Ukraine
Digital Development Country Profile

With the contribution of:

Acknowledgments

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As digital transformation is a complex and dynamic process, this document is treated as a living document that can be amended at any point in time depending on the availability of additional information. Comments and additional inputs should be sent to the ITU Office for Europe (EURregion@itu.int).

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1. Introduction

1.1. Background and Context

Development through digital transformation is a complex issue and touches on many enablers, from broadband availability to policies and sectoral e-strategies, as well as specific programmes fostering digital inclusion or the development of innovative communities.

Various independent research projects have been carried out by the International Telecommunication Union (ITU), United Nations (UN) agencies, and stakeholders in understanding these enablers, their impact on countries, the gaps, and opportunities. However, these studies may not reflect the inherent interdependencies among them. There is a need to provide a simple view and narrative about a country's capacity to digitally transform, and the various components contributing to this process.

Digital development through digital transformation has become increasingly important since the outbreak of the COVID-19 pandemic, and more recently in the specific case of Ukraine with the sustainable recovery scenario of the country from the impact of the war [1] which outburst in February 2022. In that regard, various UN agencies, and other stakeholders have assisted the country in their respective capacities relying substantially on the digital component.

Extending the availability of products and services, and empowering citizens, workers, and students in their daily engagements and needs has become clear priorities in all countries over le the years. In this sense, the ability to leverage the progress made in the digital sphere is an important factor in determining a resilient, sustainable, and inclusive recovery for Ukraine.

"Digital" is not only a solution to an emergency but a long-term investment against risk, it is necessary to unravel the various dimensions of digital development in different countries as information and communication technologies (ICTs) become increasingly important for the achievement of the Sustainable Development Goals (SDGs) by 2030.

1.1. Objective of the Report

The aim of the Digital Development County Profiles series is to provide a comparative analysis of priority countries of the European region, namely Albania, Bosnia and Herzegovina, Georgia, Moldova, Montenegro, North Macedonia, Serbia, and Ukraine.

The Report addresses digital transformation based on the various experiences of the ITU, the UN specialised agency for ICTs, and other UN system organizations, offering a broad overview of the activities and projects being implemented at the national level and in the wider region.

In particular, the country profile benefits from the inputs of the UN agencies members of the UN Digital Transformation Group for Europe and Central Asia (UNDTG4ECA), a multi-UN agency platform

1 The term 'war' is used according to the Resolution adopted by the General Assembly on 2 March 2022. To read the Resolution, visit following link: https://documents-dds-ny.un.org/doc/UNDOC/GEN/N22/293/36/PDF/N2229336.pdf?OpenElement

acting at the regional level under the UN Regional Collaborative Platform[2]. The UNDTG4ECA is co-led by ITU and UNECE and is composed of representatives of FAO, IFAD, ILO, IOM, UNDP, UNEP, UNESCO, UNFPA, UN Habitat, UNICEF, UNIDO, UNWTO, UN Women, WHO, WIPO, and WMO. The Group's mandate aims at facilitating cooperation between different UN agencies in the field of digital transformation. It further promotes coordinated UN support to the Member States in their implementation of the 2030 Agenda through ICTs and provide support to the UN Country Teams (UNCTs) on digital transformation issues. It strengthens information sharing on activities of the UN System in Europe and Central Asia while providing support to the work of the Issues Based Coalitions and the Regional Knowledge Hub covering both the Europe and Central Asia regions.

Considering the events occurring in Ukraine, this country profile specifically aims at providing a comparative analysis of the digital development level of the country before and after the war that started on the 24th of February 2022. It seeks to provide support to the UNCT, as well as national and international stakeholders in their sustainable recovery endeavour through digital for development by pursuing the below specific objectives:

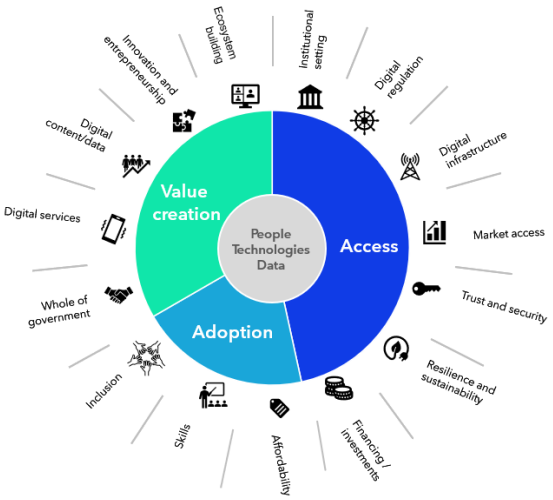
i) Facilitate the coordination of the one-UN response to the effect of the war in Ukraine in relation to ICT and Digital Development;
ii) Provide an overview of the potential support that may be leveraged upon the request of the UNCT;
iii) Support the effort in collecting analytical work on the effect of the war in Ukraine and give insights on the main ICT/Digital related challenges that should be addressed during the roll-out of the UN Transitional Framework and beyond;
iv) Contribute to the mapping of ongoing and planned activities to avoid overlapping efforts. In that sense, seek to undertake a holistic approach to ensure efficient recovery of and through ICT and digital; and
v) Support the UNCT and beyond by facilitating fundraising activities to scale initiatives related to digital development.

Overall, this report seeks to build a reference for discussions on digital development at the country level in Ukraine. It will serve as a guide for future dialogue with country stakeholders and pave the way for increasing fit-for-purpose engagements of the UN system in the country. It will equip decision-makers at the national level and international stakeholders with an overview of the various components of digital development at the country level.

[2] Access the website of the Regional Collaborative Platform (RCP) here: https://unsdg.un.org/un-in-action/rcp-europe-and-central-asia

1.3. Methodology

The research has identified a three-building block framework that analyses digital transformation from a variety of perspectives, enabling an understanding of how the various dimensions of digital development interact at the country level. Below is a summary of each building block and elaboration of how the particular dimension fits in the overall digital development scenario of the country. The figure on the side demonstrates a visual representation of the framework, with its building blocks and related components.



1) **Access**: Robust ICT infrastructure represents a critical precondition for the transformation of a country. It provides the foundation for innovative services and economic activity to take place. With the Covid-19 pandemic, countries and communities lacking connectivity faced a greater disruption than those who did not, therefore raising the overall importance of reliable and safe infrastructure and services that are available to all. ICT infrastructure needs to be evaluated based on several aspects critical to meaningful connectivity. Government holds a central role in promoting the right strategies collaboratively across various entities. This includes setting in place the conditions for the right mix of policies and regulations to facilitate attainment of universal and affordable connectivity through resilient infrastructure deployments that ensure ubiquitous network coverage including “last mile” and hardest-to-connect uneconomical areas.

2) **Adoption**: Developing digital skills and building human capacities to empower citizens, strengthen employability, and create new job opportunities is essential to match the needs of the gigabit society. The pandemic has exacerbated pre-existing inequalities, especially amongst refugees, migrants, persons with disabilities, women, and girls. While connectivity is the backbone of digital transformation, adopting a ‘people-centric’ digital transformation is vital to ensure that all members of society are not only connected but meaningfully connected and, thus, fully enjoy the fruit of an ever-growing digital world. To this end, special emphasis should be given to bridging the digital divide and equipping all groups of society, including groups of people with specific needs, to take advantage of ICTs by enabling digital skills development.

3) **Value Creation**: Access to government services by citizens enables productivity, transparency, and equality in digital development. Ensuring that public services are delivered digitally is an important component of digital transformation, triggering a reduction in costs and bureaucracy, and increasing efficiency. Governments also have an important role in ensuring that public sector transformation becomes a catalyst for digital transformation in the wider economy. Most economic benefits accumulate when ICTs are also used to transform other sectors. Agriculture and health are of high importance for Southeastern European countries in the scope of this study and play a key role in job creation and economic inclusion. Going beyond the digitalization of sectors, there is a need to create an enabling environment supporting digital innovation to accelerate digital transformation as a whole in a country. The ability to digitally innovate domestically is also considered a sign of maturity which leverages the two building blocks addressed previously. Without entrepreneurship-driven innovation,

economic opportunities remain unexplored and the global competitiveness of countries in an increasingly digital landscape is put at risk. Through strong digital innovation ecosystems, countries can benefit from increased productivity, economic growth, and employment opportunities that catalyse digital transformation and ensure that long-term digital development has a positive impact on the country's broader economic development.

The country profiles benefited from secondary research information, including various ITU publications, activities, and statistics, as well as additional research. Moreover, the content from other stakeholders' publications and deliverables were taken into account. Each piece of content is presented using the context of the relevant building block under which the information has been inserted, and therefore adopts one of the 3 perspectives of digital transformation.

2. Country Profile – Ukraine

2.1. Building Block 1: Access

Broadband development is of primary importance and remains a prerequisite to ensure digital development. It is the backbone for every aspect of the economy acting as a fundamental enabler for businesses, consumers, and citizens. Safe and reliable access to the next generation of infrastructure (fixed, mobile, wireless, satellite) and ICT is a key prerequisite for advancing sustainable development. Creating the right conditions for digital technologies to be broadly utilized will accelerate economic growth in the wider region. From revamping institutional practices to revising legal frameworks, expanding digital access to all demographic groups must be on the policy agendas of forward-looking leaders.

This section will provide a general overview of i) the institutional setting in place in charge of governing policy related to ICTs and digital development in the country; ii) rules and regulations related to digital; iii) the state of digital infrastructure; iv) market dynamics; v) security matters; vi) system resilience; and vii) funding arrangements.

2.1.1. Institutional Setting

There are three main institutional layers related to ICTs and digital development in the country: ICT infrastructure state entities, the cyber security entities, and the general executive state entities at the level of the Cabinet of Ministers in Ukraine.

The main recent change in the institutional ecosystem on the digital policy has occurred with the establishment of the Ministry of Digital Transformation of Ukraine (Ministry of Digital Transformation) in 2019.

The Ministry of Digital Transformation of Ukraine is the main authority in the system of the central authorities of Ukraine, which provides the formation and implementation of public policy in such fields as: digitization, digital development, digital economy, digital innovations and technologies, e-government and e-democracy, information society development, informatization; implementation of electronic document flow; development of digital skills and digital rights of citizens; open data, public

electronic registers, development of national electronic information resources and interoperability, development of infrastructure of broadband access to the Internet and telecommunications, electronic commerce and business; electronic and administrative services; in the fields of electronic trust services and electronic identification; IT industry development; development and functioning of the legal regime Diia.City.[3] At the level of the Parliament, the committee on the digital transformation has been operative since 2019.

The Ministry of Digital Transformation facilitated the establishment of the Deputy Position of the Chief Digital transformation Officers (CDTOs) in the executive entities – State agencies, Ministers as well in the regional administrations and after in communities.[4] This has been a significant advancement in the formulation of the institutional setting. At the central executive level CDTOS shall promote the digital aspects in the realisation of the respective policies.[5] At the regional level, CDTOs will help in the digitalisation of the regions that was defined as a main target of Ministry of Digital Transformation.[6] Communities also have to follow the way to become digitalised in few steps:

- A position is created, to which a person responsible for digitization is appointed.
- The program and action plan are determined, which are approved by the community.
- The specialized department joins the Ministry of Digital Transformation n to start reforming the system.

As for the cyber security, the institutional setting is the following according to the law 2163-VIII "On the basic principles of providing cybersecurity":

- The Cabinet of Ministers of Ukraine ensures the formation and implementation of state policy in the field of cyber security.
- The coordination of activities in the field of cyber security as a component of the national security of Ukraine is carried out by the President of Ukraine through the National Security and Defence Council of Ukraine headed by him.
- Within the National Security and Defence Council of Ukraine in 2016 the National Cyber Security Coordination Center was created that coordinates and monitors the activities of security and defence sector entities that ensure cyber security, makes proposals to the President of Ukraine regarding the formation and clarification of the Cyber Security Strategy of Ukraine.

Entities that directly implement measures to ensure cyber security within their competence are: [7]

1) Ministries and other central bodies of executive power;
2) Local state administrations;
3) Local self-government bodies;
4) Law enforcement, intelligence and counter-intelligence bodies, entities of operational and investigative activities; For example – the cyber police that Combats cybercrimes, informs population on the emergence of new cybercriminals and has other responsibilities.
5) Armed Forces of Ukraine, other military formations formed in accordance with the law;
6) National Bank of Ukraine;

[3] https://www.kmu.gov.ua/npas/pitannya-ministerstva-cifrovoyi-t180919
[4] https://zakon.rada.gov.ua/laws/show/194-2020-п#Text
[5] https://plan2.diia.gov.ua
[6] https://thedigital.gov.ua/news/mikhaylo-fedorov-u-kozhnomu-misti-ta-gromadi-zyavlyatsya-zastupniki-z-tsifrovoi-transformatsii
[7] https://zakon.rada.gov.ua/laws/show/2163-19#Text

7) Enterprises, institutions and organizations classified as critical infrastructure objects;
8) Business entities, citizens of Ukraine and associations of citizens, other persons who conduct activities and/or provide services related to national information resources, electronic information services, execution of electronic transactions, electronic communications, information protection and cyber protection.

In terms of the telecommunication infrastructure, Ukraine has the regulatory body – the National Commission for the state of electronic communication and radiofrequency spectrum and the postal services.[8] It was founded in 2011 and reformed in 2021. Commission performs state regulation the state monitoring and prevention of the violation of the legislative norms regarding the electronic communications, radiofrequency and postal services. As well in the context of the European integration, it carries out and facilitates the approximation of the Ukrainian legislature to the EU legislature.

The policy on radio frequencies is executed by Ukrainian State Centre of Radio Frequencies (UDCR). It among others upon instructions of the head of the National Commission for State Regulation in the Field of Communication and Informatization, participates in state supervision of compliance with the legislation on the radio frequency resource of Ukraine. UDCR also provides international protection, coordination of radio frequencies, participates in the work of the International Telecommunication Union.[9]
State Service of Special Communications and Information Protection of Ukraine is a specialized central executive authority for special communication and information security, a defence and security agency being the principal actor in the national cybersecurity system. It coordinates the activities of cybersecurity actors in the field of cyber defence and administers communication.[10] SSCIP carries out 93 tasks and functions and forms state policy in 16 spheres.

In 2019 the National Center for Operational and Technical Management of Telecommunications Networks (NTSOTU) was established within the SSCIP. In accordance with the Law of Ukraine "On Telecommunications", is designed to ensure the operational and technical management of telecommunications networks for public use by all telecommunications operators in emergency situations, states of emergency and martial law. [11]

The effect of the war

While the institutional setting has not substantially changed, the work of all state institutions has become focused on policies dealing with war, namely – attacks on digital and critical infrastructures, access to the internet, the trade of technologies, the digital economy, and the use of cryptocurrency in the context of war. Computer systems in different Ukrainian ministries, government organisations, and banks are the targets to constant cyberattacks and cyber threats posed by the Russian

[8] https://zakon.rada.gov.ua/laws/show/1971-IX#Text
[9] https://www.ucrf.gov.ua/about/diyalnist/osnovni-napryamki-diyalnosti
[10] https://cip.gov.ua/en/statics/pro-derszhpeczv-yazku
[11] https://www.kmu.gov.ua/npas/pro-utvorennya-nacionalnogo-centru-operativno-tehnichnogo-upravlinnya-merezhami-telekomunikacij?fbclid=IwAR193oYU-H-p9uYbpySwD6FS6UBR6a8YjRFbOZNKq4uw8orSD6gVmljAt58

Federation.[12] According to UN Habitat, Migration and military service are exacerbating a chronic lack of IT specialists.

In July 2022 the government with the Decree 787 established the State service for the protection of critical infrastructure and ensuring the national system of stability of Ukraine.[13] The legal grounds for developing the draft of this resolution are the requirements of the Law of Ukraine "On Critical Infrastructure". The newly created central body of executive power will have a special status, the activities of which will be directed and coordinated by the Cabinet of Ministers of Ukraine. It will ensure the formation and implementation of state policy in the field of critical infrastructure protection and ensuring the national resilience system.

2.1.2. Digital Regulation

Connectivity policies and regulations

The ICT sector development is currently among the top government priorities. At regulatory standpoint, Ukraine currently scores 78 in the ITU ICT Regulatory Tracker, placing the country at the 41st place among the European countries and at the 92nd place among 193 countries considered for the 2020 ranking.

The ITU Tracker pinpoints the changes taking place in the ICT regulatory environment. It facilitates benchmarking and the identification of trends and gaps in ICT legal and regulatory frameworks and allows decision-makers to make the case for further regulatory reform towards achieving a vibrant and inclusive ICT sector. The ICT Regulatory Tracker is composed of 50 indicators grouped into four clusters:

ICT Regulatory Tracker group clusters	Ukraine Score	Max Score
Regulatory authority (focusing on the functioning of the separate regulator)	16	20
Regulatory mandates (who regulates what)	15	22
Regulatory regime (what regulation exists in major areas)	22	30
Competition framework for the ICT sector (level of competition in the main market segments)	25	28
Overall Score	**78.00**	**100**

Table 1 – The ICT Regulatory Tracker, Ukraine Source: ITU

[12] https://www.oecd-ilibrary.org/economics/digitalisation-for-recovery-in-ukraine_c5477864-en
[13] https://zakon.rada.gov.ua/laws/show/787-2022-n#Text

Ukraine is positioned among the group of countries with a Third-Generation regulatory regime (G3). The country reached it only in 2018 and is among the 8.9% of European region countries with the G3 regime. The country's overall result is significantly lower than the Europe region average score of 86.9, but is slightly above the world one of 71,9.

Figure 1 – ICT Regulatory Tracker, Ukraine in 2007: 44.83 (G2) vs 2020: 78 (G3)

Source: ITU

Recently, ITU launched a reviewed Fifth Generation of regulation benchmark, focused on collaboration among different stakeholders in the ICT sector and with other sectors of the economy.

The G5 Benchmark takes data from 193 countries, expands to cover four pillars, with 70 indicators taken into account: national collaborative governance, digital development toolbox, digital economic policy agenda and policy design principles.

G5 Benchmark Pillars	Ukraine Scores	Europe average
National Collaborative Governance	9.26	20.37
Digital Development Toolbox	9.72	18.74
Digital Economic Policy Agenda	10.49	14.52
Policy Design Principles	12.04	13.97
Overall Score	**41.51**	67.60

Table 2 – G5 Benchmark 2021, Ukraine

Source: ITU

According to the latest data, Ukraine scores 41.51 in the G5 benchmark, with transitioning level of readiness for the digital transformation, which leaves a lot of space for improvement if compared to

Europe region average of 67.60. This positions the country on the 119th place among 193 countries and suggests that there is still margin of improvement.

The main progresses of digital regulation in Ukraine started in January 2018, when the government and the State Agency for E-Governance of Ukraine published the new "Digital Agenda for Ukraine 2020". The main pillars of agenda are:

- Telecommunication and ICT infrastructure;
- Digital skills;
- E-market;
- Digital governance;
- Innovation and R&D;
- Trust and cybersecurity;
- Benefits from ICT for society and the economy. [14]

To enact its implementation and accelerate the processes, the Cabinet of Ministers created a Coordination Council. It included government officials and an expert group comprised of more than 100 IT experts united under the Ukrainian non-governmental organization the "HiTech Office". They joined forces to work on the Concept Paper on Digital Society and Digital Economy development and identified the first steps to be taken. As a result of these joint efforts, in January 2018, the Government approved the "Concept Paper of Digital Economy and Digital Society Development in Ukraine for 2018 – 2020". [15]

This Concept aims to address Ukraine's challenges, needs and opportunities by implementing the accelerated scenario of digital development which envisages:

- Removing legislative, institutional, fiscal and other barriers to the development of the digital economy;
- Incentivizing and encouraging business and industry in general to digitize;
- Creating demand among citizens for digitalization;
- Developing digital infrastructure as a basis for using the benefits of the digital world in everyday life and a platform for achieving economic efficiency;
- Developing and deepening of digital competencies of citizens to ensure their readiness to use digital opportunities, as well as to overcome the associated risks;
- Developing digital entrepreneurship, creating appropriate (including analogue) infrastructure to support innovation, implementing funding mechanisms, incentives and support.[16]

[14] ITU, 5G Implementation in non-EU countries of the Europe Region, p.80, retrieved from https://www.itu.int/en/myitu/Publications/2021/10/12/12/56/5G-implementation-in-non-European-Union-countries-of-the-Europe-region

[15] ITU Report – DIGITAL SKILLS DEVELOPMENT UKRAINE GOOD PRACTICE CASE STUDY, p.9, retrieved from https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Publications/2021/Digital%20Skills%20Development%20–%20Ukraine%20–%20Good%20practice%20case%20study.pdf

[16] https://zakon.rada.gov.ua/laws/show/67-2018-p#Text

In addition, the document also establishes the priority sectors and suggestions for digital development in Ukraine, with a particular focus on bridging the digital divide through the development of digital infrastructures, and harmonization with European and world initiatives as well as governance. [17]

Apart from the strategies, the number of laws have been approved since 2019 in order to promote further connectivity and set common standards in the telecommunication domain.

In July 2019 the Decree of the President of Ukraine from 8.07.2019 No 497/2019 «On some measures to improve access to mobile Internet» was approved. [18] In 2020 the Cabinet of Minister of Ukraine has approved by Decree 1189-p on the plan of measures to improve the quality of mobile (mobile) communication services for 2020-2022. It has established the requirements for the operators.[19] In June the launch of system of monitoring of the quality of mobile connection was announced by Ministry of Digital Transformation and partners.[20] Later in October 2021 first time in Ukraine the technical criteria of the quality of mobile Internet were established. This important document made the operators to increase the quality of their services in the cities and villages so that every Ukrainian have the minimally accessible quality level of connectivity.[21]

In January 2021 the law on the electronic communications was signed that has fostered the connectivity and better link between a state, the providers and the customers of the electronic communications [22] This law also implements the EU standards on the electronic communications.

In September 2021 the government has approved crucial document – the broadband development plan for 2021-2022. In has set the priorities for connectivity of 6 000 institutions of social infrastructure to the fixed broadband connections. As well the national platform on the monitoring of broadband connectivity had to established – broadband.gov.ua[23] In October 2021 the Interdepartmental Commission on International Trade cancelled the introduction of a special duty on the import of foreign cables that prevented the negative effect of the deployment of ICT and increase of prices for the Internet.[24]

In 2021, the Ministry of Digital Transformation launched the governmental program “Internet-subvention” for fibre networks roll-out in rural areas. The program aimed to encourage fixed broadband operators to connect sparsely populated areas in order to provide the Internet to 1.5 million Ukrainians, connect 6000 of education, medical and cultural institutions to the Internet in 3 thousand villages. Ministry of Digital Transformation created the link where local communities can apply to have their villages connected.[25] The Government has allocated 483,8 mln UAH to 670

[17] ITU, 5G Implementation in non-EU countries of the Europe Region, p.80, retrieved from https://www.itu.int/en/myitu/Publications/2021/10/12/12/56/5G-implementation-in-non-European-Union-countries-of-the-Europe-region
[18] https://zakon.rada.gov.ua/laws/show/497/2019#Text
[19] https://zakon.rada.gov.ua/laws/show/1189-2020-p#Text
[20] https://thedigital.gov.ua/news/mintsifra-ta-partneri-gotuyut-zapusk-sistemi-z-monitoringu-yakosti-mobilnogo-zvyazku
[21] https://thedigital.gov.ua/news/4g-bez-zatrimok-ta-bud-de-vstanovleni-standarti-yakosti-mobilnogo-zvyazku
[22] https://thedigital.gov.ua/news/prezident-ukraini-pidpisav-zakon-pro-elektronni-komunikatsii
[23] https://zakon.rada.gov.ua/laws/show/1069-2021-p#Text
[24] https://ukurier.gov.ua/uk/articles/pro-skasuvannya-rishennya-mizhvidomchoyi-komisiyi-/
[25] https://bb.gov.ua

territorial communities. [26] As of August 2022, 922 082 Ukrainians have been connected to the Internet.[27]

As for the local development of connectivity, Kyiv subway is the example. In 2020 the Kyiv city Council provided access to the large telecom operators to deploy 4G in the Kyiv subway.[28] And in the last station was equipped by 4G in May 2021. [29] In 2020 everyday more than 300 000 were using 4G in subway. [30]

The effect of the war

Connectivity in times war has become crucial. Since the start of the war on the 24th of February, the networks have been significantly damaged. Operators are all the time deploying, restoring the networks in the regions that were affected by the war. The governmental policy and the policies of operators in this regard have included several important steps to provide better connectivity to citizens:

- On 24th of February NCEC adopted decisions No. 3 "On the approval of the temporary procedure for the use of radio frequency spectrum by special and general users during a special period and under conditions of emergency or the martial law" and No. 4 "On the approval of the temporary procedure for implementation of temporary restrictions on the use of radio equipment, radiating devices, radio-electronic means and special-purpose radiating devices in the entire territory of Ukraine or in particular regions thereof under emergency conditions or the martial law".[31]
- On 7th of March the National Roaming has been introduced by the operators with the help of state institutions. This provided better connectivity for Ukrainians due to the possibility to switch between different mobile operators.[32]
- On 8th of April the European Commission and the parliament has fostered the joint statement between EU operators and Ukrainian operators for providing free rooming and free call from abroad to Ukraine.[33] This agreement has been pro-long in the end of July.[34]
- On 22d of July the law 5811 regarding the simplification of placement of technical means of electronic communications entered into force that will allow to build 4G stations much quicker to increase the connectivity all over Ukraine.[35]

Next generation infrastructure: 5G Regulations

Ukraine journey towards 5G network rollout started in May 2019 on World Radio Day when the President signed a decree in this regard. The decree stated that the 5G network will be launched in

[26] https://thedigital.gov.ua/news/ponad-milyon-ukraintsiv-zmozhut-pidklyuchitisya-do-optichnogo-internetu-v-2021-rotsi-zavdyaki-proektu-internet-subventsiya
[27] https://datastudio.google.com/u/0/reporting/1fd597ee-b1bd-4c8e-b249-a922ea9f1e4e/page/bJibC
[28] https://thedigital.gov.ua/news/kiivrada-dozvolila-4g-v-metro-merezhu-vzhe-buduyut
[29] https://www.epravda.com.ua/rus/news/2021/05/11/673744/
[30] https://tech.liga.net/telecom/novosti/v-metro-kieva-ostalas-odna-stantsiya-bez-4g
[31] Data provided by the SSSCIP date 17.08.29022
[32] https://www.radiosvoboda.org/a/news-zvyazok-rouminh-operatory-ukrayina/31741667.html
[33] https://ec.europa.eu/commission/presscorner/detail/uk/ip_22_2371
[34] https://suspilne.media/262205-es-prodovziv-diu-bezoplatnogo-roumingu-dla-ukrainciv-za-kordonom/
[35] https://zakon.rada.gov.ua/laws/show/2078-IX#Text

2020 but provided no additional details. Based on this decree the Government together with the National Commission for the State Regulation of Communications and Informatization (NCCIR) should articulate and adopt a step-by-step plan for 5G implementation. Consequently, in November 2019 NCCIR issued a Decision No. 529 confirming that it will allocate countrywide 5G-suitable wireless spectrum in the 3 400 MHz-3 600 MHz range on a competitive or tender basis.

In May 2019, Vodafone Ukraine announced its readiness to launch 5G tests, and the Lifecell in partnership with Ericsson tested 5G mobile technology in Kyiv in the 28 GHz frequency range. Through Ma-MIMO, a peak download speed of 25.6 Gbit/s was reached in the ultra-high frequency range of 28 GHz. Between December 2019 and May 2020, Ericsson and the operator Lifecell conducted 5G tests using the 3.5 GHz band in seven of the operator's points of sale in six Ukrainian cities: Kyiv, Dnipro, Kharkiv, Lviv, Odessa and Cherksay.

Moreover, in February 2020, the Ministry of Digital Transformation of Ukraine and Ericsson signed a memorandum of cooperation in the development of fixed and mobile 4G LTE-A and 5G networks. A joint working group is being organized to work on technical expertise in mobile and fixed internet development, as well as provide advisory and information support to the ministry on the evolution of mobile communications, frequency strategy and licensing policies.

In April 2020, Vodafone Ukraine completed testing of AirScale equipment from Nokia on its LTE network in Kyiv. The 5G-ready equipment was tested in the 1 800 MHz and 2 600 MHz bands, achieving connectivity speeds as fast as 525 Mbit/s. In July 2020, Vodafone Ukraine and Kyivstar signed a memorandum of intent on network sharing for exchange of the 900 MHz spectrum in eight Ukrainian regions. The agreement covers both passive and active infrastructure on operators' mobile networks and should result in an acceleration of LTE technology coverage of Ukraine, reaching the country's rural areas and highways.

Since authorities conducted the 4G frequencies auction in 2018, telecommunication sector actors are currently focused on 4G network expansion and covering the rural areas with broadband Internet. In January 2020, Kyivstar, Lifecell and Vodafone Ukraine submitted a joint statement on redistribution of the 900 MHz band and separate applications for licence renewal to NCCIR. As a result, in March 2020 NCCIR allowed these operators to begin offering 4G LTE-900 services starting on 1 July 2020 with an obligation to offer services to all areas of the country with a population of over 2 000 people over the next two years.
To foster the development of current 4G networks and advance the potential of 5G-enabled services and applications, the Cabinet of Ministers of Ukraine instructed the Ministry of Health to raise the maximum permissible level of electromagnetic radiation by a factor of 10 – from 10 μW/cm2 to 100 μW/cm2. In such a way, the high level of electromagnetic radiation is 30–300 MHz, ultra-high is 300-3000 MHz, and very high is 30–300 GHz. Similar adjustment of the EMF legislation was previously done in 2017, when the permissible level was increased from 2.5 to 10 μW/cm2.

In response to public pressure concerning alleged health hazards from the introduction of 5G in Ukraine, an order issued by the President of Ukraine in July 2020 requested NCCIR to propose a number of measures to resolve the issue and provide the public with the appropriate information on the impact of mobile technologies and networks. In August 2020, NCCIR announced its action plan to

fulfil the President's request aiming to involve the Ministry of Digital Transformation, the Ministry of Health, the Administration of the State Service for Special Communications and Information Protection of Ukraine and other bodies in taking action on a number of EMF-related challenges. Some of the actions included:

- Providing protocols for the measurement of EMFs by operators;
- Public consultations with suppliers of radio equipment;
- Developing and approving the procedure for the relevant bodies in the Ukrainian Ministry of Health's system to measure compliance with EMF levels at the request of citizens.
- Adopting national standards that are necessary to assess the impact of EMF from cellular base stations on humans;
- Carrying out regular measurements within the Ministry of Health's system to monitor EMF levels during the deployment of 5G networks;
- Introducing a warning sign to signal the presence of a source of non-ionizing radiation and the relevant danger level for humans;
- Additional medical research on the effects on humans of non-ionizing radiation from 5G stations;
- Rising awareness on the impact of mobile radio technologies on human health.

Private stakeholders in Ukraine are also engaging with questions pertaining to EMF. In August 2020, representatives from Huawei Ukraine and ZTE presented solutions on EMFs from 5G base stations and on 5G Ma-MIMO EMF to NCCIR.[36]

In June 2021, research work was supposed to be carried out to determine the cost of radio frequencies in the 700 MHz and 3400-3800 MHz ranges. And they will also investigate the possibility of joint use of the 5G mobile communication system. For the implementation of the 5G implementation project, the Ministry of Digital was asked to allocate UAH 4.6 billion from the state budget. But money for 2021 was not allocated for this[37]. Thus, in August 2021 the Cabinet of Ministers of Ukraine has postponed the launch of 5G.[38] But nevertheless, Ukraine launched in October 5G Lab - test zone in the techno park in Kyiv – Unit.City. It is joint project of Ministry of Digital Transformation, Vodafone Ukraine, and Huawei. [39]

The effect of the war

The war has significantly affected the digital infrastructure in Ukraine. Thus, the efforts of operators are focused on rebuilding network in order to provide the connectivity to people in the area affected by war. According to Head of Mobile Communications Development at the Ministry of Digital Transformation Stas Prybytko the discussions on launch of 5G in Ukraine can be resumed as soon as operators cope with the damages caused by war in the next half year or year. [40]

[36] ITU, 5G Implementation in non-EU countries of the Europe Region, pp.82-85, retrieved from https://www.itu.int/en/myitu/Publications/2021/10/12/12/56/5G-implementation-in-non-European-Union-countries-of-the-Europe-region

[37] https://suspilne.media/153695-comu-kabmin-vidterminuvav-zapusk-5g-v-ukraini-poasnue-ekspert/

[38] https://www.youtube.com/watch?v=aJ1nx5PTNQw

[39] https://tech.liga.net/telecom/novosti/v-ukraine-poyavilsya-5g-rasskazyvaem-podrobnosti

[40] https://tsn.ua/ru/ukrayina/kak-vosstanavlivayut-mobilnuyu-svyaz-na-deokkupirovannyh-territoriyah-rasskazyvaet-ekspert-2106424.html

2.1.3. Digital Infrastructure

In line with ITU data, 75.04% of people in Ukraine used the Internet in 2020. The share of Internet users was steadily growing over the past decade with an average of 5% (rounded) increment per year. While on many fronts, Ukraine finds itself well above World averages in terms of key Telecommunications and internet Indicators, there remains a non-negligible gap on some key indicators between the country and Europe region averages.

Key Indicators (2021)	Ukraine	Europe	World
Fixed-telephone subscribers per 100 inhabitants	5.51	31.2	11.2
Mobile-cellular subscribers per 100 inhabitants	135.03	118.2	109.9
Active mobile-broadband subscribers per 100 inhabitants	80.12	105.3	83.2
Coverage by at least 3G (% of population)	91.60	98.5	95.0
Coverage by at least LTE/WiMAX (% of population)	91.60	98.7	87.6
Individuals using the Internet (%)	75.04*	87.2	62.5
Households with Internet access at home (%)	79.2*	87.6*	65.7*
Fixed-broadband subscribers per 100 inhabitants	18.27	34.7	16.7
Fixed-broadband subscribers by speed tiers, % distribution:			
-256 kbit/s to 2 Mbit/s	1.0*	0.3*	1.8*
-2 to 10 Mbit/s	4.7*	6.4*	6.7*
-equal to or above 10 Mbit/s	94*	92.3*	89.9*

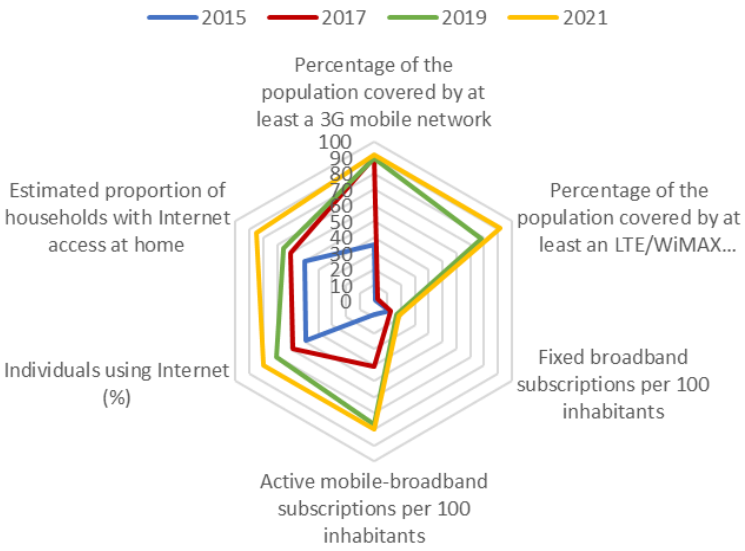
* Latest data available for 2020 Source ITU

Table 3. Key Telecommunications & Internet Indicators in Ukraine in comparison to the European and World average[41][42]

[41] ITU, World Telecommunication/ICT Indicators Database, August 2021, retrieved from https://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/Digital-Development.aspx

[42] ITU global and regional ICT data, retrieved from https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ITU_regional_global_Key_ICT_indicator_aggregates_Oct_2021.xlsx

Figure 2 – The basic indicators of ICT-access and usage in Ukraine[43]



Source: ITU

Figure above shows a comparison of basic indicators of ICT access and usage in Ukraine during the year 2015, 2017, 2019, 2021.

Looking more in-depth into the availability of connectivity, the ITU report on "The status of connectivity in 9 non-EU countries of Europe region",[44] prepared in the context of the ITU Regional Forum for Europe on Meaningful Connectivity held on 8 and 9 March 2021,[45] gives a retrospective view at how the factor of availability evolved and shows Ukraine's positioning compared to regional peers.

In terms of availability of connectivity, Ukraine witnessed an extension of services, both demographically and geographically, and have scored significant improvements over the past years in indicators considered for this domain:

- Percentage of the population covered by at least an 4G/LTE/WiMAX mobile network: according to the latest ITU data, 91.6% of the total population of Ukraine was covered by at least 3G mobile cellular network in 2021 and the same percent of the individuals were located within a range of LTE/WIMAX cellular network.
- The estimated proportion of households with Internet access at home: the availability of Internet at home continues to prove an area of challenge in Ukraine. About 21% of households remained without Internet as of 2020, placing the country among the three least advanced regional peers in that year. However, there is a stable increase of the coverage since 2011 with an average yearly growth of 5.6 percentage points. As a result, the share of Internet availability in households reached 65.8% in 2019, and 79.2% in 2020, with 86% of urban and 66% of rural

[43] ITU, World Telecommunication/ICT Indicators Database, August 2021, retrieved from https://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/Digital-Development.aspx

[44] ITU, The Status of Connectivity in 9 non-EU countries of Europe region, retrieved from https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2021/Meaningful%20Connectivity/Report%20-%20The%20Status%20of%20Connectivity%20in%209%20non-EU%20countries%20of%20Europe%20region_final_clean.pdf

[45] To learn more about the forum, visit following link: https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Pages/Events/2021/MC/Default.aspx

distribution, surpassing the world average of 65.7% in 2020, but still has to streamline its efforts to get closer to the Europe average of 87.6%.

- Number of fibre connections per 100 inhabitants: this parameter, though closely related to the uptake, seeks to provide an indication on reliable Internet penetration at the premises level (home or business), relative to the number of citizens. Ukraine reported almost 4.9mln in absolute numbers and 12 FTTH/B subscriptions per 100 inhabitants in 2019, exceeding the EU-27 average of 8.7 for the same year and placing the country the second among nine non-EU countries of the European region in terms of the fibre-to-the-home/building (FTTH/B) subscriptions per 100 inhabitants. Besides, the fibre subscriptions as a share of total fixed broadband subscriptions remained higher in the nine non-EU countries than in the EU-27 for the entire period of 2015-2019. FTTH/B internet subscribers.

The effect of the war

The data on the connectivity for 2022 are not yet available. But the damages according to ITU the Interim assessment on damages to telecommunication infrastructure and resilience of the ICT ecosystem in Ukraineare analysed hereinafter.[46]

Since the beginning of the war in February 2022, with the purpose of using the facilities in their interests and for their own needs, the aggressor either destroyed completely or seized the regular operation of public and private terrestrial telecommunications and critical infrastructure in the temporarily occupied and war-affected territories of the country. Fifteen providers of electronic communication networks and services reported complete loss of control over their networks and equipment. The scale of destruction in the areas, where active hostilities take place, are estimated at 100%.

Even though all the damages can be fully estimated only after the war comes to an end through an ex-post assessment, the ITU Interim assessment on damages to telecommunication infrastructure and resilience of the ICT ecosystem in Ukraine comprises the following data on damages:

ICT networks of operators were partially and, in some instances, fully destroyed or occupied in more than 10 regions of Ukraine (out of 24).

- For 7 months of war, 1123 cyberattacks targeting Ukrainian different sectors including – telecommunications – were reported.
- As of July 2022, 12.2% of settlements completely (and 3.1% partially) lost access to mobile communications and 11% of base stations of mobile operators are out of service. As of June, 20% of the country's telecommunications infrastructure was damaged or destroyed.
- As of April 6, 2022, 20 TV centres were destroyed to one degree or another. According to preliminary estimates of The Radio Broadcasting, Radio Communication and Television Concern (RRT) of Ukraine, the damage to the TV and radio infrastructure amounts to more than UAH 600mln

[46] ITU, Interim assessment on damages to telecommunication infrastructure and resilience of the ICT ecosystem in Ukraine2022, https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Publications/2022/Interim%20report_Ukraine/Interim%20assessment%20on%20damages%20to%20telecommunication%20infrastructure%20and%20resilience%20of%20the%20ICT%20ecosystem%20in%20Ukraine%20-2022-12-22_FINAL.pdf

- The economic losses of the telecom market have been estimated at more than USD 0.1 billion - the companies provide 22% fewer services than before the start of the war that has resulted in their decreased income and revenues.
- Some USD 1.79 billion is needed to restore the telecommunication sector to pre-war development. Direct damage of telecom facilities, networks, systems, and equipment is estimated at USD 0.71 billion. [47]

As most of the war-affected areas of Ukraine continued to suffer destruction and loss of communication signal, being deficient in possibility of restoring optical fibre cable infrastructure, the resilience of the telecommunication network was restored and strengthened through Elon Musk's Starlink – a low Earth orbit space technology operating with over 3000 satellites located between 540 and 570km altitude, and providing high-speed Internet with download rates exceeding 136Mbps and median latency of just 43 milliseconds.48 Around 12000 terminals (transceivers) have been delivered to Ukraine upon the request of the Ministry of Digital Transformation, the software of which has been upgraded to avoid signal jamming (interference) between the terminal and a satellite and adapted for use on a battlefield. A firmware update enabled terminals to be powered by a car's cigarette lighter[49,] allowing officials and citizens of war-affected territories to communicate with each other and the world.[50]

2.1.4. Market Access

The competition in the ICT industry is highly consolidated with 4,760 players.[51] Three major operators in charge of the wireless market - Kyivstar (VEON), Vodafone Ukraine (NEQSOL), Lifecell (Turkcell), in descending order of market share, and four smaller national players, cumulatively controlling around 3% of the market, altogether cover 99.9% of the population of Ukraine with mobile-cellular technology and 91.6% of the population with at least 3G mobile network by 2021.

The fixed broadband market is represented by the „big six" with Ukrtelecom (SCM Group), operating ADSL+ and optical fibre and covering more than 2,300 settlements; Kyivstar, with FTTB in more than 118 cities; Volia, the largest cable TV operator, with point of presence in more than 33 cities; Triolan, with hybrid fibre/coaxial cable services in about 11 cities; Vega (a former sister company of Ukrtelecom, now part of Vodafone Ukraine), with a presence in about 90 cities and PJSC Datagroup.

Fibre and capacity leasing are: PJSC Ukrtelecom, Omega Telekom, Atracom, PJSC Datagroup, PJSC Farlep-Invest (VEGA) and Eurotranstelecom Ltd (ETT). Widespread and accelerated deployment of the mobile broadband networks and next generation technologies led to considerable growth of the volume of wholesale traffic in the country, leading to an increased number of (22 in total, of which 5 in Kharkiv, 2 in Donetsk, 1 in Mariupol and 1 in Zaporizhzhia) local Internet Exchange Points (IXPs),

[47] ITU, Interim assessment on damages to telecommunication infrastructure and resilience of the ICT ecosystem in Ukraine, 2022, https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Publications/2022/Interim%20report_Ukraine/Interim%20assessment%20on%20damages%20to%20telecommunication%20infrastructure%20and%20resilience%20of%20the%20ICT%20ecosystem%20in%20Ukraine%20-2022-12-22_FINAL.pdf

[48] https://www.bbc.com/ukrainian/news-60583913
[49] https://www.wired.com/story/starlink-ukraine-internet/
[50] https://www.cnbc.com/2022/05/02/ukraine-official-150000-using-spacexs-starlink-daily.html
[51] SSCIP data provided of 17 August 2022

that facilitate local exchange of traffic among operators and releasing the capacity of the trunk backbones for the transit of international traffic.

As regards the International wholesale market, Ukraine's international interconnectivity is deregulated and quite robust with at least one interconnection with all seven neighbouring countries, of which five are interconnected through two or more physically separate cross-border routes. Four diverse geographic locations spin Ukraine's thirteen (13) international Internet Exchange Points (IXPs) of which 3 IXPs are located in Kharkiv, 2 in Donetsk and 2 in Odessa regions, connected with major international traffic exchange points, including DE-CIX, Germany and AMS-IX, Netherlands. UA-IX, GigaNET and DTEL-IX are among the largest IXPs of the country. Of the major carriers, Telia, Orange, Cogent, Vodafone and Hurricane Electric have multiple points of presence and some lease optical fibre networks.

Dark fibre wholesale market is dominated by Atrakom LLC, Eurotranstelecom LLC, Naftogaz and Ukrtelecom providing excessive lines of nationwide optical fibre backbone infrastructure thus ensuring continuous network operation by means of redundancy and resilience.

The wholesale market is additionally comprised of the State-owned enterprises and municipalities registered as wholesale operators, some of which are: JSC Ukrainian Railways (Ukrzaliznytsia), the Ukrainian Sea Ports Authority (USPA), the Ukrainian Sea Port „Yuznyi", National Nuclear Energy Generating Company „Energoatom", etc. They cumulatively possess more than 10,000 km of unutilized non-commercialized fibre infrastructure and some of them have international cross-border connections with neighbouring peers.

The capital investments of fixed and mobile operators in the telecommunication sector in 2020 amounted to some UAH 14,297 billion (approx. USD 530 million), up from UAH 11,734 billion in 2019, out of the total amount (including annual foreign investment in telecommunications) of over UAH 16,135 billion, (approx. USD 598 million).

Capital expenditure on the new broadband network infrastructure rollout throughout the country was decreased after February 24, 2022, as network deployments were slowed or suspended to ensure engineers' health and safety during the war. However, the expenditure soared in the war-affected regions. Capex of Lifecell in the first quarter of 2022 amounted to UAH 711.6mln up by 24.30% year-to-year.

Despite the negative global economic trends caused by the COVID-19 pandemic, the telecommunications industry increased its revenues. In 2020, the revenues obtained from the service provision amounted to UAH 73,7 billion (approx. EUR 2.3 billion)[52]. It increased in 2020 by 10.9% compared to 2019. Five main market trends that characterized this development dynamics were:

- Expansion of 4G coverage on the territory of Ukraine with the use of radio frequency bands of 1800 MHz and 2600 MHz;
- Reforming and launching 4G networks in the 900 MHz radio frequency band by mobile operators to provide modern telecommunications services in rural areas and on Ukrainian highways;

[52] The National Bank of Ukraine, exchange rate on 17.01.2022 of EUR 31.989, retrieved from https://bank.gov.ua/en/markets/exchangerates?date=2022-01-17&period=daily

- Increase in the volume of services and the number of users with Internet access;
- Increase in the number of users of modern electronic services, primarily of the government services and in the fields of e-commerce, e-health, and education;
- Growing demand for machine-to-machine and Internet of Things services among banks, security service providers, housing and communal service providers, as well as the transport and logistics companies.

The revenues obtained from the mobile networks service provision amounted to UAH 73,7 billion (approx. USD 2.7 billion). It increased in 2020 by almost 13.3% compared to 2019. In 2020, the largest shares of the revenue were registered by mobile communications - 63.7% followed by fixed-broadband access to the Internet - 18.8%. The revenue from the provision of mobile communication services increased by 24.9% and amounted to UAH 46.9 billion (approx. USD 1.7 billion).

In the first quarter of 2022 three the largest mobile network operators reported growth in their financial indicators, mostly due to a) fulfilment of their 4G license obligations related to expansion of 4G network coverage throughout Ukraine, b) increase of network capacity, c) growth of the number of users and uptake in the first two months of the year and c) extensive usage of the roaming services.[53]

Since 2011, UNECE has supported the project on establishing a port community system (PCS) in Odessa called PPL 33-35, which they also dub as "local single window" (see www.singlewindow.org),[54] as well as a series of activities to support the national Single Window project run by the Ministry of Finance, notably on using the UN/CEFACT standards. The PPL 33-35 PCS enlarged its activities to encompass all ports of Ukraine and was on the way of becoming a national Maritime Single Window. The expertise amassed in this PCS, notably in preparing data and documents in electronic format to be passed to the regulatory agencies is very useful in the current situation, when goods formerly exported or imported by sea have to be redirected by land to the border with the EU, and information exchange coordinated with the regulatory agencies, even if the port is blocked and the PCS's maritime operation are seriously limited.

Several pilot projects involving digitalization of information exchange using the UN/CEFACT standards were carried out in Ukraine, in connection to trade with other countries. [55]

The effect of the war

As the war has significantly damaged and continues to damage the ICT infrastructure, it respectively caused significant costs to the operators.

Violating the basic international principles of the functioning of public telecommunications networks, the aggressor unilaterally changed the international numbering system defined by the International

[53] ITU, Interim assessment on damages to telecommunication infrastructure and resilience of the ICT ecosystem in Ukraine, 2022, https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Publications/2022/Interim%20report_Ukraine/Interim%20assessment%20on%20damages%20to%20telecommunication%20infrastructure%20and%20resilience%20of%20the%20ICT%20ecosystem%20in%20Ukraine%20-2022-12-22_FINAL.pdf
[54] www.singlewindow.org
[55] https://unttc.org/stream/electronic-trade-and-transport-documents-and-data

Telecommunication Union ITU-T E.164(11/2010) and ITU-T E.212(09/2016) and the national numbering system of Ukraine, by introducing new national destination codes (NDC) for the temporarily occupied and war-affected territories of Ukraine and using them under the country code (CC) [7], allocated by the ITU to the Russian Federation and the Republic of Kazakhstan. Ukrainian NDCs [71], [72] and a mobile network code (MNC) [99] as well as NDCs [978], [941], [958], [949], [959], [990], [365] and [869] have been used by fixed and mobile communication networks operating for the benefit of an aggressor in the temporarily occupied territories of Crimea, Sevastopol, Donetsk, Luhansk, Kherson and Zaporizhzhia regions by switching to the international numbering system of the Russian Federation.[56]

According to the "Report on direct damage of the infrastructure, indirect losses of Ukraine's economy, inflicted by the war, and a preliminary assessment of the country's financial needs for reconstruction and recovery", prepared as part of the activities of the Loss Audit Working Group of the National Council on restoration of Ukraine from the consequences of the war, the assessment of the digital infrastructure of the country as of August 2022, looks as follows:[57]

Type of losses	**Measurement unit**	**Quantity of objects (baseline)**	**Quantity of damaged objects**	**Estimation of losses (UAH billion)**	**Estimation of losses (USD billion)**
Direct damages					
Fixed line operators	unit	4162	726	9.3	0.3
Mobile operators	-	-	-	6.1	0.2
Total direct losses of the ICT industry	**UAH billion**			**15.4**	**0.6**
Indirect losses					
Reduction of fixed-line operators' income	UAH billion	-	-	9.4	0.3
Reduction of mobile operators' income	UAH billion	-	-	22.7	0.8
Total indirect losses of the ICT industry	**UAH billion**	**-**	**-**	**32.1**	**1.1**
The need for recovery	UAH billion				
Restoration of operators' Infrastructure	UAH billion	-	-	21.6	0.8
Restoration of operators'	UAH	-	-	6.4	0.2

[56] ITU, Interim assessment on damages to telecommunication infrastructure and resilience of the ICT ecosystem in Ukraine, 2022, https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Publications/2022/Interim%20report_Ukraine/Interim%20assessment%20on%20damages%20to%20telecommunication%20infrastructure%20and%20resilience%20of%20the%20ICT%20ecosystem%20in%20Ukraine%20-2022-12-22_FINAL.pdf

[57] https://kse.ua/wp-content/uploads/2022/07/NRC_CLEAN_Final_Jul1_Losses-and-Needs-Report.pdf

work/activities	billion				
General preliminary need for recovery		**-**	**-**	**28.0**	**1.0**

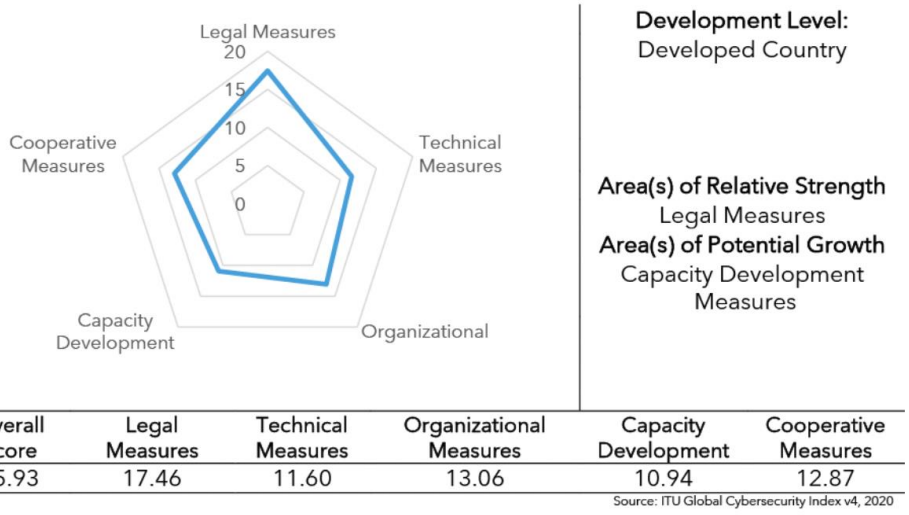
Table 4. Direct and indirect losses of digital infrastructure due to the military aggression against Ukraine and a preliminary assessment of the sector's needs for recovery, in monetary terms.

Source: Ministry of Digital Transformation, NCEC, Operators of electronic communication networks

2.1.5. Trust and Security

According to the 2020 ITU Global Cybersecurity Index, Ukraine ranks 39th in the Europe region and 78th globally. This index is a trusted reference that measures the commitment of countries to cybersecurity at a global level – to raise awareness of the importance and different dimensions of the issue and assess countries' ICT sector resilience and reliability.

Figure 3 – GCI 2020 Country profile



Overall Score	Legal Measures	Technical Measures	Organizational Measures	Capacity Development	Cooperative Measures
65.93	17.46	11.60	13.06	10.94	12.87

Source: ITU Global Cybersecurity Index v4, 2020

Source: ITU Global Cybersecurity Index

The country's overall score is 65.93, which is quite far from the European region average of 80.7. However, in 2018, the country ranked 32nd in the Europe region in this same index, and 54th globally, which emphasized a clear need for greater efforts and commitment to strengthening the country's cybersecurity.[58]

The country has ratified the Budapest Convention on cybercrime by the Law No. 2824-IV of 7 September 2005, but its cybersecurity landscape was shaped by multiple elements, including the institutional and legislative frameworks.

[58] ITU Global Cybersecurity Index (GCI) 2018, p.61, retrieved from https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-GCI.01-2018-PDF-E.pdf

The Ukraine first Cyber Security Strategy was approved by the President in March 2016. It aimed to create conditions that ensure a safe cyberspace and its use in the interests of individuals, the society and the government. The strategy defined the national cybersecurity system, the main actors in cybersecurity, principles and main threats, as well as the main directions of countering them. Areas identified as key ones for ensuring cybersecurity in Ukraine are:

- Development of safe, sustainable and reliable cyberspace;
- Cybersecurity of the government electronic information resources;
- Critical infrastructure cybersecurity;
- Development of cybersecurity capacity in defence sector;
- Fighting cybercrimes.[59]

The strategy implementation resulted in the adoption of the Law "On Basic Principles of Cybersecurity of Ukraine",[60] improvement of the regulatory support for cybersecurity of critical information infrastructure facilities, and approval of the procedures for its definition and general requirements for its cybersecurity. Entities for cybersecurity or cyber defence have been established in the State Service for Special Communications and Information Protection of Ukraine, the Security Service of Ukraine, the National Bank of Ukraine, the Ministry of Infrastructure of Ukraine, and the Armed Forces of Ukraine. Moreover, the National Coordination Centre for Cyber Security as a working body of the National Security and Defence Council of Ukraine was established and Cyber Security Month has been launched.

At the same time, the national cybersecurity system activities remain insufficiently coordinated and aimed at fulfilling only current tasks. The issues of operational exchange of information on cyber threats, an effective training system and an effective model of public-private partnership remain unresolved. Besides the organization and conduct of research in the field of cybersecurity is insufficient. As well as the strategy was performed only for 40%.[61]

To address these and other issues, the new Cyber Security Strategy of Ukraine was approved in August 2021. The strategy outlines challenges and cyber threats, strategic goals and necessary steps to achieve cyber resilience. The highlighted national cybersecurity priorities are:

- Securing cyberspace to protect the sovereignty of the state and the development of society;
- Protection of the rights, freedoms and legitimate interests of the citizens of Ukraine in cyberspace;
- European and Euro-Atlantic integration in the field of cybersecurity.

Furthermore, it details the strategic goals to be achieved during the period of implementation of this Strategy which covers building the capacity of deterrence, gaining cyber resilience, and improving interactions among the national and international stakeholders.[62]

This strategic framework is completed by the legal one which includes:

- The Law of Ukraine No 2163-VIII of 5 October 2017 “On the Basic Principles of Cybersecurity of Ukraine”;[63]

[59] https://zakon.rada.gov.ua/laws/show/96/2016/ed20160315#Text
[60] https://zakon.rada.gov.ua/laws/show/2163-19
[61] https://www.president.gov.ua/documents/4472021-40013
[62] https://zakon.rada.gov.ua/laws/show/447/2021#n7
[63] https://zakon.rada.gov.ua/laws/show/2163-19#Text

- Law of Ukraine "On protection of information in information and telecommunication systems";[64]
- Law of Ukraine on Personal Data Protection No 2297-VI dated 1 June 2010;
- The Resolution of the Cabinet of Ministers of Ukraine No 518 of 19 June 2019 "On the Adoption of the General Requirements to the Cybersecurity of the Critical Infrastructure Objects";
- The Resolution of the Cabinet of Ministers of Ukraine No 943 of 9 October 2020 "On Certain Questions of the Critical Infrastructure Objects".

Apart from the institutions dealing with cybersecurity mentioned in chapter on institutional setting, the State Service of Special Communications and Information Protection of Ukraine (SSSCIP) is considered in detail as it has number of important for cyber security ecosystem entities:

Entity	Division	Responsibilities
SSSCIP	The state Cyber Protection Centre of SSSCIP [65]	– Implements the organizational and technical model of cyber security as a component of the national cyber security system by: – Ensures the functioning and development of CERT-UA, ect.
	Cyber centre UA30 [66]	– Responds to cyber incidents – Acquires skills and knowledge in the field of cyber protection, ect.
	CERT-UA - Government computer emergency response team of Ukraine [67]	– Prevents and reacts to the cyber accidents at the state institutions – Helps and conducts education trainings for the state agencies in cyber security on the cyber threats, etc.

Table 5. The entities dealing with cybersecurity within SSSCIP

On 13 and 14th of January 2022, the largest cyberattack registered since 4 years on state entities happened in Ukraine but according to the SISCIP and Security Service of Ukraine no leak of data happened.[68] At that time the web-sites of the Ministry of Education, the Ministry of Foreign Affairs, the Ministry of Internal Affairs, the State Emergency Service, the Ministry of Sports, the Ministry of Energy, the Ministry of Agrarian Policy, the Ministry of Veterans, the Diia portal and many others were not working properly.

The effect of the war

[64] https://zakon.rada.gov.ua/laws/show/80/94-вр#Text
[65] https://scpc.gov.ua/main-functions-and-tasks
[66] https://thedigital.gov.ua/news/v-ukraini-vidkrili-kibertsentr-ua30-yakiy-zakhishchatime-derzhavu-vid-kiberatak
[67] https://cert.gov.ua/about-us
[68] https://biz.nv.ua/ukr/tech/ataka-na-ukrajinski-derzhsayti-postrazhdali-70-resursiv-novini-ukrajini-50208623.html

The cyber-attacks on Ukraine began a month before the start of military attacks on the 24th of February. Thus, Ukraine had time to resist and to make conclusions. During the war, the number of cyberattacks in Ukraine tripled compared to the previous year. The most attacked targetter state authorities, media resources, the energy sector, and the logistics sector.[69] On the 24th an hour before the military aggression cyber-attack was done on the KA-SAT satellite network that is operated by Viasat and serves, including some state institutions of Ukraine. [70]

For 6 month the number of cyber-attacks increased to 1123.[71] The main targets are government and local authorities as well as all infrastructure that works for population livelihood – more in figure **. In comparison – for 4 month the number of cyber-attacks was 796.

Figure 4 – Areas of 1123 cyber-attacks on Ukraine in 6 months of war

Source: SSSCIP

In order to improve the state of cyber security and prevent cybercrime, in March 2022 the Verkhovna Rada of Ukraine voted to amend Articles 361 and 361-1 of the Criminal Code of Ukraine, which

[69] https://cip.gov.ua/ua/news/kilkist-kiberatak-pid-chas-viini-zrosla-vtrichi
[70] https://www.consilium.europa.eu/en/press/press-releases/2022/05/10/russian-cyber-operations-against-ukraine-declaration-by-the-high-representative-on-behalf-of-the-european-union/?utm_source=dsms-auto&utm_medium=email&utm_campaign=Russian+cyber+operations+against+Ukraine%3a+Declaration+by+the+High+Representative+on+behalf+of+the+European+Union
[71] https://cip.gov.ua/en/news/bilshe-tisyachi-raziv-atakuvali-ukrayinu-vorozhi-khakeri-za-chas-viini

authorizes external specialists to get involved in searching and eliminating shortcomings, gaps, errors and vulnerabilities in software products and information and communication systems.[72]

The war has proved that is has its own cyber security dimension. Thus apart from defensive capabilities in cyber security Ukraine has started to develop offensive one. As part of a joint initiative, the Ministry of Culture and Information Policy of Ukraine (MinCult) and the Ministry of Digital Transformation have created the Internet Army to combat propaganda. Almost 500,000 developers, designers, copywriters, marketers, and other professionals have joined special chats to volunteer as part of these "armies".[73]

2.1.6. Resilience of Digital infrastructure

The National Security Strategy of Ukraine from 2020 established resilience as one of the fundamental principles of security.[74]

Eventually in September 2021 the Concept of National Resilience System's Development was approved by the National Security and Defence Council of Ukraine in order to establish with all the means required the system of national resilience. It defines the national resilience as the *'ability of the state and society to effectively withstand threats of any nature and character, adapt to changes in the security environment, sustain their stable functioning, and quickly regain the desired balance after crise'.* [75] As for the infrastructure the number of measured have been taken to improve the digital resilience of critical infrastructure. The main legislative documents include:

- Decree of the Cabinet of Ministers Decree dated 19 June 2019, No.518 [76] on the approval of General requirements for cyber protection of critical infrastructure object
- Order of the State Special Communications Administration dated October 6, 2021 No. 60 on the approval of Methodological recommendations on increasing the level of cyber protection of critical information infrastructure. [77]
- Decree of the Cabinet of Ministers of Ukraine dated 9 October 2020 No.943 on some question of the objects of Critical information infrastructure. [78]
- Decree of the President of Ukraine dated 27 September 2021 No. 479/202on conception of provision of the national system of resilience. [79]
- Law 1882-IX dated 21 November 2021 on Critical infrastructure that entered into force on 15 June 2022. [80]

[72] https://zakon.rada.gov.ua/laws/show/2149-20#Text
[73] https://www.strategeast.org/all_reports/Ukrainian_Digital_Resistance_Report_web.pdf
[74] https://zakon.rada.gov.ua/laws/show/392/2020#Text
[75] https://www.rnbo.gov.ua/ua/Ukazy/5017.html
[76] https://zakon.rada.gov.ua/laws/show/518-2019-п#Text
[77] https://cip.gov.ua/ua/docs/nakaz-administraciyi-derzhspeczv-yazku-vid-06-zhovtnya-2021-roku-601-pro-zatverdzhennya-metodichnikh-rekomendacii-shodo-pidvishennya-rivnya-kiberzakhistu-kritichnoyi-informaciinoyi-infrastrukturi
[78] https://zakon.rada.gov.ua/laws/show/943-2020-п#Text
[79] https://www.president.gov.ua/documents/4792021-40181
[80] https://zakon.rada.gov.ua/laws/show/1882-20?lang=en#Text

- Decree of the Cabinet of Ministers dated July 12, 2022 No. 787 on the establishment of the State Service for the Protection of Critical Infrastructure and Ensuring the National System of Ukraine's Stability.[81]

In September 2021 the national broadband plan for 2021-2022 was approved and included, among other, the creation of the broadband coverage platform 'broadband.gov.ua'. This platform is the instrument for analysing and monitoring the progress of deployment of broadband connections all around Ukraine, according to the plan of the Ministry of Digital Transformation. [82] In addition, the largest Ukrainian telecom provider - Vodafone, Kyivstar, Lifecell - also have their own coverage maps.

The effect of the war

Since the start of war, the map on broadband coverage has stopped to operate because of the damage to the ICT infrastructure caused by the military attacks. The same situation occurred with the maps of operators. Although the operators are on the way to restore the infrastructure, it still has to be done on the temporary occupied territories.

Since 2014 Ukraine is considered as a 'test place' of all Russia cyber tools so it has made the Ukrainian ICT more resilience to the cyber damages but still vulnerable to the physical damages. Thus, in the context of the current war, Ukraine's cyber security system proved to be resilient to the possible extent. The example is the attack on the Ukrtelecom in March 2022 that has been quickly countered with the protection of the information services due to the support of the international partners.

Having observed accumulation of troops in the border areas of Ukraine couple of months prior to the military attack and mobilization of massive combat forces, including tanks, artillery, rockets, and other heavy weaponry, the ICT sector of Ukraine took preparatory measures for increasing resiliency of the critical and telecommunication networks and systems in anticipation of a probable military attack.
Lifecell effectively utilized a pre-developed plan of actions drafted for the event of natural or manmade hazards, including armed military aggression, partly shaped and adjusted by the "lessons" of 2014. All of the company's new development and planning over the previous eight years anticipated the possibility of this scenario.
In the outlook of a military attack, Kyivstar and Vodafone Ukraine took extensive precautionary advance measures of strengthening system and network infrastructure resilience for the emergency situation.[83] Ukraine is building contingency plans to safeguard its sensitive data which will mitigate the situation with cyberattacks.[84]

The SSSCIP contributes as well to the promotion of the digital resilience of infrastructure. It announced in January 2021 about the cooperation with USAID under the project "Cybersecurity for Critical Infrastructure in Ukraine" in order to increase the stability of Ukraine's critical infrastructure, including critical information infrastructure. The partnership opens up new opportunities in the field of

[81] https://www.kmu.gov.ua/npas/pro-utvorennia-derzhavnoi-sluzhby-zakhystu-krytychnoi-infrastruktury-ta-zabezpechennia-natsionalnoi-systemy-stiikosti-ukrainy-787-120722
[82] https://thedigital.gov.ua/news/internet-dlya-kozhnogo-uryad-zatverdiv-plan-zakhodiv-iz-rozvitku-shirokosmugovogo-dostupu-na-2021-2022-roki
[83] https://www.bbc.com/ukrainian/features-61120584
[84] https://www.oecd-ilibrary.org/economics/digitalisation-for-recovery-in-ukraine_c5477864-en

strengthening Ukraine's cyber security by supporting legal and regulatory reforms, training technical specialists and involving the private sector. [85]

The resilience of Ukrainian digital infrastructure now is even more tangible, as operation of all governmental services and objects of critical information infrastructure are operating in times of war and constant cyber-attacks.

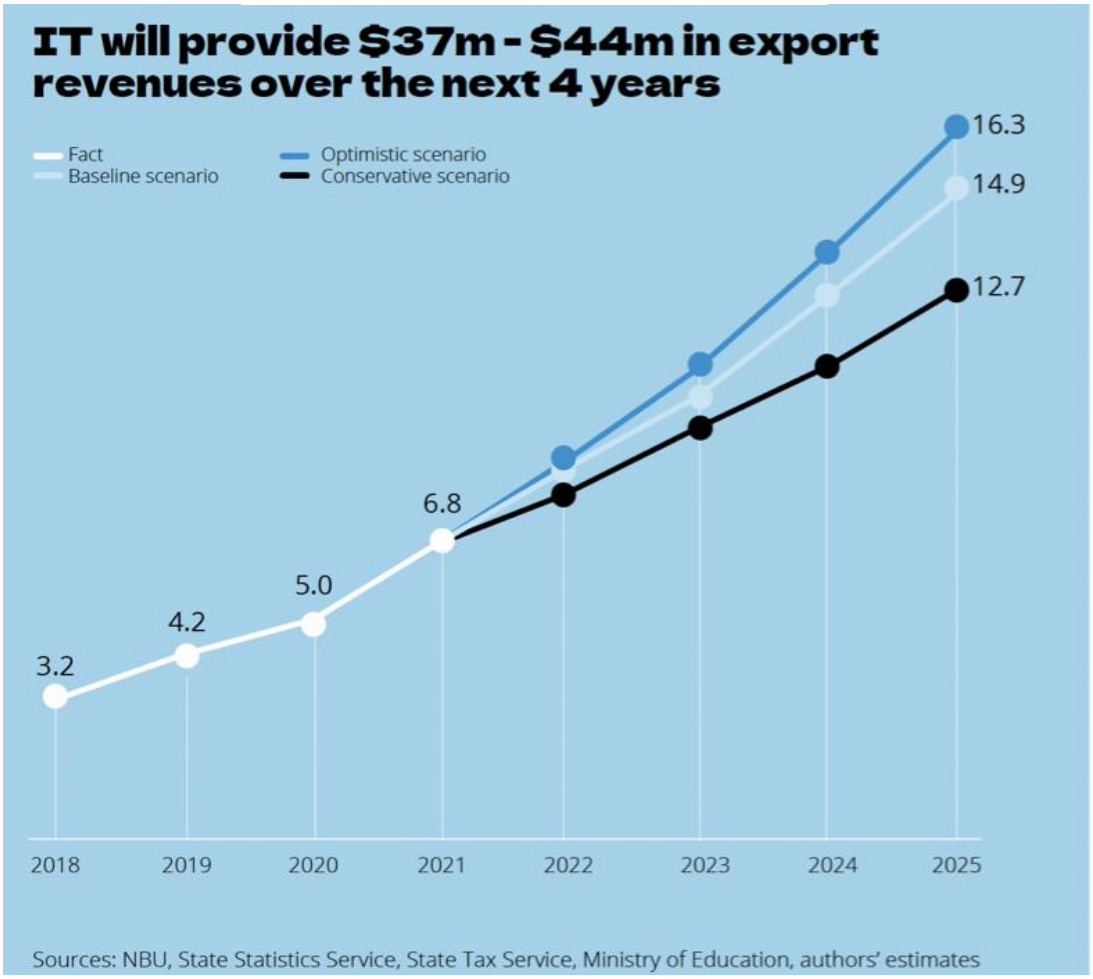
2.1.7. Financing and Investments

For a long time, Ukraine has been trying to attract the investments to the digital domain, especially to IT. According to the IT investment guide that is elaborated by the National Investment Council of Ukraine, 2020 was a record year for Ukrainian IT sector with 188 agreements concluded with the Ukrainian companies accounting for a total worth of $571 million. International funds are used mainly at the early-stage financing as a seed-money, after which companies manage to be competitive thanks to the quality of their products. [86]

There are 5000 active companies in the Ukrainian market. Ukraine is home for the large tech start-ups such as for Jiji, Reface, MacPaw and Headway, Grammarly, etc. In 2021, 188 venture agreements were concluded leading to the amount of finance of 534 mln $.[87] The IT market in Ukraine is the third-largest attractor of foreign currency into the economy in the country.[88] The figure below [89] shows how the share of IT in the export of services was growing resulting in the largest export-oriented domain.

[85] https://cip.gov.ua/ua/news/derzhspeczv-yazku-rozpochala-spivpracyu-z-usaid-u-sferi-kiberbezpeki
[86] http://www.nicouncil.org.ua/en/investment-eng/392-it-industry-guide.html
[87] https://drive.google.com/file/d/1LujaT9pHEGhgpRRojfnlZgQikkyillbE/view
[88] https://techcrunch.com/2022/06/07/6-reasons-to-invest-in-startups-from-ukraine/
[89] https://itukraine.org.ua/en/results-of-a-national-study-of-the-it-industry.html

Figure 5 – Export revenues from IT



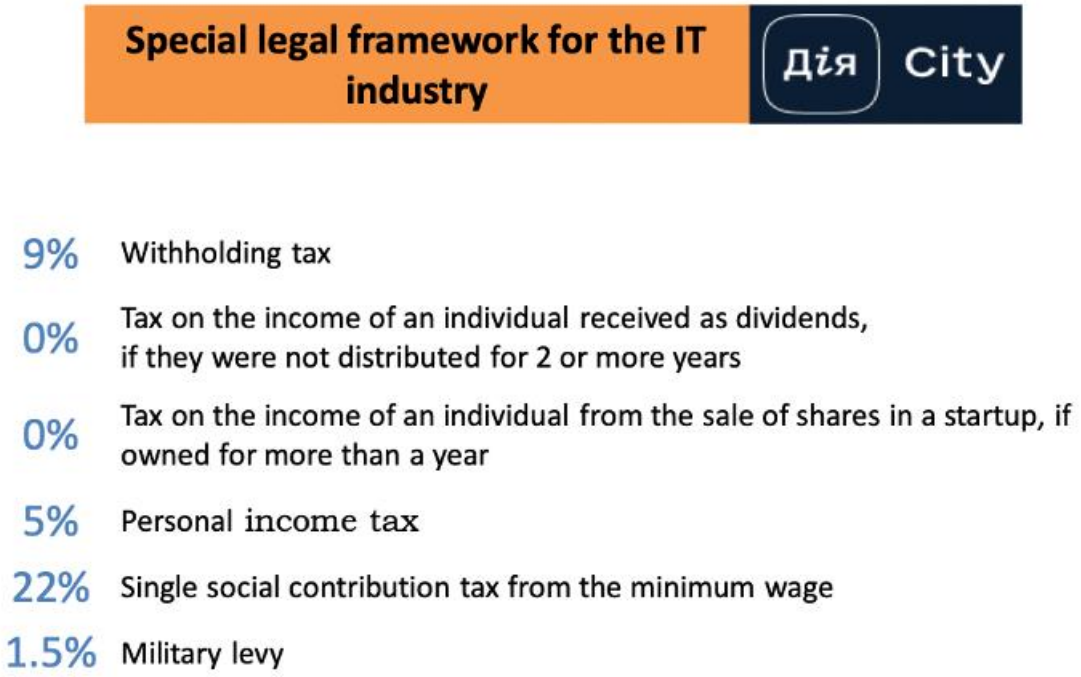
Source: IT Ukraine Association

In 2021 the export of computer services has grown to 6,7 billion $ having increased at 36% in comparison to 2020.[90] The main drives of the increase of the exports of services are the US (40% of export) and the UK (10%). In 2022 prior to war the indicator of export of the services in February was the highest in the history of Ukraine IT and has increased to - $839 million that is at 43% bigger than in the respective period last year.

Considering this, the Ukrainian government has launched a number of initiatives to attract the investment to the IT sector to drive all domains of the digital transformation. The Ministry of Digital Transformation has driven the creation of the Diia City – special legal and tax space for IT business that makes it easier and less expensive to manage and operate business. The details are at the figure 6 below.

[90] https://biz.nv.ua/tech/obem-ukrainskogo-it-eksporta-sostavil-6-8-mlrd-dollarov-novosti-ukrainy-50210150.html

Figure 6 – Diia City regime



Source: Ministry of Digital Transformation

Such activity was aimed to make Ukraine the main European IT hub and to increase the part of IT in the GDP from 4% to 10 while increasing the income to 16.5$ bln.[91] For the establishment of Diia City Ukrainian parliament in December 2021 approved the law №1946-IX, on changes to the tax regulations concerning advancement of the digital economy in Ukraine and that later was signed by the President of Ukraine. Diia City launched on 8Th February 2022 is the zone operating all over Ukraine.

Ukraine is also developing strategic communications and has launched the Trade&Invest chapter on the main website of Ukraine, 'Ukraine.ua'. It aims at explaining to the public the benefits of the innovative start-up ecosystem in Ukraine.[92]

The effect of the war

The Minister of Digital transformation from the very first days of war has started the campaign – Digital Blockage of Russia. Following the war in Ukraine, many companies have withdrawn from the Russian market and entered the Ukrainian Market. For example, the 2 big digital payment services – Revolut and Paypal which Ukraine has been encouraging for a long time to enter the market. As well as Starlink is now working on opening a representative office in Ukraine.[93]

[91] https://www.ukrinform.ua/rubric-technology/3399849-zavdaki-diacity-castka-it-u-vvp-ukraini-moze-zrosti-z-4-do-10-zelenskij.html

[92] https://ukraine.ua/invest-trade/startup-ecosystem-ukraine/

[93] https://www.ukrinform.net/rubric-society/3468959-starlink-ukraine-registered-as-representative-office-of-spacex.html

The government now is focusing on the development of the digital economy as considering the war digital services are as valuable as never before for the economic recovery. Diia City has updated its criteria of residence to simplify them as much as possible while the taxation regimes remains as it was. Thus, the companies will not be deprived the status of the residence even if it does not correspond to the criteria's – number of employees, average salary and etc. The residence will not be obliged to provide independent audit reports to the 1st of January until the year that will follow the year of peace.[94]

As for the market stability and investments, according to the National Bank of Ukraine, the export-oriented IT industry provided a record $ 2 billion revenue for the first quarter of 2022, despite martial law, mobilization, forced relocation of businesses and teams. A similar figure in 2021 was $ 1.44 billion. In fact, the volume of IT exports increased by 28%.[95]

The Ukrainian IT sector has proved to be resilient and flexible during the three first months of war. Lots of companies have in advanced brought their offices to the West or with the start of the war quickly relocated to safer places to keep work up to run. Yet in all regions of Ukraine IT specialists work with the periodic sounds of air alarms, but the market continues to function. Nearly 90% of IT specialists haven't seen any changes to their job or workload since the war began, according to a survey by DOU.[96]

Most companies have retained customers and the volume of their contracts. As a result, the industry remains financially stable, provides regular foreign exchange earnings to the economy of Ukraine and the state budget, and pays taxes in advance. The figures eloquently illustrate this. In March 2022, the Ukrainian IT industry kept 96% of computer services exports ($ 522 million) compared to the same period of the last year ($ 546 million).[97]

As the development of the IT sector is integral to the maintenance of the country's GDP, the government fully supports it. For example, during the war, safe regions in the west of Ukraine turned into new hubs for IT companies. The government initiated its own programs of support of the Ukrainian IT ecosystem.

One of them is the project Digital4Freedom presented in Lugano in the Ukrainian Recovery Conference in order to encourage the foreign companies to invest in Ukraine. At the conference the top world tech companies were present including Microsoft, Rakuten, Apple, Amazon, Google, IBM, Palantir, Mastercard, Visa etc. The initiative is promoted as the digital 'lendlis' to create the most free and digital country that will be the min IT-hub in the Eastern Europe with the focus on the security decisions.[98]
Considering the resilience that Ukrainian IT market has demonstrated, it is still operating and developing. If foreign investors continue to invest in Ukrainian IT, even during the war, the domain will continue to develop.

[94] https://t.me/zedigital/1451
[95] https://itukraine.org.ua/en/the-it-industry-provided-a-record-$-2-billion-in-export-earnings-during-the-war.html
[96] https://dou.ua/lenta/articles/ukrainian-it-during-war/
[97] https://itukraine.org.ua/en/the-it-industry-provided-a-record-$-2-billion-in-export-earnings-during-the-war.html
[98] https://thedigital.gov.ua/news/mintsifra-zapuskae-digital4freedom-mizhnarodnu-initsiativu-strimkogo-vidnovlennya-ta-rozvitku-ukraini-cherez-innovatsii-ta-tsifrovizatsiyu

2.2. Building Block 2: Adoption

Fully unpacking the use of ICTs by various groups in society can allow for a more informed understanding of the digital divide, as well as offering insight into which policy interventions can guarantee equitable access. This requires a closer look at the myriad of dimensions of digital inclusion, including i) measures designed to increase the affordability of digital services; ii) interventions created to enhance the skills of individuals; and iii) proposals that extend access to ICTs for all in Ukraine.

2.2.1. Affordability

To ensure that access to connectivity is meaningful, there is a need for such connectivity to be affordable, so that it is inclusive and accessible to the most. Access and affordability are thus the strongest determinants of another factor of connectivity, uptake.

As regards to the affordability dimension, considering the Broadband Commission's target for the prices of the entry-level broadband services to be kept below 2% of monthly GNI per capita, Ukraine provides relatively affordable Internet access.

In 2021, the data-only mobile broadband basket cost was 1.47% of Gross National Income per capita (GNIpc) for a monthly allowance of 2GB, which ranked the country 85th globally (up from 2020, with 1.54% of GNIpc and a global ranking of 89th place). [99] Meanwhile, in 2021 the country was ranked 57th globally based on fixed-broadband basket cost of 1.76% of GNIpc for a 5GB Internet data cap, (down from 56th place in 2020, with the fixed-broadband basket cost of 1.60% of GNI per capita, for a 5Gb Internet data cap). [100]

Even though the country achieved the Broadband Commission affordability target of 2% for both the data-only mobile-broadband and fixed-broadband baskets costs, Ukraine is still far from reaching the European region average of 0.51% as well as world average of 1.25% of monthly GNI per capita on data-only mobile broadband basket cost, and 1.28% of GNI per capita on fixed-broadband basket cost.[101] Moreover, the in-depth analysis revealed that there is a significant part of the population that could not afford broadband in the Eastern part of Europe. In Ukraine, the share of the population who cannot afford any of the baskets reached around 30%. [102]

Finally, when it comes to connectivity uptake, Ukraine has a weaker position in comparison to regional peers, even though it demonstrated good performance on the affordability and availability dimensions outlined above:

- Fixed broadband subscriptions per 100 inhabitants. Over the last decade, the amount of fixed broadband subscriptions in Ukraine in absolute figures grew from 3.2mln to 7.6mln, with a slight decline of numbers in 2021 comparing to the peak of 7.8mln subscribers registered in 2020, and per 100 inhabitants experienced an annual growth with a Compound Annual Growth Rate (CAGR) of 10.14%.

[99] https://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/IPB.aspx
[100] https://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/IPB.aspx
[101] https://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/IPB.aspx
[102] ITU, Measuring digital development ICT price trends, pp. 51, retrieved from https://www.itu.int/en/ITUD/Statistics/Documents/publications/prices2020/ITU_ICTPriceTrends_2020.pdf

- Active mobile-broadband subscriptions per 100 inhabitants: even though, in 2020, the number of active mobile-broadband subscriptions per 100 inhabitants reached 85.3, (surpassing the world average of 77.3), which represents an increase of almost 81% compared to 2018, this result still fell beneath the European region average of 101.5 subscriptions per 100 inhabitants for the same year. The numbers experienced a downward trend in 2021 registering 80.12 active mobile-broadband subscriptions per 100 inhabitants, falling behind the world average of 83.2 and European average of 105.3 in 2021. This can be explained by the rollout of fixed-broadband networks and respective service availability.
- Estimated proportion of households with a computer: the pattern of moderate but stable increase is observed in the case of the share of estimated proportion of households with a computer. In 2020, this share reached 66.2%, with 75% of urban and 47% of rural distribution, experiencing an annual growth with a CAGR of 7.8% since 2011. Between 2015 and 2018, the average CAGR for the nine non-EU countries of Europe was 0.6%. However, Ukraine was among the six of them which demonstrated limited, albeit positive, growth.
- Internet users (as % of the population): in line with ITU data, 75.04% of people in Ukraine used the Internet in 2020.[103] The share of Internet users was steadily growing over the past decade with an average of 5% (rounded) increment per year.

The effect of the war

No data available for 2022.

2.2.2. Skills

As stated in the ITU Report – Digital Skills Development Ukraine Good Practice Case Study[34], the lack of conceptual foundation for the formation of state policy in the field of digital skills hindered digitization processes in all spheres of public life and the economy, as well as reduced the efficiency of public e-services.

In 2019 the Ministry of Digital Transformation has set the target of educating 6 million Ukrainians in digital literacy over 3 years. [104] The process of digital skills development at the national level accelerated with adapting the European DigComp Frameworks.[105] The basis for further multistakeholder effort of its transformation into a practical tool was put by the Erasmus+ project which worked on adapting the European DigComp 2.0 to the Ukrainian needs. It demonstrated a holistic approach, a so-called benchmark conceptual model that could be adapted to many areas of life: education, employment, active citizenship, and social inclusion. In its turn, the DigComp Framework 2.1 showcases the spheres, descriptors, and levels of digital skills. It serves as a reference for policymakers, professional standard developers, educators, HRs, etc. and citizens on what to teach and how to assess digital skills.

Based on the DigComp framework for citizens, a number of context specific digital competency frameworks were developed in Ukraine. Several derivative frameworks have recently been developed

[103] ITU,https://www.itu.int/en/ITUD/Statistics/Pages/stat/default.aspxhttps://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/Digital-Development.aspx
[104] https://thedigital.gov.ua/ministry
[105] https://ec.europa.eu/jrc/en/digcomp

for educators, public officers, and entrepreneurs. DigComp framework for doctors is expected to be published in 2022. These professional DigComp frameworks aim to provide the instruments which could help various target audiences. For instance, professionals can benefit from self-evaluation, setting learning goals, identifying gaps and training opportunities, as well as facilitating job search. Policy makers can get support in monitoring professional digital skills, curricula development, and measuring human capital which is needed to take advantage of the possibilities offered by a digital society. Human resource specialists can use them for setting qualifications needed in terms of digital skills while educators for planning and designing education and training offers.

In 2019, the Ministry of Digital Transformation conducted a survey conceptually based on DigComp 2.1. It showed that 37.9% of the Ukrainians aged between 18 and 70 have low basic e-skills, and 15.1% do not have them at all. In such a way, 53% of the population needs to develop digital skills. The majority of 61.6% of people with digital skills at the level above average are young people between 10 and 17.[106]

The second survey conducted in 2021 showed a gradual increase in the level of digital skills in comparison to 2019. The number of Ukrainians with digital skills below the basic level decreased by 5.2% or 1.42 million people reaching 47.8% of the population. The share of those with no skills decreased by 4% or 1.09 million people.

Nevertheless, the approval of the "Concept Paper on Digital Skills for Ukrainian Citizens" in March 2021 served as a starting point for upskilling and reskilling the workforce's digital competences. It aims to raise public awareness on the issue of the low level of digital skills, showcase key principles, approaches, objectives, as well as the actions to increase the level of digital literacy of the population. The Concept Action Plan aims to launch legislative, informational, scientific, methodological, and organizational processes for the further development of digital competencies across the country. All actions should comply with the SMART-goal approach and be completed by 2025.
The expected outcomes are meanwhile complemented by results generated from a number of recently launched initiatives. One of them is the Online Platform Diia.Digital Education launched in January 2020 with an aim to reach the goal of educating at least 6 million Ukrainians in digital skills by the end of 2023. Its two components include an online platform with different categories of digital skills training courses and self-assessment tests for different target groups, as well as an offline network of Digital Skills Centres with a programme to bridge the digital divide.

Another part of Diia.Digital Education Project is offline part, that include more than 6000 Digital Hubs – physical places, mostly based on local libraries, where are: computer or some kind of equipment with access to the Internet and a person who can help with simple request. The impact generated by the platform is increasing exponentially. As of 1 January 2021, the platform had 400,000 users taking eSkills courses. Ten months later, the platform had more than 1 million active participants and 833 000 of which in Digital Education.

Digital literacy tests are also available on the platform. "Digigram" offers an opportunity for any citizen to check their digital literacy. This platform provides two versions of the test for citizens and separate

[106] https://osvita.diia.gov.ua/uploads/0/588-the_first_in_the_history_of_ukraine_research_compressed.pdf

tests for teachers, doctors, and civil servants. After completing the test, citizens receive a certificate and access to educational materials meant to further improve their skills. Among the educational materials in the edutainment format are over 70 educational movies.
Another one is the "Train the Trainer" Program provided through the Diia.Digital Education Platform. The eSkills trainers of the offline Hub can take an interactive course with practical assignments for free and receive a certificate after successful completion. The course covers such topics as creating the training plan and guiding users through Diia.Digital Education series, the concept of blended learning, and how to adapt courses to individual learning paths and needs. It also includes good practices and recommendations on the efficient use of digital technologies for teaching and learning, etc.

As of November 2021, more than 2209 trainers completed the course and were certified. Yet, the dropout rate is still high, at nearly 43.6% of participants. It means that the reasons need to be analysed and the curriculum improved in the coming years. Nevertheless, the number of DigComp trainers is steadily increasing to ensure that DigComp training is supported in the regions and local communities.

The effect of the war

The next evaluation of the digital skills will be done in 2023, thus measurement of the level of growth of digital skills in Ukraine for 2022 will not be done.
As Diia.Digital education project continues to function, the number of trainers has increased to 2 363 people and the number of online series on digital literacy for layers, teachers, journalists, medical workers, civic servant, pupils to more than 75 in 2022. As of August, the number of Ukrainians who are registered in the system of Diia.Digital Education has grown to 1,7 million. The number of people who just visited the websites of the project – 9,7 million. The numbers of the people who took the tests on above mentioned Digigram are presented in the table 6. [107]

Digigram 2.0 for citizens	169.742
Digigram for teachers	210.206
Digigram 1.0 for citizens	237.013
Digigram for civil servants	92.411
Digigram for medical workers	69.512
ICDL Ukrainian digital citizen	16.104

Table 6. Number of people taking Digigram

In August 2022 the Ministry of Digital Transformation together with partners, the Binance blockchain ecosystem and the Lviv IT Cluster started the project – IT-generation that is aimed to provide to Ukrainians from 21 to 60 years old without prior experience in IT the opportunity to obtain for free the education and profession in the field of IT. 22 IT schools provide the education. In 2 weeks 47,996

[107] https://osvita.diia.gov.ua/en/statistic

sent 211,312 applications for participation in the IT Generation project.[108] That proved the significant interest in the acquisition of digital skills, in particular IT skills.

According to Ministry of Digital Transformation, soon the educational portal will be launched – part of the project "Diia. Digital Education" but the one entirely devoted to the topic of online safety. This portal will have content blocks for children, parents, teachers, where Ukrainians find a lot of information on the topic of personal safety in the network. [109]
In the framework of the Global Education Coalition (GEC) initiative, support of hybrid and distance teaching and learning through the provision of hardware, software, and teacher training is taking place. In particular the activities include such dimensions according to UNSECO:

- Facilitation and amplification of partnership with Google (devices and software) and training to Ukrainian teachers. The donation of Google Chromebooks to Ukrainian teachers are leveraged.
- Provision of intensive teacher training on the use of the devices and teaching contents made available by the GEC partners, that are fully aligned to the national curriculum and available in the Ukrainian language. [110]

2.2.3. Inclusion

Bridging the gendered digital divide

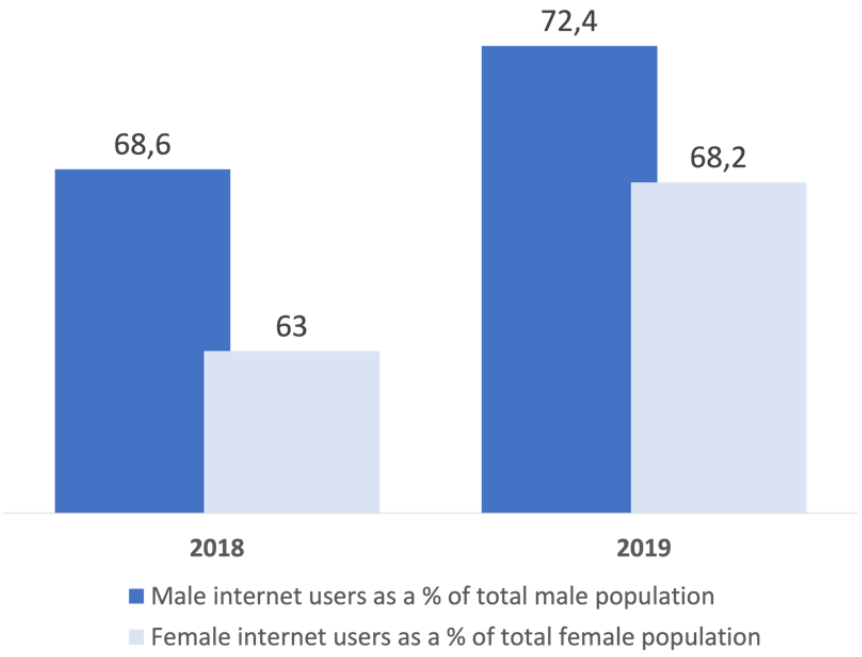
Women's access to ICT

In terms of Internet use in the general population, the gender gap in Ukraine is relatively small. According to the latest data available, 68.2% of the female population is using the Internet, which is 4.2 percentage points lower than the share of men using the Internet. Even though the share of women using Internet increased in 2019 with 8.2 percentage points compared to 2018, the gender gap did not diminish dramatically.

Compared to 2018 when the data showed a difference of 5.6 percentage points between the shares of male and female Internet users.[111] Before the war, Roma women in Ukraine also reported difficulties supporting online learning for their children due both to lack of technical capacity, and lack of access to connected digital devices.[112]

[108] https://it-generation.gov.ua
[109] https://ms.detector.media/trendi/post/29868/2022-07-18-valeriya-ionan-mintsyfry-my-zminyuiemo-shkilnyy-kurs-informatyky-vin-bude-pronyzanyy-tsyfrovoyu-gramotnistyu/
[110] ttps://globaleducationcoalition.unesco.org
[111] ITU, World Telecommunication/ICT Indicators Database , August 2021, retrieved from https://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/Digital-Development.aspx
[112] UNW, 2020, Rapid Gender Assessment of the Situation and Needs of Women in the Context of Covid-19 in Ukraine, available at https://www2.unwomen.org/-/media/field%20office%20eca/attachments/publications/2020/05/rga%20summary%20report_eng_web-min.pdf?la=en&vs=4314

Figure 7 – Share of female and male Internet users in 2018 vs 2019



Source: ITU-UN Women

Women's participation and leadership in ICT

Women account for 46% of individual entrepreneurs, but they lead only 30% of enterprises and organizations. According to Ukrainian online service YouControl, from 2017 to 2019, the number of individual female entrepreneurs in IT grew by 62%. In comparison to 2018, in 2019 the number of female individual entrepreneurs in IT grew by 24% which is faster than the overall entrepreneurs number growth of 19%. Besides, the overall number of women employed in the IT industry is steadily growing, but hardly reached a quarter of the total number of IT specialists. In the ICT sector, 74.8% of management positions are held by men, and 25.2% held by women.[113]
The most in-demand new profession among women is a cyber security specialist (82.4%), and the least in-demand is an expert in creating digital doppelgangers (36%). Top 3 factors how the development of ICT effects employees: [114]

- Emergence of new forms of employment (remote, freelance, etc.) women - 62.7%, men - 50%;
- Flexible work schedule opportunities for women - 62.5%, men - 48.8%;
- Formation of new digital skills for women - 62.5%, men - 49.2%.

Women in ICT education

Technical education is the foundation of Ukraine's IT ecosystem. Every year, over 150 000 students graduate, of whom around 40 000 obtain degrees in technological studies, including some 15 000 IT

[113] ITU-UN Women, Digitally Empowered Generation Equality: Women, Girls and ICT in the context of COVID 19 in selected Western Balkan and Eastern Europe Partnership countries, p.85, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en
[114] https://www.ukrinform.ua/rubric-economy/3274197-cifrova-ekonomika-doslidniki-kneu-stvorili-doroznu-kartu-rozvitku-ludskogo-kapitalu.html

specialists. Additionally, around 40 000 IT specialists graduate annually from IT schools.[115] Yet young people report a gap between the "old fashioned" and "highly theoretical" curriculum that they are being taught and the world of innovation that characterizes the forward-looking technology ecosystem. Thus, the "New School" education reform implemented in the country includes the creation of the first generation of gender-sensitive textbooks and the development of e-learning tools based on gender equality. According to the strategy, all documents produced as part of the reform will be subject to antidiscrimination expertise and adjusted on the basis of gender equality.[116]

This is particularly important because even parents who encourage girls to obtain good grades in all subjects – including STEM – may not be supportive when it comes to girls choosing a science or technology career. Similarly, teachers may not take girls' ambitions seriously or even display offensive attitudes. This includes cases like questioning whether women had enrolled in a technology-related faculty simply to "find a husband". This kind of attitudes and beliefs affect students' confidence in and perception of their own skills.[117]

With the transition to online learning, girls reported feeling more pressure over online learning because they "study more and take school more seriously." Besides, Roma women reported difficulties supporting online learning for their children owing to a lack of both technical capacity and access to connected digital devices. To partially overcome this issue, a group running STEM workshops for girls held their programming on weekends, when parents were not working, so that girls could use their parents' laptops.[118]

Dark side of ICT and cyberviolence

Ukraine faces unprecedented challenges affecting gender equality and the enjoyment of equal rights and opportunities by women, particularly those facing multiple forms of discrimination. The structural discrimination of women persists in both the public and private spheres to varying extents. Ukraine adopted a law on preventing and counteracting domestic violence in 2017 as well as ratified the Istanbul Convention on 18 July.[119]

Cyberspace in Ukraine is rife with abusive and harmful expressions of violence. Spikes in online violence against women often coincide with four major events: scheduled releases of annual government data; electoral cycles; salient political events; and highly visible or controversial actions by women in the public eye. In many cases, perpetrators who attacked politicians endeavoured to degrade victims by questioning their abilities as civil servants. An analysis of data from 2014-2018

[115] ITU-UN Women, Digitally Empowered Generation Equality: Women, Girls and ICT in the context of COVID 19 in selected Western Balkan and Eastern Europe Partnership countries, p.86, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en

[116] ITU-UN Women, Digitally Empowered Generation Equality: Women, Girls and ICT in the context of COVID 19 in selected Western Balkan and Eastern Europe Partnership countries, p.17, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en

[117] ITU-UN Women, Digitally Empowered Generation Equality: Women, Girls and ICT in the context of COVID 19 in selected Western Balkan and Eastern Europe Partnership countries, p.12, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en

[118] ITU-UN Women, Digitally Empowered Generation Equality: Women, Girls and ICT in the context of COVID 19 in selected Western Balkan and Eastern Europe Partnership countries, pp.7,9 retrieved from http://handle.itu.int/11.1002/pub/818d024e-en

[119] https://www.president.gov.ua/news/prezident-pidpisav-zakon-pro-ratifikaciyu-stambulskoyi-konve-75969

showed that women were more likely to face socio-psychological harassment and they primarily face attacks against their physical appearance, intelligence and professional competence.[120]

In November 2021, the Council of Europe Expert Group on Action against Violence against Women (VAW) and Domestic Violence (GREVIO) published its General Recommendation No.1 on the digital dimension of violence against women.[121] In monitoring the implementation of the Istanbul Convention,[122] GREVIO has identified that the digital dimension of VAW is often being overlooked in domestic laws and policies. In its General Recommendation No.1, the first it has adopted, it outlines the problem of both gender-based violence against women committed online and facilitated by technology. "It coins the term "the digital dimension of violence against women" as comprehensive enough to comprise both online acts of violence and those perpetrated through technology, including technology yet to be developed". States ratified Istanbul convention are expected to address efficiently risks of online violence as one of forms of violence against women and girls.

Good practices to increase women participation in STEM careers

Among the Ukraine's best practices is the STEM IS FEM initiative which offers wide exposure to the STEM field to schoolgirls aged 12-17 years throughout the country. Through a series of two-day workshops, girls participate in "dive-in educational modules", lectures from role models and inspirational speakers, hands-on problem-solving challenges and visits to high-tech companies, among other activities. The aim is to offer career perspectives to enable girls to picture themselves working in a STEM-related field.
Modules include bioengineering, energetics and ecology, engineering and robotics, 3D modelling and printing, mechanical engineering, construction and architecture, and computer science and artificial intelligence. The goal of the modules is to foster a community of girls. Monthly online activities are also available after the workshops.

Another example of successful initiatives is a contest entitled "Best gender-sensitive STEM lessons: How to teach". It was held two years in the row to encourage teachers to design new, immersive approaches to ensure girls' engagement. Teachers in the fields of mathematics, physics, chemistry, computer science, technology, astronomy and geography, among others, submitted lessons plans that were judged on their creativity, innovativeness, use of equipment and gender sensitivity.

Private sector also tries to support women working in IT field. One of them is Ukraine's largest IT companies "Intelius" which provides comprehensive benefits for families. These include baby essentials for employees with new-borns and classes and educational tours to teach older children about technology. Children are welcome in the office, where on-site day-care facilities are equipped with toys, books and games, and a childcare worker supervises small children. The company also made

[120] ITU-UN Women, Digitally Empowered Generation Equality: Women, Girls and ICT in the context of COVID 19 in selected Western Balkan and Eastern Europe Partnership countries, p.86, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en
[121] Council of Europe General Recommendation No. 1 on the digital dimension of violence against women (2021), https://rm.coe.int/grevio-rec-no-on-digital-violence-against-women/1680a49147
122 To learn more about Istanbul Convention, https://www.coe.int/en/web/istanbul-convention/historical-background

efforts to ensure that the office space was child-friendly, such as by refitting windows for safety. Lastly, study spaces are available for older children to do their homework on site.[123]

Last but not the least, in Ukrainian annually the number of events takes place on the International Girls in ICT Day, which is a global initiative aiming at raising awareness among girls and young women about the importance of digital skills and encouraging them to study and build careers in ICT.[124]

The effect of the war

With the start of the war in February 2022 up to 20% of all workers in the IT industry left Ukraine during the war – that's approximately 57,000 people, of whom the majority – 64% were women. [125] The number of projects were introduced to support women both those who stayed in the country and left it, namely:

- The public organization STEM is FEM in partnership with the Swiss educational organization Empowerment Lab and with the support of Oracle launched free online IT courses for girls aged 12-16.[126]
- Ministry of Digital Transformation together with the Projector Institute, with the support of Diia.Business, have launched the fund that will help 5,000 Ukrainian women who temporarily left their hometowns, to master creative & tech professions and receive a scholarship for their studies. The fund will cover 2 parts – 10 short intensive programs on different IT topics and career support with access to the job database, communication with potential tech companies, advice on resume writing, interviewing, etc. [127]
- Public organization INSCIENCE launched the "Be" platform for women who want to master the professions of testers, developers or designers. Mentors, specialists from the best Ukrainian and global companies will support women in their job search. [128]

As for the legislation advancement, on 18 July 2022, the Permanent Representative of Ukraine to the Council of Europe deposited the instrument of ratification of Istanbul Convention. The Convention will enter into force on 1 November 2022 in Ukraine.[129] The country has become the 36th State to ratify the Council of Europe's Convention which is the most far-reaching legally binding human rights treaty covering all forms of violence against women and domestic violence and is particularly relevant to address online and technology-facilitated violence against women.

ICT and Digital Accessibility for Persons with Disabilities

[123] ITU-UN Women, Digitally Empowered Generation Equality: Women, Girls and ICT in the context of COVID 19 in selected Western Balkan and Eastern Europe Partnership countries, pp. 22,26,43, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en
[124] https://www.itu.int/women-and-girls/girls-in-ict/
[125] https://itcluster.lviv.ua/projects/it-research/
[126] https://rubryka.com/2022/08/15/bezkoshtovni-it-kursy-dlya-divchat/
[127] https://t.me/mintsyfra/2880
[128] https://obvious-face-97d.notion.site/6f8d441e6465406eae466c41d800a32e
[129] https://www.president.gov.ua/news/prezident-pidpisav-zakon-pro-ratifikaciyu-stambulskoyi-konve-75969

Ukraine ratified the Convention on the Rights of Persons with Disabilities (UN CRPD)[130] and the Optional Protocol to the UNCRPD in February 2010. The UNCRPD stipulates (Article 9 - Accessibility) that countries should ensure equal access of persons with disabilities to the physical environment, transportation, information, and communications, including information and communications technologies and systems. Yet, Ukraine has not signed the World Intellectual Property Organization Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired, or Otherwise Print Disabled.[131]
Besides, according to the Art. 21, para 1 (e) of UNCRPD, countries should recognize (and promote the use of) sign languages. Only a few European countries have recognized sign languages in their constitutions as mother-tongue languages of deaf citizens. However, Ukraine is one of the countries that passed laws or regulations to facilitate the use of sign languages.[132]

In such a way, in April 2019, the Ukrainian parliament voted a new law, "On provision of the functioning of the Ukrainian language as the State language" which entered into force in June 2019. The Article 3 of the law is dedicated to support Ukrainian language. It is envisioned, inter alia, through development of Ukrainian sign language as the main or one of the main means of communication of sign language speakers. The status, principles and rights of sign language speakers are determined by the Article 4 of the same law.[133]

Access to emergency services for persons with disabilities is critical particularly during the COVID-19 pandemic. However, together with the challenges it brought, it also became a catalyst in enhancing their rights. In response to the pandemic, the Ukrainian Government put in place a 24/7 remote-interpreting service, affirming its leadership in providing accessible emergency communications to the deaf or hard of hearing persons. The government has also launched the mobile application '101', which complements traditional services and enables communication between the State Emergency Service of Ukraine and the community, providing citizens, including persons with disabilities, with the necessary information and assistance.[134]

ITU continuously supports the country to advance on digital accessibility. Accessibility is not only embedded in the Union's strategic goals and targets but also, in 2018, ITU Member States affirmed that enabling environments ensuring accessible ICTs for persons with disabilities should be established in all countries by 2023.[135] In this sense, ITU Office for Europe actively collaborates with partner organizations to foster enabling environments, ensuring accessible ICTs for persons with disabilities and inclusive digital society in the region. The efforts to promote ICTs accessibility consist of the following tracks:

- Annual ITU-EC Forum on Accessible Europe: ICT for All;[136]

[130] https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html
131 https://wipolex.wipo.int/en/treaties/ShowResults?start_year=ANY&end_year=ANY&search_what=C&code=ALL&treaty_id=843
[132] ITU, ICT accessibility assessment for the Europe region, p.52, retrieved from http://handle.itu.int/11.1002/pub/8182b00a-en
[133] https://zakon.rada.gov.ua/laws/show/2704-19#Text
[134] ITU, ICT accessibility assessment for the Europe region, p.42, retrieved from http://handle.itu.int/11.1002/pub/8182b00a-en
[135] ITU Strategic Goal 2 – Inclusiveness, Target 2.9.
[136] https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Pages/Events/2020/AE21/default.aspx

- Regional Competition: Innovative Digital Solutions for Accessible Europe;[137]
- ICT Accessibility Assessment for Europe Region;[138]
- Technical Assessment in Enhancing ICTs Accessibility at a country level – Example of Serbia;[139]
- Capacity building in ICT Accessibility.[140]

The civil society and private sector are also active in providing accessibility to IT professions for people with disabilities. In December 2019 the project that enables people with physical disabilities (having severe forms of diseases or injuries of 1, 2 and 3 groups of disabilities) to receive free education and basic knowledge in the specialization "software testing" (Software Testing) and help with internships in IT companies of Ukraine or freelance was launched.[141]

The effect of the war

The war in Ukraine has drastically increased the number of persons with disabilities, which affects their quality of life and future employment opportunities. While the number of patients needing prosthetics increased, the domestic supply of components to make prosthetics has reduced. Most of the prosthetics in Ukraine are manufactured by foreign producers. Because of this, prosthetics and rehabilitation require a significant amount of time and financial investment. Moreover, the warranty for prosthetics does not cover maintenance in Ukraine. To address this issue, the UNIDO offers the initiative 'Emergency assistance for 3D-printed prosthetics in Ukraine' since the 3D-printed prosthetics are known to have higher customization, lighter weight, shorter delivery period and less cost. With the use of artificial intelligence, 3D CAD softwaresa large number of prosthetics can be manufactured automatically. It can be fitted remotely, which enables the delivery of prosthetics to users in remote places. The proposed project aims to transfer the technology for producing 3D-printed prosthetics in Ukraine from Japan and promote job creation for amputees who have been fitted and rehabilitated with 3D-printed prosthetics.

ICTs for Refugees and Asylum-Seekers

As for July 2022 in the result of the war the UN stated nearly 9 million people have left Ukraine.[142] For Ukrainians who fled the country for European countries one of the advancements is the creation of a new platform – Treatment4Ukraine.[143] It is designed specifically for Ukrainian refugees who have HIV, viral hepatitis, tuberculosis or are on replacement maintenance therapy. The site was developed by a team of international health experts with the support of the Ministry of Health of Ukraine and the Centre for Public Health. [144]

A regional U-Report chatbot was launched by UNICEF to engage young refugees and their families with information about their rights and services in host countries (Romania, Moldova and Italy). To date, 3 national U-Report platforms have activated the chatbot and other countries are planning to launch it

[137] https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Pages/Events/2020/AE21/Regional-Competition.aspx
[138] https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2020/AE20/event/D-PHCB-ICT_ACCESS_EUR.01-2021-PDF-E.pdf
[139] https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Pages/Events/2021/SNS/Default.aspx
[140] https://www.itu.int/en/ITU-D/Digital-Inclusion/Persons-with-Disabilities/Pages/ResourcesOnICTAccessibility.aspx
[141] https://www.beqatoday.com
[142] https://www.reuters.com/world/europe/over-9-million-border-crossings-registered-ukraine-un-agency-2022-07-13/
[143] https://www.treatment4ukraine.com/en/home/
[144] https://visitukraine.today/uk/blog/553/zapracyuvala-nova-platforma-dlya-bizenciv-yaki-potrebuyut-osoblivoi-medicnoi-dopomogi-zakordonom

soon. The most activated sections of the chatbot are: (i) traveling outside of Ukraine (with EU and Moldova subsections equally divided); (ii) how to stay safe and alert while on the move; and (iii) country-specific information (with Italy and Poland being the most accessed countries). [145]

A digital tool "HOPE" that enables the collection and processing of data required for cash programs to provide a response to humanitarian crises was also launched by UNICEF. It can (i) collect beneficiary data, (ii) associate data with cash programmes, (iii) create target population (iv) manage payment lists (v) send them to Financial Service Providers (FSP), (vi) reconcile payments, (vii) triangulate payment verification information directly from beneficiaries, (viii) handle grievances and feedback, as well as reporting.

Internally displaced people (IDP)

In 2020 Ministry of Digital Transformation has launched the test version of provision of the online document for the registration of the internally people in Ukraine. Thus 1,5 million IDP as of 2020 could show the document in the Diia application.[146]

After the military attacks since 24 February 2022 according to International Migration Organisation as of the end of June 20202 the number of internally displaced persons in Ukraine was 6,2 million. But 5.5 million Ukrainians already came back to their homes. [147]

On 20 April 2022 the Ministry of Digital Transformation of Ukraine launched the new public digital online service on the Diia mobile applications which allows citizens to register as internally displaced person. Thousands of Ukrainians who were forced to leave their homes and move to other cities due to the war are now able to easily register as IDPs showing that despite the war in Ukraine, the digitalization for civilians is not on hold but on the contrary, it progresses. The registration made it possible for internally-displaced persons to get a monthly allowance of UAH 2,000 per person and UAH 3,000 per child and person with disabilities demonstrating a real human-centred impact of digital technology in Ukraine.[148]

One of the essential problems for internally displaced people is the identification if they lost their documents. Thus, From July 15, internally displaced persons can register and receive assistance from the state even without a passport. They can do it on the basis of a certificate from the State Migration Service (SMS) or through the Diia application. [149]

Building trust and confidence in the use of ICTs for children and the Youth

Ukraine ratified the Council of Europe Convention on Protection of Children against Sexual Exploitation and Sexual Abuse ("the Lanzarote Convention") in December 2012 and is a member of the WePROTECT Global Alliance.

[145] To learn more about the initiative, visit following website: https://www.unicef.org/ukraine/en/stories/online-youth-volunteering
[146] https://diia.gov.ua/news/vprovadzhuyemo-cifrovu-dovidku-dlya-pereselenciv
[147] http://www.mlsp.gov.ua/labour/control/uk/publish/article?art_id=191761&cat_id=107177
[148] Data provided by the Ministry of Digital Transformation of Ukraine on the 15th of September
[149] https://decentralization.gov.ua/news/15229

Yet, Ukraine is among the top 3 suppliers of child pornography in the world. According to the Prosecutor General Irina Venediktova, every week, 5,000 devices upload this kind of porn. In most of the cases, sexual violence is carried out by people from children's inner circle, and by relatives in 30% of all cases.[150]

The current state of online safety in Ukraine is changing but there seems to be room for further improvement. The progress and work already carried out at national level include the following legal acts:

- Law "On Amendments to Certain Legislative Acts of Ukraine Concerning the Implementation of the Council of Europe Convention for the Protection of Children against Sexual Exploitation and Sexual Abuse" of February 18, 2021; [151]
- National Strategy for Reforming the System of Justice for Children for the period up to 2023, approved in December 2018; [152]
- State Social Program "National Action Plan for the Implementation of the UN Convention on the Rights of the Child" for the period up to 2021, approved in May 2018; [153]
- Law of Ukraine "On Childhood Protection" of April 26, 2001.[154]

The legal framework ensured that there are existing measures in place to prevent offenders convicted of child abuse crimes from taking a position as a social worker, adopted parents, police officers, or a role in public office.[155] Besides, the punishment for production, dissemination and sale of child porn was tightened and carry between 8 and 12 years in prison.

Despite considerable progress, there seems to be no coordinated body or organization to guide and direct activities on online child protection in Ukraine. There is a diverse group of organizations, NGOs, as well as industry and ministries involved in child online protection in Ukraine, but there appears to be little collaboration amongst the stakeholders. Moreover, the general level of awareness of online risks and threats is low, particularly amongst parents.[156]

To raise the awareness, a Safer Internet Day is organized in the country on the yearly basis with the support of the Institute of Modernisation of Educational Content of the Ministry of Education and Science of Ukraine. It informs children, young people, teachers, youth workers, parents and caregivers about online safety.[157]

Moreover, in September 2020, the Child Online Safety Consultation Line 1545 was launched in Ukraine. The line offers 24/7 support to children and parents who have encountered problems an opportunity to consult with experts and get the information on safe behaviour in the digital environment.[158]

[150] https://tass.com/society/1296935
[151] https://zakon.rada.gov.ua/laws/show/1256-20#Text
[152] https://zakon.rada.gov.ua/laws/show/1027-2018-p#Text
[153] https://zakon.rada.gov.ua/laws/show/1027-2018-p#Text
[154] https://zakon.rada.gov.ua/laws/show/2402-14#Text
[155] ITU Status of national child online protection ecosystems in South Eastern Europe, p. 26, retrieved from http://handle.itu.int/11.1002/pub/815a8b6c-en
[156] ITU Status of national child online protection ecosystems in South Eastern Europe, p. 28, retrieved from http://handle.itu.int/11.1002/pub/815a8b6c-en
[157] https://www.saferinternetday.org/en-GB/in-your-country/ukraine
[158] https://www.kmu.gov.ua/uryadova-garyacha-liniya-1545

International cooperation supports country's efforts in ensuring effective online protection. In this sense, the Council of Europe implemented the Project Combating violence against children in Ukraine lasting until 31 December 2021. This project is a direct follow-up to the to the previous Council of Europe project on Combating violence against women and children implemented in 2017-2018.[159]

Meanwhile, through its COP Guidelines, ITU is supporting Ukraine among other countries in Europe and beyond to adopt a strategic and holistic approach to child online protection that brings all components together at the country level, as well as to provide expert guidance on the various dimensions of COP, including for children, parents and educators, industry and policymakers.[160]
The ITU National child online safety assessment for Ukraine, conducted in line with the COP Guidelines, provided the following recommendations:

- Implement the recommendations made by the Council of Europe project (End Online Child Sexual Exploitation and Abuse@Europe – EndOCSEA@Europe) in accordance with the Lanzarote and Budapest Convention, especially the recommendations to review International Instruments and Criminalisation of OCSEA;
- Review and update the Law of Ukraine on Education to include cyberbullying to recognize that bullying can occur online as well as physically;
- Establish a national stakeholder council;
- Provide parents with simple parental control tools;
- Manage the access to Internet in schools and the public open Wi-Fi;
- Implement a reporting mechanism for child sexual abuse material;
- Establish a Ukraine safer Internet centre modelled on the European Network of Safer Internet Centres;
- Raise awareness and reach a greater understanding across the population of the laws related to child online protection;
- Increase the number of international partners;
- Ensure educators' professional development to enable them to spot child online protection issues through the signs of abuse as well as provide children with the defined digital competencies;
- Undertake comprehensive academic research on child online protection in Ukraine.
- Review Article 156 of the Criminal Code to include the offence of grooming.

The ITU COP Guidelines for parents and educators, industry, policymakers and children and the Youth were translated into Ukrainian language and officially launched in January 2021 during the Conference "Online Safety: Contemporary Challenges". [161] Prior to this Ministry of Digital Transformation in cooperation with the NGO MINZMIN, and with the support of ITU, conducted the online training series on child safety online that have been viewed more than 2365 times on Youtube by parents and teachers. [162]

[159] https://www.coe.int/en/web/kyiv/combating-violence-against-children-in-ukraine
[160] ITU COP Guidelines, retrieved from https://www.itu-cop-guidelines.com/
[161] https://thedigital.gov.ua/storage/uploads/files/news_post/2021/1/za-initsiativi-mintsifri-pidgotuvali-rekomendatsii-shchodo-zakhistu-ditey-u-tsifrovomu-seredovishchi/COP-Guidelines-for-Parents-Educators-UAfin.pdf
[162] https://minzmin.org.ua/onlinesafetyschool/

In 2021 the Ministry of Digital Transformation has developed a National Online Child Protection Strategy up to 2025 based on the rule of law, gender equality, partnership, support and international support.[163] The strategy is aimed to implement the standards of leading international organizations, the OSCE, the Global Partnership to Stop Violence Against Children, the WePROTECT Global Alliance and the United Nations International Telecommunication Union. [164]

The effect of the war

Children in Ukraine have been extremely vulnerable to the content in social media about war as it reminds them about the events which they could see in real life. Moreover, hate-speech, cyberbullying is the every-day reality in today's online environment. These problems are addressed by the projects of Ukrainian NGOs while at the level of the Ministry of Digital Transformation the online-safety platform will also focused on the child online safety.

2.3. Building Block 3: Value Creation

One of the most important triggers of the digital transformation at the national level is the government's approach to ICTs for governance, administrative purposes and the delivery of public services online. This section will look at i) the approach to e-government in Ukraine ii) the administration of digital services; iii) the management of digital content and data; iv) the policies which have spurred innovation and entrepreneurship; and v) the efforts which have been pursued to create an environment that spurs innovation.

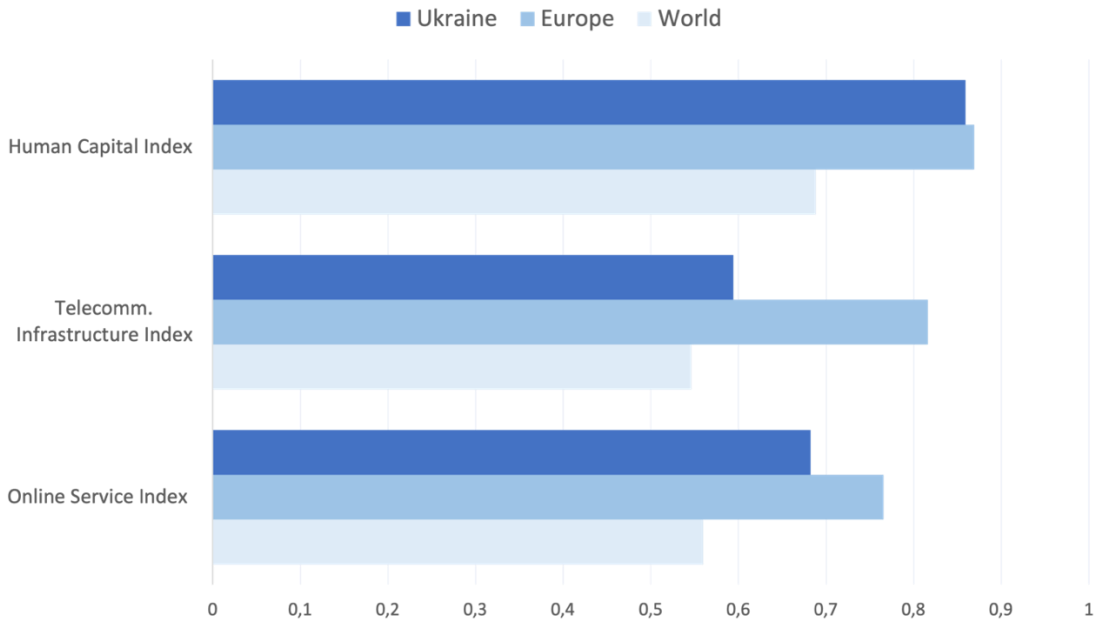
2.3.1. Whole-of-Government

According to the 2020 UN E-Government Survey results, Ukraine is among the 13 countries (Armenia, Azerbaijan, Bahamas, Costa Rica, Georgia, Hungary, Islamic Republic of Iran, Kyrgyzstan, Mauritius, Philippines, Seychelles, Sri Lanka and Ukraine) with very highly developed human capital, but the state of their infrastructure may be impeding further progress.
Even though the Telecommunications Infrastructure Index is diminishing the overall country score, E-Government Development Index (EGDI) ranked Ukraine 69th out of 193 countries with a score of 0.7. This result is far above the world average score of 0.6, but still needs improvement to reach the European average of 0.8. The comparative assessment of Ukraine scores with the European and world averages on online service component, telecommunication infrastructure component and human capital component is reflected in the Figure 8.

Figure 8 – Comparative assessment of Ukraine on EGDI components with European and the world average scores in 2020

163 https://thedigital.gov.ua/storage/uploads/files/normative_document/2020/7/НАЦІОНАЛЬНА_СТРАТЕГІЯ_З_ЗАХИСТУ_ДІТЕЙ_В_ЦИФРОВОМУ_СЕРЕДОВИЩІ_НА.pdf

164 https://www.ukrinform.ua/rubric-society/3174118-mincifri-rozrobilo-nacionalnu-strategiu-onlajnzahistu-ditej.html



Source: E-Government Development Index (EGDI)

Compared to 2018 results, the country has improved it's positioning in the ranking by 13 positions, increasing its score by 0.09 points by 2020. In 2018 the country already scored highly on Human Capital Index. Thus, the increase of this indicator was less significant than the growth registered on the other two components. Similar dynamics is registered with regard to 2020 E-Participation Index which ranks the country 46th out of 193 countries with a score of 0.8. The country improved its performance by 0.1 points and its position in the ranking by 29 places compared to 2018. [165][166]

Ukraine has well-developed human capital Index as of 2020 EDGI, thus Ukraine tries to increase the citizen's participation in the governmental process. The increase of Ukraine public sector efficiency is due to substantial work of implementing since 2018 of a broad range of reforms. In this sense, the Digital Agenda for Ukraine adopted in January 2018 was the main strategic document providing direction for Ukraine's digital transformation. Its Digital Governance pillar addressed the ways to modernise Ukraine's public administration including through development of public sector architecture, data collection, application, technology, information security architectures, common business processes, introducing unified document templates and standard solutions including the UN/CEFACT semantic standards for data and document exchange.

The country's digital backbone for e-governance and e-services, which currently connects more than 80 authorities, was rolled out in 2018 with first data exchanges occurring in 2019. Called "Trembita", the platform ensured since then 180 different electronic interactions and services with more than a million data exchanges monthly.[167]

[165] UN E-GOVERNMENT SURVEY 2020, retrieved from https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2020

[166] UN E-GOVERNMENT SURVEY 2018, retrieved from https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2018

[167] https://e-estonia.com/deployment-of-trembita-system-in-ukraine-a-milestone-for-estonian-digitisation-efforts/?fbclid=IwAR2gWeu0zxaLDGnAe_nWBb_slwJgKAYVK2CXtRDu2mwylIMEw7ctf8pcTgI

Historically, the Ukrainian State Agency for eGovernance which was established in 2014 was responsible for the digital government policy formulation and implementation, ensuring the interoperability of state registries, as well as monitoring and evaluation of IT systems in state authorities. In 2019, this mandate, together with the role of the key driver of digital transformation in Ukraine has been undertaken by the Ministry of Digital Transformation. Its activity targets a large number of areas including digital economy, innovation and technology, e-government and e-democracy, information society development, open data, telecom infrastructure, electronic trust services and electronic identification, IT industry development, etc. Also the Estonian project E-governance academy has been operative in Ukraine since 2014 due to which number of Ukrainian official had the visits to Tallin to increase the competence on the e-governance systems. [168]

For successful implementation of the Digital Agenda of Ukraine, the Concept of digital economy and society development and action plan for its implementation for 2018 – 2020 was adopted in January 2018. In 2019, the Action Plan for the implementation of eServices development concept for 2019 – 2020 was adopted. It aimed to improve the quality of administrative services delivery for citizens and businesses.
Additionally, the Government adopted the Action Plan for the Implementation of the eGovernment Development Concept for 2018-2020. The Action Plan is focused on modernisation of eServices and of the public administration, as well as on management of the eGovernment development process.

In line with the country's strategic vision, a comprehensive legal framework enabling e-government transformation was completed by several more strategic and normative acts as follows:

- Action Plan on Open Government Partnership Initiative Implementation for Years 2018-2020;
- Action Plan on the Implementation of the International Open Data Charter Principles;
- Decree no. 56 Some Questions of Digital Development, which defined the digital by default principle;
- Law of Ukraine on Access to Public Information;
- Law on Electronic Trust Services;
- Procedure of Compliance Assessment in the Sphere of Trust Electronic Services;
- Procedure of Use of Trust Electronic Services by State and Local Authorities, and by State-Owned Enterprises;
- Order on Requirements to the Electronic Identification Tools and their Use in eGovernance;
- Law on Public Electronic Registries;
- Decree no. 357 Some Questions on Interoperability of State Information Resources;
- Decree no. 55 Some Questions of Administrative Activity Recording;
- Decree no. 60 On Requirements to Data Formats of Electronic Documents Flow in State Entities.

In July 2021 Verkhovna Rada at the meeting on 17 June approved the first reading the draft law No. 5495 about the paperless regime, that ceases the transfer of the paper documents in Ukraine. Thus Government agencies in Ukraine cannot display paper documents, proofs and confirmations, such as

[168] https://ega.ee/success_story/egovernment-ukraine/

information in state registers. [169] That is the significant advancement in the digitalisation of the whole-government communication that for years was advocated in Ukraine.

Another notable law approved on 17 February 2022 is the law №2655 on cloud services. The law allows the state institutions to keep data and public register and back-ups on cloud services located outside of Ukraine, rather than process on their own. According to the Ministry of Digital Transformation, this will increase the presence of the Big tech companies in the Ukrainian market and contribute to the creation of data centres. Moreover, this step increases the security of the data and public registers in times of the war.[170] As for the open data as a part of e-governance, Ukraine have been defined in 2021 according to Open Data Maturity rating as a trend-setter being ranked sixth among all European countries in terms of data openness.[171]

Ukraine significantly advanced in the introduction of more than 10 digital systems and registries, including but limiting to: [172]

- State electronic system of construction. The register of construction activities is a comprehensive database that combines information about construction objects, participants in the construction process, information about permit documents, urban planning and design documentation, project expertise, information about technical inventory and a lot of other information that was previously stored in separate registers and databases.[173]
- State information system of the Ministry of Internal Affairs (MIA). The new sectoral program of informatization of the MIA system is focused on the development of public services of a single information system of the MIA, the implementation and modernization of national electronic information resources as components of the EIS of the MIA, and the creation of an innovative infrastructure of bodies of the MIA system. [174]
- Automated educational management complex. The main goal of the complex is to ensure the transition to electronic document flow (reporting, communication, notifications, surveys, voting, operational data collection) and optimization of business process data in the field of preschool, general secondary, extracurricular and vocational education and education administrations at the local and regional levels. It will significantly increase the reliability of educational statistical and administrative information and, on this basis, will improve the quality of management decisions, in particular regarding the distribution of educational subvention funds and other budget funds for financing education.[175]
- Unified register of veterans. Its objective is maintained up-to-date information and automatically analyse programs for social protection of war veterans. In turn, the central bodies of executive power will be able to exchange information more effectively.[176]

Ukraine's government is currently actively engaged in aligning its future efforts with the GovStack Initiative to support the development of an equitable and open-access digital ecosystem. This multi-

[169] https://thedigital.gov.ua/news/verkhovna-rada-ukhvalila-v-pershomu-chitanni-zakon-pro-rezhim-bez-paperiv-yak-vin-bude-vprovadzheniy-v-ukraini
[170] https://www.facebook.com/mintsyfra/posts/332997625536227
[171] https://data.europa.eu/sites/default/files/country-factsheet_ukraine_2021.pdf
[172] Data provided by the Ministry of Digital Transformation of Ukraine on the 15th of September
[173] https://e-construction.gov.ua/faq
[174] https://mvs.gov.ua/uk/ministry/projekti-mvs/informatizaciya-sistemi-mvs-ukrayini
[175] https://mon.gov.ua/ua/osvita/cifrova-osvita/avtomatizovanij-informacijnij-kompleks-osvitnogo-menedzhmentu
[176] https://mvs.gov.ua/uk/press-center/news/jedinii-rejestr-veteraniv-viini-informuvatime-veteraniv-pro-peredbaceni-yim-zakonodavstvom-prava-pilgi-i-garantiyi

stakeholder initiative led by ITU, the Government of Estonia, the Government of Germany, and the Digital Impact Alliance (DIAL), aims to support countries in leveraging the building block approach in service delivery and thus efficiently deploy reusable digital services at scale.
This partnership will not only elevate the country's digital agenda and praise Ukraine's digital transformation successes, but also ensure that the world can fully leverage the capabilities of the Ukrainian digital public goods.

The effect of the war

The war that disrupted many governmental processes has proved the need to have the access to the digital services and e-governance in general.

- On the 24th of February, the Ministry of Justice and state enterprise "National information systems" has made the decision to suspend the operation of number of state registers and data bases administrated by the state in view of the risks of access by the criminals and enemy.[177] But they were still partly accessible.[178] As of September, they have been restored. [179]
- In March 2022, the Cabinet of Ministers has issued the decree no 209 that allowed the Ministry to change the territories where the registers shall not be accessible. Thus, in May 2022, the Ministry made the decision No. 1992/5 of changing the territories within which the access to the registers is changed, especially cities in Donetsk region.[180]
- On the first of August, the governmental portal of open data have started to work again. And the Ministry of Digital Transformation have launched public discussion of changes to legislation in this area. It aims to establish new rules for access to open data during martial law in Ukraine. [181]

Also, as the Academy of e-Governance resumed its activities in Ukraine in such dimensions:

- Strengthening the cybersecurity of Ukraine,
- Security of state registries and databases of Ukraine,
- Material support from the state bodies of Ukraine thanks to additional funding provided by the European Union.[182]

2.3.2. Digital Services

Since 2019, Ukraine has made a significant breakthrough in digitalization of the public services. The world's first passports in a smartphone, introduction of a digital driver's license, the fastest, digital signature enabled business registration — all this became possible as a result of the program "The State in a Smartphone", implemented by the Ministry of Digital Transformation, together with other ministries and international organizations.[183]

[177] https://nais.gov.ua/article/timchasovo-prizupineno-robotu-edinih-ta-derjavnih-reestriv-ministerstva-yustitsii-ukraini
[178] https://ain.ua/2022/03/28/derzhavni-reyestry-v-umovah-voyennogo-stanu-yak-i-shho-praczyuye/
[179] The data provided by the Ministry of Digital Transformation of Ukraine on the 15th of September
[180] https://ips.ligazakon.net/document/view/Re37873?an=1
[181] https://thedigital.gov.ua/regulations/povidomlennya-pro-provedennya-publichnogo-gromadskogo-obgovorennya-proyektu-postanovi-kabinetu-ministriv-ukrayini-pro-vnesennya-zmin-do-postanov-kabinetu-ministriv-ukrayini-vid-21-zhovtnya-2015-r-835-ta-vid-30-listopada-2016-r-867
[182] https://ega.ee/news/ega-team-ukraine-continues-work-ukraine/
[183] https://thedigital.gov.ua/news/ukraintsi-naybilshe-doviryayut-programi-derzhava-u-smartfoni-ta-tsifrovizatsii-opituvannya-reyting

Digital services are fundamental enablers of digital transformation. E-learning, for instance, can expand the horizons of students and expand the pool of qualified human resources'. Other areas, such as e-agriculture can have a strong impact on the economic development of the country and e-health, can significantly improve citizens wellbeing and quality of life. Looking at the case of Ukraine, it is worth mentioning the "State in a Smartphone" led by the Ministry of Digital Transformation. This nationwide initiative was launched in 2019 with the intention to digitize all state services until 2024.

The goals to be achieved are:

- 100% of public services available to citizens and businesses online.
- 95% of transport infrastructure, settlements and their social facilities with access to highspeed Internet.
- 6 million Ukrainians involved in the digital skills development programme.
- at least 10% of country's GDP generated by IT-industry.[184]

Moreover, in 2018 and 2019 information system "Vulyk" started to be introduced in the Centres of the Administrative services. The system was created by the Academy of e-Governance (Estonia) in cooperation with the State Agency for E-Government of Ukraine within the framework of the EGOV4UKRAINE project of the U-LEAD support program with Europe. As of 2021 there were 800 Centres of the Administrtive services in Ukraine and in June 2021 more than 250 centres across Ukraine were connected to "Vulyk". The advantage of "Vulyka" is its integration with the "Trembita" data exchange system, which provides electronic interaction between authorities.[185]

The simple, clear and fast interaction between individuals and government is ensured through Diia online platform. It is a web portal, a mobile application, and the brand of e-governance in Ukraine. The Ministry initially launched the Diia Portal on February 6, 2020, and introduced the version 2.0 on October 5, 2020, during the Diia Summit, where the government presented the first major update to the application and web portal under the "Diia 2.0" brand. Since its launch, the number of active users grew exponentially, reaching 14 million of active users in February 2022.[186]

In 2021, 60% of Ukrainians less than once served as sovereign electronic services. Among the most popular services is the addition of the Diia portal. Among the popular public services are those related to cars (15%), obtaining passports and other services of the State Migration Service (14%), receiving subsidies (13%), pension provision (11.5%), private entrepreneurship (11%), taxation (10.5%) and obtaining information from state registers (10%).[187] In February at the Diia Summit three more important electronic services were presented - change of place of registration; certificate of criminal

[184] https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Publications/2021/Digital%20Skills%20Development%20–%20Ukraine%20–%20Good%20practice%20case%20study.pdf, p.10

[185] https://vulyk.gov.ua/infopages/about

[186] https://www.facebook.com/diia.gov.ua/posts/737876980949988

[187] https://www.ukrinform.ua/rubric-society/3390800-za-rik-60-ukrainciv-skoristalisa-elektronnimi-poslugami.html

record and opinion polls.[188] The number of users as of February grew to 14 million. Electronic services contributed to the decrease of corruption and saved Ukrainians 14.7 billion hryvnias in 2020-2021.[189] In the cooperation with the EU4Digital project Ukraine also have been working on the introduction of the digital signature for business that would significantly speed up business processes. [190]

The effect of the war

Since the beginning of the war, the respective services were introduced, especially the ones for internally displaced people mentioned in the chapter "Inclusion".

As of September 15th, 18 million Ukrainians use the Diia application with digital documents and government services directly on their smartphones, and 20.5 million use the portal, which is 50% of the entire population of the country. There are 14 digital documents and 20 services available in the app. There are more than 70 state services on the Diia portal. During the war in Ukraine, we launched more than 15 new services:

- Report on damaged/destroyed property. The state is doing everything to rebuild every home. Information about the damaged property can be submitted in the Diia application.
- eAid project – the opportunity to apply for payment of UAH 6,500 to Ukrainians living in the areas where the most active hostilities are taking place, was implemented in Diia. Businesses and employers who employed IDPs during the war can receive compensation of UAH 6,500 from the state for each such employee.
- Car sharing. After all, this service is especially relevant now, when many Ukrainians have taken the cars of relatives or acquaintances to go to safer places. And they need documents to use the car. The application is submitted in a few clicks and processed in up to 10 minutes.
- Services for entrepreneurs. On the Diia portal, entrepreneurs can use a new service — eDeclaration. This is a document that replaces 374 types of permits required for the work of entrepreneurs during martial law. Also an opportunity to submit a 2% single tax payer declaration and pay a 2% single tax in the application and on the Diia portal was added.
- Active involvement of the population in helping the military through eVorog (eEnemy) –a chatbot that allows users to report the location of enemy troops & hardware. Ministry of Digital Transformation also added to Diia the opportunity for all Ukrainians to donate funds to help the army to a verified charity fund, and since May 2022 to the global fundraising platform UNITED24.

On August 31, new services and documents were launched in Diia: digital pension card, digital residence permit, documents in English and car sharing feature:

- E-permit for permanent and temporary residence. Diia has become more accessible to foreigners with biometric documents who have the right to live in Ukraine. That is, citizens of another state can verify their identity in Ukraine with a digital document in Diia in various cases of life. The e-passport displays the information from your permanent residence permit from the

[188] https://thedigital.gov.ua/news/ukraintsi-naybilshe-doviryayut-programi-derzhava-u-smartfoni-ta-tsifrovizatsii-opituvannya-reyting
[189] https://www.ukrinform.ua/rubric-economy/3399904-smigal-za-dva-roki-ekonomia-vid-onlajnposlug-stanovit-147-milarda.html
[190] https://eufordigital.eu/esignature-and-ukraine-leading-the-way-towards-faster-and-easier-international-business-exchanges/

demographic register. It is available in Diia, if you have the tax number (RNOKPP). Also, people with residence permits will be able to create Diia.Signature and use Diia services.

- Digital pension card is displayed in two ways: by age (for women over 55, for men over 60) – it is displayed automatically; and a special one (for example, due to disability, loss of a breadwinner, etc.) – you can add it yourself. The age pension certificate is automatically loaded, just like your digital passport. Like other documents in the app, it can be verified or shared using a QR code.
- English versions of documents have become available in Diia. Since the beginning of the war, over 9 million Ukrainians have crossed the border of Ukraine. Many did not have time or were not able to take their passport or driver's license with them. That is why documents in English are important for Ukrainians who are currently abroad and using Diia.
- At the end of July, Diia PL obtained the official status of a digital residence permit. And the digital driver's license and technical passport in Diia will be soon displayed in the Polish mObywatel application thanks to the cross-state sharing service.[191]

Lastly, Kyiv Digital, transport application that was previously used by the residents to pay utility bills and parking tickets, has become the essential tool for warnings and alarms in the city during the war. It provides with a map of the closest bomb shelters and places to get critical supplies like insulin, food or gasoline. It also sends warnings of incoming air raids. The app allows people to request Internet access for their bomb shelters.[192]
The PPL 33-35 port community system in Odessa also assists businesses with electronic filing and clearance of data and documents for international trade according to UNECE.

ICTs in Education

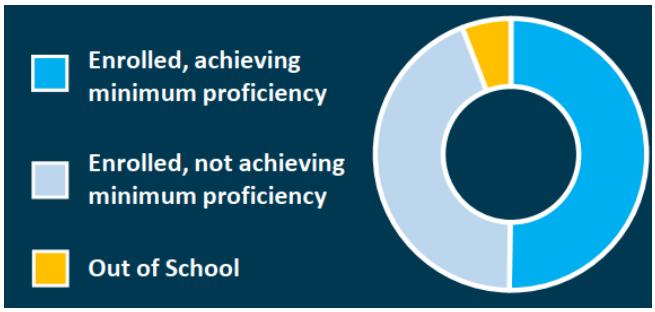
In the context of e-government, e-administration and e-delivery of government services are fundamental enablers of digital transformation. Looking at the education sector from a perspective of the governance of the education system and the delivery of education, and beyond the actual content delivered (i.e., curricula including digital skills), proves that ICTs are playing an even more essential role.

The new ITU-UNICEF report on "Connectivity in Education: Status and recent developments in 9 non-EU countries of Europe region" published in October 2021[193] looks at the two dimensions of ICTs for e-government of education and ICTs as a medium for delivering remote education.

Figure 9 – Enrolment in Ukraine

[191] Data are provided by the Ministry of Digital Transformation on the 15th of September
[192] https://time.com/6163708/kyiv-digital-technology-app/

[193] ITU, Connectivity in education: Status and recent developments in nine non-European Union countries, retrieved from http://handle.itu.int/11.1002/pub/81a5eef1-en



Prior to the war, Ukraine had 5.7 million school-aged children and 1.5 million students enrolled in higher education.[194] According to the Ministry of Education and Science of Ukraine, 3.6 million students followed distance education and completed the 2021/2022 school year.[195]

Significant reforms towards the school digitization, introduction of competency-based curriculum, and significant changes in key education indicators, together with other reforms, triggered improvements in education infrastructure and quality throughout the country.
In 2013, the National Strategy for the Development of Education in Ukraine for the period up to 2021 was launched. Its two overarching goals were (i) increasing the availability of high-quality and competitive education to every citizen, as well as (ii) ensuring citizens development in accordance with their individual abilities, needs and aspirations. Among the strategic directions of state policy in the field of education, this strategy enhanced the importance of

- Cultivating a safe educational environment.
- Accelerating the development of scientific and innovative activities in education and improving the quality of education on an innovative basis.
- Modernizing the informatization of education, with a focus on improving the provision of library and information resources in education and science.
- Creating a modern material and technical basis for the education system.

The 2017 Education Act and a concept paper entitled “The New Ukrainian School” acknowledged the importance of ICTs both in the education process and in the management of educational institutions. The plan also lists ICTs and digital skills as one of the 10 key competencies for the education system. The overarching goal points to the need to harmonize all levels of education both in the liberal arts and humanities and in science and technology, maintaining good traditions and securing a high level of education in science and ICT in every school. The actions aimed to reach this goal are broken down into three implementation phases: phase I (2016-2018), phase II (2019-2022), and phase III (2023-2029).

Additionally, in January 2018, the Government and State Agency for e-Governance of Ukraine published a new Digital Agenda for Ukraine 2020, which aimed to guide the country’s digital development. The digitalization of education is listed as one of the priority sectors alongside other initiatives aiming to bridge the digital divide through the development of digital infrastructure.

[194] UNESCO/UIS data base, 2022
[195] MESU/Education Cluster Rapid Needs Assessment, to be published, initial report can be found here https://www.humanitarianresponse.info/en/operations/ukraine/document/ukraine-education-needs-assessment-survey-initial-report-key-findings

Despite all the government measures, according to the research conducted by the Ministry of Digital Transformation, there are 16 317 schools in Ukraine, about 60 per cent of which have an Internet connection using fibre-optic technologies, while 40 per cent lack Internet infrastructure. Most of these institutions are located in villages and small towns. However, the challenges that emerged during the COVID-19 pandemic, changed the way authorities approached the education process.

In April 2020, the government launched the Ukrainian Online School Initiative for pupils for grades 5-11. The project's main goal is to provide hybrid TV-and-Internet educational content to all students facing the challenges imposed by COVID-19.[196] The online platform "All-Ukrainian School Online '' was launched in December 2020 by the Ministry of Education and Science of Ukraine in close collaboration with the Ministry of Digital Transformation and public association "Osvitoria". The platform helps manage high-quality distance learning and guarantees equal access to educational materials for students across the country and abroad. This online resource for students in grade 5-11 contains teaching and learning materials on 18 basic subjects, which are structured according to the principle of microlearning and are aligned to the state curriculum. Registration on the platform is free and allows users to subscribe to courses, review materials and track their progress. "All Ukrainian Online School" currently has 400,000 users from more than 120 countries. The platform will continue operating for the new school year free of charge. The private sector also provided online learning platforms free of charge, such as Optima, which helped more than 100,000 students finish the 2021/2022 school year.[197]

Additionally, according to a 2018 PISA study, the majority of students in report countries have Internet access at home. In fact, over 90% of (secondary) school students in North Macedonia, Serbia, Ukraine, BiH and Montenegro have access to the Internet.[198]

In July 2021 the Ministry of Digital Transformation and the Ministry of Education have launched the program to provide more than 60,000 teachers with laptops this year. The 2021 state budget provides additional funding — 1 billion hryvnias for the fight against COVID-19 and its consequences during the educational process in general secondary education institutions. In particular, UAH 980 million was allocated specifically for the purchase of laptops for teachers.[199]
Eventually, 62 674 laptops were provided to schools. Ministry of Digital Transformation has created the public dashboard how many laptops were bought and delivered to schools. [200]

The effect of the war

[196] https://www.kmu.gov.ua/en/news/6-kvitnya-na-youtube-kanali-mon-ta-shche-na-14-telekanalah-ta-mediaresursah-startuvala-vseukrayinska-shkola-onlajn

[197] UNESCO data (reference)
[198] OECD, 2020, Learning Remotely when schools close: How well are Students and Schools Prepared? Insights from PISA, available at https://www.oecd.org/coronavirus/policy-responses/learning-remotely-when-schools-close-how-well-are-students-and-schools-prepared-insights-from-pisa-3bfda1f7/
[199] https://mon.gov.ua/ua/news/980-mln-grn-subvenciyi-na-noutbuki-dlya-vchiteliv-mincifra-z-mon-prodovzhuyut-cifrovizuvati-osvitnyu-sferu
[200] https://thedigital.gov.ua/projects/notebook_coverage?fbclid=IwAR2Xqas4NYHedhzAIIb-nRIoZ7xKDRLGZPj__CMwZoNpwz1xX4X6LVmzmNw

As a result of the attack on Ukraine, 830 institutions of general secondary education were damaged, 111 were destroyed.[201] Students could continue remotely study in the schools that were damaged or destroyed. [202] Despite the martial law, more than 350,000 children who have completed the 9th grade are preparing to receive their certificates of completion of basic secondary education. Also, 229,000 eleventh graders will receive a certificate of completion of general secondary education.[203] The beginning of the war, distance education supported the continuation of teaching and learning for millions of students inside and outside of Ukraine, according to UNESCO.

In August the Ministry of Digital Transformation has stated that Ukrainian education institutions will for free receive the equipment from telecom companies to develop Wi-Fi in shelters, so that education process continue. Representatives of educational institutions will be able to apply for Wi-Fi in shelters through an online form. It will be possible to track in real time how many applications have been received and from where though the dashboard. Shelter in an educational institution is the main requirement for the possibility of face-to-face education in wartime conditions. As of August 2022, only 30% of schools had shelters. [204]

Key stakeholders also engaged in recovering the digital education within the country. The programme "Ukraine digital: Ensuring academic success in times of crisis" supports Ukrainian higher education institutions in maintaining, implementing, and offering their virtual courses. German higher education institutions offer a virtual platform for Ukrainian refugee students so they can continue and complete their current studies in Ukraine virtually.[205]

Digital Agriculture

According to 2018 data, 71.3% of the country territory represent agricultural land, but the share of arable land is about 56.8% of the country territory. However, the latest available data show that the employment in agriculture reached its lowest indicator since the country gained independence. In 2019, only 14 % of total employment was in the agriculture sector. It is dominated by men, as the percentage of male employment is 16% while female employment is only 11%. It is worth mentioning that the biggest decrease in employment of both men and women in this sector happened in 2014.[206]

Still, this sector remains one of the main sectors of the Ukrainian economy, contributing in 2020 to 9.3% of GDP.[207] According to ITU-FAO "Status of Digital Agriculture in 18 Countries of Europe and Central Asia" the Ukrainian agricultural sector is dominated by large farms and agroholdings, with about 70 agricultural companies engaged in relative monoculture on 25% of the arable land. Besides

[201] https://nus.org.ua/news/skilky-poshkodzheno-i-zrujnovano-shkil-v-ukrayini-dani-mon/
[202] https://nus.org.ua/questions/osoblyvosti-roboty-shkil-pid-chas-vijny-vidpovidi-na-zapytannya-vid-osvitngo-ombudsmena/
[203] https://www.dw.com/uk/shkola-pid-chas-viiny-chy-provalyvsia-navchalnyi-rik-v-ukraini/a-61978671
[204] https://thedigital.gov.ua/news/wi-fi-v-ukrittyakh-osvitnikh-zakladiv-yak-doluchitisya-do-proektu-mintsifri
[205] https://www.daad.de/en/information-services-for-higher-education-institutions/further-information-on-daad-programmes/ukraine-digital/
[206] World Bank Open Data, retrieved from https://data.worldbank.org/topic/agriculture-and-rural-development?locations=UA

[207] World Bank Open Data, retrieved from https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=UA

the large and medium entities, an estimated 900 000 or so unregistered smaller or family farms produce crops with higher added value for local markets and generate most job opportunities in rural areas. Because of the very favourable climate conditions and rich soils, Ukraine's agricultural sector has great potential for improvement and further development.

According to the survey conducted in the framework of the 'Digital technologies in the grain sector of Ukraine' study, different PATs had been used on approx. 8,4 million hectares of Ukraine's agricultural lands, or About 45 percent of the grain and oilseeds area planted by commercial farms/agricultural enterprises. The use of PATs varies by the size of farms. While only 13 percent of small commercial grain farms used any type of PATs, their use increased with the farm sizes.[208]

According to a study from 2015, the country has failed for years to design and support the establishment of sustainable agricultural extension schemes and there were almost no active extension services in Ukrainian rural areas. This further worsened the plight of small farms, which have not been provided with effective advice on how to develop and integrate with value chains, and lack the funds and knowledge needed to take advantage of such services.
In the same year, the Agricultural and Rural Development Strategy 2020 was approved as the guiding document for agricultural and rural policy in Ukraine. It focused on land reform, food security, agri-food value chain development, rural development and the revival of the Ukrainian village.

The Concept for development of the digital economy and society of Ukraine for 2018-2020 introduced the concept of "precision agriculture", which refers to the use of ICTs for collecting real-time data on weather, soil and air quality, crop maturity, animal behaviour and other indicators to optimize the use of inputs such as seeds and fertilizers, pesticides, water, etc. In the same year, the government proposed a resolution on agriculture digitalization. Due to changes in the government and state policy to stimulate precision agriculture technologies drifted the focus on expanding state support programmes.[209]

Moreover, in the digital economy section of the Digital Agenda for Ukraine, there is a digital agriculture subsection that stresses the fundamental role of digital technologies in the agricultural sector's development in the next 50 years. The agenda refers essentially to precision agriculture, citing the economic, environmental, health-related and social benefits thereof. The agenda calls for support for the production, technical, educational and scientific aspects of precision agriculture, the training of qualified specialists and the creation of a milieu that can facilitate the "digitalization" of the agricultural sector. It also considers that the "digitization" of agriculture should be viewed as part of a

[208] Prikhodko, D., Sikachyna, O., Pedersen, E., Sylvester, G. and Rybchynshyi, R. 2022. Digital technologies in the grain sector of Ukraine. FAO Investment Centre Country Highlights, No. 18. Rome, FAO

[209] Prikhodko, D., Sikachyna, O., Pedersen, E., Sylvester, G. and Rybchynshyi, R. 2022. Digital technologies in the grain sector of Ukraine. FAO Investment Centre Country Highlights, No. 18. Rome, FAO

broader programme of "digitization" of the countryside, bridging the digital divide and promoting the socio-economic revival of rural areas.[210]

Among the latest legal framework developments is the State Strategy for Regional Development for 2021-2027, which particularly focuses on agricultural co-operation, small and medium-sized agricultural producers, storage infrastructure, and the introduction of new technologies and equipment for the processing of agricultural raw materials.

The study on "Digital technologies in the grain sector of Ukraine" published by FAO and EBRD in the framework of the project called "Digital technologies in Agriculture" identified the following challenges related to precision agriculture technologies:

- Lack of knowledge and understanding of technology as a whole and its potential benefits
- Challenges in estimating returns on investment
- Technology integrators, outsourcing, and skilled staff shortage.[211]

The development of State Land Cadastre is crucial to the functioning of the agricultural land market. In this sense, the cabinet of Minister's Resolution of March 2020, requires that the approval of all types of land management documentation be transmitted and approved in electronic form through a personal account at StateGeoCadastre. The Law on the National Infrastructure of Geospatial Data, which entered into force in June 2020, aims to enhance access to geospatial data, the development of markets for modern geo-information products and services.

Moreover, the law adopted in November 2020 created a single state information system, the State Agrarian Register. It aims to integrate information on agricultural producers and their property as well as on related land, the environment, labour, finances and credits, among others. The law also expands to the range of potential recipients of state support to include enterprises engaged in aquaculture, organic production, irrigation, vegetables, fruits and berries.[212]

National and foreign private investors and accelerators were showing a growing interest in Ukrainian agritech start-ups, even though the annual investment in Ukrainian agritech start-ups did not exceed USD 4 million in 2018.[213]

- In 2014, a Ukrainian information technology (IT) company named KM Core invested USD 1.2 million in eFarmer, a precision farming company founded in 2014 with offices in the Netherlands and Ukraine.[214]

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[210] ITU and FAO. 2020. Status of Digital Agriculture in 18 countries of Europe and Central Asia, retrieved from https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Publications/Status of Agriculture in Europe and Central Asia %287%29.pdf

[211] FAO.2022. Digital technologies in the grain sector of Ukraine. FAO Investment Centre Country Highlights, No. 18, retrieved from https://www.fao.org/3/cc1600en/cc1600en.pdf

[212] https://www.oecd-ilibrary.org/sites/9972bb3a-en/index.html?itemId=%2Fcontent%2Fcomponent%2F9972bb3a-en&fbclid=IwAR3xdZ07fRIDLCsdXW-zgweHVE8V0TZQ5MdK_ObVBbRDuvCLBiJVazr1Tb8

[213] National Investment Council of Ukraine, 2018

[214] National Investment Council of Ukraine, 2018

- In 2016, Agrieye, a start-up that empowers farmers to farm more sustainably through multispectral cameras and autonomous drones for remote sensing and soil analysis raised a total of USD 350 000 from angel investors and the Norwegian Katapult Accelerator. [215]
- Similarly, Kray Technologies, a developer of unmanned aerial vehicles for spraying crops with plant protection products and growth regulators, obtained a grant from the United States of America Civilian Research and Development Foundation in 2016 andfurther USD 600 000 from investors, including Ukraine-based Chernovetskyi Investment Group in 2017.[216]
- Other notable examples of agritech companies that were supported by the CRDF Global's Science and Technology Entrepreneurship Program (STEP) in Ukraine and awarded in various competitions are Tradomatic and AGRO.BI. The first one is a digital matchmaker for farmers and buyers in Ukraine and offers a mobile trade platform. Through a chat bot, agricultural traders can identify best prices, observe market trends, and search for potential buyers in a single one-stop shop. AGRO.BI is a business intelligence platform that uses high-precision drone imagery and original machine learning technologies to help farmers mitigate threats to crop yielf and maximize profitability.[217]

Multinational suppliers of agricultural inputs, machinery and equipment introduce their own digital solutions in Ukrainian agricultural sector, including those to improve application of fertilizers, crop protection use, irrigation systems, carbon emission calculation. Satellite monitoring of fields, precision farming tools, navigation systems, and digital sensor technologies are as well being increasingly used by large Ukrainian agroholdings. In addition, agroholdings deploy various IT solutions to integrate the obtained data into enterprise management systems and enable data analysis with modern analytical tools. A substantial portion of these modern tools has been developed by local technology providers or in-house IT specialists.[218] Also, large Ukrainian agricultural holdings are becoming increasingly involved in proprietary and joint agritech projects, working with e-agriculture companies such as Bitrek (telemetry equipment producer) and Craftscanner (automating adjustments of soil cultivation depth). There is also an association, AgTech Ukraine, to promote the role of IT in agriculture.

Besides, UNDP Supporting Green Recovery in Ukraine Project implements a pilot to develop digital Environment, Social and Governance (ESG) risk assessment tool to be placed in public Diia. Business platform for the use by agricultural producers to familiarize them with non-financial risks of their business activities. The farmers will be able to familiarize with ESG approach, assess their non-financial risks, develop their businesses with sustainable development goals and hence improve their access to finance.

Additionally, FAO indicates that will support Ukraine in the development of national procedures for the establishment of pest-free areas, production places and sites, and supporting the country to join the ePhyto Solution system by adjusting the already existing phytosanitary information system.[219] ePhyto, developed by the Secretariat of the International Plant Protection Convention (IPPC), is a

[215] National Investment Council of Ukraine, 2018
[216] National Investment Council of Ukraine, 2018
[217] https://www.crdfglobal.org/news/digitizing-agribusiness-ukraine
[218] https://www.largescaleagriculture.com/home/news-details/what-drives-digital-transformation-of-agriculture-the-case-of- ukraine/
[219] https://uga.ua/en/news/iag-of-the-ippc-ephyto-solution-calls-on-governments-to-adopt-ephyto/

global system for issuing and delivering electronic phytosanitary certificates from exporting countries to importing countries. The system reduces risks in trade as well as costs incurred by national plant protection organizations (NPPOs) of exporting countries. The increased effectiveness of the phytosanitary information flow and the electronically issued certificates strengthen the trust between trading parties.

Furthermore, due to a recent request, FAO is currently exploring the possibility to support the Government of Ukraine to establish a governmental platform under the State Fishery Agency to accelerate the digitalization of the administrative processes behind the management of fisheries, the so-called "e-Fish" system.[220] The project is currently in a concept phase, including the below-detailed functions and specifications, and will be proposed as part of a new contribution agreement for the European Union to consider. Due to this reason, the finalized e-Fish portal may differ as further internal- and external technical discussions are foreseen with the Ministry of Agrarian Policy and Food, the European Union, the State Fisheries Agency, and other relevant stakeholders. The digital architecture of the State Fishery Agency was established in the framework of the digital strategy of the Ministry of Agrarian Policy and Food of Ukraine. The design should rely as much as possible on a combination of existing off-the-shelf Fisheries Information Systems (FIS) and Aquaculture-related equivalents available on the market as services and cloud-based platforms and tools, able to:

- Deliver front-facing online portals;
- Host and integrate all subsystems;
- Provide Single-Sign-On (SSO) for seamless access by end users throughout all systems and databases.

Additionally, many multinational suppliers of agricultural inputs, machinery and equipment introduce their own digital solutions in Ukrainian agricultural sector, including those to improve application of fertilizers, crop protection use, irrigation systems, carbon emission calculation.

On the other hand, FAO-EBRD interviews held before the aggression showed that large Ukrainian agricultural holdings have increasingly interest in becoming involved in proprietary and joint agriculture-based technology projects. As an example, the UkrLandFarming was cooperating with the FarmQa company based in the United States of America on soil density management. Kernel, a large agricultural holding was working with several other domestic and foreign start-ups specializing in drone solutions. MHP, the largest poultry producer, was developing a number of innovations, including the GeoInformation System project, which collects, processes and visualizes all data related to farmland management.[221]

FAO states that support can be provided in order to the Government of Ukraine establish an e-platform supporting all e-Fish subsystems. Given the varied nature of all Cabinets (industrial and sport- and amateur fishing), the main platform must act as a knowledge management system to store, categorise and ease the consultation of normative and technical material. The goal of said platform is to support the establishment of a single stable cabinet of industrial fishing users, and to create a

[220] https://www.fao.org/countryprofiles/index/en/?iso3=UKR

[221] Prikhodko, D., Sikachyna, O., Pedersen, E., Sylvester, G. and Rybchynshyi, R. 2022. Digital technologies in the grain sector of Ukraine. FAO Investment Centre Country Highlights, No. 18. Rome, FAO

single cabinet of sport and amateur fishing. The system focusing on industrial fisheries allows users to create certificates of origin and track the shipment, movement, and inventory of goods with a QR code identification system. Additionally provides information about water objects, including location and cadastre numbers, ownership rights, allowed catching limits, and information about bioresources. Registry of fishing gear (types, user tags, and ships) and registry of licenses are also included.

Last but not the least, under the EU funded Recovery and Peacebuilding Programme, FAO has undertaken a technical gap analysis on the existing system register of wood and, based on the findings, FAO developed the technical specification and relevant Terms of References for the development of the Electronic register of wood 2.0 (ERW 2.0). Finally,the "Doradnyk" website developed with FAO's support under the EU-funded Recovery and Peacebuilding Programme in Eastern Ukraine promotes the development of the Agricultural Knowledge and Innovation Systems (AKIS) in Ukraine.

The effect of the war

The impact of the war since the 24th of February on the digitalisation of the sector is yet to be estimated, as for many agrobusinesses the main goal is to cope with the economic loses from the war, especially in the war-affected regions. Because of the occupation, about 30% of Ukraine's agricultural land cannot be used for its intended purpose.[222] As of June 8, 2022, farmers from seven war-affected regions of Ukraine lost 2,281 units of agricultural machinery. These are farmers from Kyiv Oblast, Sumy Oblast, Chernihiv Oblast, Luhansk Oblast, Donetsk Oblast, Kherson Oblast and Mykolaiv Oblast.[223]

According to FAO series of risks have been identifies as a result of the aggression. The risks are categorized into 3 areas as of:

- Risks associated with the food and agriculture market
- Macroeconomic risks
- Humanitarian risks.[224]

In June 2022, the Deputy Minister for Digital Development, Digital Transformation and Digitization of the Ministry of Agrarian Policy and Food of Ukraine (MAPF) presented its digital strategy also called "Concept of digital development: AGRO". The strategy aims to address the challenges of old registers, paper-based processes, the need to contact several institutions to obtain certain services, the lack of official data on a single platform, the need for physical presence and the corruption risks.[225] The AGRO concept aims at addressing these challenges by creating a unified architecture of digital services in agriculture, to minimise contact of people with civil servants, to use satellite technology to obtain objective information from the fields, to digitally-transform and automate all administrative services, to introduce electronic permitting procedures, to trace all processes and to create tools for implementing evidence-based decisions. The strategy lays down a unified architecture for the eGovernment systems and services in agriculture based on the following key components:[226]

[222] https://rayon.in.ua/news/517131-popri-viynu-yak-ukrainski-fermeri-zakhishchayut-urozhay
[223] https://lb.ua/society/2022/06/10/519633_z_pochatku_viyni_ukrainski_agrarii.html
[224] FAO. 2022. Implications on word food security and agriculture, including global food prices, arising from the aggression of the Russian Federation against Ukraine. ERC/22/14 – NI972, FAO, May 2022. https://www.fao.org/3/ni972en/ni972en.pdf
[225] Information provided by the Ministry of Agrarian Policy and Food of Ukraine to FAO
[226] Information provided by the Ministry of Agrarian Policy and Food of Ukraine to FAO

- State Agrarian Registry (SAR): a platform that facilitates farmers' access to support programmes
- Information and analytical portal: a single dashboard with the main official indicators of the agriculture sector, which would serve as an evidence-based decision-making tool with the integration of other state resources
- Portal of the food security: a portal for food security monitoring that provides information on the availability of basic products, on their prices, and that traces deficits and high prices of goods, with current prices and information provided on interchangeability of certain groups of goods
- Cabinet of farmers: a single state window of access for farmers to all necessary service (administrative services, financial credits, state support, official statistics, satellite monitoring and commodity agricultural exchange)
- StateGeoCadastre: a digital cadastre for access and efficient use of official cartographic data integrated with the National Geospatial Data Infrastructure (NSDI) to offer updated cartographic materials in digital form (digital mapping), a state land cadastre, an automated system for using up-to-date satellite data to analyse the state of agricultural production, the monitoring of land relations and a digital cabinet of land surveyor
- Digital architecture of State Fishery Agency: or "e-fish", a governmental platform under the State Fishery Agency to accelerate the digitalization of the administrative processes behind the management of fisheries.

The State Agrarian Registry (SAR) online platform represents one of the key components of MAPF's AGRO digital strategy. Launched in August 2022, the SAR was developed thanks to technical and financial assistance from the European Union, as well as support from World Bank. Open to all Ukrainian farmers for registration, the online platform will function as the single digital hub for agricultural producers in Ukraine.[227] The SAR integrates with State Registry of Property Rights for Real Estate and their Encumbrances, the State Land Cadastre, the State Registry of Legal Entities, Individual Entrepreneurs, and Civil Organizations, the animal registry, and the tax registry. The SAR works similarly to a Farm Register, a critical eGovernment system implemented by EU Member States. Individuals or legal entities of any size of farmers, and agricultural producers can register to the system, while it is expected that registration of recipients of State Support and EU grants will be mandatory. Registered farmers can manage their user information while accessing information in state registries including land records. Users can upload their data on their land use and area for each crop, information on livestock, etc. The system enables direct communication between the farmers and state and local authorities. It's possible to apply for state subsidies, targeted, subsidised credit programmes, and loans and technical assistance from EU and other international donors.[228]

Many countries have been heavily dependent on direct food imports from Ukraine. Countries in Africa, the Middle East, Europe and Asia import a significant share of their wheat, barley, corn or vegetable oils from Ukraine. In 2019, Ukraine alone accounted for 23 percent and 20 percent of African wheat and maize imports, respectively; 28 percent of European maize imports; 12.5 percent of Asian cereal imports, and 55 percent of crude rape oil imports in the Middle East. FAO expects 10 percent decrease

[227] https://www.eeas.europa.eu/delegations/ukraine/eu-support-ukraine-has-launched-state-agrarian-registry-online-platform-farmers_en?s=232
[228] https://www.kmu.gov.ua/news/za-spryiannia-ies-ukraina-zapustyla-derzhavnyi-ahrarnyi-reiestr-onlain-platformu-dlia-pidtrymky-fermeriv

in the yield of winter crops in Ukraine due to delayed, missed, or insufficient application of fertilizers, and difficulties in pest and disease control. [229]

Digital Health

The government of Ukraine undertook major steps to modernize the ICT infrastructure aiming to improve the healthcare service response, as well as to increase the efficiency of core services which results among in patient satisfaction.

In 2016 the Cabinet of Ministers of Ukraine approved the Concept of health care financing reform, which helped increase the efficiency of the system and improve approaches to its financing model. The systemic changes held during 2017-2020 care sector included The Law of Ukraine "On State Financial Guarantees of Public Health Care", Resolution of the Cabinet of Ministers of Ukraine of April 25, 2018 no 411 "Some Issues of the Electronic Health Care System" (Official Gazette of Ukraine, 2018, 46, p. 1604), as well as a number of bylaws in which the electronic health care system and digital tools are defined as fundamental to the development of the field.

An important step towards an e-Health system accessible by patients, providers and administrators was the launch in 2018 of "eZdorovya". This system was initially developed and tested by Transparency International Ukraine in 2017 to support the restructuring of health financing and allow for better management of public spending. With its transformation into a state-owned enterprise, it aimed to digitize all appointments and medical records, thereby making paper-based record-keeping obsolete. The next steps for eZdorovya are the roll-out of digital patient health records and the integration of the secondary and tertiary care levels into the system.[230] Attention will be needed not to create situations of exclusions from these systems, in particular for people lacking adequate personal documentation.

In October 2019, Deputy Prime Minister, Minister of Digital Transformation Mykhailo Fedorov together with Health Minister Zoriana Skaletska have agreed on a joint plan of priorities and actions for the development of eHealth. The Action Plan (2019-2020) was developed with an active engagement of the representatives of the National Health Service of Ukraine, eHealth Association, interested NGOs, information systems developers and international technical assistance projects. It envisaged 14 steps which included the approval of the concept of an electronic healthcare system, conducting an audit of existing information systems and registers in the sector, and the development of a plan for the introduction of standards for the storage and transfer of medical information.[231]

In December 2020, the Cabinet of Ministers of Ukraine approved the order no.1671-r on the approval of the Concept of development of electronic health care. This Concept defines the main directions of e-health development, the existing problems and ways to solve them, as well as the expected results and issues of resource provision. Its implementation is envisaged until 2025 in two stages.

[229] FAO. 2022. Implications on word food security and agriculture, including global food prices, arising from the aggression of the Russian Federation against Ukraine. ERC/22/14 – NI972, FAO, May 2022.
[230] https://thedocs.worldbank.org/en/doc/796791611679539176-0090022021/original/ReformsintheHealthSectorinUkraine.pdf
[231] https://www.kmu.gov.ua/en/news/zatverdzheno-plan-rozvitku-sistemi-ehealth

The purpose of this Concept is to form political, legal, organizational, technological and ideological conditions and principles of e-health development in Ukraine, which will improve the quality and accessibility of medical services, empower patients, ensure their continuing health care and safety, increase effective management and use of resources, a high level of public awareness on healthy lifestyles, disease prevention and health care.

The concept implementation is expected to be achieved through:

- Regulatory and legal support for the development of e-health;
- Organizational, managerial and technical support of e-health development;
- Resource provision of e-health development;
- Ensuring the quality, safety and accessibility of e-health.[232]

Later, in September 2021, the Ukrainian government adopted an Action Plan aimed to ensure the effective coordination and control over the Concept implementation.[233]

According to dashboard of the governmental projects of digital transformation, among the most priority areas by 2023, the Ministry of Health has identified:[234]

- Development of medical services and management of medical information (electronic health care system); electronic patient office, electronic hospital, electronic treatment plan, electronic medical examinations, sensitive data module, electronic medical reports (on temporary incapacity, for obtaining a driver's license, on the state of a person's functionality, on death);
- Ensuring the quality and safety of medicines, medical devices (e-medicine): electronic stock management system for medicines and medical products "eStock", modernization of the State Register of Medicines, creation of the State Register of Medical Products, electronic prescription for insulins, narcotics and all prescription drugs;
- Promotion of a healthy lifestyle, protection of the population from infectious diseases and prevention of socially dangerous diseases (e-public health): electronic integrated information system for monitoring infectious diseases (ELISSZ), medical information system.

As for Covid, from September 2021, an international COVID vaccination certificate was made available in the Diia application. The development and technical implementation of COVID-certificates were jointly carried out by the Ministry of Digital Transformation, the Ministry of Health, the National Health Service of Ukraine, the Ministry of Foreign Affairs, and the State Tax Service. In Ukraine all relevant patient data is included into the electronic healthcare system. The document can be generated in the Diia application or on the Diia Portal with the use of electronic signature. In case a paper certificate is needed, the Diia app sends a request to the electronic healthcare system then the E-health system transfers medical data for the COVID-certificate to the Diia app. and a certificate is generated in PDF format. It can be printed out or be saved to the file on the mobile phone or other device and can be seen through the QR code on the screen. COVID certificates can be used like other official documents

[232] https://zakon.rada.gov.ua/laws/show/1671-2020-p#n8
[233] https://zakon.rada.gov.ua/laws/show/1175-2021-p?fbclid=IwAR3oGlTTQYjQuJ3iNHzZlvw2tbYBp60gH5m0luERPg8m4hA7D5LqEynbhZg#Text
[234] https://plan2.diia.gov.ua/projects?fbclid=IwAR1qj--MPvWg1SvPecO4P_uFxzGvBk0hxtOwlqNDNFxq17c0pk2kwVGi9M

in the Diia. One can check if the certificate is valid by QR-code, which is convenient, because there's no need to introduce additional special equipment for checking.[235]

The effect of the war

As of August, 884 medical facilities were damaged, of which 123 were destroyed. With shelling, the occupiers disabled 87 ambulances, seized 241 cars, and also damaged about 450 pharmacies.[236] As of June 2, there have been 269 confirmed attacks on health care, killing at least 76 people and injuring 59 people according to WHO. [237]

The recent development in the digitalisation in July - August 2022 are:

- Largest Ukrainian operator 'Kyivstar' bought the share in the largest medical information system Helsi.[238] The company owns 69.99% of Helsi Ukraine LLC.[239] The company has has more than 23 million patients. The objective of such partnership is to make e-health accessible to all Ukrainians who fled their homes. Kyivstar will focus on strengthening the already existing digital service, scaling the number of users, simplifying the client experience with medical services. [240]

- According to the Order of the Ministry of Health of Ukraine dated 21.07.2022 No. 1284 on the approval of amendments to certain regulatory acts of the Ministry of Health of Ukraine from August 1, Ukrainians will start receiving electronic prescriptions for antibiotics in addition to the paper prescription.[241] Such an opportunity will be available in institutions that are connected to the electronic health care system (EHS). [242]

The Rapid Gender Analysis by UN Women and CARE international underlined that both women and men respondents highlighted mental health as the area of their life most impacted by the war, linked to fear and anxiety as a result of trauma, displacement, family separation and loss of livelihoods.[243] In many cases, psychological help is available online. This also means the support is less accessible for those without [good] internet access, or the ability to use such technology. Community social service centres that might have previously offered this support are currently catering for displaced people or are involved in collecting humanitarian aid.
A free psychological help line has been launched in Ukraine. Anyone affected by the war can turn to her. Currently, almost 60% need psychological help. the line accepts calls from citizens of Ukraine who are currently in other countries. [244]

[235] ITU Report – DIGITAL SKILLS DEVELOPMENT UKRAINE GOOD PRACTICE CASE STUDY, p.17
[236] https://mind.ua/publications/20245779-medicina-v-umovah-vijni-yak-zminilasya-sistema-ohoroni-zdorov-ya
[237] https://ukraine.un.org/uk/184816-sto-dniv-viyny-sprychynyly-sylnyy-tysk-na-systemu-okhorony-zdorovya-ukrayiny
[238] https://kyivstar.ua/uk/mm/news-and-promotions/kyyivstar-ta-helsi-obyednalysya-ta-zroblyat-cyfrovu-medycynu-dostupnoyu-dlya
[239] https://forbes.ua/news/kiivstar-kupiv-medichniy-servis-helsi-do-viyni-servis-otsinyuvali-v-30-40-mln-19082022-7810?fbclid=IwAR2rEkgV2AfB4NiPPpGUXwf_2xHUTSEglaDrGNddWvgaVAJoxjzTDbB0n2c
[240] https://www.unian.ua/techno/kijivstar-ta-helsi-ob-yednalisya-ta-zroblyat-cifrovu-medicinu-dostupnoyu-dlya-kozhnogo-ukrajincya-11942667.html
[241] **https://zakon.rada.gov.ua/laws/show/z0826-22#Text**
[242] https://suspilne.media/266495-z-1-serpna-ukrainci-otrimuvatimut-elektronnij-recept-na-antibiotik-moz/
[243] To learn more about Rapid Gender Analysis by UN Women and CARE International, visit the following link: https://eca.unwomen.org/en/digital-library/publications/2022/05/rapid-gender-analysis-of-ukraine-0
[244] http://www.golos.com.ua/news/167357

Materials circularity: E-waste management

According to the ITU-UNEP-UNITAR Regional E-waste Monitor CIS + Georgia[245], in Ukraine, E-waste is regulated within the framework of the general waste management regulations which is the Law no.187/98-BP of 1998 "On Waste". This Law defines the basic principles of state policy on waste, namely: ensuring the collection and disposal of waste; minimizing waste generation; organisation of control over the placement of waste; etc.
In this regard, Ukraine has signed and ratified several conventions in early 2000s. The Basel Convention entered into force in 2000, Rotterdam Convention in 2004, and Stockholm Convention in 2007. However, Ukraine has not yet signed the Minamata Convention on Mercury.

As for institutional framework, there are four main authorities responsible of e-waste and waste management in Ukraine which are the Ministry of Ecology and Natural Resources, the Ministry of Regional Development, Construction and Housing and Communal Services, the State Customs Service, and the State Statistics Service. However, it is worth noting that there are a number of stakeholders that are also in in charge with e-waste.

Existing technical regulations and orders specifically dedicated to e-waste management include:

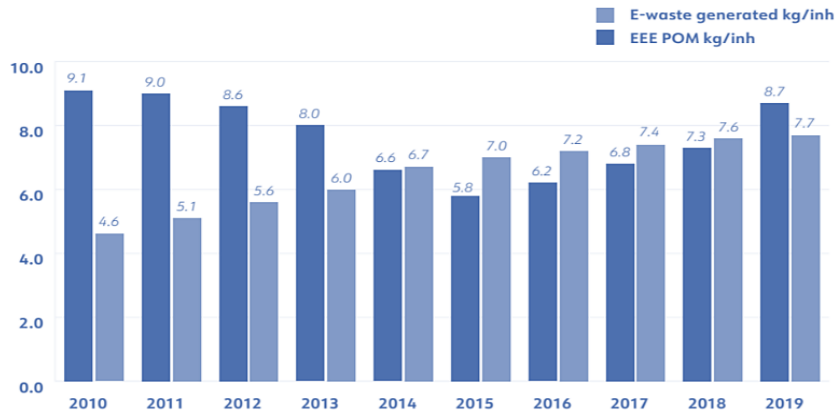
- Resolution of the Ministers Cabinet of Ukraine of September 22, 2017 "On approval of the Technical regulation on use restriction for some hazardous substances in EEE";
- Resolution of the Ministers Cabinet of Ukraine "On the procedure of functioning and maintenance of roster and information system, registration, reporting in information system for placement in the management market of EEE and e-waste";
- Order of the Ministry on the issues of the housing and communal services (HCS) of Ukraine "On approval of the methodological recommendations for collection of WEEE in the composition of domestic waste";
- Order of the Ministry on the HCS issues of Ukraine "On approval of the methodological recommendations on detection of morphological content of solid domestic waste";
- Order of the Ministry of the regional development, construction, and HCS of Ukraine No. 423 dated August 30, 2013 "On approval of the Methodological recommendations on safe handling of hazardous waste components in the composition of domestic waste";
- Order of the Cabinet of Ministers of Ukraine dated July 13, 2020 No. 1120 "On approving the provision on control over cross-border transportation of hazardous wastes and their utilisation/removal and yellow and green list of wastes".

Within the EU-funded Twinning project named "Renewables Development in Ukraine" aiming, the Ministry of Regional Development of Ukraine received support for improving the legal framework on disposal of e-waste and batteries. In this framework, the draft law "On batteries and accumulators" and the draft law "On e-waste" have been developed. Both draft laws are currently undergoing approval procedures. In addition to these, the following papers have also been created and are awaiting official approval as part of an effort to approximate EU law in the area of e-waste management:

[245] Regional E-waste Monitor CIS + Georgia, 2021, retrieved from: https://ewastemonitor.info/wp-content/uploads/2021/11/REM_2021_CISGEORGIA_WEB_final_nov_11_spreads.pdf

- The draft bylaw 'On establishing rules for marking the capacity of portable secondary (rechargeable) and automotive batteries and accumulators.'
- The draft resolution of the Cabinet of Ministers of Ukraine 'On creation of the State Agency of Ukraine on waste management', announced on August 14, 2019, but not yet approved.
- The draft law of Ukraine 'On the State Environmental control'.

Figure 10 – EEE POM and e-waste generated in Ukraine



The existing legislative framework does not allow for effective accounting and reporting or for monitoring systems in the field of e-waste management. Even though the regular reporting on waste management is in the mandate of the State Statistic Service of Ukraine, information on e-waste is not specifically available or required. Besides, there is currently no definition of the list of goods and products related to e-waste, no statistical record of the volume of their production and treatment/recycling, as well as no legal basis for regulating the process of handling them. Moreover, no administrative liability exists for failure to separate waste collection.

Due to the lack of official data availability, UNU/UNITAR internal data has been used to quantify the main statistics indicators for e-waste in Ukraine. The amount of electrical and electronic equipment (EEE) placed on the market (POM) in Ukraine has increased over the past five years. Still, there was a relevant drop from 9.1 kg/inh (414.8 kt) in 2010 to 5.8 kg/inh (248.2 kt) in 2015 before the increase to 8.7 kg/inh (365.7 kt) in 2019. Still, the value hasn't reached the level of 2009.
The e-waste generated in Ukraine mostly consists of small equipment (34%), large equipment (26%), and temperature exchange equipment (26%), reaching together an amount of 7.6 kg/inh. While it is known that there is the domestic production of EEE in Ukraine, there is no data available regarding their quantities.

The e-waste generated in Ukraine consistently rose from 4.6 kg/inh (211.1 kt) in 2010 to 7.7 kg/inh (324.1 kt) in 2019. In 2019, the highest share of 31% of e-waste was small equipment, followed by 24% of temperature exchange equipment.

Consumers can hand e-waste over at municipal or private collection points and at retail shops that have take-back obligations. More than one hundred companies are licenced for e-waste management

in Ukraine, and 80% of them are also licenced for waste recycling. So, the infrastructure of the country is developed enough to implement an effective e-waste management system.

Digital environmental information system

In 2020, Country maturity report on sharing and dissemination of environmental information was commissioned by the European Environment Agency in cooperation with UNECE under the framework of the ENI SEIS II East project207 supported by the European Union. The report208 analysed the status and main challenges for e-government, open data and environmental information system and included a roadmap on how to address these challenges in English and Ukrainian. The Roadmap is aligned with the Convention's Recommendations on the more effective use of electronic information tools209 and the Protocol on PRTRs210. In particular, the assistance to the government should support the development of the ambitious Open Environment portal and pollutant release and transfer register that would significantly improve public access for environmental open data.

Ukraine as a Party to the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (the Aarhus Convention) and its Protocol on Pollutant Release and Transfer Registers (the Protocol on PRTRs) undertook obligations to ensure effective public access to information and to justice and public participation in decision-making in environmental matters with regard to programmes, plans, policies, projects and legislation economy-wide and specific economic sectors including: agriculture, forestry and fishing; energy; mining; manufacturing ; transport; water; waste; tourism; and housing, buildings and construction, as well as to regional and urban development.

Coherent, and integrated digital information system for reporting and dissemination of environmental data and information is effective tool to implement key obligations of the two treaties and support transparent, inclusive, participatory and evidence-based decision-making with numerous benefits for the transformation towards a robust and sustainable economy in Ukraine. Such benefits may include:

- Effective and informed public participation in decision-making ensures that the activity on the greening the economy (the related plan, programme or project) is more acceptable to population and less harmful to the environment;
- Hidden/unexpected aspects of the proposed activity can be uncovered early, helping to avoid costly mistakes, public unrest and the required remedy actions;
- Integration of environment and health considerations into sectoral development plans, programmes and policies, as well as to projects, through raising public awareness and promoting effective public participation in decision-making related to greening the economy;
- Improved governance, inter-ministerial and multi-stakeholder coordination at the national and subnational levels and coordination for promotion of green and circular economy;
- Promotion of PRTR data as a major driving force for pollution reduction throughout different sectors of the economy; it will lead to competition among generators of pollutants to reduce their releases;
- Promotion of PRTR data to policymakers as the key indicator for measuring progress in reducing pollutants, advancing sustainability and the success of a green economy;
- Governments, academia, research institutions, the public, and businesses driving eco-innovation can utilize the PRTR as a common indicator.

In 2020, Country maturity report on sharing and dissemination of environmental information was commissioned by the European Environment Agency in cooperation with UNECE under the framework of the ENI SEIS II East project[246] supported by the European Union. The report[247] analysed the status and main challenges for e-government, open data and environmental information system and included a roadmap on how to address these challenges.

The Roadmap is aligned with the Convention's Recommendations on the more effective use of electronic information tools[248] and the Protocol on PRTRs. In particular, the assistance to the government should support the development of the ambitious Open Environment portal and pollutant release and transfer register that would significantly improve public access for environmental open data. Further progress in their implementation is reflected in 2021 national implementation reports. [249]

The effect of the war

In May 2022, Ukraine Parliamentary Committee on Digital Transformation had expressed its support for the draft law on the National Register of Emissions and Transfer of Pollutants. The draft law was adopted by the parliament in its first reading in July 2022 and is now being finalized.[250]

2.3.3. Digital Content and Data

Data protection is a separate milestone in the Ukrainian digital policy that needs consideration. The last law "On the Protection of Personal Data" No. 2297-VI was adopted in 2010. It has paved the basic principles of data protection, which are as follow:

- Need to obtain the consent of the subject of personal data for their processing;
- General and special requirements for the processing of personal data;
- The rights of the subject of personal data;
- The rules of cross-border transfer of personal data, etc.

But this law has not established the ways and mechanisms of protection of data. Until 2014, the body in charge of data was the State service on the Protection of Personal Data. This body was dismissed and the power were given to the Human Rights Commissioner of the Verkhovna Rada of Ukraine and to the Courts.[251]

There were several discussions in recent years within the civil society on the need to update the law, especially with the elaboration and entering effect of the EU GDPR. The update of the law is considered as an international legal obligations of Ukraine under the EU Association agreement.

[246] ttps://eni-seis.eionet.europa.eu/east (access to environmental information)
[247] https://unece.org/sites/default/files/2021-03/Ukraine%20Country%20Maturity%20Report%20EN.pdf; https://eni-seis.eionet.europa.eu/east/areas-of-work/access-to-environmental-information/products/ukraine-roadmap-en/@@download/file; and https://eni-seis.eionet.europa.eu/east/areas-of-work/access-to-environmental-information/products/ukraine-roadmap-ua/@@download/file
[248] https://unece.org/environment-policy/publications/recommendations-more-effective-use-electronic-information-tools
[249] https://aarhusclearinghouse.unece.org/national-reports
[250] https://aarhusclearinghouse.unece.org/national-reports
[251] https://biz.ligazakon.net/news/207564_yak-vdbuvatsya-reforma-zakonodavstva-pro-zakhist-personalnikh-danikh-v-ukran

Moreover, the new legislation is an opportunity for the Ukrainian business to process the data of the European citizens and in such way to expand the scope of operation by accessing the EU digital space. On the other hand, many Ukrainian business were not ready to implement such laws due to the costs it would entail. This was one of the main reasons why the process was slowed down.

Eventually in 2021 the two draft laws corresponding to EU standards were presented:

- The draft law on the protection of data No.5628 dated 7 June 2021. It fully updates the rules of the collection and processing of data and the means of its protection. [252]
- The draft law on the National commission on the protection of the personal data and access to the public information No.6177 dated 18 October 2021. It has suggested the creation of the new controlling body in the domain of protection of data.[253]

The two draft laws were supposed to be considered by the Parliament in 2022 and were aimed to establish the new system in the domain of the protection of data. Especially the draft law on personal data should have introduced, among others, the below changes: [254]

- The specifications made in the defining of personal data as for example concerning the underage persons, data of dead people and processing of genetic and biometric data. It provides that the law considers the developments in technologies and risks;
- Detailing and clearer formulation of the principles of personal data processing;
- Clear formulation of the grounds for personal data processing;
- Transparent requirements for consent to the processing of personal data, which will avoid abuse and manipulation;
- Expansion of digital rights adding the right to be forgotten and the tight to the mobility of data
- Definition of duties of the controller and operator of personal data;
- Procedure for notification of personal data leakage. The defining of “cyber incident” was broaden as well as to the administrative and criminal responsibility is added the significant fines – up to 300 000 UAH;
- The facilitation of the protection of data ‘by design’.

Diia is the main governmental project on provision of the digital services. In January 2022 the information was circulated about the leak of data of millions of Ukrainians. But Diia application does not save personal data according to the Minister of Digital Transformation.[255] When user log in to Diia, the documents are pulled up again. All data is transferred and taken exclusively from the encrypted view, and for some of the critical data, the blockchain technology of distributed data protection is used.[256] This enhances trust of Ukrainians to the governmental online services and to Diia for which cyber security is of paramount importance.

The effect of the war

[252] https://www.kmu.gov.ua/bills/proekt-zakonu-pro-zakhist-personalnikh-danikh
[253] https://www.kmu.gov.ua/bills/proekt-zakonu-pro-natsionalnu-komisiyu-z-pitan-zakhistu-personalnikh-danikh-ta-dostupu-do-publichnoi-informatsii
[254] https://biz.ligazakon.net/analitycs/208322_chi-stane-2022-rk-chasom-dlya-perezapusku-sistemi-zakhistu-personalnikh-danikh-v-ukran
[255] https://t.me/zedigital/970
[256] https://diia.gov.ua/faq/17

With the introduction of the martial law in Ukraine, a number of changes have been made to the existing law including parts related to personal data. Significant change relates to the amendment of the criminal code in terms of the data protection:

- Law No. 2111 dated 3 March 2022 on the simplification of investigative actions.
- Law No. 2137 dated 15 March 2022 on amendments to the procedures for inspection of the scene, search, temporary access, which relate to computer systems and access to data. It among other includes a new investigative action was provided for copying records from surveillance devices.

For example, as for the latter, according to the new rules, the prosecutor, in agreement with the head of the prosecutor's office, can authorize temporary access to:

- Medicinal secret;
- Bank secrecy;
- Data from telecommunications operators and providers, in particular about the connection, the subscriber, the provision of telecommunication services, including the receipt of services, their duration, content, transmission routes, etc.;
- Personal data that are in the personal possession of a person or in the personal data base of the data owner.
  But personal communication of the person was not covered by the new changes.[257]

Despite the martial law, the draft law on the personal data is still on the agenda. On the 5th of August 2022, the Committee on Digital Transformation has recommended to the Parliament the adoption of the draft law of personal data of 7 June 2021.[258]

2.3.4. Innovation and Entrepreneurship

In recent years Ukraine has set up the number of good practices in the support of innovations and entrepreneurship. Investment into the startup sector went up 10 times during the past 5 years – from $39 million in 2014 to $509 million in 2019. More than 146,000 patents and utility models have been registered in Ukraine since 2007.[259] According to data of February 2022 Ukraine has 1702 start-ups and scaleups. 240 000 from 42,5 million citizens are tech talents. [260]

At the national level, since 2019 State Enterprise Development and Export Office together with the Ministry of Digital Transformation of Ukraine have launched the project – Diia.Business for the development of entrepreneurship and export. The project has two components: an online portal and a network of support centres for entrepreneurs. A network of support centres for entrepreneurs Action.Business is a space where Ukrainians can receive free consultations, attend educational events for entrepreneurs, rent halls for events, and test their products at a special pop-up location. Before the war, Diia.Business support centres for entrepreneurs functioned in 11 cities of Ukraine, including one centre that have been established in the biggest Ukrainian university Taras Shevchenko National University of Kyiv.[261]

[257] https://www.pravda.com.ua/columns/2022/05/13/7345966/
[258] https://www.rada.gov.ua/news/razom/226505.html
[259] https://ukraine.ua/invest-trade/startup-ecosystem-ukraine/
[260] https://techecosystem.gov.ua/everything_is_techable_with_ukraine
[261] https://business.diia.gov.ua/about-project

In 2019 Ukrainian government launched the Ukrainian Startup Fund that aims to promote the creation and development of technology start-ups in the early stages, in order to increase their global competitiveness. In 2020 it has creased the start-up development strategy with the support of the World bank up to the 2025. The strategy defined 4 priorities:[262]

- Continue Funding to Support Start-up R&D and Operations.
- Promote Start-up Access to Support Services.
- Promote Globally-Competitive Incubation/Acceleration Programs
- Facilitate Cooperation among Ecosystem Stakeholders.

At the outset, there were only two support tools for start-ups: $25,000 for pre-seed grants and $50,000 for seed grants. To date, the range has expanded significantly and now includes: grants of up to 10 thousand dollars for acceleration in Ukrainian and international accelerators, innovation vouchers of up to 10 thousand dollars for participation in powerful international events, the program "Corporate Innovation" with the European Business Association; which helps to mark start-ups and corporations. The non-financial opportunities offered by the fund include educational programs, bootcamps, hackathons, demos and more. In total, the start-up can receive from the Fund up to 95 thousand US dollars.
In two years of existence, the Fund received more than 4,000 applications from start-ups, of which more than 200 received funding totalling UAH 166.9 million (approx. EUR 5.2 million)[89]. According to statistics, every second-winning start-up has already attracted additional investment, totalling about $ 30 million. Besides, the book "20 Ukrainian start-ups: success stories" was developed.[90]

In July 2021 Kyiv Academic University and twelve institutes of the National Academy of Sciences signed the Memorandum to establish the Association of Academic Cooperation "Academ.City" in Kyiv. This represented a step towards establishing a high technology science park which aims to bring together leading actors of the innovation ecosystem of Ukraine from both basic research and business and foster their mutually beneficial collaboration. The main goal of the future "Academ.City" is to advance scientific and technological developments to higher levels of readiness and stimulate their further commercialization.[93]
Another dimension is the creation on of start-up schools and incubators in educational institutions of Ukraine, which allow you to become part of the start-up movement. As of 2021, such centres exist in Kyiv, Kharkiv, Lviv, and Odesa. Organizations that are active in the development of start-up ecosystems at universities are:

- "Tech Startup School" of the Lviv Polytechnic National University;
- Entrepreneurship Center at the Lviv Business School of UCU;
- Sikorsky Challenge of the National Technical University of Ukraine "Kyiv Polytechnic Institute". Start-up ecosystems at universities are becoming an element of the implementation of state innovation policy, as this is a new way of supporting scientific developments[263]

The effect of the war

[262] https://usf.com.ua/wp-content/uploads/2020/09/strategy_usf_2020-2025.pdf
[263] http://www.investplan.com.ua/pdf/8_2021/16.pdf

Adaptation to the war is faster than to the COVID-19 pandemic – 29% more new businesses have already been registered than in the corresponding period in April 2020. In total, during the two months of the war, in the period from February 24 to April 24, 2022, 14,420 new entrepreneurs were registered in Ukraine.[264] As mentioned in the chapter "Market and investments" 90% of IT companies have not seen any change in their work. Thus, the entrepreneurs continue to operate and foster the innovation. The same situation is for start-ups. According to the research done by TechUkraine, the Ukrainian Start-up Fund, the Ministry of Digital Transformation of Ukraine and other partners:

- More than four in ten start-ups have not seen any change since the 24th of February
- More than one in ten start-up employees has had to leave their respective firms.[265]

The government also allocated to Ukrainian tech start-ups the sum up to 3,5 mln $. The main criteria for financing are the creation of 5 working places as well as the focus on the creation of the new technologies and decisions. As well Ukrainians who want to change their place of work for IT and learn for this will be allocated 30 000 UAH.[266] As well the EU has allocated €20M to support Ukrainian start-ups. According to the program, Ukrainian start-ups and companies will receive financial support in the amount of up to 60,000 euros.[267] Diia.Business centres have start to recover and to be rebuild. Currently, centres in Ternopil and Uzhhorod are fully functioning in offline. Other centres are currently in the process of resuming their activities. Also, META and a Ukrainian tech co-founding company Genesis introduced the support programme for start-up founders and C-level executives on how to grow and scale a successful tech business. Such Start-up academy partners with the different venture capital funds so that to make these financial opportunities available for the start-ups.[268]

2.3.5. Ecosystem Building

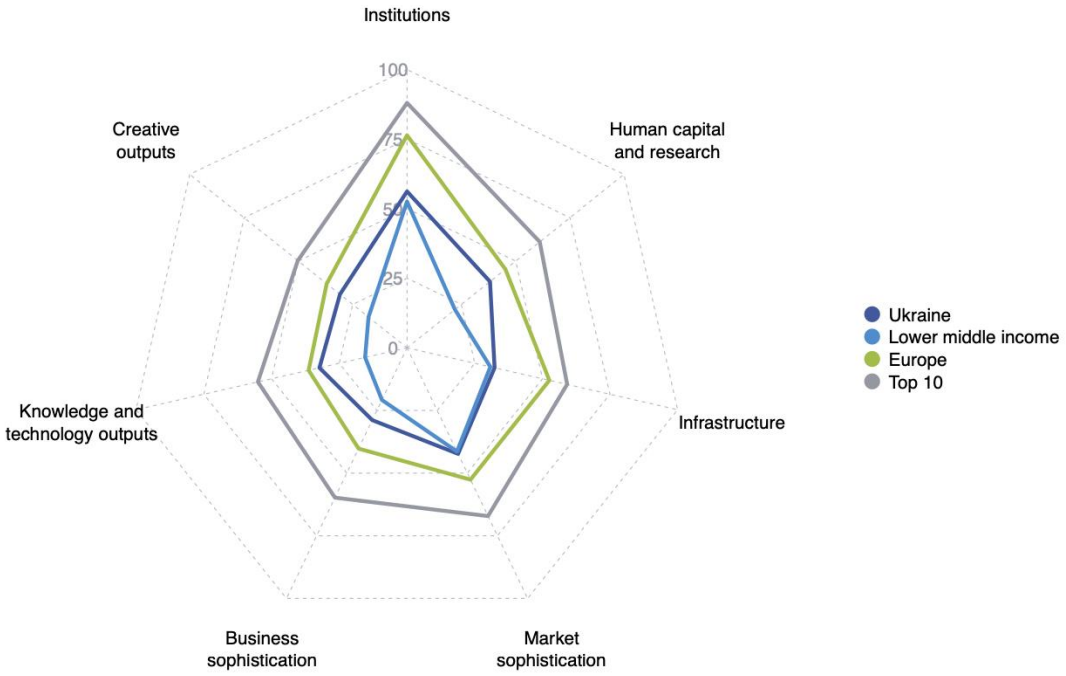
According to ITU Report "Regional Good Practices Accelerating innovation, entrepreneurship and digital transformation — Europe", Ukraine is among the European countries that have successfully launched strategic policies and initiatives to drive digital transformation and develop ICT-centric innovation ecosystems. Yet, the country's ICT infrastructure is insufficiently developed and thus requires significant public and private sector investments for balanced and equitable ICT access and usage. Besides, the country is among 21 European countries which do not have a sufficient number of people with the skills to allow countries to compete effectively on a global level, as a result of either a mismatch between academic institutions' curricula and the needs of the markets, or the exodus of skilled people from the country.[269]

Global Innovation Index (2020) ranks the country Ukraine ranks 49th among the 132 economies and ranks it the 32nd among the 39 economies in Europe. According to the index Ukraine performs above expectations for level of development.

[264] https://decentralization.gov.ua/news/14850
[265] The country at war: the voice of Ukrainians start-ups, page 8 https://drive.google.com/file/d/18kV886D29iQ3ENmS9Nell3AjFgzeBvoV/view
[266] https://www.kmu.gov.ua/news/denis-shmigal-derzhava-pidtrimaye-startapi-ta-navchannya-specialistiv-u-sferi-it
[267] https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3533
[268] https://techukraine.org/2022/06/06/meta-and-genesis-up-to-launch-a-free-startup-academy-and-propel-the-eu-tech-industry/
[269] https://www.itu.int/dms_pub/itu-d/opb/inno/D-INNO-GOOD_PRACT.03-2021-PDF-E.pdf

Weaknesses include such dimensions: political and operational instability, gross capital formation, microfinance gross loans, market capitalisation, venture capital recipients. Among the strengths the report defines: dimensions: government funding/pupil, pupil/teacher ratio, tertiary enrolment, female employed w/advanced degree, number of utilities models by origin, software spending, ICT services exports, trademarks by origin, mobile app creation. [270]

Figure 11 – The seven GII pillar scores for Ukraine



Source: Global Innovation Index (2020)

But for example, the Global Entrepreneurship Index (2018) ranks Ukraine 73rd out of 137 countries and the Global Competitiveness Index (2019) only 85th out of 141 countries.[87]

According to the Global Startup Ecosystem Index 2021, Ukraine has fallen 5 positions since 2020 and now ranks 34th globally. The country has 6 cities in the global top 1000. Kyiv is the highest-ranking city in Ukraine, and after falling 16 positions now ranks 48th, maintaining its position in the global top 50. Lviv is ranked 2nd in Ukraine, and it jumped 99 positions to 255th globally.[91] Among the ecosystem champions from Kyiv are:

- Preply online educational platform that pairs students with private tutors remotely via online chat;
- Reface which is a face-swapping app that can swap faces in videos, GIFs and memes using AI/ML technology.[95]

Even though the country has been going through economic difficulties for several years but still manages to create technology that is both scalable and global. That has become possible due to the creation of the ecosystem for the innovation development and start-up support, as IT – is defined as the priority for Ukraine in terms of economic revenues, human capital development, international image among others.

[270] https://www.globalinnovationindex.org/analysis-economy

This since 2020 Ukraine has made focus on supporting the ecosystem of innovation in number of ways: policy and regulation, establishment of tech parks, facilitation of the start-up creation, communication with foreign partners and engagement of finances.

In 2020 the Ministry of Digital Transformation of Ukraine together with partners launched the online portal Ukrainian Tech Ecosystem Overview. This is an online platform for business information about IT-companies, people, investors and the whole tech ecosystem of Ukraine in general. There is data on current IT-companies development, founders, officers and managers, companies' classification by industries, investment and funding, mergers and acquisitions, breaking news and industry's trends.[271]

As for the regulation, mentioned above Diia.City regime is the zone operating all over Ukraine and that gives the resident companies the special tax regime, more flexible employment conditions and additional instrument on the protection of investments and corporate management. As of the 4th August there are already 311 companies who are residents including such large companies as Reface, Roosh, Monobank, MacPaw, Ajax Systems, Revolut, EPAM Systems, Samsung, Genesis, NiX Solution, Softserve, Sigma. Software, RIA.com, Rozetka.[272]

Also, important part of the ecosystem is the capital's largest innovation hub - Unit City in Kyiv, opened in 2017. More than one third of the Unit City's residents are corporate innovation teams.[88] Unit City also makes a priority on helping talents, inventors and entrepreneurs to meet each other. Also, parts of the UNIT ecosystem are international networking and business empowerment including grant and mentoring programs, for example, from Amazon and the University of Berkeley.[273]

As for the international communication important role play the platform TechUkraine. It is a platform based on the desire to strengthen the Ukrainian technological ecosystem and bring Ukraine into the leaders of technological countries in the world. TechUkraine cooperates with leaders, government officials, business partners, and donors in order to promote Ukraine's Tech and Start-up Ecosystem both domestically and on the global-scale.[274]
The youth that want create innovation is united among themselves withing the project YEP – a network of academic business-incubators. The community provides a business-related education for youth, contributing to the development of the entrepreneurial ecosystem of Ukraine. For example, annually they conduct 4 days conference Start-up campus. As well YEP has introduced its own accelerators and mentorship programs in partnership with private companies. [275]

The effect of the war

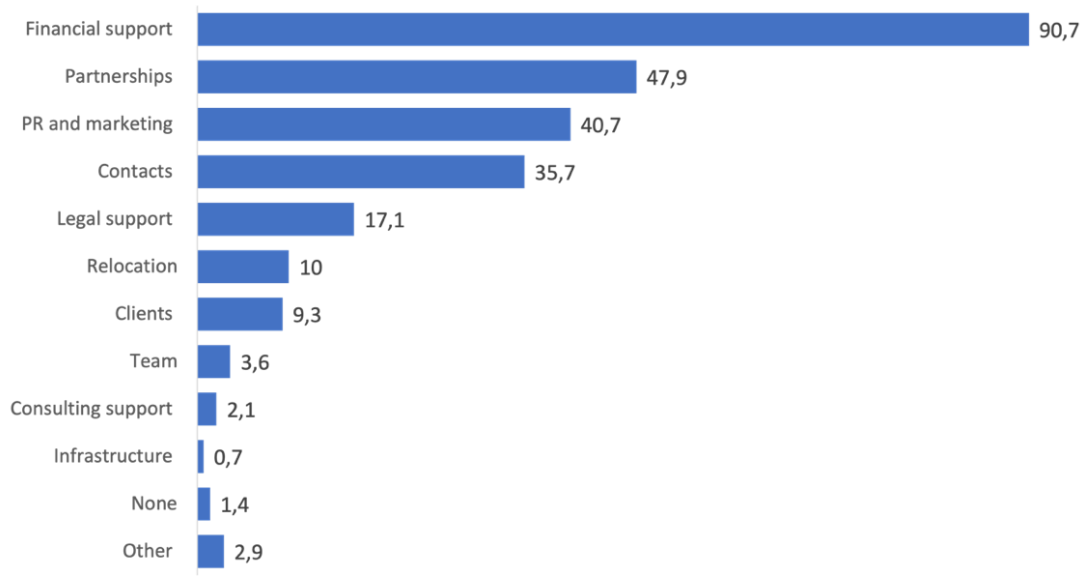
Due to the effect of war, Ukraine decreased its position in the Global Startup Ecosystem Index 2021 by 16 place, ranking 50th and still being in top-50. It is at the 30th place in Europe that decreased by 9 positions in comparison to 2021. Kyiv remains the resilience and is still in the top-10 innovative sites. Index states that one major challenge that the Ukrainian start-up ecosystem will be facing is unprecedented support from other European nations that allows Ukrainians to live and work in their

[271] https://techecosystem.gov.ua
[272] https://city.diia.gov.ua/registry/resident
[273] https://unit.city/ecosystem/
[274] https://techukraine.org/tech-ukraine/
[275] http://www.yepworld.org/ua/

countries for extended periods. This is important but the main thing is that Ukrainian tech and IT talent come back home once the war is over. [276]

Some Ukrainian start-ups have relocated but the vast majority have kept at least a part of their operations or team in Ukraine. Also, those start-ups that have not relocated are not planning on doing so at the moment. And more than half continue their operations exclusively from Ukraine. [277] But Ukrainian stat-up are in the biggest need of financing. Nine out of ten start-ups confirm they need financial support to continue operations and/or expand. As well the need is for partnership and PR and marketing. More details are on the figure 12.

Figure 12 – What do you need to continue your operations? %



Source: Research "The country at war: the voice of Ukrainians start-ups"

More than half of all start-ups state that whether they need financial support or not, they expect to expand their operations in the short-term. Every fourth start-up says they will maintain. More importantly, they still hire talents and strive to grow. [278] Working from bomb shelters, relocation of teams, reduction of funds, disruption of contracts - this is an incomplete list of problems faced by Ukrainian founders. The situation is complicated by global macro trends - the decline of financial markets and the expectation of a global recession.[279]

The government's plans to make Ukraine the county of start-ups and innovation as it was mentioned in conference on rebuilding Ukraine in Lugano in June but how to do in the long-term perspective remains the question, as instability of political situation now remail a risk in terms of investing. Another question is how to provide consistent assistance to Ukraine's start-ups as 51.1% of them have not received any support since the beginning of the war. [280]

[276] https://www.startupblink.com/startupecosystemreport2022.pdf
[277] The country at war: the voice of Ukrainians start-ups, page 8
https://drive.google.com/file/d/18kV886D29iQ3ENmS9Nell3AjFgzeBvoV/view
[278] https://techcrunch.com/2022/06/07/6-reasons-to-invest-in-startups-from-ukraine/
[279]
[280] The country at war: the voice of Ukrainians start-ups, page 19
https://drive.google.com/file/d/18kV886D29iQ3ENmS9Nell3AjFgzeBvoV/view

In additions to financing provide by the Ukrainian start-up fund and the EU, the $5 million Google will provide assistance to approximately 50 companies founded in Ukraine during 2022 withing the program Startups Ukraine Support Fund. In addition, each start-up will receive Google Cloud, as well as support from Google managers.[281] In the conditions of martial law, the Ukrainian Startup Fund, among other things, focuses on supporting innovative projects that meet the primary needs of the state. It is a new program of grant support for dual purpose projects to increase the country's defence capability and post-war reconstruction. During the month of operation of the new dual program, we have already received about 100 applications from start-ups to receive a grant, of which 43% are in the field of infrastructure reconstruction, 25% are in the field of defence. The rest of the applications are from the fields of education, cyber security and health care. All of them are currently being selected to receive a grant of up to $35,000 for their own project.[282]

The international representation of Ukrainian IT companies has become more active. In June 2023 Ukrainian tech ecosystem was time was represented at the Collision Conference in Canada that had over 35,000 visitors, 1,250+ start-ups and 800+ investors. The Ukrainian delegation had separate stand. [283]

Moreover, the Ministry of Digital Transformation has made possible the accession to the Digital Europe Programme on the 5th of September as a result of the signing by the European Commission of the respective agreement. The Programme opens Ukrainian businesses, organisations, and public administrations access to calls for financing with an overall budget of €7.5 billion for the 2021-2027 period.[284]

The ecosystem of the innovation and start-ups proved to be resilience but need lots of investments and more active multi-stakeholder cooperation, so that this domain during and after war contributes to the rebuilding efforts and priorities.

[281] https://www.campus.co/intl/uk_ua/europe/ukraine-support-fund/

[282] https://mind.ua/openmind/20245943-vizhiti-popri-vijnu-yak-ekosistema-startapiv-naroshchue-rezilentnist

[283] https://techukraine.org/2022/05/31/eight-ukrainian-startups-will-participate-at-collision-conference/

[284] https://digital-strategy.ec.europa.eu/en/news/solidarity-ukraine-digital-europe-programme-open-ukraine-access-calls-funding

3. Conclusions

This document has provided a framework to unravel digital development that includes three identified dimensions of digital transformation. It has provided information about Ukraine for each domain, based on the experiences and activities of the ITU and other stakeholders operating in the country and wider region. Moreover, the documents have traced the changes that have occurred in the ecosystem of digital transformation since the beginning of the war in Ukraine on the 24th of February 2022.

This report will serve as a reference for discussions on digital development at the country level as well as stocktaking of relevant activities, initiatives and projects and experiences developed by UN agencies involved in digital transformation work in Ukraine. In particular, it aims to provide the baseline study for strategic decisions on initiatives to be undertaken within the UN Transitional Framework and UN Sustainable Development Cooperation Framework (UNSDCF) for Ukraine, on digital and ICT development matters, to support the notion of a sustainable and resilient recovery through digital development. It will serve as a guide for future dialogue with country stakeholders and pave the way for increasingly fit-for-purpose engagements of the UN system in the country.