolute barriers to investment. A score of 100 would indicate a perception that the full implementation of policies, legal and regulatory frameworks and other enabling conditions are already in place leaving no barriers to investment.
Cable networks	This term generally refers to stand-alone networks (separated from traditional telecommunications networks) that were originally established within defined geographical areas to provide end users with "Cable TV" services. Using current digital technologies these networks have now been exploited to provide competitive fixed broadband access including voice, internet and media services.
Capex	Capital expenditures, most relevantly (in the context of this report) investments to install and upgrade **broadband infrastructures**.

CDMA	Code Division Multiple Access, along with **GSM**, was one of the early standards for mobile network expansion, now superseded in favour of the better quality and higher speed **3G**, **4G** and **5G/LTE** networks.
Cloud computing and storage	The on-demand availability of computer system resources, especially data storage (cloud storage) and computing power, without direct active management by the user. The term is generally used to describe data centres available to many users over the internet. Now predominant, large clouds often have functions distributed over multiple locations.
Critical infrastructures	Critical infrastructure means any system which is essential for providing vital economic and social functions: health, food, security, transport, energy, information systems, financial services, etc. Once these critical infrastructures are defined (on a country-by-country basis) there is a need to prepare special measures to protect networks and services from disruption by both natural disasters and man-made threats (including terrorism, cyber-attacks, disinformation, hostile foreign ownership). Planning and coordination should also take into account the increasing links between sectors and new threats including climate change and pandemics.
Digital dividend	The term "digital dividend" is normally used to describe the benefit from the release of valuable commercial spectrum resulting from the changeover from analogue to digital terrestrial broadcasting. By international agreement, large amounts of spectrum previously used by analogue TV broadcasters should be made available for the expansion of mobile broadband services. Some other outdated technology users may also be blocking spectrum release for mobile broadband growth, for example older military and navigational systems. The transfer of these systems to other bands using better technologies can also contribute to the digital dividend.
EBITDA	A company's earnings before interest, tax, depreciation and amortisation. This is a measure of the cash surplus of a company during a defined accounting period because it is calculated by subtracting all expenses except interest, taxes, depreciation, and amortisation from business revenues.
eCommerce	Electronic commerce is the buying and selling of goods and services, or the transmitting of funds, over an electronic network, primarily the internet. These business transactions occur either as business-to-business (**B2B**), business-to-consumer (B2C), consumer-to-consumer or consumer-to-business.
Edge computing	A distributed, open **IT** architecture that features decentralised processing power, enabling mobile computing and **Internet of Things (IoT)** technologies. In edge computing, data is processed by the device itself or by a local computer or server, rather than being transmitted to a data centre.
EEC	The collective name given to the Eastern Europe and Caucasus markets surveyed in the current round of EBRD reports.
eGovernment	Electronic government refers to the exploitation of web-based information technologies to improve and enhance the scope,

	efficiency and effectiveness of service delivery in the public sector.
FDIs	Foreign direct investments.
Fibre access, Fibre to the home (FTTH)	Optical fibre cables providing an infrastructure technology for fixed broadband access to end users giving very high (Gigabits per second) broadband speeds. If the fibre connection continues all the way to users' premises it is generally referred to as FTTH or fibre-to-the-premises (FTTP). If the fibre stops at an intermediate point and continues to the user on an existing copper connection, then it is usually referred to as fibre-to-the-cabinet (FTTC) or fibre-to-the-kerb (FTTK). The generic label used for connections that include fibre is FTTx.
Fixed-mobile convergence (FMC)	This generally refers to the ability of telecommunications companies to provide their subscribers with services that interact with and use both the fixed networks and mobile networks using a single customer device. At its simplest, the customer uses a mobile device installed at a fixed location, by-passing the need for a fixed connection. More sophisticated "seamless" FMC provides a mobile service that roams automatically onto the best available local network, including a mobile broadband signal, fixed wireless, **WiFi**, **Bluetooth** etc.
GNI per capita	Gross national income per capita is the monetary value of a country's final income in a year, divided by its population. It is used as an indicator of the relative economic value of markets and spending power of the population.
Grey areas	This term is used in the context of broadband network planning to refer to a geographical area of the country where only one operator plans to invest in high-speed broadband infrastructure within a timescale defined by the state policy for achieving universal broadband access. See also **White areas**.
Grey operators, entities	In the context of this study, grey operators are ones which are not complying with current legal or regulatory requirements for the sector, for example for tax, licencing or regulatory obligations. Companies that do comply regard grey operators as unfair and illegal competition.
GSM	The General System of Mobile was the previous standard (that is before **3G, 4G** and **5G**) used in Europe and adopted widely elsewhere for mobile voice communications and with some very limited data capability.
GSMA	The GSMA is an international body that represents the interests of mobile operators worldwide.
HD	High-definition service, normally used to describe better quality visual and media services that can be delivered over broadband networks.
Internet of Things (IoT)	IoT is a concept that predicts pervasive presence in the environment of a variety of things/objects that connect through wireless and wired connections. Unique addressing schemes and high-speed data capabilities are used to interact connected objects and to cooperate with other things/objects creating new applications/services and reach common goals. Applications and

	sectors that are being developed include smart homes, smart cities, smart grids, industrial/ supply chain/ logistics, connected cars, digital healthcare, smart retail, smart agriculture and many more.
IPTV	Internet protocol television – the technical name given to TV programmes for **streaming** over an internet (fixed or mobile broadband) connection.
ISPs	Internet Service Providers offering internet usage to fixed and mobile broadband customers.
ICT	Information and Communications Technologies (ICT) covers a range of digital technologies including telecommunications, internet and broadband. The services delivered now includes social media as well visual and print media, eCommerce and eGovernment. ICT infrastructure includes electronic communications networks providing access through higher speed fixed and mobile broadband services.
IT	The term Information Technology usually refers to the elements and activities (including hardware, software and labour skills) that exploit computers, storage, networking and other physical devices and processes to create, manage, store, secure and exchange all forms of electronic data. When IT is used in the communications sector (telecommunications, internet and broadband) the term **ICT** is often substituted.
ITU	The International Telecommunications Union is the United Nations specialised agency for information and communication technologies to facilitate international connectivity in communications networks and technologies and to allocate global radio spectrum and satellite orbits.
Last mile	The term normally used for the part of the network that connects customer premises with a dedicated line back to an operator's local network node. In the past the network was based on copper pair cables (local loops), but most new investments now use fibre-based local access networks. This section of the network remains the most expensive to provide.
Latency	True internet speeds are measured by a combination of **bandwidth** and latency. Latency is the delay that is introduced by the network between the time of sending the data from one point to receiving it at the next point. Latency is usually measured in milliseconds (ms). It's also referred to (during speed tests) as a "ping rate".
Local Loop Unbundling	A wholesale offering by a network operator to a broadband service provider so that it can provide an end user with fixed broadband service, normally using **ADSL** technology over the existing copper access (local loop) network. Where **fibre access** has replaced copper in the network, this wholesale service is now normally called **VULA**.
LTE	Long Term Evolution is the generic term for the current dominant mobile network standards, superseding **3G**. Starting with **4G** , LTE is expected to coexist with **5G** for some time.

Mbps	Megabits per second – the standard measure used for broadband speeds (**bandwidth**).
MVNO	Mobile Virtual Network Operator. This is a type of mobile service provider that connects end users via a separate network operator under agreement. The MVNO company provides its own branding on the service and bills the customer. The MVNO then pays wholesale charges to the network operator.
Network slicing	One of the most innovative aspects of 5G architecture, which will let operators provide portions of their networks for specific customer use cases, including separate applications within the "**Internet of Things**" realm — for example the smart home, a factory process, the connected car, or the smart energy grid.
Margin squeeze	An uncompetitive practice used by a dominant network operator. The operator will set its wholesale charges for access to its network at a level which does not allow a competitor to offer a competitively priced service in the downstream retail market.
Number portability	A service to consumers whereby they can change their fixed or mobile telecommunications supplier and still keep their existing telephone number. This has been a key aspect in promoting competition because it has removed an important barrier to consumer choice. Number portability is still important in the broadband market because service providers will typically offer ordinary telephone services within a broadband package.
Opex	Operational expenditures, most relevantly (in the context of this report) to run and maintain broadband networks on a year-by-year basis.
OTT players	Over-the-top players are service providers that offer internet-based applications over the network usually without paying full charges to the network operators. Examples are Skype (and other **VoIP** (voice-over-internet) brands, which offer very cheap phone calls over the network because the user gains access to the service via the internet.
Overall Broadband Investment Index:	The overall comparative index derived from this survey, which rates each country on a score of zero to 100 for each country surveyed. On the comparative scale, zero would indicate a perception that the investment climate is non-existent. A score of 100 would indicate a perception that the overall conditions are perfect for investment. The Broadband Investment Index is an overall index made up of three component indexes; the **Broadband Market Attractiveness Index**; the **Broadband Investment Risk Index** and the **Best Practice Index**.
PPP	Public-Private Partnerships are joint mechanisms that define financial, ownership and other responsibilities for both government and private enterprise to be involved in a single defined project.
RAN sharing	Radio Access Network sharing is a way for multiple mobile network operators to share radio access network infrastructure. This leads to increased use of the same bandwidth and also improves efficiency by rendering an increased amount network coverage for the sharing operators.

Retail-minus	An approach to wholesale service pricing agreements whereby the operator providing the service must charge less than its own retail tariff so that the purchasing operator has room to make a margin on its retail service. The level of wholesale pricing is normally adjudicated by the sector regulator.
Satellite networks	Satellites in stationary orbit (or low flying orbits) around the earth providing mainly international telecommunications links, mass coverage of satellite TV channels and also some limited internet services to more remote regions.
SEE	The collective name given to the Southern and Eastern European markets surveyed in the current round of EBRD reports.
SEMED	The collective name given to the Southern and Eastern Mediterranean markets surveyed in the current round of EBRD reports.
SMEs	Small to medium enterprises, is a convenient term for segmenting businesses and other organisations that are somewhere between the "small office-home office" (SOHO) size and the larger enterprise. The European Union has defined an SME as a legally independent company with no more than 500 employees.
State-aid rules/ regulations	These are a set of conditions, used by governments, that should be applied when government funds are used to invest or to subsidise (wholly or in part) business investments or operations in a country. The intended principal purpose of the rules is to ensure that state funds do not distort the functioning of an effective market, for example by crowding out (replacing) private investments or by leaving private investments at an unfair competitive advantage. The EU has already implemented a special set of state-aid rules for broadband infrastructure investments which are generally seen as a model also to be used in non-EU countries.
Streaming services	Services that provide on-demand film, TV shows, music and video content over a broadband service for instant viewing, rather than having to download or watch at a particular time when something is broadcast. Streaming services can typically be supported by advertising and therefore free to watch, or by subscription. Examples of popular streaming subscriptions are Disney+, Netflix, Amazon Prime, Hulu.
Terrestrial TV networks	These networks broadcast the main national and local TV and radio broadcasting channels from fixed ground-based transmitters on behalf of the media organisations that produce the programmes. In the last decade, most countries have now carried out a modernisation of their networks to complete the “digital switchover” from analogue to digital terrestrial broadcasting.
VoIP	Voice-over-Internet services which are offered by brands such as Skype. These carry voice calls “over the top” (**OTT**) of the network because the caller accesses the service via the internet and not via the telecommunications network exchange. The only fee paid by the user is normally a small call termination fee which goes to the network operator at the other end of the call.

VPNs	Virtual Private Networks – a specialist service provided by telecommunications companies to large multi-site businesses. Having VPN service means that a business does not have to rent multiple separate leased lines and many of the network management functions previously done by the business customer are now provided within a VPN service by the telecommunications provider.
VULA	Virtual Unbundled Local Access is a wholesale rental service provided by a network operator to a broadband service provider in order for the service provider to serve end users with fibre-based fixed broadband. The forerunner to this wholesale service for copper networks was termed **Local Loop Unbundling**.
Wayleave	A legal right of way granted by a landowner, generally in exchange for payment and typically for purposes such as the erection of telecommunications street furniture, overhead wires or laying of ducts.
White areas, white zones	This term is used in the context of broadband network planning to refer to a geographical area of the country where no operator plans to invest in high-speed broadband infrastructure within a timescale defined by the state policy for achieving universal broadband access. See also **Grey areas**.
Wifi	Wireless networks of small reach which are normally provided in public places so that smart phone users can access internet services without using up their network data allowances.

Annex: Emerging policy, regulatory and investor lessons from the COVID-19 pandemic

During 2020 and the first half of 2021, the EBRD survey of investor perception has analysed the views of a range of stakeholders in broadband infrastructure investment in a total of 16 countries. The full implications on broadband network investments have yet to emerge, but there is now sufficient evidence to point to certain policy and investment implications that are now being considered for the future.

The main message arising from the survey analysis appears to be that the COVID-19 experience has re-emphasised to policy makers, regulators and investors the importance of greater connectivity with more geographical coverage and better reliability for broadband networks and services.

Much of the survey analysis, together with wider international discussion and case studies, has been in the context of short-term actions for mitigating the impact of the COVID-19 pandemic. The specific themes that enhance broadband infrastructure efficiencies have been highlighted by investors even before the pandemic arose. Conducting the survey during the course of the pandemic has served to underline the importance of taking account of investors' views so that the remaining barriers to broadband investment, which vary to some extent from country-to-country, can be addressed by policy makers and sector regulatory bodies in close cooperation.

Another key issue that has been brought into sharper focus during the pandemic experiences, as reported by the participants in this survey, concerns the lack of clarity regarding critical critical infrastructures in each country and the required responses to network shocks, failures and security threats (including physical threats from, for example during natural disasters as well as breaches in cyber security).

The key messages arising from the COVID-19 pandemic are best illustrated by the following extracts and case studies.

UN Broadband Commission: COVID-19: Short-term agenda for governments and policy makers/ regulators

At international level, an "Agenda for Action" was adopted during 2020 by the United Nations Broadband Commission for Sustainable Development[35]. This recommends a set of tangible actions to mitigate the impact of the COVID-19 pandemic and to ease the immediate adverse impacts for economies and societies. Their full recommendations cover the following short-term measures on resilient connectivity, affordable access and the safe use of on-line services.

Resilient and safe connectivity

Industry and private sector *actions include ensuring connectivity and network continuity, increased bandwidth capacity and network resilience and security, including for vulnerable populations.* ***Government policy makers and regulators*** *should relieve network capacity constraints and keep networks running and operational (including decreasing taxes and fees, offering wholesale services, temporarily freeing up additional spectrum which can be immediately deployed, infrastructure sharing, using existing universal service funds, promoting cross border roaming etc).*

Affordable access

Industry and private sector *actions include in-kind support through donation of ICT services, cloud services, software, equipment and end user devices, support working from home, identify solutions for liquidity and financial shortage to ensure service continuity, offer special tariffs for related health, education, humanitarian and emergency workers, offer free SMS and zero rating for access to health, educational content and government information services.* ***Government policy makers and regulators*** *should facilitate delivery of (and remove barriers to) industry commitments and general provision of ICT*

[35] https://broadbandcommission.org/COVID19/Pages/default.aspx

services, use universal service funding to support affordable access to health, education, humanitarian and emergency services and people and communities with special needs.

Safe use of online services ***Industry and private sector*** *actions include making available broadcasting capacity for education and health, safe and secured digital platforms, open source software for health, education, food security, financial and governmental services, promote quality education and information content and services; enhance policies against disinformation, increase transparency, provide online training and safe digital tools to parents and teachers to keep children safer online.* ***Government policy makers and regulators*** *should provide guidance to consumers and the general population in areas including child online safety, data protection and cybersecurity measures, increase proactive publishing to promote access to information, support learning institutions to conduct distance classes and take actions to foster media and information literacy.*

Edited extract from short term actions for resilient and secure connectivity
https://www.broadbandcommission.org/covid-19-response/

GSMA Intelligence 'Global mobile trends report'

Navigating the Covid-19 pandemic

"The Covid-19 impact on telecommunications revenue is primarily concentrated in four areas; roaming, due to a lack of international travel; lower handset upgrades due to retail store closures; challenges in corporate and small- medium-sized enterprise (SME) markets, and general consumer spend pressures, particularly in the prepaid mobile segments.

"However, operators' resilient mobile and fibre networks have met the demands of increased data traffic, spiking to 50-100%. The increases were driven by home entertainment and work from home communications, such as video and voice calls."

Extract from 2020 GSMA report https://www.gsma.com/newsroom/press-release/gsma-intelligence-shares-global-mobile-trends-2021/

Defining and coordinating responses to network shocks, failures and security breaches, especially for 'critical infrastructures'

The requirement for telecommunications networks to respond adequately to abnormal traffic loading, service interruptions, physical damage and security breaches, including cyber-attacks, has existed before the COVID-19 pandemic. Respondents from all four EEC countries raised this issue during the survey. In Moldova and Armenia, the need was expressed better national coordination. In Georgia, a law on critical infrastructures has been used in relation to changes in the ownership of telecommunications assets, which has raised questions regarding the role of the state in protecting critical infrastructures.

Broadband networks, in particular, already play a vital role in connecting governmental organisations, businesses and the public. Any shortcomings in network performance, security and resilience have been exposed during the pandemic as a result of abnormal traffic loads. In some cases, the general quality of broadband services has been exposed as inadequate to support critical sectors during the lockdown, like the emergency services, healthcare and education.

'Critical infrastructure' means any system which is essential for providing vital economic and social functions: health, food, security, transport, energy, information systems, financial services, etc. Once these critical infrastructures are defined (on a country-by-country basis) there is a need to prepare special measures to protect networks and services from disruption by both natural disasters and man-made threats (including terrorism, cyber-attacks, disinformation, hostile foreign ownership). Planning and coordination should also take into account the increasing links between sectors and new threats (including climate change and pandemics).

This is a complex area where policy, co-ordination and action preparedness need to be clearly pre-defined. The examples and case studies in this Annex have already highlighted several aspects of the required policy and action responses, including:

-Using policy, regulatory and service provider options for increasing network capacity, including network sharing and wholesale access, temporary spectrum awards, universal service funds, national and cross-border roaming, donation of ICT services to vulnerable entities, free or reduced tariff connectivity for related health, education, humanitarian and emergency workers and free public access to health, education and government information services[36]

...-Defining critical infrastructures and preparing ex-ante supervision arrangements in critical sectors (for example energy, transport, water, health, digital infrastructure, finance sector) plus ex-post supervision for critical digital service providers (on-line marketplaces, cloud and online search engines)[37]

-A clear and defined co-ordination role for the sector's response, including the adoption of a set of network and information security measures along the lines of the EU-wide cyber security legislation[38]*. This has three parts; defining 'national capabilities' including the need to establish a 'Cyber Security Instant Response Team'*[39]*; cross-border collaboration; and national supervision of critical sectors*[40]*.*

The telecommunication industry in the post-COVID-19 world – increasing broadband connectivity

Most innovative models to bring about universal broadband connectivity existed prior to the pandemic. The pandemic has merely reinforced the need to accelerate, scale up or expand them to more geographical contexts. Broadband expansion into non-commercially attractive areas requires extensive cross-sector coordination between diverse organisations with varied vested interests. Examples of such initiatives are;

-The regulatory enforcement of best-practice wholesale access and unbundling procedures to provide a fair and transparent route for new investors to reduce deployment costs.

-Infrastructure sharing including backhaul, ducts, towers, spectrum and last-mile access.

-The creation of specialist companies to offer wholesale facilities including towers and fibre networks.

-Creating open network environments that reduce deployment costs substantially. The concept involves the creation of joint venture telecommunications and platform companies, supported by direct financing instruments.

Summary extracts from ITU report "The telecommunications sector in the post-COVID 19 world:
https://www.itu.int/en/myitu/Publications/2021/05/11/08/10/The-telecommunication-industry-in-the-post-COVID-19-world

[36] https://www.broadbandcommission.org/covid-19-response/

[37] See also https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12462-Protecting-critical-infrastructure-in-the-EU-new-rules_en

[38] https://www.enisa.europa.eu/topics/nis-directive

[39] See: https://www.ncsc.gov.uk/collection/incident-management/creating-incident-response-team#:~:text=A%20cyber%20security%20incident%20response%20team%20(CSIRT)%20consists%20of%20the,the%20nature%20of%20the%20incident.

[40] See https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/662604/EPRS_BRI(2021)662604_EN.pdf

How COVID-19 has pushed companies over the technology tipping point—and transformed business forever

"During the pandemic, consumers have moved dramatically toward online channels, and companies and industries have responded in turn…. (with)…… a rapid shift toward interacting with customers through digital channels. They also show that rates of adoption are years ahead of where they were….

"The customer-facing elements of organisational operating models are not the only ones that have been affected. (Companies) report similar accelerations in the digitisation of their core internal operations (such as back-office, production, and R&D processes) and of interactions in their supply chains. Unlike customer-facing changes, the rate of adoption is consistent across regions.

"When (companies) were asked why their organizations didn't implement these changes before *the crisis, just over half say that they weren't a top business priority. The crisis removed this barrier:*

Extracts from the 2020 McKinsey survey: https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever

Case studies from European Union countries

France: Ensuring national co-operation

Fortunately, digital networks were able to cope effectively with the sudden and unprecedented increase in digital uses during the first lockdown. However, some content providers experienced overloads, which disrupted access to their services (videoconferencing, eLearning services, etc.) for a short adaptation period.

Following a proactive dialogue involving by the Government and sector stakeholders, 'heavy' network users, such as video streaming platforms and online gaming platforms reduced the strain their content put on the network by capping the bandwidth their services required and by scheduling downloads and service updates during off-peak hours.

Stakeholders' collaboration was efficient in responding to the COVID-19 first "hard" lockdown. For future work, this situation has emphasised the need for close collaboration between national (and European when relevant) ICT stakeholders to increase the ecosystem's resilience and react promptly to unexpected events that could have an impact on the networks' traffic load.

Portugal: Better monitoring of complaints

Complaints about electronic communications increased significantly with the COVID19 crisis during 2020, mainly about service faults, technical assistance, service connection and internet speeds. The sector regulator was able to analyse complaints that were being submitted daily by end users. Based on this, the regulator was able to carry out timely consumer protection during the COVID-19 crisis, including publishing frequently asked questions plus a Consumer Guide about the impact of COVID-19.

As a result, a proposal has been made to Government for the adoption of new legal rules protecting end users from the impact of COVID-19 based on the analysis of complaints. These new rules will question service providers about the measures adopted to address the issues most complained about.

The regulator's website information guide about the impact of COVID-19 on consumers' experiences and rights was viewed around 9,000 times. The frequently asked questions webpage was accessed over 55,000 times.

Ireland: Temporary spectrum award

The swiftness and impact of the COVID-19 lockdown measures resulted in significant changes to the normal traffic levels and patterns of electronic communications networks in Ireland. Given increased

traffic demands placed on wireless networks, the regulator consulted upon and put in place a licensing framework for the temporary assignment of spectrum rights.

Spectrum rights for an overall period of up to six months were made available to the three mobile operators for rapidly use.

There has been a 67% aggregate increase in data traffic on mobile networks which indicates that the temporary assignment of spectrum rights was an appropriate initiative.

Croatia: Resilience of telecommunications networks

During 2020, Croatia experienced the COVID-19 crisis and two damaging earthquakes. Electronic communications networks showed remarkable resilience, but these crises had a variety of impacts on operators, such as closing points of sale, disrupting the supply chain, increasing the resources needed for customer care, and so on, but the overall impact was limited.

In addition, as a consequence of full or partial lockdowns, there has been a massive shift in traffic from offices, schools, and universities to the home. Work from home via video conferencing, online education for schools and universities, extensive use of online services, and increased use of video streaming and gaming have resulted in unprecedented growth in network usage. The COVID-19 pandemic and the resulting restrictions have highlighted the importance of communications and connectivity of broadband networks.

As a result of this experience, it has been recommended that Croatia adopts an 'Agenda for Action' based on the UN Broadband Commission's recommendations[41] The medium–term agenda includes a set of high-level actions requiring more coordination among national and international stakeholders:

1) Acceleration and implementation of digital cooperation and digital strategies and policies;

2) Elevation to the G20 level of resilient broadband networks as a basic right;

3) Implementation of agile and flexible regulatory measures to support an inclusive and competitive digital environment;

4) Adoption of strategies aimed at promoting universal connectivity by mobilising public and private funding and investment;

5) Implementation of streamlined actions and partnerships to promote the expansion of broadband connectivity, digital services, and digital inclusiveness to unconnected communities and populations;

6) Promotion of the ongoing importance of connectivity for education, access to information, and online user empowerment though media and information literacy;

7) Highlighting of areas where connectivity is playing a key role in the COVID-19 pandemic response and widespread dissemination of these stories to help build better and more resilient societies;

8) Identification of major partners for public financing of connectivity to vital services, including schools, and actions to attract institutional finance investors looking for a compelling market opportunity.

Overall lessons from the COVID-19 experience in the EU

The overall resilience of the internet made it possible to cope with the unprecedented increase of traffic on fixed and mobile networks in Europe during the COVID-19 crisis and no major congestion issue occurred.

All national regulators conclude that despite the severity and difficulties introduced by this public health crisis in Europe, they were able to act with considerable flexibility.

[41] See: https://www.broadbandcommission.org/covid-19-response/

Operators were constantly monitoring their networks' ability to cope with the increased traffic and pre-empt capacity shortages, finding solutions proactively in partnership with their associated digital platform service providers, national regulators and governments.

At a time when people were relying much more on electronic communications services and were facing an unprecedented degree of economic and financial uncertainty, operators voluntarily introduced relief measures and new tariff plans to cater to the particular needs of certain consumer groups like doctors or families with schoolchildren.

France, Portugal and Ireland edited case studies from the 2021 draft BEREC Report on COVID-19 crisis – lessons learned regarding communications networks and services for a resilient society: https://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/9969-draft-berec-report-on-covid-19-crisis-le_0.pdf

Croatia case study: Extract from 2021 World Bank report "Assessment of the digital market in Croatia." https://openknowledge.worldbank.org/handle/10986/35541

Overall lessons edited extract from the 2021 draft BEREC Report on COVID-19 crisis – lessons learned regarding communications networks and services for a resilient society: https://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/9969-draft-berec-report-on-covid-19-crisis-le_0.pdf

Regulatory coordination role for the response to COVID-19

In the face of the COVID-19 pandemic, the sector regulator in the United Kingdom set itself two key objectives:

-To ensure network resilience and protect critical services.

-To ensure the networks continued to work well as people moved to work and learn from home, stay in touch with friends and family, and keep themselves entertained.

To achieve these objectives, the regulator worked closely with network providers and the government to track the measures that they were taking to manage network demands and congestion effectively, where necessary prioritising action required to protect critical services.

The reliability of emergency and healthcare calls was a critical priority. Under the regulatory rules, providers must ensure that emergency calls can be connected at all times, even in challenging circumstances. At the request of the government, the regulator acted to introduce a special '119' number for use as part of the National Health Service's pandemic response programme.

The regulator reinforced its role to keep the UK spectrum free from interference, by prioritising action that protected critical services, such as for power networks. Engineers and technicians were designated as 'key workers' and tasked to keep the airwaves safe and functioning.

The regulator pressed ahead with decisions aimed at promoting investment and competition in fibre networks and the release of more spectrum for 5G services.

Reporting to the regulator, telecommunications providers closely monitored traffic on their networks, and measures were taken by content providers, streaming services, content delivery networks and gaming companies, to mitigate the impact of the increased load on the network.

-Christmas 2020 saw a new peak of internet traffic. Fixed data usage has increased almost 80% in the last two years and lockdowns also saw a shift in how people use their services. Daytime traffic increased significantly. Upload traffic also increased, driven by more use of video calling. Mobile networks also successfully coped with the increased demands and changes in network traffic patterns, including a shift of hotspots from city centres to the suburbs and residential areas.

-The regulator noted that networks had the capacity to meet these demands and stayed well within capacity limits

Summary extract from Ofcom July 2021 report:

https://www.ofcom.org.uk/about-ofcom/annual-reports-and-plans/2020-21-annual-report?utm_medium=email&utm_campaign=Ofcom%20Annual%20Report%20and%20Accounts%20202021&utm_content=Ofcom%20Annual%20Report%20and%20Accounts%20202021+CID_947445ff15ff9a150556828bb022d55c&utm_source=updates&utm_term=Annual%20Report%20and%20Accounts

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