ASSESSING E-RESILIENCE

in Kazakhstan, Kyrgyzstan and Mongolia

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Abstract

This working paper is prepared under the framework of the Asia-Pacific Information Superhighway initiative (AP-IS) and provides an overview of policy responses and recommendations to enable the e-resilience of Information and Communications Technology (ICT) infrastructure and the use of ICT for societal resilience, which is a key component of crisis preparedness and instrumental in deciding on response.

This Working Paper is prepared to support policymakers of three countries - Kazakhstan, Kyrgyzstan, and Mongolia - target countries of the Regional Economic Cooperation and Integration (RECI) - Development Account 11th Tranche project. The paper serves as an example of harnessing the E-resilience monitoring dashboard, developed by ESCAP in 2021, for analysis and a way forward recommendations, responding to the necessity and aspiration of enhancing e-resilience, focusing on the cases of the above three countries.

In this paper, policymakers from Kazakhstan, Kyrgyzstan and Mongolia may discover key entry points for improvement of e-resilience capacity, or indicate the areas for collaboration, and decide on future direction of ICT policy to grow into a full-fledged e-resilient society through regional cooperation.

This Working Paper and the online e-resilience monitoring dashboard provide scoping of opportunities for countries' cooperation and highlight the importance of e-resilience along with vital contributions to policy design and reforms that will enable sustainable growth.

The visuals are drawn from the interactive on-line e-resilience monitoring dashboard, available at the ESCAP website with the data sourced from official data for the period covering 2018-2020.

Keywords

Abbreviations and Acronyms

AP-IS	Asia-Pacific Information Superhighway
CICTSTI	Committee of Information, Communications and Technology and Science, Technology and Innovation
ENEA	East and North-East Asia:
ESCAP	Economic and Social Commission for Asia and the Pacific
GIS	Geographic Information System
ICT	Information and Communications Technology
Mbps	Megabit per second
NCA	North and Central Asia
PICS	Pacific Island Countries
RECI	Regional Economic Cooperation and Integration
SA	South Asia
SME	Small and Medium-sized Enterprises

1. Introduction

The Third Session of the Committee of Information, Communications and Technology and Science, Technology, and Innovation (CICTSTI-3) in August 2020[2] recognized that the coronavirus (COVID-19) pandemic has further demonstrated the importance of e-resilience readiness, and recommended to expand the regional multi-stakeholder collaboration to scale up broadband internet capacities for the effective use of technological innovation and harnessing technology to address disasters and major challenges such as COVID-19.

In the middle of the pandemic crisis, the ability to properly measure e-resilience becomes a key component of successful disaster risk management and adaptation strategy in the recovery period. Furthermore, the contributing actions to enhance e-resilience readiness have been highlighted to prepare the post-pandemic era.

E-resilience readiness: a critical factor of national risk management through ICT

As the third pillar of the Master Plan of the Asia-Pacific Information Superhighway (AP-IS), e-resilience is defined as the ability of ICT systems to resist, absorb, accommodate, adapt to, transform, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.[3]

From a pandemic management perspective, e-resilience can be interpreted in two ways: resilience of ICT infrastructure networks; and

ICT for societal resilience. Based on this, Figure 1 sets out a possible structure of e-resilience framework, informing ICT's role in each phase of the disaster or crisis cycle under two aspects.

On one hand, e-resilience of ICT infrastructure networks stands for the capacity of ICT systems in response to external disturbances. As a matter of fact, it is easier for a country with resilient ICT infrastructure to minimize the damage and secure public safety than others without preparedness when facing a crisis. Specifically, resilient ICT infrastructure networks can avoid the creation of new risks, addressing the underlying risk factors, ensuring continuity plans on connectivity and enabling rapid multidimensional assessment for each phase of a pandemic period.

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[2] More information of the session is available at https://www.unescap.org/events/committee-information-and-communications-technology-science-technology-and-innovation-third.
[3] UN ESCAP (2020), Collaborative actions to harness technologies during pandemics. Available at https://www.unescap.org/sites/default/files/CICTSTI_1_item%202_E.pdf.

Figure 1: E-resilience framework from a pandemic management perspective

Pandemic phase and ICT role	Risk prevention	Risk reduction	Preparedness, adaptation and response	Recovery phase
Key task	Improving pandemic-informed investments, strategies, operations in ICT connectivity, risk analytics for early warning and enhanced preparedness	Mitigating the chance of virus-induced disruption, damage, socio-economic losses, through development of analytical tools, applications, lessons learnt	Risk indexing, lessening the impacts by preparing and being able to respond to new pandemics. Developing an e-resilience index to assess readiness	Restoring functions with graded lockdowns, and operations, recovering to build back better
ICT for its own resilience	• Avoiding creation of new risks • Avoiding exacerbation of existing risks • Avoiding transfer of risks	• Addressing the underlying risk factors • Reducing vulnerability to pandemics • Increasing network capacity and protection through alternatives such as co-deployment of infrastructure • Reducing exposure • Investing in early warning	• Ensuring continuity plans on connectivity • Ensuring redundancy and backups • Ensuring response readiness • Ensuring training and drills • Ensuring contingency planning • Ensuring emergency mechanism • Ensuring early recovery	• Enabling rapid multi-dimensional assessment • Enabling estimation of needs • Ensuring recovery strategy • Investing to reduce future risks • Adaptive and innovative ICT networks
ICT for society's resilience	• Utilizing ICT to improve risk assessments • Utilizing ICT for better analysis • Utilizing ICT for development planning through real time data management, scenario planning techniques	• Establishing and utilizing risk databases • Utilizing GIS, remote sensing, science and technology for disaster risk reduction • Fostering knowledge and innovation • Enhancing risk monitoring and warning	• Utilizing ICT for preparedness • Utilizing ICT for assessment and emergency decision-making • Enhancing communication and coordination at all levels • Enhancing technologies for real data management and scenario planning	• Enabling rapid assessments and detailed post-disaster needs assessment • Acceptance of uncertainty and unpredictability • Public-private cooperation framework for diversity and redundancy

Source: ESCAP (2020), Collaborative actions to harness technologies during pandemics, Table 2. Available at
https://www.unescap.org/sites/default/files/CICTSTI_1_item%202_E.pdf.

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For instance, solid ICT infrastructure and networks have protected ordinary people's life against COVID-19, by enabling real-time information sharing to manage infections and online learning systems for students, and expanded market for SMEs, during the time of crisis and social distancing. In this sense, it can be highlighted that the reliability, diversity, speed and resilience of national and regional ICT infrastructure shall be a critical development priority in the region.

On the other hand, ICT for societal resilience signifies ICT's role in linking people, machines, data, institutions and communities at all levels, aside from the role as infrastructure itself. A country with high e-resilience can recover from crisis faster due to the timeliness and speed of the information flow of well-connected system across all sectors of the society. In detail, ICT for societal resilience consists of utilizing ICT for risk prevention and response, enhancing communications and coordination, and fostering knowledge and innovation through ICT skills. Regional/International cooperation and high-level dialogues between countries to build effective management system could be an essential.

Therefore, e-resilience readiness can be considered as an essence of risk management contributing to social and economic stabilization. Furthermore, it becomes a prerequisite for countries to accord extended recognition and commit sustainable efforts through the collaboration between countries in the region toward establishing solid e-resilient economies and societies entering the new digital era.

Bearing in mind the importance of proper measuring e-resilience[4], ESCAP has developed the interactive E-resilience Monitoring Dashboard, which may help national policymakers to spot the strengths as well as "bottlenecks" and important areas in the above-mentioned efforts in the more structured and visual way.

For high resolution of analysis, the Dashboard serves indicators categorized by four pillars comprising e-resilience to facilitate understanding of policy impacts on separate areas. More information with regard to the dashboard can be found in the user guide.

As an extension of the RECI project this Working Paper serves as an example of harnessing the ESCAP E-resilience monitoring dashboard which focuses on three cases of target countries: Kazakhstan, Kyrgyzstan, and Mongolia. The Working Paper in three target countries does some analysis and proposes recommendations as a way forward, responding to the necessity and aspiration of enhancing e-resilience readiness.

For the analysis of readiness, the ICT indicators are grouped into four pillars (ESCAP, 2020):

1. **ICT policy** in different sectors build the foundation for e-resilience modelling,

2. **ICT's role in setting up new systems and applications** is important in e-adaption and recovering from the pandemic,

3. **ICT's role in data management** (gathering, big data analysis, and decision making) leads into actions and policies which influence disaster resilience and adaptability,

4. **ICT infrastructure resilience** is a physical foundation for all the above.

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[4] More information is available at https://www.unescap.org/kp/2021/e-resilience-readiness-ict-infrastructure

Under each pillar, e-resilience of target countries could be estimated through considering scores of each group indicators.

For intuitive understanding, scores are represented in certain colors which signify the level of performance of the economy in terms of the pillar or component concerned.

Proposed color spectrum vary from red (the lowest) to dark green (the highest) in five stages corresponding to the appointed score intervals, as following:

Red (0% - 30.9 %): the least ready economy in the pillar or component concerned. Requires more investments or support from other member states to achieve e-resilience.

Orange (31% - 44.9%): the economy does not perform well enough in the pillar or component concerned. In transition and requires more resources and capacity building and investments to achieve better e-resilience.

Yellow (45%- 59.9%): the economy is a good performer when it comes to the pillar or component concerned, nevertheless there is a room for improvement which requires some more resources and capacity building to become more e-resilient.

Light green (60% - 74.9%): the economy is a strong performer because of solid showings in the pillar or component concerned. Ready for sharing experiences, services, and tools (e.g. e-platforms and e-market spaces) at interstate level, and there is some room for improvement to become more e-resilient.

Dark green (75% - 100%): the economies, which are the global leaders and most e-ready societies performing at the highest level in the index pillar or component concerned. This in turn demonstrates high e-resilience and readiness for intercountry sharing of experience and services.

The findings of assessing e-resilience readiness of target countries are highlighted below. Policy suggestions to step forward with contribution from the interactive online e-resilience monitoring dashboard as a toolkit (see more at https://drrgateway.net/regional-toolkits) are also proposed.

In this paper, policymakers from Kazakhstan, Kyrgyzstan and Mongolia may discover key entry points for improvement of e-resilience capacity, or indicate the areas for collaboration, and decide on future direction of ICT policy to grow into a full-fledged e-resilient society through regional cooperation.

2. Overview of E-resilience Monitoring Framework

The critical four pillars, introduced in the section above, can be considered as important dimensions of the resilience of ICT infrastructure and networks in the RECI project target countries. Thus, these four pillars plus a risk evaluating component, through their corresponding indicators, can be factored into the framework of e-resilience monitoring dashboard and further can be used to monitor e-resilience, including over time. In other words, strengthened ICT infrastructure and improved access to Internet and innovative technologies adoption, while proper evaluation of hazards existing in each country, can ease the response, recovery and overall societal resilience to possible future crises.

2.1. Understanding Hazard and Exposure

As a first step according to the ESCAP e-resilience guiding principles on understanding the risk[5], it may be worthwhile to have a look at

Figure 2, presenting the risk level into colors as yellow (medium-risk) for Kyrgyzstan, light green (low-risk) for Kazakhstan and dark green (lowest-risk) for Mongolia. It specifies the highest value of risk equal to 5 for Kyrgyzstan, 2.4 for Kazakhstan, followed by 1.5 for Mongolia, the lowest.

Figure 2 : Hazard and Exposure Scores in LLDCs as of 2020 (covers 2018-20)

RED: 6.5 – 10 risk is very high
ORANGE: 5.1 – 6.49 risk is high
YELLOW: 3.5- 5.09 risk is medium
LIGHT GREEN: 2 – 3.49 risk is low
DARK GREEN: 0 – 1.99 risk is very low
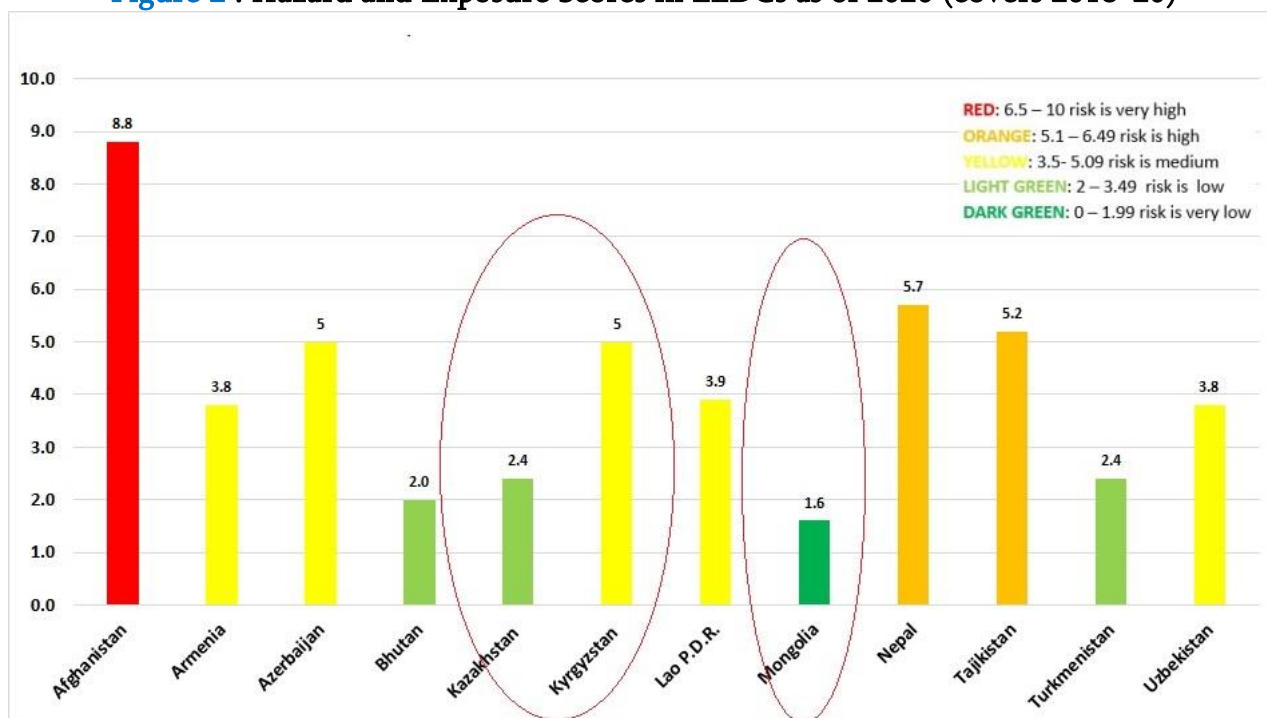
Source: Authors, based on INFORM Risk Indicator data, URL: https://drmkc.jrc.ec.europa.eu/inform-index/INFORM-Risk; Page 4 of the E-Resilience Monitoring Dashboard 2021 could be found at: E-resilience Monitoring Dashboard | ICT & DRR Gateway[6]

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[5] More information on e-resilience guiding principles is available at E-Resilience Readiness of ICT Infrastructure | ESCAP (unescap.org)

[6] E-resilience Monitoring Dashboard | ICT & DRR Gateway

This may help to identify the countries at high risk of crisis that are likely to require international support or assistance and need of the development of relevant proactive crisis management framework through effective and efficient allocation of proper resources, including ICT, for disaster management focused on anticipating, mitigating of crisis, and building back better[7].

Hazard & Exposure parameter of three countries are composed of natural hazards, especially floods, earthquakes, and droughts, which are the most frequent disasters in North and Central Asia (Figure 3). Specifically, Kazakhstan and Kyrgyzstan are prone to the earthquakes, droughts, and exposed to epidemic. Mongolia is mostly prone to droughts and to the lesser extent floods; and human originated hazards, represented by conflicts probability, which is considerable for Kyrgyzstan.

Figure 3 : Share of disasters in North and Central Asia* by number of occurrences (2000-2020)
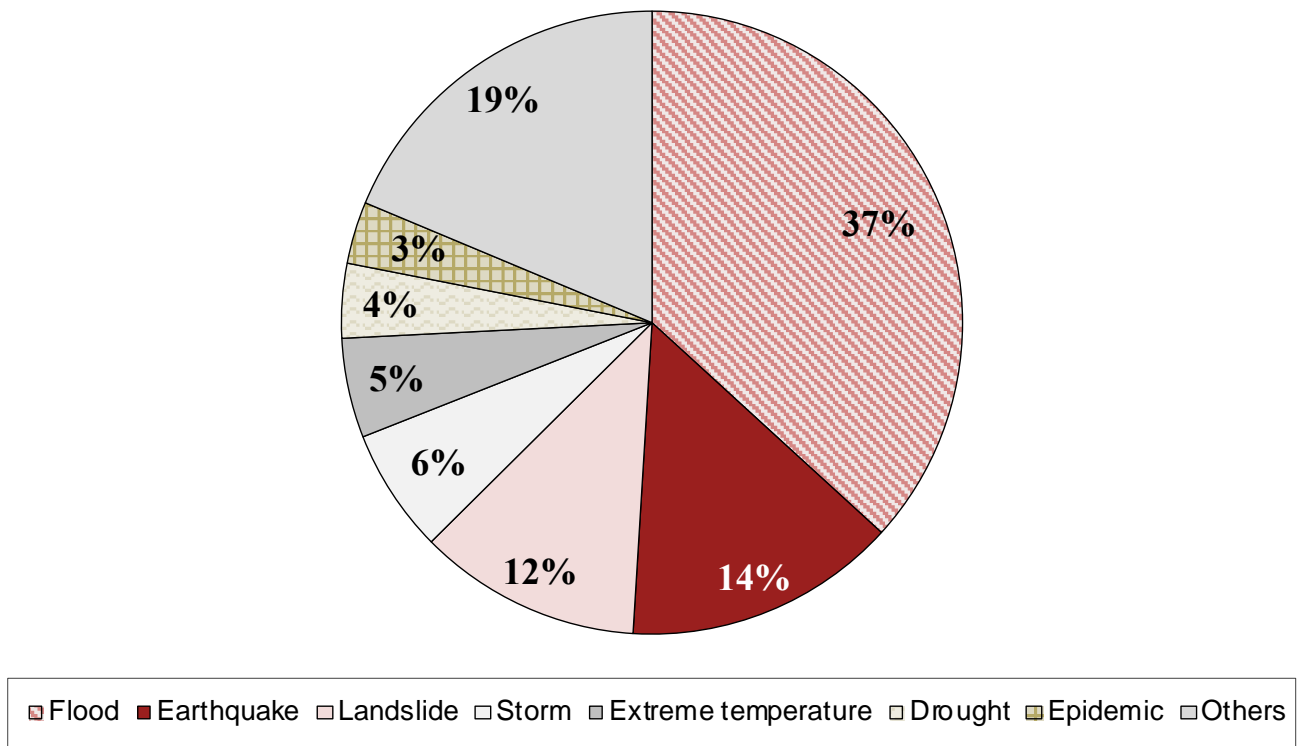
Source: EM-DAT, CRED / UCLouvain, Brussels, Belgium.
*Countries: Armenia, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.

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[7] More information on the particular Hazards for each country is available at https://drmkc.jrc.ec.europa.eu/inform-index/INFORM-Risk/Country-Profile/moduleId/1767/id/419/controller/Admin/action/CountryProfile

To enhance e-resilience readiness in the region, it is necessary to assess their present status and analyze enabling factors. Analysis of ICT indicator scores and performances, categorized by four following pillars could be drawn from the Figure 2, of the e-resilience monitoring dashboard. Policymakers may assess the state of each pillar through the colors of indicators, stretched from red (the least e-resilience-ready) to green (the readiest) color set, as mentioned above.

2.2. Assessing ICT policy support for e-resilience of network

Glancing through the ICT indicator performance within this pillar of the e-resilience monitoring dashboard, policymakers may undertake a quick assessment of existing indicators, such as ease of doing business; legal framework's adaptability to emerging technologies; e-commerce legislation; ICT regulatory environment; cybersecurity; adult literacy; R&D expenditure by governments and higher education.

Kazakhstan's ICT performance in education, internet security and nurturing businesses is very high. The adult literacy (99.80/100), mean year of schooling (11.80), cybersecurity (0.78/1), secure internet servers (2,358.98/1,000,000) and ease of doing business (79.56/100) represent a great opportunity for digital economy performance in those fields, once enabled by relevant sector-based ICT policy. On the other hand, there is a room for strengthened pursuit of creating conducive regulatory environment. Moreover, the red color of some indicators indicates the low R&D and higher education investment by the government, which might be challenging for the deployment of emerging technologies.

Kyrgyzstan performs well in ICT regulatory environment, which is based on a composite index-the ICT regulatory tracker- that provides measure of the existence and features of ICT legal and regulatory frameworks. It includes 50 indicators, covering regulatory authority, regulatory mandate, regulatory regime, and competition framework. The latter have especially good scores. The internet security - cyber security and secure internet servers are recorded as low, such as 0.25/1 and 287.91/1,000,000, respectively. Cybersecurity and Legal Framework to emerging technologies requires the policy and investment intervention.

Mongolia is a good performer in ICT regulatory environment, with a high score in the regulatory regime, followed by regulatory authority and regulatory mandate. Better adaptation measures to emerging technologies and ease of doing business areas requires attention (Figure 4).

Overall, in all three countries the legislation to support ICT-based socio-economic activities, with an adopted legislation or draft law pending adoption in three out of four assessed areas: electronic transactions, consumer protection, privacy and data protection, and cybercrime and can be advised to try to fill in the remaining gap shortly. Countries may want to share this progress and build strategies together which could be effective for risk prevention and societal preparedness to multiple external risk. Still, there is room in all countries for further improvement towards the most E-resilient economy.

The "perception-based Survey on E-resilience Readiness", conducted by ESCAP in 2020, with respondents from Kazakhstan, Kyrgyzstan and Mongolia [8] highlighted the need for improving the resilience of ICT network infrastructure, enhancing ICT utilization for facilitation of access to essential health services and expanding investments and creating conducive policy environments to adopt emerging technologies for the next generation, as illustrated through ratings, capturing the average scores of answers to 31 questions (Figure 5).

[8] ESCAP Survey on e-resilience readiness results, RECI. Available at https://www.unescap.org/sites/default/files/Annex%203%2C%20 Survey%20A%20results%2C%20updated_0.pdf.

Figure 4: ICT policy in some sectors in Mongolia
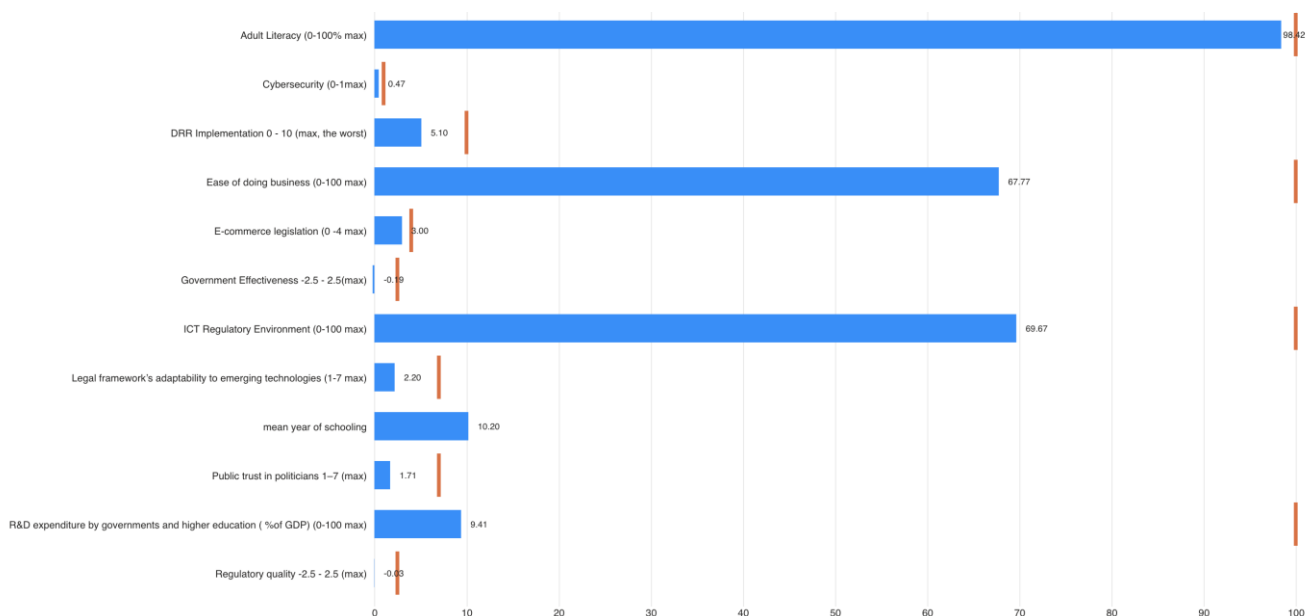
Figure 5 : E-resilience readiness in RECI target countries, as of 3 July 2020
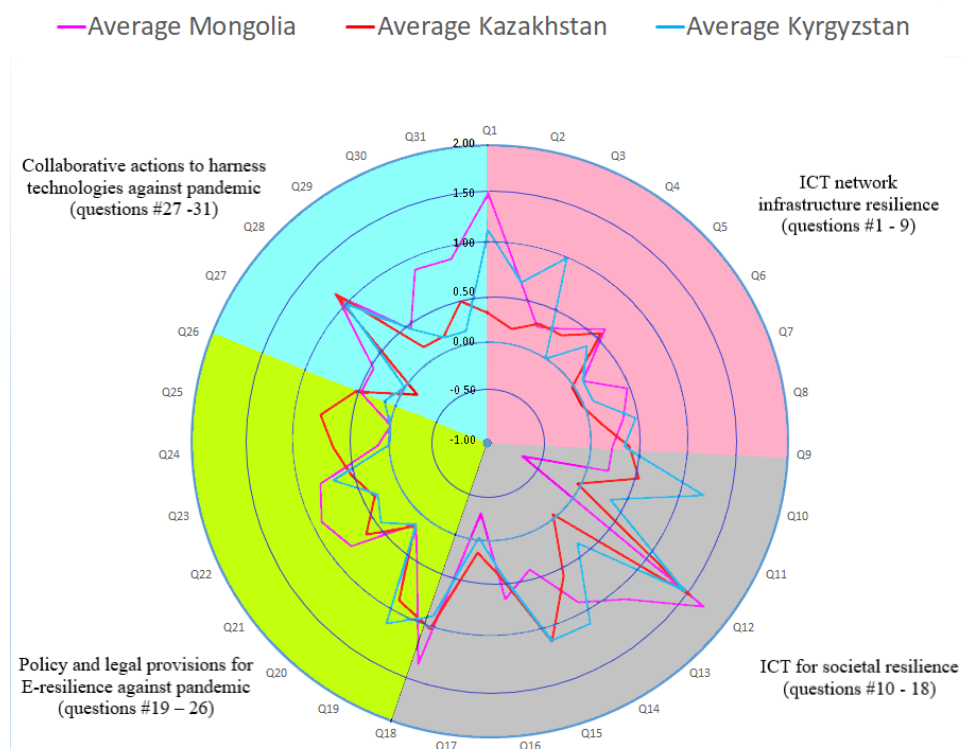
Particularly, lack of development and embracement of emerging technologies in NCA

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[9] E-resilience Monitoring Dashboard | ICT & DRR Gateway

further stands out when comparing with ENEA. New technologies are critical to improve country's risk management in terms of facilitating the invention of innovative methodology and solution which lead to the developments of analysis, forecasting and response abilities. And for adopting and utilizing those technologies, adequate funding and receptive legal environment should be accompanied. According to the e-resilience dashboard, two indicators on legal framework's adaptability to emerging technologies and R&D expenditure by governments and higher education represent country's adaptability for new technologies. These are mostly colored in red and orange within NCA countries while those of ENEA are generally in yellow and green (See Figure 6 and Figure 7 below). Therefore, NCA countries may need to push for attracting financial support and legal assistance of developing/adopting latest models and techniques to build enhanced capacity to prevent, reduce, prepare and response and recover from national crisis through strengthened e-resilience readiness.

Figure 6 : ICT Policy in different sectors for ENEA

Pillar	Name	China	Hong Kong(China)	Japan	Mongolia	Rep. Korea	Russian Federation
ICT policy in different sectors	Adult Literacy (0-100% max)	96.84		99.00	98.42	99.00	99.73
	Cybersecurity (0-1max)	0.83		0.88	0.47	0.87	0.84
	DRR Implementation 0 - 10 (max, the worst)	2.50		1.90	5.10	1.50	
	Ease of doing business (0-100 max)	84.37	97.44	84.49	66.40	95.11	84.78
	E-commerce legislation (0 -4 max)	4.00		4.00	3.00	4.00	1.00
	Government Effectiveness -2.5 - 2.5(max)	0.52	1.74	1.59	-0.19	1.38	0.15
	ICT Regulatory Environment (0-100 max)	44.02	84.36	71.24	67.96	81.86	35.91
	Legal framework's adaptability to emerging technologies (1-7 max)		4.62	4.23	2.20	4.40	3.80
	mean year of schooling	7.90		12.80	10.20	12.20	12.00
	Public trust in politicians 1–7 (max)	4.50	4.80	4.50	2.50	2.50	
	R&D expenditure by governments and higher education (%of GDP) (0-100 max)	42.53	9.87	64.69	0.22	92.41	17.00
	Regulatory quality -2.5 - 2.5 (max)	-0.14	2.21	1.33	-0.03	1.09	-0.54
	Secure Internet servers (per million population)	734.98	60,546. 13	18,701. 35	1,690.46	4,543.84	9,339.02

Source: Page 1 of the E-Resilience Monitoring Dashboard 2021 could be found at: E-resilience Monitoring Dashboard | ICT & DRR Gateway[10]

[10] E-resilience Monitoring Dashboard | ICT & DRR Gateway

Pillar	Name	Armenia	Azerbaijan	Georgia	Kazakhstan	Kyrgyzstan	Russian Federation	Tajikistan	Turkmenistan	Uzbekistan
ICT policy in different sectors	Adult Literacy (0-100% max)	99.74	99.79	99.36	99.80	99.59	99.73	99.80	99.70	99.99
	Cybersecurity (0-1max)	0.50	0.65	0.86	0.78	0.25	0.84	0.26		
	DRR Implementation 0 - 10 (max, the worst)	7.50		4.70	3.80	3.70		4.60		2.60
	Ease of doing business (0-100 max)	74.50	76.71	83.70	79.56	67.82	84.78	61.27		
	E-commerce legislation (0 -4 max)	3.00	3.00	2.00	3.00	3.00	1.00	3.00		
	Government Effectiveness -2.5 - 2.5(max)	-0.07	-0.14	0.83	0.12	-0.68	0.15	-1.05	-1.16	-0.51
	ICT Regulatory Environment (0-100 max)	85.50	70.50	92.50	54.00	74.50	35.91	14.00		
	Legal framework's adaptability to emerging technologies (1-7 max)	3.41	4.27		3.38	2.15	3.80	2.84		
	mean year of schooling	11.80	10.50	12.80	11.80	10.90	12.00	10.70	9.80	11.50
	Public trust in politicians 1–7 (max)	3.20	4.65	2.90	3.76	2.84		4.25		
	R&D expenditure by governments and higher education (%of GDP) (0-100 max)	18.91	18.03	30.46	5.72	7.57	17.00	9.70		
	Regulatory quality -2.5 - 2.5 (max)	0.27	-0.38	1.12	0.14	-0.35	-0.54	-1.05		
	Secure Internet servers (per	478.75	368.84	2,776.33	2,358.98	287.91	9,339.02	71.13		

Source: Page 1 of the E-Resilience Monitoring Dashboard 2021 could be found at: E-resilience Monitoring Dashboard | ICT & DRR Gateway[11]

Hence, policymakers in NCA and ENEA as an entry point, may want to review and update the relevant regulations related to digitalization; incorporating e-resilience principles into policies and legislation; creating more conducive legal environment for digitalization including provision of incentives for investments in research and innovation; and paying careful attention on cybersecurity matters. These measures may enhance resilience of ICT infrastructure networks and make practical transition to a network-ready society in both regions.

For further improvement, countries in both regions can bridge remaining e-readiness gaps existing between cybersecurity, e-commerce, regulation and R&D investment, legal framework. Narrowing such divides will enable countries and regions to become much e-resilient and cope with crisis in far more effective manner.

In the middle of progress, regional collaborations may be leveraged for accelerating e-resilience growth in terms of ICT policy advancement. For instance, Kyrgyzstan and Tajikistan may make great strides in e-resilience with assistance from neighboring states. Although more than half of countries in the region are good performer in most parts, those two countries are observable in line with drawing necessity of improving e-resilience in most sectors of ICT policy. Notably, both countries are commonly deficient in security and regulatory environment matters. In this case, more skillful countries such as Kazakhstan may share best practices and learned lessons which can be valuable for less resilient countries to pick up and reflect in policy making. These partnerships can contribute to inclusive and balanced growth in regional/international perspective through leading vulnerable countries to be equipped with much enhanced e-resilience and readiness.

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[11] IBID

2.3. Assessing availability of ICT infrastructure

In this pillar, the level of e-resilience readiness can be estimated through the colors of indicators in Figure 8. The rapid assessment of this pillar includes scores of the following indicators: percentage of individuals using the Internet; fixed (wired) broadband subscriptions per 100 inhabitants; active mobile-broadband subscriptions per 100 inhabitants; mobile tariffs; handset prices; percentage of households with Internet access at home; percentage of households with a computer; 4G mobile network coverage.

Kazakhstan illustrates a decent e-resilience readiness of ICT infrastructure. The 4G network coverage, mobile cellular subscriptions, households with a computer and internet access demonstrate high scores, and therefore better e-resilience readiness, that may support the foundations of the digital economy. Specifically, the internet and mobile network have spread to most individuals and households showing high e-resilience in ICT infrastructure. However, the necessity of addressing quality and affordability of internet connections still remains, in line with the yellow colors of fixed broadband subscriptions and handset prices. Regarding the quality and affordability of internet connections, more resources and capacity building are required to enhance e-resilience readiness status.

Kyrgyzstan's data had shown a remarkable performance of the foundations set for economy through e-resilience. The dark-green coloring of the scores for the mobile network coverage and mobile broadband subscriptions can be factored in e-resilience status. Data also shows

that most fixed-broadband services offer high-speed internet access which is over 10 mbit/s. However, Kyrgyzstan still lacks substantial internet penetration. Red and orange coloring of indicators requires attention, regarding the low number of households with internet access at home and in schools, and a large number of households and schools that cannot access to the internet at their locations. Moreover, the country has a poor affordability of handsets, as proved by the red color of handset prices. In conclusion, in Kyrgyzstan, most people have limited use of fixed-broadband, despite of the quality it provides, whereas brisk usage in mobile environment is evident. Therefore, further investments and support for actual internet usage, particularly fixed-broadband, may be required to enhance e-resilience and e-readiness of the country.

Mongolia has a presentable ICT infrastructure of mobile network and in ICT education. It shows stable economic performance of mobile subscriptions and accessibility of schools. The 4G network coverage and a few emerging issues related to fixed broadband could be improved. The accessibility, affordability and quality of the fixed broadband indicators are mostly in red, which implies the least ready economy in the pillar. Specifically, regarding accessibility and affordability, fixed broadband subscriptions, handset prices and households with a computer and internet access at home all present low values represented in red, such as 9.66, 30.46, 30.00 and 22.99, out of 100, accordingly. With respect to the quality, the fixed broadband services which serve higher than 10 Mbit/s are merely 0.58 percent of total

services, pinpointing the shortage of network quality. Therefore, in case of Mongolia, expanded investments and support for fixed broadband may be required to achieve advanced e-resilience and e-readiness of terrestrial networks.

Comparing the average download speed of NCA and ENEA through Figures 9-10, the necessity of improving network quality of NCA is further clarified. Regarding mobile broadband, average download speed in NCA is few tens of megabits per second shown as light green colors covering most parts of the region. Besides, there are some areas with worse connection which presented in warm colors mostly distributed in around

Kazakhstan, Uzbekistan, Kyrgyzstan, and Tajikistan. On the contrary, speed maps of ENEA, containing leading countries of ICT infrastructure, largely showed green and blue colors representing high speed of internet. In terms of fixed broadband, NCA draws larger attention to improve. Not only being far behind ENEA, NCA also falls short of global standard. In comparison with high speed of fixed broadband in ENEA, relatively warm colors of NCA are outstanding which ranges from 1 to 10 megabits per second. This proves the severity of fixed broadband quality of NCA, being far less than recommendation speed equivalent to 10 to 25 Mbps for general usage, according to the Broadband Guide by FCC[12].

Figure 8 : ICT infrastructure scoring in Kazakhstan, Kyrgyzstan, and Mongolia

Pillar	Name	Kazakhstan	Kyrgyzstan	Mongolia
ICT infrastructure as a physical foundation	4G mobile network coverage (0-100 % max)	75.30	70.00	45.00
	Active mobile-broadband subscriptions per 100 inhabitants (0-100 % max)	77.57	94.03	83.72
	Computer software spending (0-100 % max)	0.02	0.09	0.13
	Fixed (wired) broadband subscriptions per 100 inhabitants	13.44	5.64	9.66
	Fixed-broadband subscriptions, >10 Mbit/s, % of total fixed-broadband subscriptions, (0-100 % max)	51.83	64.27	0.58
	Handset prices (%monthly GDP per capita) (0-100 max)	55.61	16.35	30.46
	International Internet bandwidth per Internet user (kbit/s)	55,067.84	47,863.64	22,399.44
	Internet access in schools (0-100 % max)		41.37	70.66
	Mobile cellular subscriptions per 100 inhabitants (0-100 max)	120.00	120.00	120.00
	Mobile tariffs (%monthly GDP per capita) (0-100 % max)	93.53	33.43	48.92
	Percentage of Households with a computer (0-100 % max)	80.53	23.29	30.00
	Percentage of households with Internet access at home (0-100 % max)	87.59	21.11	22.99
	Percentage of Individuals using theInternet (0-100 % max)	78.90	38.00	47.16

Source: Page 1 of the E-Resilience Monitoring Dashboard 2021 could be found at: E-resilience Monitoring Dashboard | ICT & DRR Gateway[13]

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[12] Federal Communications Commission (2020), Broadband Speed Guide.
 Available at
https://www.fcc.gov/sites/default/files/broadband_speed_guide.pdf.

[13] E-resilience Monitoring Dashboard | ICT & DRR Gateway

Figure 9 : Average internet download speed of fixed broadband in NCA
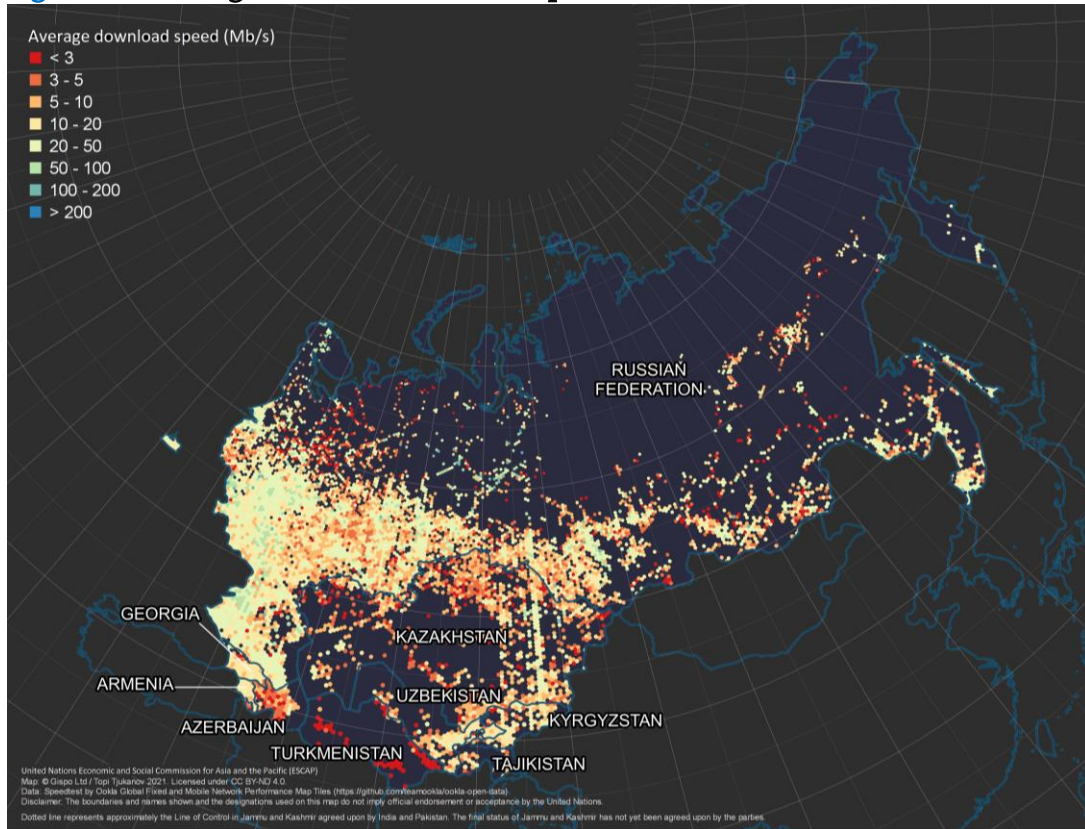
Source: ESCAP (2021), Visualizing Broadband Speeds in Asia and the Pacific. Available at
https://unescap.org/kp/2021/visualizing-broadband-speeds-asia-and-pacific-0.

Figure 10 : Average internet download speed of fixed broadband in ENEA
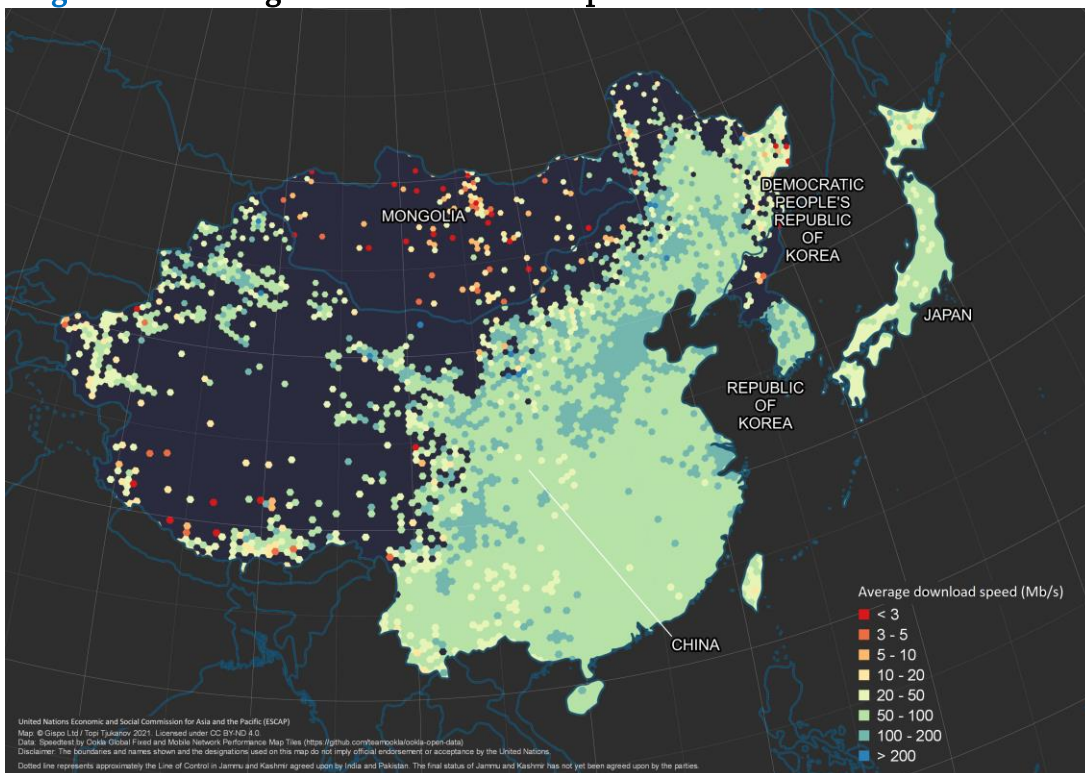
Source: ESCAP (2021), Visualizing Broadband Speeds in Asia and the Pacific. Available at
https://unescap.org/kp/2021/visualizing-broadband-speeds-asia-and-pacific-0.

Assessing E-Resilience in Kazakhstan, Kyrgyzstan, and Mongolia

In summary, all three countries may want to put measures to improve network quality and affordability of devices to enhance substantial internet penetration. ICT network is vastly critical in all aspects of pandemic management as serving as a foundation for connection and information transmission. Every component of network, including quality, affordability and availability affect the achievement of prevention, reduction, response and recovery of any crisis in terms of resilience of ICT infrastructure networks. Especially, Kyrgyzstan and Mongolia may want to popularize the use of computers and internet, which will enable people to experience high-speed network and create better performance in industries. Ultimately leading to economic growth of the country through enhanced e-resilience and e-readiness.

In the process, countries may wish to further promote and set a new cooperation at the sub-regional level such as regional dialogues and joint development. Pacific Internet Exchange Point by ESCAP [14] could be an example of regional cooperation in terms of improving Internet connectivity within the region. They also can acquire learned lessons or key information from leading countries to accelerate the development and prevent potential crisis in the near future.

In addition, accelerating investments in next generation infrastructure networks as a physical foundation for e-resilience, can be recommended, while enhancing the awareness of the benefits of innovative approaches, including the cost-effectiveness of fibre-optic cables co-deployment along passive infrastructure networks such as road and energy.

In this regard, ESCAP has developed a policy making toolkit[15] to support capacity of RECI pilot countries in designing policy measures and enable multi-collaboration framework of ICT, Energy and/or Transport stakeholders in designing and implementing infrastructure projects considering cross-sectoral synergy of co-deployment.

The online policy tools that will be launched in 2021 are: (i) **Single information portal** [16] with automation modules on determining compatibility, economic efficiency and identification of infrastructure projects that lend themselves to ICT co-deployment. (ii) **Simulation model**[17] for the development of smart corridors with a focus on three potential corridors.

2.4. Assessing data management and the role of ICTs for disaster resilience and adaptability of networks

For a quick analysis under this pillar, policymakers may want to consider the following indicators: Online Service Index (OSI); E-participation; availability of local online content; use of virtual social networks; ICT skills; publication and use of open data; online access to financial account.

In **Kazakhstan** ICT's role is instrumental at the e-governance level, as well as on the personal, which reflected in high values of OSI, use of virtual social networks, ICT skills, availability of local online content. This country may want to share experience and best practice with

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[14] ESCAP, Pacific Internet Exchange Point (IXP). Available at https://www.unescap.org/events/second-working-group-pacific-internet-exchange-point-ixp-and-capacity-training-workshop-ixp-s.
[15] ESCAP webinar of 10 November 2020 materials. Available at https://www.unescap.org/events/digital-connectivity-and-e-resilience-better-crisis-preparedness-virtual-meeting.

[16] Partnership Portal on Co-deployment available at https://drrgateway.net/partnership-portal-co-deployment
[17] Infrastructure Corridors Simulator available at https://drrgateway.net/infrastructure-corridors-simulator

neighboring states. For further development, it would be worthwhile to accelerate development the online financial services, such as fintech and utilization of open data to complete e-readiness in data management.

Kyrgyzstan may also put more efforts to improve online financial services, social networks, and online services (OSI), which may include the development of a national portal, e-services portal, and e-participation portal, as well as the websites of the related ministries of education, labor, social services, health, finance, and environment, as applicable.

Figure 11 : IT's role in data management in Kazakhstan
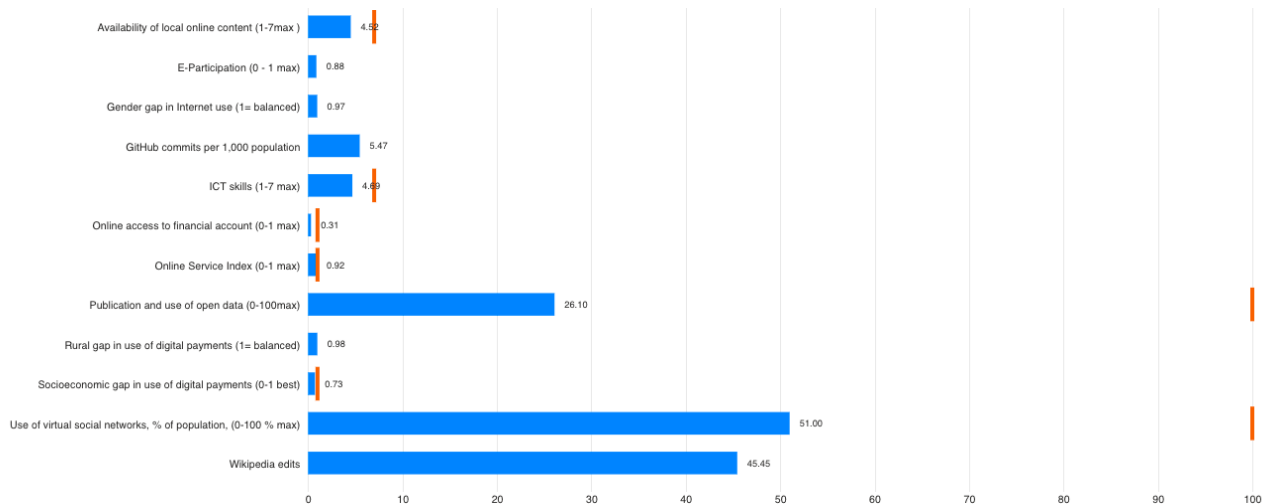
Source: Page 2 of the E-Resilience Monitoring Dashboard 2021 could be found at: E-resilience Monitoring Dashboard | ICT & DRR Gateway[18]

Figure 12 : ICT's role in data management in Kyrgyzstan
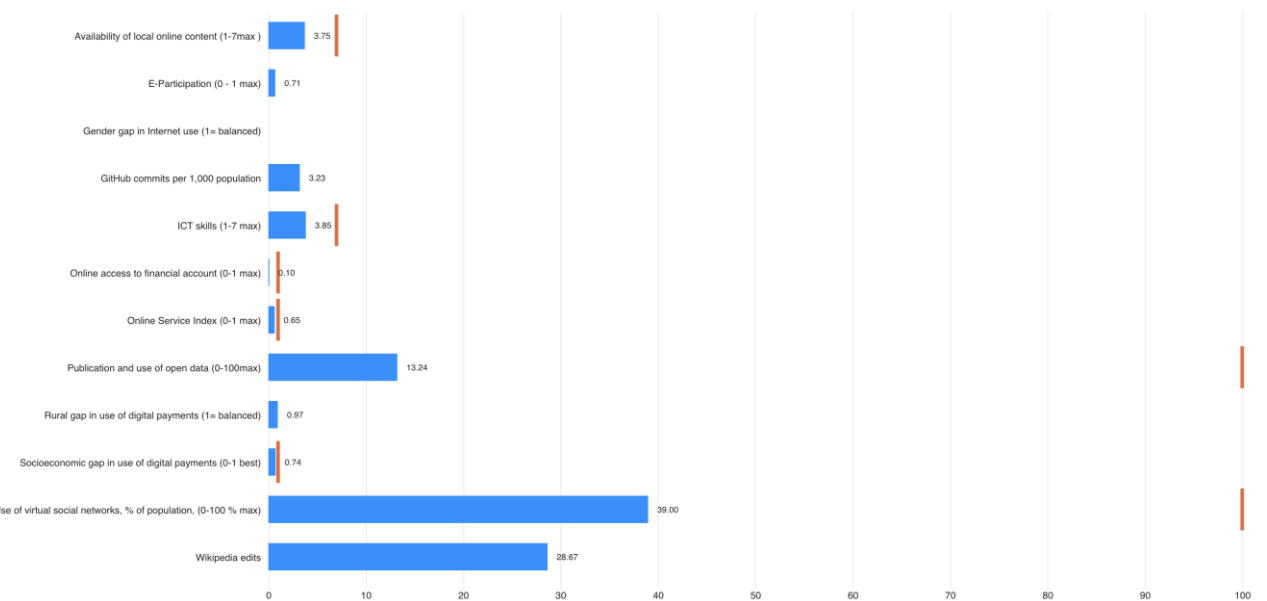
Source: Page 2 of the E-Resilience Monitoring Dashboard 2021 could be found at: E-resilience Monitoring Dashboard | ICT & DRR Gateway[19]

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[18] E-resilience Monitoring Dashboard | ICT & DRR Gateway

[19] E-resilience Monitoring Dashboard | ICT & DRR Gateway

Mongolia demonstrates high scores in use of social networks and a good progress in the use of online access to financial accounts. Nevertheless, the online environment has not fully matured yet in terms of the shortage of online services and contents which support virtual environment on the internet. Moreover, the level of online policy participation is relatively low. Therefore, the country may need to improve the ICT skills of people, e-participation and expand delivery of online services (OSI) by the government. Additionally, there is a significant importance of promoting online financial services and open data utilization, as well as other two countries.

In overall, three countries illustrate the high or medium level of online contents, online services, and ICT skills as reliant to each country. In the light of this, it can be assumed that three countries have stable resilience by means of ensuring connectivity and information accessibility for better preparedness, adaption, and response to the crisis through vibrant online societies they have. However, most economies are not fully ready to e-resilience yet, regarding online financial services and the utilization of open data. In this sense, it is necessary to provide larger number of online services and contents through upgraded ICT skills to enhance e-readiness. Looking at other sub-regions, it is common to being deficient in online financial services and public data, except for few leading countries such as Republic of Korea and Japan in ENEA.

Therefore, countries belonging to both regions, who are falling behind in those areas, may want to devise strategies to promote online financial services and publication and use of open data to improve their e-resilience in terms of economy and disaster response. In addition, they can attempt to invigorate virtual social networks and upgrade ICT skills to create more connected and e-resilience ready society with plenty of fascinating online social services that people can easily access and use with highly developed digital literacy.

Along the way, countries can promote cooperation within industries or between public and private sectors. For example, online financial services can be effectively expanded through collaboration of financial and IT company. Fintech could be suggested as a case of extended form. Conducive policy regime and legal environment are also recommended to support. Besides, disclosure and utilization of data can be promoted with assistance of administrative coordination from government and voluntary-based participation from private companies. Creating supportive regulatory environment, making bilateral agreements on data sharing, establishing cloud network system can be conducted to proceed as consulting mutual interests.

Moreover, countries may receive guidance from leading country within/outside the region. Among NCA countries, the data management and ICT's role for disaster resilience of Russian Federation is highly remarkable. It has distinctive capacities across all attributes in terms of data management, even comparable with global leaders such as Japan and Republic of Korea in ENEA. Russian Federation may share experience and best practice with neighboring states for better e-resilience readiness of the region.

2.5. Assessing adaptation and recovery through capacity to set up new systems and applications.

A rapid assessment analysis may be based on the indicators such as adoption of emerging technologies; businesses with website; government promotion of investment in emerging technologies; investment in emerging technologies; medium- and high-tech industry; mobile apps development; R&D expenditure by businesses.

Kazakhstan succeeded in expanding its online market for businesses and establishing convenience mobile environment through the developed applications. The country also shows its aspirations for developing and applying emerging technologies to boost the economic growth. In spite of the desire for high technology, the actual progress of transition towards new systems and applications are not remarkable. In this context, it is essential to facilitate substantial investment in emerging technologies, especially by private sectors, to acquire sophisticated technologies (Figure 13).

Kyrgyzstan is highly estimated in the digitalization level of businesses and mobile applications. Nevertheless, neither e-commerce nor the significance of emerging technologies has grown yet. Therefore, expanded investment and promotion for high technologies from both public and private sectors are recommended to adopt new systems and applications in accordance with the enhancement of e-resilience.

In **Mongolia** mobile applications development scores well. However, the data shows that in other aspects the ICT's role became exceedingly ineffective. Policymakers may need to draw attention for promoting the online market and the development of investment of advanced technologies, in further. In conclusion, it is time for the country to design and take the initiative in online businesses and technology to lay the foundation of becoming global leaders with the most ready to e-resilience societies (Figure 14).
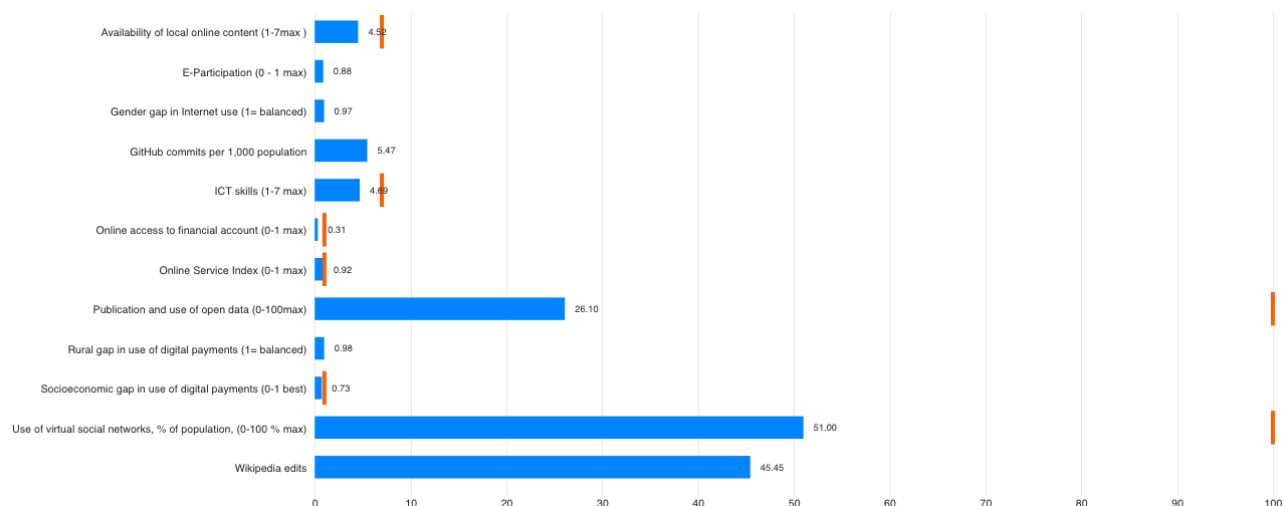
Figure 13 : ICT's role in setting up new systems and applications scored for Kazakhstan
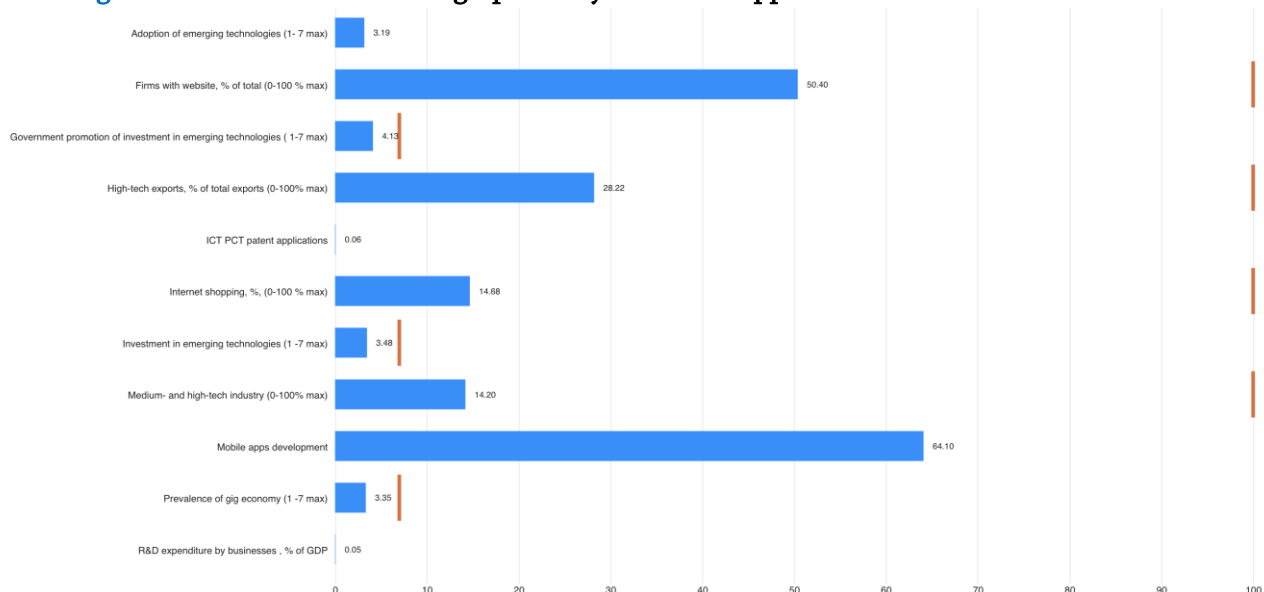
Source: Page 2 of the E-Resilience Monitoring Dashboard 2021 could be found at: E-resilience Monitoring Dashboard | ICT & DRR Gateway[20]

[20] E-resilience Monitoring Dashboard | ICT & DRR Gateway

Figure 14 : ICT's role in setting up new systems and applications scored for Mongolia

Indicator	Value
Availability of local online content (1-7max)	4.52
E-Participation (0 - 1 max)	0.88
Gender gap in Internet use (1= balanced)	0.97
GitHub commits per 1,000 population	5.47
ICT skills (1-7 max)	4.69
Online access to financial account (0-1 max)	0.31
Online Service Index (0-1 max)	0.92
Publication and use of open data (0-100max)	26.10
Rural gap in use of digital payments (1= balanced)	0.98
Socioeconomic gap in use of digital payments (0-1 best)	0.73
Use of virtual social networks, % of population, (0-100 % max)	51.00
Wikipedia edits	45.45

Source: Page 2 of the E-Resilience Monitoring Dashboard 2021 could be found at: E-resilience Monitoring Dashboard | ICT & DRR Gateway[21]

In general, further improvement is anticipated for NCA including above three countries. Red, orange and yellow colors of most indicators demand strong attention of policymakers in the region to strengthen capacity to set up new systems and applications. Especially, increased awareness and expedition of the public and private sectors is required for countries to adopt high and latest technology. High-tech exports, medium- and high-tech industry and R&D expenditure by businesses are greatly lower than government promotion and overall investment in emerging technologies. This contrast proves the lack of support and consciousness of the numerous stakeholders, in opposition to the government's efforts. High technology is a crucial factor to complete digital economy. As the most advanced technique, it would keep update all components of economy and society to become most e-resilient in a very efficient and adaptive manner by assimilating and collaborating full range of technologies. In addition, high and latest technology is significant for preemptive defense against crisis. Countries with latest technology are more capable to build effective and efficient measures to prevent possible risks. Regarding resilience of ICT infrastructure networks, it helps avoid creation of new risks. Improved infrastructure with updated models and systems can provide more accurate information to forecast the future crisis and eliminate related risk factors. With respect to ICT for societal resilience, it facilitates risk prevention in all process including risk assessments, analysis and planning. New methodology or applications based on emerging technology propose innovative alternatives or enhance productivity of previous approach to estimate, analyze and prepare potential risks. Early warning system can elaborate the importance of embracing high and new technology as a representative example.

Accordingly, countries may desire to take action to promote awareness and investment on high and frontier technology. Taking a reference of leading countries would be a guaranteed and effective way to improve. Especially, Russian Federation is worthy to benchmark, as being only

[21] E-resilience Monitoring Dashboard | ICT & DRR Gateway

country high resilience in most indicators within NCA. In the meantime, policymakers can consider following factors: policy regime; regulatory framework; regular trainings for experts; national project; funding system; and public events or campaign.

Countries can take a look out of own region as well. They may request systemic assistance or consultation from ENEA to proceed adoption of high and emerging technology in a proper way. Furthermore, they also can give a hand to demanding regions such as SA and PICS by sharing learned lessons and promoting supportive collaboration with their advanced e-resilience in the future.

3. Way Forward

As a result of the analysis the following recommendations may be given for further advancing of the e-resilience readiness in the three concerned member-states:

➤ In line with the significance of e-resilience readiness, especially to cope with the current crisis, the newly launched interactive dashboard 2021 is recommended for policymakers and professionals to measure e-resilience readiness and monitor its progress over time through existing and widely-accepted indicators at the national, subregional and/or regional levels. The dashboard offers interactive contents of ICT scores of the indicators which enable users, particularly policy makers, to apprehend e-resilience readiness of countries and regions.

➤ All three countries may want to put measures to improve network quality, especially fixed, and affordability of devices to enhance substantial internet penetration, which, if not timely addressed, might be hampering building full-fledged e-resilient society. In the process, countries may wish to further promote and set a new cooperation at the sub-regional level such as regional dialogues and joint development. In this regard Pacific Internet Exchange Point by ESCAP [22] could be an example of regional cooperation in terms of improving Internet connectivity within the region. They also can acquire learned lessons or key information from leading countries to accelerate the development and prevent potential crisis in the near future.

➤ Accelerating investments in next generation infrastructure networks as a physical foundation for e-resilience, can be recommended, while enhancing the awareness of the benefits of innovative approaches,

including the cost-effectiveness of fibre-optic cables co-deployment along passive infrastructure networks such as road and energy. In this regard it can be recommended to RECI pilot countries to consult the ESCAP policy making toolkit [23] in designing policy measures and implementing infrastructure projects that leverage cross-sectoral synergy of co-deployment through multi-collaboration framework of ICT, Energy and/or Transport.

➤ It should be highlighted, cooperation among countries to make more e-resilient and network-ready society are required at the two dimensions of resilience, i.e. (i) Resilience of ICT infrastructure networks and (ii) ICT for societal resilience.

For harmonious partnership across regions, ESCAP recently presented the second action plan of Asia-Pacific Information Superhighway (AP-IS) [24] as the sole region-wide intergovernmental cooperation platform which promotes inclusive digital transformation of Asia and the Pacific through self-initiated implementation and cooperation from member States.

E-resilience is an essential component of the connectivity pillar of this AP-IS second action plan, which member-countries are encouraged to contribute and support through implementation on the national levels as well as through region-wide cooperation.

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[22] ESCAP, Pacific Internet Exchange Point (IXP). Available at https://www.unescap.org/events/second-working-group-pacific-internet-exchange-point-ixp-and-capacity-training-workshop-ixp-s
[23] ESCAP webinar of 10 November 2020 materials. Available at https://www.unescap.org/events/digital-connectivity-and-e-resilience-better-crisis-preparedness-virtual-meeting.
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