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Entrepreneurial Discovery Workshop Report II

**Topic: INFORMATION AND COMMUNICATION
TECHNOLOGIES**



Information Society
Development Institute
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EDP workshop overview

On June 20, 2019, the Ministry of Education, Culture and Research, with the support of the Joint Research Center of the European Commission and in partnership with the Information Society Development Institute, organized the first entrepreneurial discovery process (EDP) workshop in Information and Communication Technologies (ICT) priority domain.

The event was attended by 44 people, representatives of public authorities, universities, research institutes, private sector and civil society, distributed as follows:

Working group	<i>Micro/ nanomaterials and electronic engineering</i>	<i>Interoperability, open data and e-infrastructures</i>	<i>Mobile apps, software development, cloud computing</i>
Nr. de reprezentanți	<i>Facilitator: Ion Cosuleanu</i>	<i>Facilitator: Sergiu Porcescu</i>	<i>Facilitator: Mihai Grecu</i>
Business	3	5	9
Academia	6	7	2
Civil society	-	2	1
Public authorities	3	4	2
Total:	12	18	14

The main purpose of the EDP workshop was to carry out the SWOT analysis and to formulate the vision for the future development of the priority domain, including per identified subdomains.

The EDP workshop aimed to validate the subdomains identified as being priorities for the further identification of smart specialty niches. As part of the mapping the economic, scientific and innovation potential and identification of the preliminary areas for smart specialization, 4 ICT subdomains were identified, which have potential for smart specialization:

- Semiconductor materials and circuits, IoT
- Mobile apps, software, coding, cloud computing
- Research e-Infrastructures, Big Data, Bioinformatics
- Cyber security

During the EDP workshop discussions the subdomains were refined to include the following:

- *Micro / nanomaterials and electronic engineering*
- *Interoperability, open data and e-Infrastructures*
- *Software engineering, Mobile apps, cloud computing*

The EDP workshop agenda included an introductory plenary session, where representatives of relevant public authorities (dr. Aliona Onofrei from the Ministry of Education, Culture and Research, Ms Oxana Rusanovschi from the Ministry of Economy and Infrastructure) highlighted the importance of the entrepreneurial discovery process for the ICT sector. The Director of the Information Society Development Institute, dr.Igor Cojocar, made a short presentation of the EDP workshop agenda and methodology.

The presentations delivered by the members of the national smart specialisation technical group (dr. Sergiu Porcescu - National Contact Point for the Joint Research Center of the EC, Diana Russu - Chamber of Commerce and Industry of the Republic of Moldova, dr.hab. Larisa Savga - Trade Co-operative University of Moldova) focused on several relevant topics. These included smart specialization in the Republic Moldova, identified priority areas, entrepreneurial discovery process, examples of good practices / success stories, key elements of strategic planning.

The presentations were followed by 2 participatory exercises, moderated by facilitators:

- performing SWOT analysis of the identified subdomains and the priority domain as a whole,

- developing visions for the identified subdomains and then a common vision for the future of the ICT priority domain as a whole.

Current status of the ICT sector

ICT has a tremendous potential to contribute to Moldova's economy. Moldova has a unique location with access to markets in both the East and the West, and a highly trained, multilingual workforce. ICT accounts for 6,6% of GDP with a growth tendency. Since 2006, Moldova has seen a 20-fold growth in exports of ICT products and services. Overall job growth in the ICT sector has reached 15% per year – currently employing over 20,000 Moldovans, including 13,000 tech engineering and software development professionals.¹ In the "Ease of starting a business" category, Moldova ranked 14th globally with a score of 95.55 (out of the maximum 100), with only four days required to open a new business in Chisinau. The survival rate for IT companies in Moldova in their first two years is 54.4%, an 18 percentage point increase against the average for all companies in the national economy.²

ICT has been identified by the Moldovan government as a priority sector for economic development. Moldova has jumped 63 places on the World Bank's Ease of Doing Business index since 2009 to rank 47 in 2018,³ above the regional average for Europe and Central Asia. The country has also made significant investments and progress in the domain of e-government, improving the overall business climate with initiatives such as online fiscal declarations systems, biometric passport, automated border crossing systems based on electronic passports, digital map, mobile digital signature and online services. Development organizations (USAID, UNDP, World Bank etc.) are actively involved in improving ICT sector competitiveness in the country.

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. ICT infrastructure in Moldova is at a satisfactory level and is ranked 52th out of 129 in the world⁴, with intensive use of software and ICT services identified. Moldova is ranked 48th among 140 countries in terms of ICT adoption⁵ and the 6th among the countries with the cheapest Internet in the world⁶, that demonstrating the existence of business opportunities for the development all over the country.

As for the Communications segment of ICT, it is represented by 2 international and 1 national operator of mobile telephony, one dominant and several alternative fixed telephony operators which provide modern communication services to mobile cellular networks, optical communication systems and DSL subscriber lines.

ICT Industry Competitiveness 2023 Strategy approved in 2018 outlines a path for exponential industry growth. Specific law on IT Parks already exists in Moldova since 2018, providing a series of incentives, such as the visa-free travel for ICT professionals and a streamlined 7% flat corporate tax. The law enabled the development of Moldova's first virtual IT Park, which by June 2019 was hosting around 450 residents, about 57% of which are software development companies. USAID partnered with local private IT company Starnet to develop Moldova's first state-of-the-art physical ICT Park. Branded as downtown Chisinau's "Digital City," this \$15 million investment is a game-changer – providing a Silicon-Valley-type working environment to foster creativity and competitiveness.⁷

In cooperation with the Technical University, a consortium of organizations (including USAID, the Moldovan Association of Private ICT Companies, Microsoft, and IBM) have launched Tekwill (IT Excellence and Innovation Center), with a focus on incubating and accelerating digital tech startups on digital technologies.

¹ <https://md.usembassy.gov/moldova-business-week-ict-panel-introductory-remarks/>

² Moldovan IT Players Priming for Worldwide Presence http://ict.md/files/documents/IDC_Report_Moldova_2019.pdf

³ <https://www.doingbusiness.org/en/data/exploreconomies/moldova>

⁴ Global Innovation Index 2019 <https://www.globalinnovationindex.org/home>

⁵ WEF Global Competitiveness Report 2018.

<http://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf>

⁶ <https://www.atlasandboots.com/remote-jobs/countries-with-the-cheapest-internet-world/>

⁷ <https://md.usembassy.gov/moldova-business-week-ict-panel-introductory-remarks/>

Cutting-edge innovation centers to increase tech human capital are developed with the support of international donors and in partnership with global corporations such as IBM, Microsoft, and others – with a total joint investment exceeding \$10 million over five years, from 2015-2020. Housed at Moldova's largest universities, these innovation centers are the largest collaborative investment in developing Moldova's workforce of tomorrow.⁸ STEM education is being actively promoted starting at school level, where coding, robotics and 3D printing are all being used to create collaborative learning environments in the classroom. Moldova's Youth Robotics team recently scored 3rd at the Global Robotics Competition 2018 in Mexico, demonstrating globally competitive tech talent.

Following international trends, the Blockchain Association of Moldova (BAM) has been established and is the voice of Blockchain technology in Moldova since 2017. BAM is a strong advocate for Blockchain Technology in Moldova and works with all levels of government and other stakeholders to support employment growth and career opportunities in Blockchain technology and crypto-economy, to promote and sustain community development initiatives, and to enhance consumer safety and industry competitiveness.⁹

In terms of national research capacities in ICT, a significant R&D activity is focused on super/semi conductive materials and circuitry, quantum and photonics, spintronics, materials science, nanotechnology, as well as electrical and electronic equipment, all concentrated in several well-established research institution. In 2019, Association of Companies in the Electronics Industry of Moldova (ACEM) was set up, aiming to develop, promote and increase the competitiveness of the electronics industry including microelectronics, nanotechnologies, embedded systems, software, R&D in the Republic of Moldova through viable partnerships.

Moldova has been quite active in the area of nanotechnology, with numerous nano-related events being held in Moldova, as well as impressive international collaborations with world leaders in the field. NanoTechWeb.org, a UK website, listed 4 nanotechnology developments from Moldova as some of the best in the world. It is likely that these achievements will boost Moldova's image in the European Research Area and lead to attraction of investments in national high-tech areas.

⁸ ATIC Annual Report 2017-2018. http://ict.md/files/documents/ATIC_Annual_Report_2017_2018.pdf

⁹ <https://www.linkedin.com/company/blockchain-association-of-moldova/about/>

SWOT analysis of the ICT sector

Strengths

- Ease of doing business
- ICT industry - one of the priority areas for the country's economic development
- ICT-specific incentives: Moldovan legislation sets the necessary prerequisites for boosting industry development, established IT virtual park with multiple incentives
- Focus on e-Government and implementation of various IT solutions in the public sector
- Highly qualified, multilingual ICT employees, with experience in internationally-tested projects
- Enhanced collaboration between the public and private sector and development partners
- More than 90% of territory covered with broadband networks
- Relevant scientific publications in identified sub-domains, including those co-authored with international partners

Weaknesses

- The skills and number of IT employees do not fully meet the needs of the ICT industry
- Limited investments in IT specialists' education and training
- Emigration of qualified employees
- Fragmented local IT industry
- Limited digital innovation capabilities of local IT companies
- Lack of access to venture capital and business angel funding
- Lack of granular data (detailed, recent, up-to-date) on RDI activities and results.
- Scarce funding for ICT research and small number of research projects
- Low entrepreneurial activity

Opportunities

- Awareness of ICT sector issues and needs at government level
- Establishing partnerships with multinational ICT companies
- Attracting foreign and domestic investments for the development of IT start-ups
- Continuous development of technologies and innovations and the corresponding absorption capacity
- Developing e-commerce and e-procurement solutions
- Attracting qualified human resources
- Developing new regional added-value infrastructures
- Opportunities brought by the EU Framework Program for Research and Innovation Horizon 2020 and the upcoming Horizon Europe.
- Moldova - a test field for the latest mobile technologies

Threats

- International competitive pressure
- Education system slow to adapt to the demands of the ICT labor market
- Small pool of available students in ICT specialties
- Low attractiveness of the RDI area, reflected in researchers' lack of motivation
- Low investment in high-tech solutions from local SMEs
- Limited / inadequate training of potential employees
- Prolonged economic crisis
- Geopolitical instability
- Delays in implementing public administration reform

The main development factors identified for the 3 subdomains, resulting from the participatory group exercise, are summarised in Table 1.

Table 1. Main development factors per subdomain

Micro/ nanomaterials and electronic engineering	Interoperability, open data and e-infrastructures	Mobile apps, software development, cloud computing
<ul style="list-style-type: none"> • Scientific and engineering specialisation of the country. • More than 90% of territory covered with broadband networks. • Incentives for skilled human resources. • Developing the automotive industry based on electronics and ICT. • Engineering and applied research culture developed over the last 40 years. • Relevant educational institutions / study programs in the field. • Concentrated research groups in the field of nanomaterials, nanotechnologies and electronic engineering in Moldovan research institutions, with significant results at international level. • Moldova developed some unique photovoltaic technologies in Southeastern Europe, based on Gallium arsenide (GaAs) for the aerospace sector. • Design and launch of the first Moldovan satellite. • Migration of qualified scientific and engineering personnel. • Inertness of the local electronics industry • Limited cooperation between national research groups and the private sector. 	<ul style="list-style-type: none"> • High performance communications infrastructure. • Increased transparency. • Changing culture and attitudes towards data • Opportunities and traditions of ICT education. • Initiatives on open government data • Federalization of access to electronic services. • Adaptation and implementation of international standards on data sharing • Insufficient resources for collaborative projects • Migration of skilled staff • Security of information and electronic systems • Inadequate legal framework • Lack of standardization in data exchange and interoperability • Political and economic instability of the country. 	<ul style="list-style-type: none"> • Developed telecommunication infrastructure (High Speed Internet) • Highly-developed mobile telephony • Moldova is a testing ground for the latest mobile technologies • Attracting foreign investments for development projects in the field. • Lack of state-funded projects for research institutions, SMEs • Lack of venture capital (investment) • Insufficient investment in mobile applications. • Low level of competitiveness of domestic companies. • Talents from universities, specializing in specific areas: mobile apps, gaming etc. • Inappropriate adaptation of the curriculum to the needs of the ICT sector. • Inadequate competence of the teaching staff in educational institutions • Emigration of ICT specialists

Vision for the ICT sector

By 2029, the ICT sector will be based on a legal framework developed and harmonized with European and international standards, providing an adequate investment climate for ICT business development and stimulating the public-private partnership aimed to capitalize on e-transformation opportunities in health, agriculture, energy, education, new materials and technologies, public administration.

The main objectives to achieve this vision

- Adopting and implementing a national program on smart investments in ICT and promoting the local ICT industry on European and international markets.
- Achieving a high level of digital competences of the population in all age groups.
- Implementing an efficient economic model for the funding of research and production infrastructure, based on relevant experience and good practices.
- Efficient STEM education system.
- Creating a favorable ICT environment to hinder the migration of specialists.
- Dynamic industry for the production of ICT devices and equipment, based on local research results in the fields of spintronics, photonics, plasmonics, nanotechnologies.
- Developing smart ICT solutions for Smart House, Smart City, Robotics, Artificial Intelligence.
- Establishing ICT clusters.
- From outsourcing to business based on high value added products and services.
- Equitable access of companies to projects / acquisitions in the field.
- Increased share of funding for ICT innovation and technology transfer projects.
- Implementation of ICT standards as a facilitator for sector development.
- National research e-Infrastructure interconnected at European and international levels, contributing to a joint, coherent and interoperable information space in RDI sector and fostering cooperation between RDI and private sector.
- Skilled, continuously-educated workforce.
- Setting up ICT research and innovation centers, recognised at European and international levels.

Conclusions

EDP workshops have proved there are scientific and business achievements, that could potentially become smart specialisation niches. They could also serve as basis for collaborative projects between Quadruple Helix actors, aiming to mitigate the societal challenges and increase the competitiveness of the national economy.

Recommendations

Several rounds of EDP workshops should be organised in order to identify the most relevant smart specialization niches. In this context, encouraging the participation of relevant actors is of major importance and requires the identification of appropriate mechanisms.

Due to the overlap in time between the EDP workshop and exam sessions in universities, as well as reporting terms in companies, the participation rate of some important actors was lower than initially planned.

The discussion on instruments/ policy mix was not covered by this meeting due to the lack of time and will follow in the next EDP meetings.

The following table summarises the sectorial goals and objectives per subdomains, resulted from the participatory exercise.

Table 2. Sectorial goals and objectives in ICT

1. What is the present situation of the priority subdomain?		
<i>Micro/ nanomaterials and electronic engineering</i>	<i>Interoperability, open data and e-infrastructures</i>	<i>Mobile apps, software development, cloud computing</i>
<ul style="list-style-type: none"> • Society availability to develop the ICT sector; • Engineering and applied research culture developed over the last 40 years; • Concentrated research groups in the field of nanomaterials, nanotechnologies and electronic engineering in Moldovan research institutions, with significant results at international level. • Companies' openness in terms of implementing new technologies; • Relevant educational institutions / study programs in the field; • Scarcely funded ICT research and innovation, leading to inadequate ICT RDI infrastructure • Continued massive emigration of qualified specialists, due to foreign partners poaching employees. • Inadequate skillsets of ICT graduates. • Insufficient clustering in the field. • Small local market for electronic components. <p><i>Relevant niches:</i></p> <ul style="list-style-type: none"> • Materials, components and devices for health protection. • Transducers for monitoring processes, phenomena, etc., based on new operating principles. 	<ul style="list-style-type: none"> • Fragmented sector – separate IT solutions/ silos lacking interconnection and a common vision, despite the achievements in the e-Government segment and the opening of government data; • Small pool of qualified employees, prone to migration. • Lack of e-infrastructures mapping, hindering their use by the private sector. • Inadequate adoption of ICT standards. Insufficient interoperability of data, systems, processes in the public sector, as well as between public sector, business and civil society. <p><i>Potential niches:</i></p> <ul style="list-style-type: none"> • Digital infrastructures and interoperable IT solutions. • Exploring the opportunities offered by Big Data and Artificial Intelligence to create innovative and competitive solutions in the relevant markets. • Open data infrastructures in public administration and private sector. • Nationally and internationally integrated digital content 	<ul style="list-style-type: none"> • IT parks provide significant incentives for the development of ICT companies. • Cost/ quality competition on the international market. • Moldovan ICT companies are not well-known / promoted on international markets. • Incentives to use M-Cloud, other cloud solutions. • High-end connectivity. • Multilingual employees. • The skills and number of IT employees do not fully meet the needs of the ICT industry. • Favorable geographic position: proximity to European markets, European time zone. • Openness of ICT sector to align student skills with market realities. • Difficulties in attracting students for internships.

2. What are the key challenges?		
<i>Micro/ nanomaterials and electronic engineering</i>	<i>Interoperability, open data and e-infrastructures</i>	<i>Mobile apps, software development, cloud computing</i>
<ul style="list-style-type: none"> • Strong competition in regional and global ICT markets. • Increased negative health impact of new mobile technologies (5G). 	<ul style="list-style-type: none"> • Security of information and electronic systems • Migration of human capital • Political and economic instability in the country • High costs for data acquisition, management, and usage • The risk of controlled Internet communications 	<ul style="list-style-type: none"> • Competition from ICT companies in neighboring countries (Romania, Ukraine). • Lack of creative industry specialists. • Tackling continuously growing information security requirements (in terms of personnel, capacities, legislation, management, etc.). • Slow adaptation of the education system to the demands of the IT labor market. • Inadequate cooperation between the educational, research and production sectors.
3. What are the sectorial goals of the subdomain?		
<i>Micro/ nanomaterials and electronic engineering</i>	<i>Interoperability, open data and e-infrastructures</i>	<i>Mobile apps, software development, cloud computing</i>
<p>By 2029, <i>Micro / nanomaterials and electronic engineering sector</i> will be focused on development of micro / nanomaterials and electronic components with novel properties, required on the domestic and international markets, which will contribute to improving the quality of life by implementation of Smart City, Smart House, intelligent, personalized medicine, etc.</p>	<p>By 2029, <i>Interoperability, open data and e-Infrastructure sector</i> will be set in a well-developed regulatory environment, stimulating business engagement, providing open, secure, free and interoperable data, employing a well-qualified workforce, with internationally recognised RDI centers and research e-Infrastructure interconnected at European and international levels.</p>	<p>By 2029, <i>Mobile apps, software engineering, cloud computing sector</i> will be competitive on European and international digital markets, offering appropriate investment climate for ICT development and innovation, with qualified professionals and effective dialogue between academia, educational and business.</p>

4. What are the main objectives to achieve sectorial goals?

<i>Micro/ nanomaterials and electronic engineering</i>	<i>Interoperability, open data and e-infrastructures</i>	<i>Mobile apps, software development, cloud computing</i>
<ul style="list-style-type: none"> • Creating a favorable ICT environment to hinder the migration of specialists. • Implementating an efficient economic model for the funding of research and production infrastructure. • Dynamic industry for the production of ICT devices and equipment, based on local research results in the fields of spintronics, photonics, plasmonics, nanotechnologies. • Supporting the set up of ICT clusters in this sector, encouraging the cooperation between RDI and private sector. • Wide-scale marketing of nanomaterial-based devices for health protection and the military. • Developing smart ICT solutions for Smart House, Smart City, Robotics, and Artificial Intelligence. 	<ul style="list-style-type: none"> • Adequate funding for collaborative projects between business and research. • Relevant legal framework developed and harmonized with the European and international norms. • Implementation of international standards, including open standards for data exchange and interoperability. • Increased openness for development and innovation among public institutions. • Effective communication between private sector, academia, education and public administration. 	<ul style="list-style-type: none"> • National program on smart investments in ICT and promoting the local ICT industry on European and international markets. • Improved ICT education system, based on effective STEM education and continuous education and upskilling of employees. • From outsourcing to business based on high value added products and services. • Equitable access of companies to projects / acquisitions in the field. • Increased share of funding for ICT innovation and technology transfer projects.

5. Which key stakeholders should be involved to achieve the sectorial goals?

<i>Micro/ nanomaterials and electronic engineering</i>	<i>Interoperability, open data and e-infrastructures</i>	<i>Mobile apps, software development, cloud computing</i>
<ul style="list-style-type: none"> • Academia (Technical University of Moldova, State University of Moldova, Academy of Economic Studies, Institute of Mathematics and Computer Science, Institute of Electronic Engineering and Nanotechnologies, National Center for Materials Study and Testing, Information Society Development Institute, ICT Excellence Center Tekwill) • Private sector (Endava, DAAC System, MoldovaITPark, Starnet IT Park, Orange, Moldcell, Moldtelecom, Deeplace, Pentalog, Alfasoft, Ritlabs, QSystem, ELIRI, Association of ICT Companies etc.). • Civil Society (Rectors' Council, Labor Market Observatory, professional associations, Hubs, RENAM, Educational Resources for Moldova, Association of Librarians of the Republic of Moldova). • Public Authorities (Ministry of Education, Culture and Research, Ministry of Economy and Infrastructure, National Agency for R&D, National Agency for Quality Assurance in Research and Education) • International development partners (USAID, UNDP, EBRD etc.) 		

VISION for the priority domain Information and Communication Technologies

1. What is the present situation of the priority domain?

- Highly qualified, multilingual ICT employees, with experience in internationally-tested projects
- Small pool of available IT specialists, prone to migration.
- Relevant educational institutions / study programs in the field.
- The skills and number of IT employees do not fully meet the needs of the ICT industry.
- Coverage of more than 90% of territory with broadband networks, high-end connectivity.
- Fragmented sector – separate IT solutions/ silos lacking interconnection and a common vision.
- IT parks provide significant incentives for the development of ICT companies.
- Attractive geographic position: proximity to European markets, European time zone.
- Engineering and applied research culture developed over the last 40 years.
- Concentrated research groups in the field of nanomaterials, nanotechnologies and electronic engineering in Moldovan research institutions, with significant results at international level.
- Cost / quality competition on international markets, but ICT companies in Moldova aren't well-known / promoted.
- Scarce funding for ICT research and innovation.
- Inadequate ICT RDI infrastructure.
- Openness of economic agents to implement new technologies

Potential niches:

- Digital infrastructures and interoperable IT solutions
- Exploring the opportunities of Big Data and Artificial Intelligence to create innovative and competitive solutions in the relevant markets.
- Open data infrastructures in public administration and private sector.
- Nationally and internationally integrated digital content.

2. What are the key challenges?

- Tackling continuously growing information security requirements (in terms of personnel, capacities, legislation, management, etc.).
- Education system slow to adapt to the demands of the ICT labor market
- Competition from ICT companies in neighboring countries (Romania, Ukraine).
- High costs for data acquisition, management and usage.
- Migration of human capital

3. What should the priority domain be like in 2029 in order to stay competitive, innovative and answer the societal challenges (VISION)?

By 2029, the ICT sector will be based on a legal framework developed and harmonized with European and international standards, providing an adequate investment climate for ICT business development and stimulating the public-private partnership aimed to capitalize on e-transformation opportunities in health, agriculture, energy, education, new materials and technologies, public administration.

4. What are the main objectives to achieve this vision?

- Adopting and implementing a national program on smart investments in ICT and promoting the local ICT industry on European and international markets.
- Achieving a high level of digital competences of the population in all age groups.

- Implementating an efficient economic model for the funding of research and production infrastructure, based on relevant experience and good practices.
- Efficient STEM education system.
- Creating a favorable ICT environment to hinder the migration of specialists.
- Dynamic industry for the production of ICT devices and equipment, based on local research results in the fields of spintronics, photonics, plasmonics, nanotechnologies.
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- Implementation of ICT standards as a facilitator for sector development.
- National research e-Infrastructure interconnected at European and international levels, contributing to a joint, coherent and interoperable information space in RDI sector and fostering cooperation between RDI and private sector.
- Skilled, continuously-educated workforce.
- Setting up ICT research and innovation centers, recognised at European and international levels.

5. Which key stakeholders should be involved to achieve this vision?

- Academia and research (institutes, universities, colleges, etc.)
- Private sector (SMEs, joint ventures, entrepreneurs' associations, industrial parks)
- Public sector (central and local public administration)
- International partners in RDI, business and NGO sectors
- Trade promotion organizations, professional associations.