Republic of Moldova
Digital Development Country Profile

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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 innovation communities.

Various independent research projects have been carried out by the ITU, 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 country's capacity to digitally transform, and various components contributing to this process.

Digital development through digital transformation has become ever more important since the outbreak of the COVID-19 pandemic, and various UN agencies and other stakeholders have assisted countries 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 during times of lockdown has become clear priorities of all countries. The ability to leverage the progress made in the digital sphere has become an important factor in determining resilience during the COVID-19 crisis.

As the situation is developing into a new normal where "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 ICTs become increasingly important for the achievement of the Sustainable Development Goals by 2030.

1.2 Objective of the Report

The aim of the Digital Development Country Profiles series is to provide a comparative analysis for 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.

This report seeks to build a reference for discussions on digital development at country level in Moldova. 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.

1.3 Methodology

The research has identified a *five-building-blocks framework* that analyses digital transformation from a variety of perspectives, enabling an understanding of how the various dimensions of digital development interact at country level. Below is a summary of each building block and an elaboration of how the particular dimension fits in the overall digital development scenario of the country.

1) Meaningful connectivity as a foundation for digital development and transformation: 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 infrastructure and services that are available to all. ICT infrastructure needs to be evaluated based on several aspects critical to meaningful connectivity.

2) People-centric digital transformation: 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) Government-centric digital transformation: 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 not only in promoting the right strategies collaboratively across various entities but also in ensuring that public sector transformation becomes a catalyst for digital transformation in the wider economy.

4) Sector-centric digital transformation: Although the ICT sector is important in digital transformation, 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.

5) Digital-centric innovation ecosystem: Creating an enabling environment supporting digital innovation is essential to accelerate digital transformation in a country. The ability to digitally innovate domestically is also considered a sign of maturity which leverages all four dimensions 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. In addition, 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 5 perspectives of digital transformation.

2. Country Profile – Republic of Moldova

2.1 Building Block 1 – Meaningful connectivity as foundation for digital transformation

As stressed in the introduction, 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. Access to the next generation of infrastructure (fixed, mobile, wireless, satellite) at an affordable price is a key prerequisite for advancing sustainable development.

This section will provide a general overview of i) connectivity indicators for the Republic of Moldova, to position the country in a European and global context, and will then dive into ii) the market environment; iii) current trends in access, affordability and use; iv) latest developments in connectivity policy and regulation; v) 5G development; and vi) infrastructure cybersecurity.

2.1.1 General overview on connectivity indicators

During the last decade, the Republic of Moldova registered a significant increase in ICT usage and coverage with the rollout on the large scale of fixed and mobile broadband networks. As a result, in 2020, 100% of the country's population is covered by 3G and 99% with 4G/LTE.[1]

According to the National Regulatory Agency for Electronic Communications and Information Technology in Moldova (ANRCETI), fixed broadband access registered a dynamic growth of 7.2% in 2020 in terms of the number of final users compared to 2019, and reached over 719 000 users. Contrarily, the number of mobile internet users decreased by 0.4%, reaching 2 371 108 users.

The number of fixed broadband subscriptions per 100 inhabitants reached a share of 27,2% in 2020, with a 2.2 percentage point increase compared to 2019. The FTTx technology proved to be the most widely used and currently covers 72.3% of fixed broadband subscriptions, registering an increase of 4.9 percentage points. At the same time, xDSL technology ensures 19,2% of connections, the coaxial cable connections (DOCSIS) reach 8.2%, and the other technologies cover only 0.3% of connections.[2]

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

[2] ANRCETI Report "Anuar statistic dezvoltarea comunicaţiilor electronice în republica moldova, pentru anul 2020", pp. 4,30, retrieved from https://anrceti.md/files/filefield/Anuar%20statistic_2020.pdf

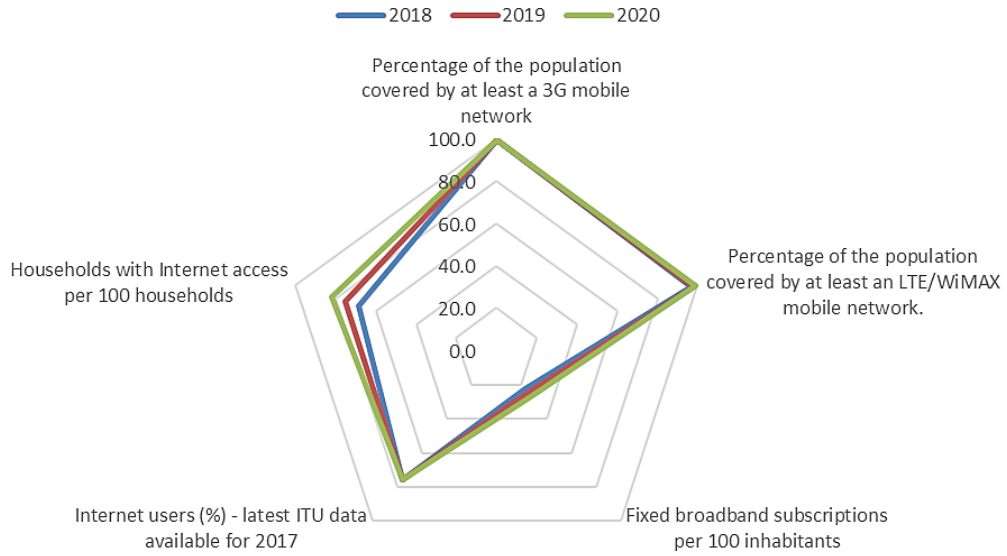
Concerning the mobile broadband market, the number of mobile broadband subscriptions per 100 inhabitants in 2020 was 89.8%, with a 1 percentage point increase compared to 2019. The total number of users accessing mobile Internet via 4G networks increased by 6.8% compared to the end of 2019 and amounted to over 1 600 000.[3] The traffic generated by mobile broadband users via smartphones increased by 47.2% in 2019 to about 52 452 TB[4] and followed the same trend in 2020, when it increased by 55.3% and reached 81 450 TB.[5]

Table 1 below summarizes a set of key telecom indicators for the Republic of Moldova for 2018, 2019, and 2020. Besides, the positive dynamics of basic ICT indicators' evolution is emphasized in the Figure 1.

Table 1. Evolution of Key Telecommunications & Internet Indicators in the Republic of Moldova

Key Indicator	2018	2019	2020
Fixed telephone subs per 100 inhabitants	40.6	40.0	38.9
Mobile cellular subs per 100 inhabitants	133.2	134.8	129.5
Active mobile broadband subs per 100 inhabitants	79.4	88.8	89.8
3G coverage (% of population)	99.8	99.9	99.9
LTE/WiMAX coverage (% of population)	97.0	98.0	99.0
Households with internet access per 100 households	68.5	75.0	81.7
Fix broadband subs per 100 inhabitants	22.8	25.0	27.2

Figure 1. The basic indicators of ICT-access and usage in Moldova



[3]ANRCETI Report "Anuar statistic dezvoltarea comunicaţiilor electronice în republica moldova, pentru anul 2020", pp. 4,34, retrieved from https://anrceti.md/files/filefield/Anuar%20statistic_2020.pdf

[4]ANRCETI Report "Anuar statistic dezvoltarea comunicaţiilor electronice în republica moldova, pentru anul 2019", p.4, retrieved from https://anrceti.md/files/filefield/Anuar%20statistic%202019_22aprilie_2020.pdf

[5] ANRCETI Report "Anuar statistic dezvoltarea comunicaţiilor electronice în republica moldova, pentru anul 2020", p.4, retrieved from https://anrceti.md/files/filefield/Anuar%20statistic_2020.pdf

2.1.2 Market environment

According to the ITU *Measuring Information Society Report 2018*, Moldova has a dynamic and competitive telecommunication market, which is characterized by high internet access speeds, high level of mobile services accessibility, and technological development. Telecommunication authorities try to apply best practices of market regulation in order to create a favourable environment for information society development while having minimum intervention from the government.[6]

Main public authorities concerned in this process are the Ministry of Economy and Infrastructure of the Republic of Moldova, which aims to develop and promote policies directed towards ensuring sustainable growth of the ICT sector, and the National Regulatory Agency for Electronic Communications and Information Technology in Moldova, which regulates the telecommunication market, ensures the implementation of strategies development and supervises the compliance with the sector legislation.

According to the revenue generated in 2020, the fixed broadband Internet market was covered mainly by three operators. In this segment, the biggest share belongs to "Moldtelecom" with 61.1%, which is followed by "Starnet Solutions" with 21%, and "Orange Moldova" with 7.5%. The total share of other fixed Internet access providers was 10.4%, with an increase of only 0.1 percentage points compared to 2019 data.[7]

The mobile broadband market is also divided between three providers. According to the revenue generated in 2020, “Orange Moldova” holds the biggest share of 62%, “Moldcell” has 30%, and “Moldtelecom” share is 8%.[8]

Based on the revenues registered in 2020, the electronic communications market reported a decrease of MDL 231,7 mil. (approx. EUR 10,9 million), which is -3.8% compared to 2019, and amounted to approximately MDL 6 billion (approx. EUR 282 million). This was caused by a decrease in sales in almost all the market segments, the only exceptions being fixed and mobile broadband access services. The sales revenue of fixed and mobile broadband services increased compared to 2019 by 1.7% and reached MDL 2.6 billion (approx. EUR 122 million). However, the highest revenue growth of 2.8% was recorded in the mobile broadband market.[9][10]

2.1.3 Meaningful connectivity in the regional context

Meaningful connectivity depends on a variety of factors. The most important are *availability* and *affordability*. These are also the strongest determinants of another factor of connectivity, *uptake*. Looking

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[6] ITU Measuring the Information Society Report 2018 - Volume 2, p. 127, retrieved from https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2018/MISR-2018-Vol-2-E.pdf

[7] ANRCETI Report “Anuar statistic dezvoltarea comunicaţiilor electronice în republica moldova, pentru anul 2020”, p.24, retrieved from https://anrceti.md/files/filefield/Anuar%20statistic_2020.pdf

[8] ANRCETI Report “Anuar statistic dezvoltarea comunicaţiilor electronice în republica moldova, pentru anul 2020”, p.26, retrieved from https://anrceti.md/files/filefield/Anuar%20statistic_2020.pdf

[9] Using the current exchange rate of the National Bank of Moldova of 21.2165 as of 20.06.2021, retrieved from https://www.bnm.md

[10] ANRCETI Report “Anuar statistic dezvoltarea comunicaţiilor electronice în republica moldova, pentru anul 2020”, pp. 5,23, retrieved from https://anrceti.md/files/filefield/Anuar%20statistic_2020.pdf

more in-depth at these three dimensions, the ITU report on Connectivity in 9 non-EU countries of Europe region, prepared in the context of the ITU Regional Forum for Europe on Meaningful Connectivity held on 8 and 9 March 2021,[11] shows that Moldova is relatively well positioned if compared to regional peers.

In terms of *availability of connectivity*, Moldova is performing well in all three indicators:

- Percentage of the population covered by at least an LTE/WiMAX mobile network: Moldova is the third (only preceded by Georgia and North Macedonia) among the 9 countries with 98% of the population covered by 4G/LTE services, up from 84% in 2015. The dramatic increase of 13 percentage points was registered in 2016 and followed by a 1 percentage point increase during the period 2016-2019.
- Estimated proportion of households with Internet access at home: according to the latest available data (2019), 60.8% of households in Moldova are connected to the Internet. Availability of Internet at home continues to prove an area of challenges even though the share of connected households increased by 11.7% compared to 2017.
- Number of fiber connections per 100 inhabitants: with a score of 11.1 FTTH subscriptions per 100 inhabitants in 2019, Moldova positioned itself slightly above the EU27 average of 8.7 for this year. FTTH subscriptions represent 67.2% of the fixed broadband subscriptions active in 2019.

Internet access in Moldova is relatively affordable. Due to the price drops registered over the past year the country managed to achieve the Broadband Commission's 2% target for mobile-data basket cost for the first time in 2020. Besides, Moldova was among the countries with the biggest improvements in the affordability of this fixed broadband Internet.[12]

According to most recent data, the data only mobile broadband basket cost was 0.48% of GNI per capita for a monthly allowance of 1.5 Gb, while the fixed-broadband basket cost was 2.25% of GNI per capita for a 5Gb Internet data cap.

Among 9 non-EU countries of the Europe region, Moldova is leading with its mobile-data broadband basket cost, while the fixed-broadband basket cost is slightly below the average. This is reflected as well in the international rankings, where the country shares 28th place with Sweden on the mobile-broadband basket affordability, and 71st place with Bosnia and Herzegovina on the fixed broadband basket cost.[13]

Finally, when it comes to *connectivity uptake*, Moldova is positioned in the middle in comparison to regional peers:

- Fixed broadband subscriptions per 100 inhabitants: Moldova has 16.5 subscriptions per 100 inhabitants compared to an EU-27 average of 34.3. During the last five years, it experienced

[11] https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Pages/Events/2021/MC/Default.aspx

[12] ITU Report "Measuring digital development ICT price trends", pp. 12, 24, retrieved from https://www.itu.int/en/ITU-D/Statistics/Pages/ICTprices/default.aspx

[13] ITU Report "Measuring digital development ICT price trends", pp. 66-77, retrieved from https://www.itu.int/en/ITU-D/Statistics/Pages/ICTprices/default.aspx

moderately slower annual growth with a CAGR of 6%. This rate is higher than the EU-27 average growth with a CAGR of 3.2%, but it falls behind in comparison with the 9 non-EU countries annual growth of an average of 8.7% each year from 2015 to 2019.

- Active mobile-broadband subscriptions per 100 inhabitants: the country has 58.9 subscriptions per 100 inhabitants compared to an EU-27 average of 108.8, which draws attention to the disparities that exist between European countries and Moldova.
- Estimated proportion of households with a computer: with 59.5% of households estimated to be in possession of a computer at home in 2019, Moldova is still far behind the EU-27 average of 80.5%. However, the country registered a positive trend related to this indicator justified by a 5.9% increase compared to 2017.

2.1.4 Connectivity policies and regulations

The ICT usage and coverage in the Republic of Moldova increased and spread at a high pace over the past decade. This is due to the strong government support to the sector development and its engagement in sector promotion through various strategies and regulations. Among them is the national strategy for information society development, "Digital Moldova 2020" and the Action Plan for 2013-2020.

The strategy was built upon 3 pillars covering the most important areas for the sector growth:

- Infrastructure and access;
- Digital content and electronic services;
- Capacities and usage.

The Strategy aimed to impact the ICT spread through the public, private, and business areas, and envisioned an advanced information society in Moldova by 2020. As a result of its implementation, citizens can now benefit from extended access to modern ICT infrastructure, rich digital content and an extended number of electronic services, as well as from tools and initiatives enhancing digital literacy and technological skills.[14]

In line with the Strategy objectives, the Broadband Development Program for the years 2018–2020 was approved and an action plan was adopted for its implementation. The program's overall objective was the development of broadband electronic communication networks which provide greater data transfer capacity. In order to promote the efficient management of radio spectrum resources and thus ensure the continued development of public broadband electronic communication networks and services, the Radio Spectrum Management Program for the years 2013–2020 was also created.[15]

[14]https://mei.gov.md/sites/default/files/raport_de_evaluare_moldova_digitala_2020.semnat.pdf?fbclid=IwAR3Ei7fhzkxuWCH9UotCqF3lQx_jUbBzgEwjYbUJkhRZDNKozwXNnEUnSxQ

[15] https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2020/Series%20of%20Webinars/20-00244_Status_digital_Agriculture-revFAOV4.0-MASTER-FILE-20-JUNE_REVIEW-FAO_PL_print%20(002).pdf

The Strategy was considered a great success with the 95% implementation of the planned actions. These developments raised the ICT sector as one of the engines of economic growth of the country.[16]

As a follow up to these efforts, the national development strategy "Moldova 2030"[17] was adopted by the Government in 2020 and awaits Parliament approval. It has 10 main objectives covering multiple economic and social issues. ICT plays a crosscutting role in supporting the positive change envisioned through the Strategy implementation. Among the objectives expected to be fulfilled by 2030 are:

- reaching the mobile-cellular subscriptions of 130%;
- achieving a mobile Internet penetration rate of 80%;
- increasing broadband access speed with 50% of Internet connections having at least 100 Mbps, and 45% with a least a speed between 30 – 100 Mbps;
- promoting the use of 5G connectivity for all the households across the country.

In 2020, another document that completed the country's legal framework was the Radio Spectrum Management Program for 2021-2025 which was developed with the support of ITU. It aims to ensure the necessary radio spectrum resources for the continued development of ICTs in the Republic of Moldova, and sets out recommendations for spectrum allocations over the next five years. While the document provides some clarity to market players on intended spectrum allocations, some issues remain unclear: 1) allocation dates are only provisional as the regulator is responsible for the organization of licensing process; 2) license obligations yet to be determined by the regulator; and 3) methodology of reserve prices setting is somewhat opaque.[18]

From a wider regulatory standpoint, the Republic of Moldova currently scores 91 in the ITU ICT Regulatory Tracker[19]. 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:

1. Regulatory authority (focusing on the functioning of the separate regulator): Moldova scores 19 out of 20;
2. Regulatory mandates (who regulates what): Moldova scores 18 out of 22;
3. Regulatory regime (what regulation exists in major areas): Moldova scores 28 out of 30;

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[16]https://mei.gov.md/sites/default/files/raport_de_evaluare_moldova_digitala_2020.semnat.pdf?fbclid=IwAR3Ei7fhzkxuWCH9UotCqF3lQx_jUbBzgEwjYbUJkhRZDNKozwXNnEUnSxQ

[17]https://gov.md/sites/default/files/document/attachments/intr40_12_0.pdf?fbclid=IwAR1SoaI1ikrvoFOXHcScUoEfh4Z3nJsyDPp0h5YzEdiHmk_roYR7BdFUjLE

[18] ITU Collaborative Regulation Case Study for the Republic of Moldova: The Journey to G5 Regulation and Digital Transformation, pp. 12-13, retrieved from https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2021/National%20Workshop%20for%20Moldova/Moldova_final%20draft_%28clean%29.pdf

[19] www.itu.int/net4/itu-d/irt/#/country-card/MKD

4. Competition framework for the ICT sector (level of competition in the main market segments): Moldova scores 26 out of 28.

Figure 2 - ICT Regulatory Tracker – Moldova

This benchmark positions Moldova among the group of countries with a *Fourth-Generation regulatory regime (G4)*, that is integrated and led by economic and social policy goals. As the gold standard is currently Fifth Generation (G5) of regulation, focused on collaboration among different stakeholders in the ICT sector and with other sectors of the economy, there is still room for improvement for the country.[20]

The fundamental shift to the G5 regulation will require Moldova to fine-tune the way regulation is developed and executed. In this context, the ITU report "Collaborative Regulation Case Study for the Republic of Moldova: The Journey to G5 Regulation and Digital Transformation" [21] provides future steps for consideration, grouped into two distinct categories: i) best practice principles of collaborative regulation targeted at improving regulatory maturity; and ii) best practice tools of collaborative regulation that can improve digital market outcomes.

In terms of best practice collaborative regulation principles to improve regulatory maturity, five aspects are envisioned, with recommendations for each of them being provided:

- Regulatory independence and regulatory accountability: function of appointing the Board of "ANRCETI" should be shifted from the Government to the Parliament. This will strengthen the independence and accountability of the regulator, putting it on the same level of accountability as that enjoyed by other national regulatory bodies. Besides, it is important to have another branch of the government reviewing the regulator's decisions in line with established principles of separation of powers.
- Regulatory predictability: putting in place an overarching strategy focused on the development of the digital economy as a whole, and reviewing the action plan process of ANRCETI could help the Republic of Moldova reach this objective.
- Proactivity: the possibility for ANRCETI to work directly with the Parliament on legislative initiatives could help streamline the process of legal framework improvement in a timely and consistent manner. It is also important to ensure the participation of all relevant parties from the initial stages of legal drafting and complement the existing formal collaboration mechanisms with

[20] https://news.itu.int/why-we-need-5th-generation-ict-regulation/

[21] ITU Collaborative Regulation Case Study for the Republic of Moldova: The Journey to G5 Regulation and Digital Transformation, retrieved from https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2021/National%20Workshop%20for%20Moldova/Moldova_final%20draft_%28clean%29.pdf

more flexibility and space for action. The active engagement of private sector players remains critically important in this regard.

- Collaborative governance: public hearings, high-level roundtables and expert workshops, hackathons, etc., could strengthen the collaborative culture among stakeholders and help deliver the expected results.
- Regulatory expertise and capacity building: strengthening the capacity of regulators and policymakers to understand, and be equipped to deal with the challenges emerging from digitalization is an essential part of the journey towards transformation. Regulatory expertise needs to be developed continuously to integrate new technologies, competencies and skills and allow for data and evidence-based decision-making.

When it comes to best practice collaborative regulation tools to improve digital market outcomes, two aspects should be taken into consideration:

- Future orientation of policy and regulatory frameworks: Moldova's digital competitiveness can significantly improve through the use of core collaborative regulation tools like pro-competition frameworks for digital transformation, regulatory incentives to innovate, robust and enforceable mechanisms for consumer protection in the digital age.
- Monitoring and evaluation framework and leadership over implementation: introducing appropriate monitoring and evaluation framework gains extra value and may be considered by the Government. From this perspective, establishing a single body with strong coordination powers which is equipped with the necessary tools, could be a guarantee of successful strategy implementation.

As resulted from this research, Moldova's efforts towards a collaborative regulation framework and implementation could benefit from more agile and inclusive mechanisms for collaboration and a new approach to digital markets uplift. In this way, the legal frameworks have to be accompanied by a holistic, whole-of-government approach to digitization and sustainable economic development as well as strong leadership in implementation. Also, the collaborative mindset should cut across all levels, sectors and institutions, and not only be limited to the ICT sector.

2.1.5 Next generation infrastructure: 5G Development

The National Development Strategy "Moldova 2030," states that a considerable increase of the access speed is expected due to the development of new access technologies and network revamping. The document also establishes the need to promote 5G availability at over 100 Mbps for any household in the country by 2030.

To reach those targets, the Radio Spectrum Management Program for the years 2021-2025 was approved in December 2020. The Program was developed in partnership with experts from ITU and the Korean Information Society Development Institute. It sets the preconditions for the 5G spectrum bands allocation and its implementation seeks to:

- Harness available radio spectrum resources;

- Continue the application of best practice with reference to the implementation of the EU's Multiannual Policy Program in the field of radio spectrum (Radio Spectrum Policy Program RSPP, Decision 243/2012 / EU of 14.03.2012);
- Provide the possibility of implementing 5G mobile broadband communications services, which offer citizens and industries the competitive advantages necessary for development in a favourable environment.

The targeted bands for the new 2021-2025 spectrum management program include 700 MHz, 3600 MHz, 26 GHz, and also 1500 MHz (L band) and 2300MHz. The program also targets available spectrum resources from the 450MHz, E900MHz, 2100MHz and 2600MHz bands. With the ongoing strategies on the spectrum use that will pave the way for 5G implementation, the government aims to:

- Ensure stakeholders have sufficient spectrum resources that will make it possible for 5G to deliver new applications and business cases;
- Implement new broadband technologies and services that increase the capacities of existing networks;
- Attract new investments in the information and communications technology sector of the economy;
- Increase the turnover of companies in the ICT sector;
- Increase income for the state budget from capitalizing radio spectrum allocations and new economic activities from mobile electronic communications services;
- Promote the development of other sectors of the economy as a result of modernization, continuous development of the radio communications infrastructure, and diversification of the offer for mobile electronic broadband communications services;
- Increase the accessibility of broadband mobile electronic communications services as a result of establishing a fair and efficient competitive environment on the mobile electronic communications services market;
- Improve the quality of services provided;
- Reduce the digital divide between rural and urban areas;
- Create new jobs and increase the average wage in the ICT sector.

The implementation and rollout of 5G will be done in two stages: I) From 2021 to 2022, the consolidation of the current networks with spectrum re-farming and consolidation of activities on the current bands and technologies; and II) from 2022 to 2025, the creation of an enabling environment for implementation of 5G networks.

This implementation plan is supported by mobile network operators (MNOs) and various test pilots have been initiated. In March 2019, Orange Moldova became the first operator to test 5G technology in the country. In April 2019, "Moldtelecom" displayed their preliminary work on 5G research and development to the public on a mobile truck lab at the Museum of Outdoor Technology of the Technical University of Moldova.

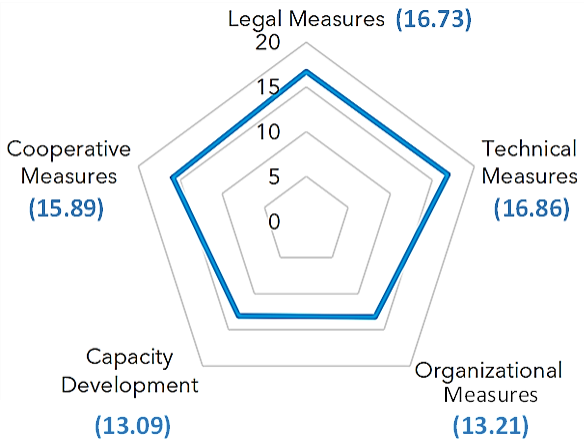
2.1.6 Increasing Infrastructure reliability through cybersecurity

According to the 2020 ITU Global Cybersecurity Index, Moldova ranks 33rd in the Europe region and 63rd 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.

The country's overall score is 75.78, which is close to the European region average of 80.7. The overall score is based on five main pillars which shape the inherent building blocks of a national cybersecurity culture, which are: legal measures, technical measures, organizational measures, capacity development, and cooperative measures.

Figure 3 – GCI 2020 Country profile



These individual scores highlight the technical measures as the country's relative strength area, as well as organizational measures and capacity development as areas of potential growth. [22]

With a vision to develop provide a safe information society, the country became a member of the Budapest Convention on cybercrime in 2009 and worked since then to address Internet safety and computer crime issues. As part of the efforts to create a comprehensive legal framework, the Government of the Republic of Moldova approved the National Strategy for Information Society Development "Digital Moldova 2020". One of its main objectives was "Enabling the conditions for greater security and trust in digital space". In order to implement this objective, the 2016-2020 National Cybersecurity Program was approved in 2015.

The Program was based on international best practices and implied harmonization with European legislations. It included seven areas of intervention as follows: safe processing, data storage and accessing, security and integrity of electronic communication networks and services, prevention capabilities and emergency response, preventing and combating cybercrime, strengthening cyber defence capabilities, education and awareness, and international cooperation.[23]

Among the Program implementation results are:

- Approval in 2017 of the Mandatory Cyber Security Requirements for the public authorities;
- Creation in 2020 of the Governmental CERT "CERT Gov" ;
- Creation in 2021 of the Military CERT.

[22] ITU Global Cybersecurity Index (GCI) 2020, pp.26,30,119, retrieved from https://www.itu.int/epublications/publication/global-cybersecurity-index-2020/en/

[23] ITU Global Cybersecurity Index (GCI) 2018, p.33, retrieved from https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-GCI.01-2018-PDF-E.pdf

However, after the program implementation, with 70% of objectives accomplished, a number of issues remained unsolved including: the lack of a national CERT, lack of qualified personnel and resources, and insufficient funds dedicated for cybersecurity.[24]

To further advance infrastructure reliability and cybersecurity resilience, Moldova approved the 2019-2024 Information Security Strategy and Action Plan. It aimed to establish the National CERT, transpose the NIS directive, ensure control and monitoring of the application of minimum cybersecurity requirements, define the national critical infrastructure and the measures needed to protect the critical infrastructure assets, as well as set the framework for counteracting hybrid threats.[25]

The country is increasingly improving its capabilities through collaboration with international organizations. In this context, ITU has been a strong supporter of the national efforts through engaging on the yearly basis in "The Moldova Cyber Week" events and capacity building initiatives. Among them was the first ALERT Cyber Drill 2017 event, which gathered Commonwealth of Independent States (CIS) and European Union (EU) representatives in regional exercise to test, develop and strengthen their cyber-protection skills in Moldova[26]

2.2 Building Block 2 – People - centric digital transformation

Addressing more in-depth the usage of ICTs by people and various groups of society allows a more comprehensive framing of the digital divide and identification of gaps that may require policy intervention to ensure that access to digital services is truly for all. This requires examining multiple dimensions of digital inclusion, including (i) digital skills development, (ii) gender issues, (iii) ICT accessibility for persons with disabilities, and (iv) child online protection.

2.2.1 Digital skills development

ICT is a digital tool that seeks to be integrated into all levels of learning across Moldova. This is one of the strategies towards improving the learners in three different ways including literacy, skills development, and comprehension. Notably, learners will use ICT as a resource to access important information that enriches their understanding hence enabling them to perform better like other OECD countries. It is important to mention that ICT will ensure that there are fewer dropouts from schools since information and classes can be available with convenience by the tutors. The educators are also expected to use ICT to enrich their teaching skills translating to better academic outcomes within these schools.[27]

The country has 18 higher educational institutions that offer IT-related studies or services. Nonetheless, the teaching methods are often focused on theory rather than practical implementation. According to a

[24] https://mei.gov.md/sites/default/files/raport_evaluare_hg_811_2015_-_07.06.2021.pdf?fbclid=IwAR0G_LNOwq6jLVlODmyZmB-JbEE-3XY35kKrnhusDWEgysrOOjy6BHfSaS8

[25] https://mei.gov.md/sites/default/files/strategia_securitatii_informationale_a_republicii_moldova_pentru_anii_2019-2024.pdf?fbclid=IwAR3tOv9ZAr1FNvUFlRUZKHCpcIdeO6cgVOgFmMDUcUK_h9K-I0_Ol_LmPv8

[26] https://www.itu.int/en/ITU-D/Cybersecurity/Pages/Moldova_cyberdrill_2017.aspx

[27] ITU Report on Connectivity in Education: Status and recent developments in 9 non-EU countries, p.55, retrieved from https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2021/Meaningful%20Connectivity/%28draft%29%20Connectivity%20in%20Education_nonEU%20countries_profiles_living%20document.pdf

study by the World Bank, "ICT professionals complained that teaching materials were too theoretical during the first two years of university. They criticized the curriculum and courses as not being related to the ICT profession, that there was a lack of optional courses, that the laboratories were usually outdated, poorly equipped and with bad Internet connections, and that teachers lacked practical experience and were usually not well trained.".

Among the drawbacks is the fact that Moldova's policy restrictions limit the potential for improved industry-academia collaboration. For example, IT industry professionals are not formally allowed to teach at universities (even part-time) unless they have advanced degrees and pedagogical certification.[28]

The fact that traditional curricula lack an emphasis on information technology often results in a decline in the popularity of STEM courses in schools and fewer students studying STEM at university. To improve this situation, legislative reforms were undertaken in line with two strategies:

- "Education Development Strategy 2014-2020" (Education 2020), which was the main policy guiding education in the country and had a strong alignment with other relevant documents. One of the strategic objectives aimed to "Ensure the effective integration of ICT in education through providing educational institutions with modern equipment, developing digital literacy, and increasing the efficiency of school management through information technology."
- National Strategy for the Development of the Information Society "Digital Moldova 2020", in accordance with the Action Plan, provides for "Strengthening ICT capacity- a high degree of use of benefits offered by them to all members of society" with a third pillar dedicated to capacities and usage. Its objective was to increase digital literacy, develop digital skills and ensure digital inclusion. It addressed two education-related strategic directions such as the Digital education program in compulsory general education and "Digital skills for all" lifelong learning and digital inclusion program. It includes strategic directions with reference to education, such as the Program Digital Education in Compulsory General Education and the Digital Continuing Education and Inclusion Program "Digital Skills for all", which represents the orientation of the education system towards the formation and development of digital skills and leads to the large-scale integration of technologies information in the educational system.

There are other framework documents and single support programs such as Digital Education for K12 (introduced in primary education). During that period, the MECC made public 42 manuals in digital format, intended 10th and 12th grades. Towards the end of 2017, 112 education institutions were equipped with ICT means and provided with robotics kits, and over 500 teachers were trained in teaching robotics in schools. The Curriculum for the discipline "Informatics" on educational levels including for grades 2-4, grades 5-6, grades 7-9, grades 10-12, optional ICT curriculum, as well and the optional subject "Robotics" was elaborated.

[28] ITU-UN Women "Digitally empowered Generation Equality: Women, girls and ICT in the context of COVID-19 in selected Western Balkan and Eastern Partnership countries", pp.17-18, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en

In 2017, the program of the ICT Centre of Excellence "Tekwill" was launched. “Tekwill in Every School” is complementing the school program and providing extracurricular ICT related classes piloted from 2020 in 77 schools. This is a complex program of online extra-curricular courses (initially covering only IT subjects), which aims to develop children's skills to be better prepared for tomorrow's professions. The initiative provides for the development of more free content on priority areas accessible to all general secondary education institutions in the Republic of Moldova. It includes several digital and innovative educational courses and resources, dedicated to students aged 13-19 and teachers. Thus, "Tekwill in every school" aims to transform education in the Republic of Moldova, both by developing interactive digital content and by introducing new methodologies in the teaching and learning process of educational institutions: blended learning and the flipped classroom. The courses will be available to be studied both independently and guided by a teacher in the classroom, by introducing them in educational institutions as optional subjects. With the help of the courses offered, students will have the opportunity to cultivate critical thinking, develop their creativity and improve their interpersonal communication skills. The creation of the courses was made possible by mobilizing the financial efforts of the private sector and citizens of the country and diaspora (within the crowdfunding campaign “TwentyTu”, conducted in 2018), as well as external development partners - UNDP Moldova, USAID, Sweden. The project also enjoys the support of the Ministry of Education, Culture and Research, based on the partnership being the Memorandum of Understanding signed on June 14, 2018. On July 1, 2020, the National Digital Literacy Program for Teachers was launched.

The digital educational content management systems or platforms were integrated in most of the higher education institutions in order to diversify and facilitate learning processes. Moodle platform is the most popular one being used by 79% of local institutions (19 out of 24). About 720 academics were involved in the development and implementation of course units with digital education contents including fully or partially online courses, seminars, webinars, teleconferences, quizzes and tests, individual work, computer-based self-assessment, etc., conducted in a traditional or virtual learning environment [29]

Also, in 2019, the “Future Classroom Lab” was launched. It offers an open and flexible training space, where teachers can experiment with teaching-learning scenarios, using both digital technologies with transformative impact (programming, robotics, Internet of Things) and state-of-the-art equipment. [30] Within this Centre, the National Digital Literacy Program for teachers was held between July-September 2020. The training was held on three levels of complexity of digital literacy. As a result of it, over 20000 teachers were trained, and 1200 educational institutions were connected to GSuite for education.[31]

These positive developments were possible due to the active engagement of ecosystem stakeholders whose commitment was reinforced during the COVID-19 crisis. As a result, conditions were created to

[29] https://mei.gov.md/sites/default/files/raport_de_evaluare_moldova_digitala_2020.semnat.pdf, p.30

[30] https://mei.gov.md/sites/default/files/raport_de_evaluare_moldova_digitala_2020.semnat.pdf, p.29

[31] www.clasaviitorului.md%2Fscopul-acestuia-este-sa-asigure-dezvoltarea-competentelor-digitale-a-cadrelor-didactice-din-invatamantul-general-pentru-a-le-oferi-acestora-noi-oportunitati-de-dezvoltare-profesionala-precum-si-a-asig%2F%3Ffbclid%3DIwAR2ddFNikGCmsSgApUKaYMBRu-EnLWg7JVPAwHOLTkJH3w_ITzrZ-URIPTk&h=AT1VPm9kS75dyliI4ujbORX3xCDLt8nnPA0duQV9iOmxzpkvJyjHJx_tSITrw3fAtV31sZRFzj5uXDRhWXJnHx2LvnVemV7L5lQ92XcquzZY80yAkd4zuLsf7Z33WYiN6Vencg

overcome the pandemic by launching several resources such as "Studii.md", "Education Online" and "Învat.Online". These online or hybrid platforms are expected to continue bringing value long after the COVID-19 recovery.

2.2.2 Bridging the gendered digital divide – Women and girls in the ICT and STEM sectors

Women's access to ICT

In Moldova, women and girls account for 31% of jobs in the ICT sector but only 19% of digital professions. Only 4.6% of girls studying in higher education choose STEM (Science, Technologies, Engineering and Mathematics). As a result, women get jobs with a lower level of qualification and remuneration in the information and communication technologies sector (ICT). Their salaries in this sector are 33% lower than the salaries of men.

Additionally, access to ICT and the Internet is also not equal. The share of households led by women who have a computer and the Internet access is 11.7% lower than the households led by men. With time, the access to computers and the Internet of households led by men grows faster than of households led by women. [32]

Women's participation and leadership in ICT

In the economy, women entrepreneurs represent about 34% of the labour market, 31% of them are entrepreneurs. In the ICT sector, only 19% are women, 20% of them are digital professionals.

Figure 4 – Share of men and women holding management roles

Out of the total number of women entrepreneurs in Moldova, 67% run companies in the field of Information Technology. This is more than men entrepreneurs' where the share is 56%. However, at the management levels, women are significantly lacking for SMEs, MEs, and large firms.

In recent years, in the ICT sector, the number of women-owned businesses is growing faster than those of men, which contributes to the reduction of gender disparities. Between 2015 and 2017 the number of enterprises in the ICT sector run by women increased by 28%, while those run by men increased by about 24%. This is a positive trend that can contribute to reducing gender inequalities.[33]

Women in ICT education

Moldova has strong university programs with specializations in IT and related sciences and almost 18 educational institutions offer studies in IT-related fields. The ministry of education is working to upgrade

[32] 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.68, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en
[33] https://www.itu.int/en/ITU-D/Conferences/WTDC/WTDC21/NoW/Pages/Events/Regional/Europe/2021_01.aspx

the ICT curricula and infrastructure in schools, and seeks to develop human capital. The total number of graduates in ICT-related fields (about 6,500 annually), is also higher as a share of graduates compared with regional peers, such as Bulgaria, Hungary, or Romania.

However, women are significantly underrepresented in ICT education and vocational education and training (VET) as well as in tertiary education. In 2018, they represented only 15.5% of total graduate students compared to 84.4% for men. Traditionally, women tend to engage more with studies in education or biological sciences.[34]

Often the reasons given are perceived cultural biases. Almost one third of female secondary school students who liked computer science in school believed that programming is "not an appropriate domain for girls". In rural areas, that perception is even higher, with 39%.[35]

ITU's Girls in ICT initiative has been tackling these issues for more than a decade now.[36] This initiative is actively promoted every year by various stakeholders including government, academia, and ICT associations. Other initiatives like GirlsGoIT are also championed by local stakeholders.[37]

Dark Side of ICT & Cyber Violence

Moldova has made a commitment to ensure gender equality. The national authorities have taken a series of actions to that end, including ratifying international conventions and adopting national plans and strategies.

Patriarchal attitudes and deeply rooted stereotypes persist regarding the roles and responsibilities of men and women in family and society. Such attitudes and stereotypes are the core drivers behind women's disadvantage in political and public life, violence against women and gender segregation, as reflected in the educational and employment choices of women and girls.[38]

Good practices in informal ICT education

GirlsGoIT Program was established in March 2015. Over five years, 543 girls have received training in software development, engineering and electronics through boot camps, summer camps and other educational activities, including internships in IT companies. This led to the establishment of girls-led local clubs in 13 regions in Moldova and GirlsGoIT Chisinau is one of them. Their mission is to prepare girls for STEM studies and the ICT labour market through internships with ICT companies. TEKEDU is the founding partner of GirlsGoIT program, implemented jointly to support Moldova's National Agenda

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[34] 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.70, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en

[35] 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

36 https://www.itu.int/net4/ITU-D/CDS/gq/GICT2021/display.asp?ProjectID=1374&Quest=58112

[37] 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

[38] 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.71, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en

on Gender Equality, Quality Education and support Decent Jobs and Employment for Women and Girls to lead in Moldova ICT labour Market. [39]

Another initiative to get more girls and women to STEM education is the "Empowering Women in ICT Skills". Implemented by the National Association of ICT Companies, with the support of UN Women Moldova and financial support of the Swedish Government, it aims to encourage Moldovan girls and women to join IT courses.[40] In 2019, this initiative reached the following milestones:

- 500 women finalized the course on FrontEnd Development, 200 participated in boot camps, 20 women have been employed in IT companies (Edition 1);
- 8 Orientation sessions for girls from all around the country, with 600 girls informed about IT professions and opportunities to study IT;
- Promo-campaign about successful women in IT with 5 success stories distributed in media;
- Tech Women Summit with the participation of over 300 girls and women;
- Over 1000 women registered for 2nd edition of National IT Program for girls and women (Front End Development, Software Tester, Digital Skills);
- Over 30 (out of 50) girls and women, who got IT scholarships (Java, SQL, Cisco) followed an internship program, found a job in IT or have been promoted due to improved skills.[41]

Tekwill ICT Excellence centre also recognized the need to address the role of women in ICT and to encourage them to engage more actively, as they represent a under-exploited source of vital talent for the sector.

Apart from the gender specific informal training programs, there are several other programs championing women in tech such as Step IT Academy and Academy+ Moldova, and ArtCOR. [42]

2.2.3 Digital inclusion and ICT accessibility for persons with disabilities

Moldova ratified the Convention on the Rights of Persons with Disabilities (UN CRPD) in September 2010, however, it has not ratified or acceded to the Optional Protocol to the UNCRPD.[43] The UNCRPD stipulates (Article 9 - Accessibility) that countries should ensure equal access of persons with disabilities to the physical environment, transportation, information and communications (ICTs), including information and communications technologies and systems. In May 2017, the Committee on the Rights of Persons with Disabilities provided its concluding observations of the situation in Moldova, based on the Initial State Report submitted by the Government of Moldova. While the Committee commended the country's adoption of legislation on equality and social inclusion of persons with disabilities, the Committee is

[39] 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.22, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en

[40] 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.70, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en

[41] https://ict.md/projects/un-women/

[42] 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.70, retrieved from http://handle.itu.int/11.1002/pub/818d024e-en

[43] ITU report on "ICT accessibility assessment for the Europe region", pp.70,72, retrieved from http://handle.itu.int/11.1002/pub/8182b00a-en

concerned by the overall lack of accessibility for persons with disabilities. Hence, the Committee included the following recommendations:

- Take all measures to ensure the implementation of legal guarantees to accessibility in all areas, including urbanism, construction and public services;
- Ensure that the sanctions for non-compliance are developed and enforced for all areas of accessibility;
- Adopt a time-bound accessibility plan of action and ensure its implementation and monitoring, in close consultation with persons with disabilities through their representative organizations;
- Pay attention to the link between article 9 of the Convention and Goal 9 and targets 11.2 and 11.7 of the Sustainable Development Goals.

Moldova has achieved several key milestones in building a legislative framework for digital inclusion and ICT accessibility. The Law on Social Inclusion no. 60/2012 establishes general provisions on accessibility for persons with disabilities, including access to information.[44] The country has also adopted the National Program for Social Inclusion of Persons with Disabilities for the years 2017-2022. One of its objectives is "ensuring accessibility to infrastructure, transport, information and communications for people with disabilities".[45] The legislations also establish the country's adherence to European and International standards such as The Code on Audio-visual Media Services no. 174/2018, which conform to the European Union Directive on Audio-visual Media Services. Additionally, the Government Decision on the official pages of public administration authorities on the Internet no. 188/2012 (in force from 2018), which specifies compatibility requirements to public authorities' websites should be built in accordance with the Web Accessibility Initiative (WAI) guidelines.

While the government has established a robust regulatory framework on the provision of accessible information and communication, implementation framework in the following aspects could benefit from further improvement in Moldova: promote the design, development, production and distribution of accessible ICTs and ICT systems at an early stage; promote the universal design of ICT products and services to be usable by all people; facilitate and promote the engagement and participation of persons with disabilities; promote the adoption of ICT accessibility in education, including role-based ICT accessibility training courses for education institution staffs; and establish financial schemes to support the provision of accessible information and communications, as well as of ICT products and services, for persons with disabilities.[46]

ITU is committed to advancing 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

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[44] Article 25 stipulates general provision for accessible information for persons with disabilities, including recognizing and promotingthe use of sign languages, accessibility of information and media (as well as information technologies and electronic communications), accessible form of publication and education materials, accessibility requirements for public website and procurements of equipment and information support.

[45] Government of Moldova report to the UN CRPD (2020), p. 14, retrieved from https://tbinternet.ohchr.org/_layouts/15/treatybodyexternal/Download.aspx?symbolno=CRPD%2fC%2fMDA%2f2-3&Lang=en

[46] Based on the country's input to the ITU "ICT Accessibility Survey for Europe Region", data collected in Q4 2020.

ensuring accessible ICTs for persons with disabilities should be established in all countries by 2023.[47] The 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;
- Regional Competition: Innovative Digital Solutions for Accessible Europe;
- ICT Accessibility Assessment for Europe Region;
- Technical Assessment in Enhancing ICTs Accessibility at a country level - Example of Serbia;
- Capacity building in ICT Accessibility.

2.2.4 Building trust and confidence in the use of ICTs for children and youth

Moldova ratified the Lanzarote Convention on the Protection of Children against Sexual Exploitation and Sexual Abuse in March 2012, but the national legal framework has not yet been fully updated to reflect its provisions. However, the country interventions are based on a comprehensive approach to child protection derived from the standards set out in the Lanzarote Convention. They focus on two main pillars: online risk prevention and child protection.

Following the same trend, Moldova is advancing on tackling the issue of child protection in the online environment but the coordinated approach is still missing.

Looking to address this challenge, the Government of the Republic of Moldova adopted an Action plan on promoting the safety of children and adolescents on the Internet for the years 2017-2020. This Action Plan aimed to promote the safety of children online which involved a diverse spectrum of public authorities and institutions.[48] The document was approved in 2017 in the context of the media coverage of an online game dangerous for children, which has upset the public opinion and the whole child protection system, the legal system and the education system, signalling the need for urgent measures and strengthened to prevent similar situations.[49]

The Action plan aimed to reduce illegal content on the Internet, promote a safer digital environment for children and adolescents, raise awareness and inform the parties in direct contact with children about the risks of the online environment, make recommendations on safe Internet browsing, develop statistics and promote research on the online safety of children and adolescents.[50]

The Action plan laid the groundwork for the first joint efforts to protect children from online dangers as prior to it several parallel and fragmented efforts were undertaken by public authorities. These efforts

[47] ITU Strategic Goal 2 – Inclusiveness, Target 2.9.

[48] ITU Report "Status of national child online protection ecosystems in South Eastern Europe", p.25, retrieved from http://handle.itu.int/11.1002/pub/815a8b6c-en

[49] https://vocea.md/balena-albastra-jocul-care-indeamna-copiii-la-suicide/?fbclid=IwAR1XNjMhbmF1eZMHiVSWdEoAc-q-KGTwXuM2esjZhWommeYsnxfjnYtLdXg

[50] https://gov.md/en/content/cabinet-approves-action-plan-promoting-internet-safety-children-and-teenagers

included the “Digital Moldova 2020” Strategy and the National Cyber Security Program that touched upon this issue.

The National Cyber Security Program of the Republic of Moldova for the years 2016-2020 and Action Plan on its implementation covered the crime of child pornography in the category of cybercrime, referring in this regard to the provisions of the Council of Europe Convention on Cybercrime, adopted in Budapest on 23 November 2001. Besides, one of the program priorities establishes the “Adjustment of national legislation to the provisions of the Council of Europe Convention for the Protection of Children against Sexual Exploitation and Abuse and of the Additional Protocol to the Convention (Lanzarote, October 25, 2007)”.[51]

Moreover, the Information Security Strategy of the Republic of Moldova for 2019-2024 and the Action Plan for its implementation pointed out a series of barriers and regulatory gaps in the field of preventing and combating cybercrime. Among its objectives is the "Protection of children from any form of abuse in the online space". For this purpose, the work is being done for combating the phenomena of child pornography and sexual harassment of children through the Internet, as well as promoting a safer Internet for children through online counsellors and encouraging reporting through specialized information projects.[52]

These policy documents governing actions to promote online child safety have a rather complex approach with actions planned in different areas of competence. However, each of the policy documents has its own coordination mechanism and they are not interconnected. There is no single entity in charge of coordinating all online child safety efforts, which makes the monitoring and evaluation process inefficient.

Besides, some mechanisms for reporting illegal online content are missing and the only web platform for advice and information about online safety currently available, www.siguronline.md, is managed by a non-governmental organization „La Strada”.

In order to change this negative trend, multiple activities are held in order to inform children, their parents and teachers about the dangers and available means of talking the online safety issues. One example of awareness-raising events is the Safer Internet Day in Moldova which is organized on the yearly basis since 2004. Since then, multiple government authorities, donors, academia, NGOs and ICT companies were supporting this initiative.

In 2019, the International Centre "La Strada" has become the official national representative of the SID initiative, and was accepted as a SID Committee in the Republic of Moldova.[53] In that year, on Safer Internet Day, La Strada launched a contest for teachers to encourage them to conduct creative activities with children and young people about safety online. During the whole month, teachers conducted

[51] https://mei.gov.md/ro/content/securitate-cibernetica
[52] https://www.legis.md/cautare/getResults?doc_id=111979&lang=ro
[53] http://lastrada.md/eng/articles/we-have-become-the-national-sid-safer-internet-day-committee-184

informational activities for more than 2 000 children from 17 schools from around the country. In 2017, La Strada also published the National Study on Children's Behaviour online.

The Guide for Parents was developed and presented during a workshop that aimed to empower parents to better understand their child's behaviour on social networks and encourage them to support their child's safe experience online.

The "Intersection" program, implemented by the La Strada, created the community of teachers in child online protection, with representatives of more than 60 educational institutions throughout the Republic of Moldova. With the support of community teachers in 2019, activities were carried out for more than 2000 children and adolescents across the country.

In 2019, IREX Europe organized Multimedia Connector for Youth. This was a combination of exercises and presentations, workshops and projections on civic activism and citizen journalism, media education and online safety for 160 young people from across Moldova.[54]

Besides, 12 educational video materials on 6 topics produced in two languages (Romanian and Russian) are currently being developed by „La Strada" with the support of UNICEF. These 15-minute video lessons designed in an attractive and child-friendly format will help raise awareness of children of different ages.

In 2020, the online counselling service "www.siguronline.md" recorded a total of 2863 enquiries from children and adults who received support in child online safety issues. This number of inquiries is 5 times higher compared to 2019.[55]

Meanwhile, the alarming statistics is still featuring the urgent need for intensifying the measures to ensure online child safety. Said-statistics show that between 2014 and 2018, the number of blocked URLs with material representing sexual abuse of children tripled from 31 226 to 105047. In 2019 were recorded 10516 materials of CSAM from Moldova and 49 criminal cases referring to sexual abuse of sexual exploitation online of minors were recorded by the police.[56]

Through its Child Online Protection (COP) Guidelines, ITU is supporting 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.[57]

For smooth implementation of the ITU COP Guidelines, the following strategic and operational recommendations are provided:

- As several public policy documents that regulated child online protection expired, it becomes imperative to plan actions in order to continue efforts in the field.

[54] ITU Report "Status of national child online protection ecosystems in South Eastern Europe", p.23
[55] https://mei.gov.md/sites/default/files/raport_de_evaluare_moldova_digitala_2020.semnat.pdf, pp.16-17
[56] The strategic review of the SAFETY CHILDREN ONLINE Public policy analysis, pp. 4,6
[57] https://www.itu-cop-guidelines.com/

- In the process of developing online child safety policies, it is necessary to involve the representatives of all public authorities and institutions concerned in the elaboration of the policies in the field. This will provide stakeholders with the same level of understanding of the subject and make them willing to assume responsibility through participation.
- For the next cycle of policies, it is necessary to establish an appropriate inter-institutional coordination mechanism in the field of child protection against online risks, but also to ensure policy coherence between different planned measures/actions in policy documents.
- In the process of developing online child safety policies, it is important to adopt internationally recommended models of public policies, and take into account the international commitments made by signing international treaties. This will include ensuring a comprehensive and appropriate approach based on international recommendations of the Lanzarote Convention and Budapest Convention, as well as updating the partnership and commitments with "WeProtect" by signing the new Recommended Policy Model for preventing and combating online sexual abuse and exploitation.
- Government authorities should empower children and develop their resilience to online abuse by reviewing the school curriculum and educational policies, integrating the safety of children online in the programs of continuous professional training of teachers, and implementing parenting skills development programs that take into account the benefits and risks associated with the use of ICT.
- Justice system response to the sexual abuse and sexual exploitation of children online shall be improved by maintaining the specialization of the structures within the prosecutor's office and the police bodies responsible for investigating and carrying out criminal prosecutions in cases of online sexual abuse and exploitation.
- The capacity of the law enforcement entities should be strengthened by developing guidelines on conducting criminal investigation and prosecution of crimes involving sexual abuse and sexual exploitation online and training them in this field particularly focusing on the interests of the child in criminal proceedings.
- Professional training of specialists in contact with the child must be provided through vocational training of specialists in the child protection system, developing the capacities of professionals in contact with children, developing institutional policies to promote online safety and instructions for specialists in the child protection system and the education system on identifying and reporting cases of online sexual abuse of children to the police.[58]

2.3 Building block 3 – Government - centric digital transformation

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.

[58] The strategic review of the SAFETY CHILDREN ONLINE Public policy analysis, pp.14-15

This section will look at (i) the general approach to e-government in Moldova and (ii) an example of the specific approach used with regards to the use of ICTs in the education system from an administrative and service delivery perspective.

2.3.1 E-government policy

Moldova was already pioneering the Government's digital transformation when countries in the region were at the first stages of considering it. Yet, the 2020 e-Government Development Index[59] ranks the country 79th globally, which is 10 positions lower than in 2018. This evolution highlighted the slow rate of current e-government development in comparison with other countries.

Even though the e-Government process in the Republic of Moldova was launched in 2006 with the approval of the e-Governance Concept, the implementation of it was on the pilot and experimental stage until 2010. In that year, the e-Government Centre was created and the e-Government transformation project for 2011-2016 came to support it.

The Strategic Program for Technological Modernization of Government for 2011-2016 approved by the Government in 2011 set the framework for the future e-transformation process and put in place most of the critical elements of the system as: e-Transformation subdivisions in all central public administration authorities, the Government Data Portal "date.gov.md" (2011), a one-stop shop for all the public services "servicii.gov.md" (2012), digital mobile signature (2012), M-Cloud (2012), a national authentication system for accessing public electronic services "MPass" (2013), government service for electronic payments "MPay" (2013), government service for digital signature "MSign" (2013), "e-Visa" (2014), and the government interoperability platform "MConnect" (2014).

The e-Governance infrastructure implemented within this strategic program boosted the public administration reform and changed the way public services are delivered. This process was guided by the National Program for Modernization of Public Services for 2014-2016 and the National Action Plan on reform of modernization of public services 2017-2021.

In 2018, the Government with the support of the World Bank Group approved the project for modernization of government services 2018-2023. It will contribute to the elimination of outdated public services and ensure the consolidation of several services in order to increase their quality in line with citizens' expectations. At the same time, access to public services at the local level is expected to be facilitated through digital channel improvement, reduction of the number of mandatory documents, as well as minimizing the duration of public service delivery.

All these projects and initiatives led by the government and supported by international donors resulted in a well-developed e-government national infrastructure. As the global rankings suggest, it still requires improvement but it already provides citizens with a wide range of services. In such a way, the national eServices portal "servicii.gov.md" currently offers Single-Sign-On access to 178 e-services and information on 649 administrative services. All the datacentres from the public authorities are migrating to MCloud.

[59] https://publicadministration.un.org/egovkb/en-us/Data-Center

The open data platform "date.gov.md" offers access to 10884 resources. The payment system MPay integrates 86 administrative public services and has registered until now about 20 mln. transactions. The government data exchange platform "MConnect" connects 71 entities, 45 of which are the public authorities.

Additionally, in 2020 the Citizens Government Portal was launched, consisting of a set of interconnected information resources and technologies, designed to provide citizens with an efficient and modern mechanism for obtaining official information about themselves. The information is obtained from the registers and information systems of data providers and delivered through a single access point or a virtual cabinet referred to as "MCabinet".[60]

2.3.2 ICTs and the education system

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

The newly ITU-UNICEF report on "Connectivity in Education: Status and recent developments in 9-non-EU countries of Europe region" published in October 2021[61] looks at the two dimensions of ICTs for e-governance of education and ICTs as a medium for delivering remote education. Moreover, it concludes that school connectivity is widely recognized as a means to a more efficient administration of educational systems, a more innovative way of distributing education content, and, most importantly, a fundamental prerequisite to endow pupils with the digital skills necessary to thrive in the job market.

In this context, the Moldovan government recognizes that student familiarization with ICTs is limited by an insufficient provision of computers and their use at a later age. According to data from Moldova's National Bureau of Statistics, schools around the country are endowed with about 32,501 computers, out of which 28,500 are used for teaching purposes. Although the equipment level of general educational institutions rose during the time, the lack of efficient management, maintenance and budgeting for computer labs also became a challenge.[62]

The strategy "Education 2020" highlights the inefficient management of the school network. This diminishes the efficiency of investments in the upgrading of institutions and limits the provision of necessary equipment. Therefore, the government is currently reforming to improve the planning and management of the network of educational institutions by implementing an educational Management Information System, comprising of a register of schools, pupils and teachers based on the school census, as well as regular and accurate collections of data in schools.

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[60] https://egov.md/ro/transparency/reports/sumar-executiv-al-raportului-privind-implementarea-planului-de-actiuni-pentru?fbclid=IwAR2pPX6frZUQ5DWsPjKai5TBR0v8uU2ra5piNj9SraBrNVwchzA5GgPe_Ic

[61] ITU-UNICEF report on "Connectivity in Education: Status and recent developments in 9-non-EU countries of Europe region", retrieved from https://www.itu.int/pub/D-PHCB-CONN_EDUC-2021

[62] ITU-UNICEF report on "Connectivity in Education: Status and recent developments in 9-non-EU countries of Europe region", p.56, retrieved from https://www.itu.int/pub/D-PHCB-CONN_EDUC-2021

Nevertheless, aiming to increase access to information and create better conditions for education, in 2013, the Government provided 1,200 computers, 220 printers, 50 multipliers and free Internet for schools across the country and in 2020 launched a nation-wide campaign titled 'Donate Computer for Education' as part of its goal to help digitize Moldova's education system.[63]

Currently, the Education Development Strategy "Education 2030" and its Action Plan is being developed in line with the National Strategy "Moldova 2030". It aims to establish a National Education System capable of providing high quality, inclusive and equitable education to all children, students and adults throughout life, at all levels of education, and in various contexts. One of its strategic objectives highlights the role of digitization in relation to the quality and viability of the education system. It reinforces the value of ICT in ensuring a high quality and sustainability of the education. Targets to be achieved by 2030 in this regard are:

- Reaching a share of 80% of all education institutions provided with the necessary hardware and software;
- Creating mechanisms and proper conditions for the development and use of educational software at all levels of the education system;
- Ensuring proper environment for online education in order to strengthen its efficiency;
- Providing access for students to various learning resources, curricular content, virtual learning spaces, devices, applications, tools, fast and reliable internet connectivity, and other teaching-learning services that best suit their needs.
- Upgrading the educational processes for harnessing modern technologies and innovations.[64]

Meanwhile, as part of the "Digital Moldova 2020" Strategy implementation, the donors joined forces in providing educational institutions with equipment and managed to achieve the following outcomes:

- 11 educational institutions were provided with robotics equipment, digital laboratories and digital manufacturing equipment (3D printers);
- 29 institutions were provided with multimedia classrooms;
- 10 institutions equipped with computing technology within the rural digital inclusion project;
- 6 computer labs were opened in 4 colleges and 2 vocational schools.

To train the population in the use of electronic services, public libraries were transformed into a network of vibrant community institutions through the Novateca Program. This network of computerized public libraries offers Internet access across the country and provides citizens with the guidance of trained librarians.[65]

[63] ITU-UNICEF report on "Connectivity in Education: Status and recent developments in 9-non-EU countries of Europe region", p.58, retrieved from https://www.itu.int/pub/D-PHCB-CONN_EDUC-2021
[64] https://ipp.md/wp-content/uploads/2021/04/Strategia-EDUCATIE-2030-Versiunea_01.pdf
[65] https://mei.gov.md/sites/default/files/raport_de_evaluare_moldova_digitala_2020.semnat.pdf

In mid-March 2020, Moldova shut down all schools in response to the COVID-19 outbreak, thus mandating schools in the country to provide distance learning opportunities for over 434,000 students.[66] In face of this emergency, many actions were undertaken to ensure that learning continued under the new conditions imposed by the global pandemic.

The Government distributed educational packages for children with disabilities and children with no access to technologies, as well as on-line informational materials regarding free on-line resources for distance learning and positive parenting during the pandemic and subsequent recovery period. Also, an agreement was signed to enable educational institutions in the country to gain access to Office 365 A1, interactive platforms for teachers' training, and support in implementing the distance learning and mixed model.[67]

Furthermore, the government sought to establish several public-private partnerships to alleviate gaps in digitalization and their negative impact on educational process. For instance, all three mobile operators on the market launched campaigns to support the teachers by providing them with free internet connection.

Additional support to the education process was provided through the launch of three platforms "educatieonline.md", "invat.online" and "studii.md". Even though the last one was developed prior to the pandemic, new functionalities were added following the emergency lockdown and the decision on home-schooling.[68]

Despite these extensive tools and initiatives, a nation-wide survey with educators in Moldova revealed that some teachers still struggle to appropriately use the recommended technologies. On the other hand, some wished that the government guidelines could have been tightened somewhat by their own school or institution, because using the same platforms could have enabled staff to better assist one another during the transition.[69]

2.3.3 E-waste management

According to the Regional E-waste Monitor CIS + Georgia[70], in Moldova, e-waste is regulated by the Law "On Waste" no.209 of 2016. It establishes the basic requirements for waste management throughout life, and introduces the principle of EPR for packages, batteries, accumulators, EEE, vehicles, and oils.

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[66] ITU-UNICEF report on "Connectivity in Education: Status and recent developments in 9-non-EU countries of Europe region", p.59, retrieved from https://www.itu.int/pub/D-PHCB-CONN_EDUC-2021

[67] ITU-UNICEF report on "Connectivity in Education: Status and recent developments in 9-non-EU countries of Europe region", p.60, retrieved from https://www.itu.int/pub/D-PHCB-CONN_EDUC-2021

[68] ITU-UNICEF report on "Connectivity in Education: Status and recent developments in 9-non-EU countries of Europe region", p.61, retrieved from https://www.itu.int/pub/D-PHCB-CONN_EDUC-2021

[69] ITU-UNICEF report on "Connectivity in Education: Status and recent developments in 9-non-EU countries of Europe region", p.62, retrieved from https://www.itu.int/pub/D-PHCB-CONN_EDUC-2021

[70] 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

Moldova signed and ratified several conventions in this sense. The Basel Convention entered into force in September 1998, the Stockholm Convention in July 2004, and the Rotterdam Convention in April 2005. Also, in 2017, the Minamata Convention on Mercury was ratified in the country.

The national legal framework around e-waste also comprises:

- Government Decision No. 212 of March 7, 2018 "Provisions on WEEE" – WEEE Regulation.
- Government Decision No. 501 of May 29, 2018 "Instructions for accounting and reporting data and information on wastes and their management".
- Government Decision No. 99 of January 30, 2018 on "the Approval of the list of waste".
- The Government Decision No. 637 of May 27, 2003 on "the control of TBM of waste and its disposal".
- The National Waste Management Strategy of Moldova 2013-2027.

According to the "Provisions on WEEE", EEE producers have been required, since January 1, 2020, to achieve minimal targets on collection that has been calculated as a percentage ratio between the total mass of e-waste collected for the related year and the average mass of total EEE POM for the three previous years. The annual minimal collection targets to be achieved by the EEE producers in 2022 is 15%, increasing by 5% on the yearly basis, and reaching 30% in 2025.

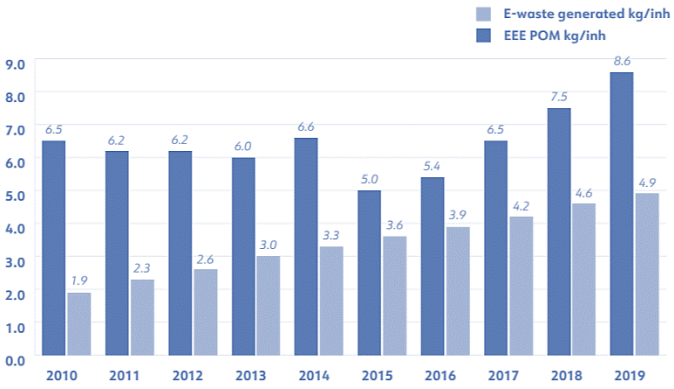
Moldova has a few treatment companies that are active in the sorting, dismantling, and primary treatment/recycling of e-waste before its export to European Union countries for further treatment and recycling. Besides, the country has enforced a national ban on e-waste imports.

Data accounting and reporting in Moldova is based on the "Automated Waste Management System", established in 2020. It is used for the collection, storage, and processing of information about waste import and export, waste producers, and entities authorized in the field, as well as the turnover of waste-related activities for the public authorities, legal entities, and physical persons involved.

The country is in the first stage of developing an e-waste infrastructure, and an EPR system has recently been introduced. Therefore, authorities still have to implement a regular e-waste data accounting process. Nevertheless, the Environment Protection Agency is already keeping records of EEE producers and products as part of the list of products falling under EPR rules. It is expected that, in upcoming years, a National Roster will be developed in Moldova that will include the exact number of imported equipment on the market, and a separate 'E-waste Roster' is expected as well. The Roster will be integrated into the state information system "Automated Waste Management System".

EEE POM in Moldova has rapidly increased in recent years, from 6.5 kg/inh in 2010 to 8.6 kg/inh in 2019. The amount of EEE POM in Moldova increased from 6.5 kg/inh (23.0 kt) in 2010 to 6.6 kg/inh in 2014. The amount declined to 5.0 kg/inh (17.8 kt) in 2015, then grew to 8.6 kg/inh (30.3 kt) in 2019, which is still below the CIS+ average of 11.0 kg/inh.

Figure 5 – EEE POM and e-waste generated in Moldova



The e-waste generated in Moldova mostly consists of large equipment (33%), small equipment (31%), and temperature exchange equipment (30%), reaching together an amount of 8 kg/inh. However, the domestic production of EEE in Moldova was only 0.01 kg/inh in 2019.

The amount of e-waste generated in the country tripled over the last decade, increasing from 1.9 kg/inh in 2010 to 4.9 kg/inh in 2019. In 2019, the largest two categories in this sense are the small equipment with 1.7 kg/inh (35%) and large equipment with 1.4 kg/inh (29%).

2.4 Building block 4 – Sector - centric digital transformation

Having addressed the digital transformation dimensions of infrastructure, people-centric and government-centric approaches, this section will utilize the critical lens of sector-centric digital transformation, analysing the specific sectors which are affected by, and which dually enable, increasing levels of digital transformation in the Republic of Moldova.

This section will address (i) digital agriculture as a key productive sector in Moldova, (ii) digital health and e-health services and (iii) the role of SMEs in fostering digital transformation.

2.4.1 Digital agriculture

In the Republic of Moldova, agriculture plays a central role in the country's economy. The arable land represents about three quarters of the total territory of the country and the sector employs about one third of the country population. Despite the large size of the sector, its performance is uneven with the highly variable growth. During the last three years, the sector accounts for 10–12% of GDP. In 2020, the share of 9.5% of GDP was registered preceded by the 2.7% decrease in comparison to the previous year.[71]

Due to the sector's vulnerability to the weather, setting it on the sustainable development path is challenging but also critical for economic growth at the country level. A small number of largescale farmers are increasingly able to exploit the expanded opportunities afforded by the free trade agreement with the EU, the country's main agricultural export destination. Smallholders, however, struggle to comply with the strict EU market requirements and therefore target the more accessible CIS markets. Subsistence farming is on the increase and productivity has fallen, leading a quarter of the young rural population to

[71] https://statistica.gov.md/category.php?l=ro&idc=191#idc=34&

migrate to cities. Smallholders are particularly vulnerable to accelerating climate change as they are the least equipped to adapt to its effects.[72]

To achieve substantial exports to the EU, Moldova's farmers must comply with the high product quality standards and traceability requirements of these markets. Improving the competitiveness of agricultural product will imply improving productivity by upgrading the production processes and increasing quality by improving harvest and post-harvest processes. All of these are complex processes that will require governmental support to be achieved.

The ICT-centric innovation ecosystem country review of Moldova performed by ITU in 2017[73], highlighted that the country strategies currently focus on international priorities and should instead refocus on national strengths. The stakeholders interviewed as part of this study said that specific ICT areas or other economic sectors or specialized niches should be prioritized under a comprehensive strategy. Some of the suggested areas were nanotechnology, e-agriculture and the aerospace industry. Also, the smart specialization areas identified in Moldova are ICTs, agriculture and food processing, biomedicine and energy (where agriculture also plays a role).

In this context, among the Government initiatives meant to achieve the sector transformation can be recalled the Strategic Program for technological modernization of development policies in the agro-industrial sector (e-agriculture) approved in 2013. The Program aimed to digitize the public services provided by the Ministry's subdivisions, create integrated information systems for preparing and implementing the sector's development strategies, and develop surveillance information systems to ensure food safety and security. The concept of e-agriculture was devised in the context of State food safety and security, the National Strategy for Agricultural and Rural Development (2014–2020), and the strategic program for the technological modernization of the government (e-Transformation).[74]

In order to solve problems in the priority sectoral needs of agriculture and contribute to the implementation of agro-industrial sector development policies, several information systems have been developed including: the Digital Agricultural Register; the State Animal Register; the System of Identification and Traceability of Animals; Automated Information System for Management of Strategic Sanitary-Veterinary Measures; the Agricultural Equipment Register; Automated Information System for the Evidence of the Applicants and the Beneficiaries of Grants (SIA ESBS); Automated information system Vine and Wine Register; Automated Information System for Management of the Release of Phytosanitary Certificates[75].

[72] ITU-FAO Report "Status of Digital Agriculture in 18 countries of Europe and Central Asia", p.31, retrieved from https://www.itu.int/en/myitu/Publications/2020/07/09/15/27/Status-of-Digital-Agriculture-in-Europe-and-Central-Asia
[73] https://www.itu.int/dms_pub/itu-d/opb/inno/D-INNO-MD-2018-01-PDF-E.pdf
[74] ITU-FAO Report "Status of Digital Agriculture in 18 countries of Europe and Central Asia", p.32, retrieved from https://www.itu.int/en/myitu/Publications/2020/07/09/15/27/Status-of-Digital-Agriculture-in-Europe-and-Central-Asia
[75] ITU-FAO Report "Status of Digital Agriculture in 18 countries of Europe and Central Asia", p.33, retrieved from https://www.itu.int/en/myitu/Publications/2020/07/09/15/27/Status-of-Digital-Agriculture-in-Europe-and-Central-Asia

Unfortunately, the agri-business sector in the country lags behind in terms of using ICT compared to other sectors of the national economy. One of the reasons is that the investments in new digital technologies are expensive and bring additional financial risks to the farmers. Local farmers would have been able to access new digital technologies through associations, cooperatives, or other forms of joint organization. However, this is not happening in Moldova.

Among the main gaps in applying ICT for the digital transformation of agriculture are (i) the lack of interoperability of the digital agriculture solutions provided by the Government; (ii) insufficient digitization of agriculture registries; (iii) lack of knowledge management and sharing; (iv) disaster management and early warning system and (v) lack of e-trade platforms.[76]

Another barrier in the sector transformation process is the limited access to relevant information and poor links between stakeholders of the value chain. To improve the situation, open and interactive access to the statistical data collected by the Ministry of Agriculture and Food Industry, the Digital Agriculture Map was launched in 2015.[77] However, this tool doesn't solve the entire issue and additional implication is required.

Private companies are also involved in providing digital solutions to farmers, including on agrometeorological data. Orange Moldova has started to introduce digital solutions for farmers, including GPS solutions for fuel control and vehicle monitoring – to optimize costs, save fuel, prevent fraud and promote auto-guidance – and digital tools for collecting, storing and analysing weather conditions to protect crops. The services are to be accessed using high-speed Internet all over the country.

Besides, the currently ongoing FAO project will significantly improve data collection and management in respect of Moldovan agricultural and rural statistics from 2020, bringing them in line with international standards and enabling the collection of data on important SDG indicators on labour productivity and smallholder incomes.[78]

Another FAO project launched in 2021 is focused on mainstreaming climate change adaptation into the country's national planning processes for reduced vulnerability to climate change at local and central levels. This three-year project will integrate climate change adaptation responses into the planning processes of the agriculture sector by facilitating the local actions of six selected districts from the country's southern, central, and northern regions for improved planning and budgeting of climate change adaptation measures.[79]

The Tekwill Project also started to engage in supporting the strategic sectors of the economy. In this context, supporting the agriculture transformation is one of the 5 business verticals in the framework of

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[76] FAO report: Digital Agriculture in Moldova: Context assessment, Mapping of the Existing Infrastructure and Needs Assessment Study

[77] https://www.arcgis.com/apps/MapSeries/index.html?appid=87c14bb5c945473a831ab7de6fb54f60

[78] ITU-FAO Report "Status of Digital Agriculture in 18 countries of Europe and Central Asia", p.33, retrieved from https://www.itu.int/en/myitu/Publications/2020/07/09/15/27/Status-of-Digital-Agriculture-in-Europe-and-Central-Asia

[79] http://www.fao.org/europe/news/detail-news/en/c/1390838/

the "Startup Moldova" Digital Impact National Program. This platform encourages sectoral collaboration between representatives of traditional and IT industries. In line with the program priorities, “AgTech conference” is organized already a second year in a row and it serves for discussion on promoting the competitiveness and sustainability of agriculture with the help of information technologies.[80]

2.4.2 Digital health

In 2013, the country adopted a National Development Strategy “Moldova 2020” which identified health as one of sector key areas for Moldova's sustainable development alongside culture, social security and environmental protection. In line with it, the National Public Health Strategy for 2014-2020 was developed and aimed to implement actions to improve the health of the population, strengthen and promote the health system, reduce inequalities in the health system and create the conditions for the alignment of public health with WHO standards.

One of the initiatives addressed by this strategy was 112 System implementation. This service is currently fully functional and is organized as an integrated structure. The 112 emergency call handling centres ensure the reception of emergency calls throughout the country, locate the caller, processes the obtained information through the Automated Information System of the 112 Service, and requests interventions of the Ambulance, Police and Fire Brigades. By design, cooperation among institutions stays at the core of this service.[81]

Another important step was the launch of Automated Information System for Primary Medicine. It is designed to automate the flow of information within the Public Health Care Institutions and represents a unique platform at the national level that integrates all information related to patient health. The system is hosted on the shared government platform – mCloud which allows significant financial savings at national level. The patient's electronic medical record is the core of this system and provides a convenient means of storing medical information to facilitate decision-making and the processing of personal data. Even though the health care professionals’ portal is operational, a patient portal is not implemented.[82]

Since 2017, the automated information system enabling hospitals to manage in real-time the information on the flow of funds, supply of medicines, sanitary materials and even data on the health condition of each patient was introduced. It now successfully operates in 15 hospitals across the country.[83]

Also, Moldova’s National Medical Insurance Company (CNAM) rolled out a number of online services like: an information system for reporting and keeping track of medical services, possibility of online payment through MPay for the compulsory health insurance, verification of the patient status in the compulsory

[80] https://startupmoldova.digital/digital-impact/

[81] https://msmps.gov.md/wp-content/uploads/2021/05/Raport-Strategia-Națională-de-Sănătate-Publică-2014-2020.pdf

[82]https://monitorul.fisc.md/editorial/lansarea_oficiala_a_sistemului_informaional_automatizat_pentru_medicina_primara.html#cut

[83] https://eufordigital.eu/better-care-better-administration-moldovan-hospitals-reap-the-benefits-of-automated-information-system/

health insurance system. CNAM services are integrated with the governmental portal "servicii.gov.md" and the newly launched citizen governmental portal.[84]

Despite several advances, the existing health information systems are not standardized nor integrated into a centralized platform. Health information remains spread between several systems and is not comprehensive in terms of data collection, quality, and evidence generation. There is an urgent need for Moldova to establish a dedicated institution responsible for managing all health information systems. Support is needed to strengthen these systems and help accelerate the adoption and use of health data standards and interoperability frameworks.

In line with the above-mentioned initiatives, an important fact that should be highlighted is that personal medical information is regulated under the Personal Data Protection Laws without a separate health data regulation. However, the data protection regulation is in the process of harmonization with the EU GDPR.[85]

Telemedicine has gained importance during the COVID-19 pandemic. It has been promoted in primary health care delivery along with developing the technical infrastructure of health facilities. To further improve telemedicine services and accelerate the use of digital tools in primary care to improve the availability and quality of care, coordinated action is required. Efforts are needed to ensure adequate training of primary care professionals and that appropriate legislation and reimbursement mechanisms are in place. Furthermore, fiscal decisions are needed to address funding issues as the sustainability of telemedicine should be a priority for future primary care.

Even though the country health system transformation still requires significant interventions, a lot of initiatives were implemented to support the sector digitization in response to the covid-19 crisis.

One of them was the platform with an active map of COVID-19 cases that ensures transparency and accessibility of information in real-time.[86]

Another way to facilitate the work of healthcare staff was the implementation of a national system that offered a possibility of reporting COVID-19 data to the National Agency for Public Health. Every person passing the covid-19 test was attributed with an identification code and the results were submitted automatically to the database of people confirmed with SARS-CoV-2.

Also, an online application called the "Medcast chatbot" was developed by a group of volunteer IT experts. It allows users a possibility to pre-diagnose COVID-19, monitor their symptoms, and report the data to their family doctor. Medical workers with credentials can as well obtain information from patients

[84] http://cnam.md

[85] Analysis of the current state of eHealth in the Eastern partner countries

[86] https://gismoldova.maps.arcgis.com/apps/opsdashboard/index.html#/d274da857ed345efa66e1fbc959b021b

under monitoring and download reports on their health. At the same time, the platform provides details about the rules imposed during the state of emergency and lockdown.[87]

As the emergency situation caused by the global pandemic crisis starts to slowly alleviate, the next steps of the health system transformation in Moldova are required. However, no national e-health strategy exists to guide this process meant to embrace recent technological developments and chart new directions. The government of Moldova recognizes the need for a National e-Health Strategy and is committed to further advancing digital solutions for health. There is a need to support the development and implementation of a national digital health strategy and establish a clear vision.

2.4.3 The role of SMEs

In Moldova, SMEs are the main drivers of the economy. According to the National Bureau of Statistics, in 2019 they represented about 98.6% from the total number of enterprises, generated 39.5% of sales revenue in economy and employed 61.6% of people working for the enterprises.

In 2019, the majority of SMEs were active in trade. Their number reached 20.3 thousand enterprises and represented 36.3% of all SMEs. Another 17.1% of all small and medium-sized enterprises were working in the manufacturing industry (8.4%) and were active in professional, scientific and technical activities (8.7%).[88]

In order to properly respond to the SMEs needs, the long-term and medium-term policy framework was provided by the Strategy for the Development of the Small and Medium-Sized Enterprise Sector for 2012-2020. This document aims to generate a shift from the consumption-based economic development model to a new paradigm oriented towards exports, investment and innovation, the political desire for European integration and global economic trends.[89]

This Strategy was followed by the Support Program for businesses with high potential of growth and internationalization approved in 2020. Its goals are to generate an increase in SMEs sales revenue through applying new business models and implementation of modern technologies, to empower SMEs to promote their products and services through national and international electronic platforms, and to facilitate SMEs access to finance.[90]

Based on these strategic documents, the Government has put in place a wide range of projects to support SMEs like: Efficient Business Management Program, "PARE 1+1" Program, Women in Business Program, Start for Youth Program, etc.[91]

Overall, the market offers favourable conditions and instruments to SMEs for their growth and efficient interaction with the government authorities. However, according to the latest surveys of ODIMM, less

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[87] https://eufordigital.eu/modern-digital-platforms-for-a-better-pandemic-response-the-key-role-of-data-in-tackling-covid-19-in-moldova/

[88] https://statistica.gov.md/newsview.php?l=ro&idc=168&id=6716

[89] https://www.odimm.md/files/ro/pdf/sec_imm/Strategia_IMM_Moldova_2014-2020.pdf

[90] https://www.legis.md/cautare/getResults?doc_id=122195&lang=ro

[91] https://www.odimm.md

than 17% of SMEs have successfully integrated digital technologies in their work, which unveil huge untapped potential but also highlights an urgent need for SMEs to transform their businesses.[92]

COVID pandemic has amplified the importance of enterprises digitization and a special focus was put on e-commerce as a large share of country SMEs are active in trade.

To support SMEs in the process of adjusting to new realities, the "SME Digitization Support Instrument" was launched in June 2020. Until now, 175 business vouchers worth MDL 3.4 million (approx. EUR 160 thousand) and 103 grants totalling MDL 16.4 million (approx. EUR 772 thousand) were offered.[93] This Program is ongoing and currently a new call was launched aiming to support women entrepreneurs and diaspora holding a business in the rural area and willing to digitally transform their business. The financial support in the form of a grant (MDL 200000 or approx. EUR 9427) is provided for the purchase of equipment and software to innovate and introduce new technologies in the context of the digitization of SMEs, consultancy in the specific steps required to implement software solutions and custom software solutions developed specifically for the enterprise, such as websites, online shops, etc.[94][95]

As part of the SME Digitization Support Instrument, about 100 entrepreneurs were trained for a month to grow their successful online business. Digital education was carried out through the “Digital Upgrade” training program, implemented by ODIMM in partnership with Startup Academy.[96]

Also, in order to facilitate the interactions between IT and non-IT companies, Moldova IT Park developed a Catalogue of local suppliers of IT solutions for e-commerce[97] and partnered with ODIMM and Tekwill’s Startup Moldova Project to boost non-tech industries assimilation of technological innovation.[98]

Despite all these efforts, a number of barriers particularly related to e-commerce are still considered as limiting ones in the SMEs transformation process. Among them is an evident lack of e-fulfilment solutions and export processes are slow and costly. Also, there is low cross-border e-commerce flow and Moldova is under-represented on international marketplaces.[99]

2.5 Building block 5 – Digital - centric innovation ecosystem

Digital innovation is both an enabler of digital transformation in all dimensions addressed above and also a measure of the robustness of digital development at the country level. A good level of digital innovation

[92] https://www.odimm.md/ro/digitalizarea

[93] https://agromedia.md/finantarea-agricultorului/fonduri/suport-financiar-pentru-digitalizarea-afacerii-cati-antreprenori-vor-beneficia-de-sustinere?fbclid=IwAR2k0bG7kL7eZ3bzaalRYLMQobWBcF1U9vdj1tIOO7nTDVgH1M3ynVK0ffk

[94] Using the current exchange rate of the National Bank of Moldova of 21.2165 as of 20.06.2021, retrieved from https://www.bnm.md

[95] https://odimm.md/ro/presa/anunturi/5033-apel-de-granturi-pentru-digitalizarea-afacerilor-din-mediul-rural?fbclid=IwAR1G9IBHb761UeoD12kN5C_e-X1Rx8DATb3LvnYyqv7G1ktIlgbEcZqiGTA

[96] https://tekwill.md/news/digital-upgrade-has-started-the-educational-program-for-digitizing-smes-2/?fbclid=IwAR3Z_DAP6hPVSnGomIG-qrthU7PWIOYrdGRH3j8HI9mW1HY2Xx5vcT63xVk

[97] https://moldovaitpark.md/wp-content/uploads/2020/07/Catalog-e-comert_final.pdf

[98] https://startupmoldova.digital

[99] https://ict.md/wp-content/uploads/2020/07/Moldova-Rapid-ECommerce-Review.pdf

in a given country also underpins endogenous digital development rather than development that depends on foreign markets.

The innovation divide stems in part from inefficiencies in the use or allocation of resources in the innovation ecosystem, from inefficiency or lack of key supports, policies, and other elements of a nurturing environment, as well as a need for stronger collaboration between stakeholders to develop a complete ecosystem through coordinated support activities.

This section addresses the importance of innovation ecosystems as local catalysers of creativity in the use of digital technologies for business. It also covers aspects related to the major challenges countries and key ecosystem stakeholders face in developing an enabling environment conducive to digital innovation and entrepreneurship across sectors.

2.5.1 Digital innovation ecosystem

Moldova ranks above average on key international rankings on entrepreneurship, innovation and technology. The Global Innovation Index (2020) ranks the country 59th out of 131 countries, and the Global Entrepreneurship Index (2019) 94th out of 137 countries. These performances are translated into similar competitiveness for the country as Moldova ranks 86th out of 141 countries in the Global Competitiveness Index (2019).[100]

Moldova is in the process of developing a robust ICT centric innovation ecosystem. There are clear strengths to build on. The country has done excellent work in preserving primary education and research activities and has a strong communication infrastructure.[101]

Still, research activities suffer from some systemic challenges that slow down the country's transformation. These are characterized by a lack of cooperation between key stakeholders i.e., academia and businesses, low capital expenditures, aging of the Research and Development (R&D) sector, as well as the dropping number of researchers in engineering sciences, technologies, agriculture, and natural sciences.[102]

In 2019 Moldova had 2767 researchers, and only 18% of them were younger than 35. The amount of expenditure on R&D represented 0.24% of the GDP. Out of this amount, operational costs were 97.3%, and the capital investments were only 2.7%.[103]

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[100] ITU Report on Regional Good Practices Accelerating innovation, entrepreneurship and digital transformation — Europe, retrieved from https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Publications/GOOD_PRACT.03-2021-PDF-E.pdf

[101] ITU Report on ICT-centric innovation ecosystem country review: Republic of Moldova, p.83, retrieved from http://handle.itu.int/11.1002/pub/810fd87d-en

[102] Report prepared under UNIDO Country Programme for Moldova 2019-2023 "THE INNOVATION ECOSYSTEM OF MOLDOVA", pp.46-47

[103] Report prepared under UNIDO Country Programme for Moldova 2019-2023 "THE INNOVATION ECOSYSTEM OF MOLDOVA", p.12

To strengthen the R&D sector, in 2018, the National Agency for Research and Development was created and the distribution of funds among research institutions is now conducted on a competitive basis. Besides, in 2019, the Government approved the National Program for the research and innovation sector for the years 2020-2023 and the Action Plan for its implementation. These set out priorities and strategic directions for development in research and innovation and ensured synchronization with the country's strategic development agenda.[104]

At the same time, there are other positive signs to be seen in the way the country is evolving. As the market in Moldova is supported by free trade agreements, the ability to work together with regional and global ecosystems provides significant opportunities to innovators. Networks are doing good work in terms of representing, connecting and supporting the ecosystem, but should be better coordinated and leveraged.

There are widespread efforts at policy reform and steps toward the development of soft infrastructure resources. The primary strategy in Moldova related to the ICT centric innovation ecosystem is called - Moldova 2020, and subsequently the Digital Moldova 2020, which is based on it. Its priorities taken together had a large-scale positive impact on the innovation ecosystem and, more broadly, the economy of Moldova. However, these strategies generally represent a vision just for the government of the country as they provide little place for the private sector or other stakeholders to take up a role other than passive beneficiary or service provider.[105]

Based on the results of the strategies implemented and the identified gaps, the strategic framework was completed by the Strategy for the "IT Industry Competitiveness and Growth" for 2015-2021 which was followed by the Strategy on information technology industry and digital innovation ecosystem development for 2018-2023.

The initiatives launched as a result of the Strategies implementation target the transparency and bureaucracy barriers to start-ups, trust gaps that prevent collaboration and the development of strong communities among stakeholders, brain drain, and upskilling of the labour.

However, most of the currently existing soft infrastructure, such as Tekwill, ArtCOR, Dreamups, XY Partners, Generator Hub, iHub, Fablab, Ziphouse, and Digital Park are clustered in Chisinau. This list is continuously expanding, bringing new soft infrastructure elements to the ecosystem like MediaCOR that was launched in November 2021. Each has a specific role that they seek to play, and fits into needs identified in terms of business culture, skills training, entrepreneurial support and other areas. For example, ArtCOR and MediaCOR are considered creative industries colliders in Moldova, that help reinvent the creative industry through its merge with technologies and innovation.

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[104] Report prepared under UNIDO Country Programme for Moldova 2019-2023 "THE INNOVATION ECOSYSTEM OF MOLDOVA", p.14-15

[105] ITU Report on ICT-centric innovation ecosystem country review: Republic of Moldova, p.25, retrieved from http://handle.itu.int/11.1002/pub/810fd87d-en

Getting outside of the city of Chisinau, two strategic initiatives are in the development phase. The regional Centre for Innovation and Technology Transfer is already under construction on the Balti University premises. EU4MOLDOVA Start-up City Cahul project (2020-2023) is currently in the launch phase and is aimed to create a Regional Innovation and Technology Centre, the STEM promotion campaign and development programs, as well as develop a seed funding and acceleration program for ICT related start-ups.[106]

Besides, there are also several initiatives covering the entire country. One of the examples is the Novateca Libraries Program which created a network of resource centres throughout the country, building on the existing space in libraries. Another example is the Moldova IT Park which is a virtual IT park that provides fiscal incentives in a form of a single tax of 7% to IT companies across the country and supports the skilled workforce attraction to the country through the IT Visa Program. Yet, about 97% of all the Park residents are in the capital city.[107]

There is interest in entrepreneurship in Moldova and many young people, especially in the tech sector, are interested in developing innovations and businesses. However, there is a substantial brain drain, either through graduates seeking opportunities abroad or through businesses incorporating in the EU, USA, or CIS to avoid barriers to entry. Consequently, there is a small talent pool with the skills to allow Moldova to compete effectively on a global level.

For further ecosystem development, several issues still must be approached. For instance, soft skills are not well represented, and technical skills are often mismatched to the experience required. Moreover, financing for all phases of innovation is broadly unavailable, and there is no local VC fund in Moldova.

3. Conclusions

This document has provided a framework to unravel digital development that includes five identified dimensions of digital transformation. It has provided information about Moldova for each domain, based on the experiences and activities of the ITU and other stakeholders operating in the country and wider region.

This report will serve as a reference for discussions on digital development at the country level as well as stock taking of relevant activities, initiatives and projects and experiences developed by UN agencies involved in digital transformation work in Moldova. It will serve as a guide for future dialogue with country

[106] EU4Digital Guide for building the ICT entrepreneurial ecosystems in the Eastern partner countries: Maturity analysis and recommendations, retrieved from https://eufordigital.eu/wp-content/uploads/2021/04/Guide-for-building-the-ICT-entrepreneurial-ecosystems-in-the-Eastern-partner-countries-maturity-analysis-and-recommendations.pdf?fbclid=IwAR2yioVMEiB5OG99oIJh3mOz2j7qNGv0Y30WmFI_B2WillPkR5sz2qlH-60

[107] Moldova IT Park annual report 2019, p.8, retrieved from https://moldovaitpark.md/wp-content/uploads/2020/02/Raport-Anual-2019_eng-1.pdf

stakeholders and pave the way for increasingly fit-for-purpose engagements of the UN system in the country.