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Short Term High Quality Studies to Support Activities under the Eastern Partnership

HiQSTEP PROJECT

ICT INNOVATION AND START-UP ECOSYSTEMS

STUDY REPORT

January 2018

Preface

This final study report on ICT Innovation and Start-up Ecosystems is part of the project '**Short term high quality studies to support activities under the Eastern Partnership – HiQSTEP, EuropeAid/132574/C/SER/Multi**', carried out by an international consortium under the leadership of Kantor Management Consultants. The present study has been carried out to support the activities of Platform II - 'Economic Integration and Convergence with EU policies' – of the Eastern Partnership.

ICT Innovation and start-up ecosystems have been identified as priority area by the EaP Platform II Work Programme 2014-2017. The DG NEAR and DG CONNECT are the driving forces in cooperation with EaP Partner Countries on this theme.

The present study was implemented by a study team under the leadership of **Sander van der Molen**, Study Team Leader, and composed of **Anna Pobol**, Senior International Expert and the following national experts: **Hambardzum Kaghketsyan** (Armenia), **Ramil Maharramov** (Azerbaijan), **Tatyana Filippova** (Belarus), **Eka Katamadze** (Georgia), **Ion Cosuleanu** (Moldova) and **Ivan Kuchytskyy, Olga Simson and Olha Krasovska** (Ukraine).

The overall supervision, quality check and management was carried out by **Przemysław Musiałkowski**, Team Leader of the HiQSTEP Project.

Sincere thanks go to the national stakeholders in all six countries who provided information in interviews and responses to questionnaires.

January 2018

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Abbreviations and acronyms

EU	European Union
EaP	Eastern Partnership
EC	European Commission
EIB	European Investment Bank
EIF	European Investment Fund
EUD	Delegation of the European Union
HiQSTEP	High Quality Studies for the Eastern Partnership
ICT	Information and Communication Technologies
IoT	Internet of Things
STL	Study Team Leader
TA	Technical assistance

Country codes

AM	Armenia
AZ	Azerbaijan
BY	Belarus
GE	Georgia
MD	Moldova
UA	Ukraine

EXECUTIVE SUMMARY

Background and purpose

The overall objective of the study was to contribute to the improvement of the enabling environment for ICT innovation and start-up ecosystems in the Easter Partnership Countries (Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine), drawing lessons from success stories in the EU and key third countries. Hence, the study project has:

a) **assessed the needs** of different ecosystems in the Partner Countries, including the needs for skills, talent, competences and investment;

b) **issued recommendations** at national level ("country roadmaps") and at EaP regional level, for promoting ecosystem development, drawing lessons from the enabling environments in the EU and key thirds countries, and taking into account the platforms and services offered by GEANT and EaPConnect;

c) **registered and mapped the stakeholders** of the partners' ecosystems ("EaP ICT Innovation Map");

d) **incorporated the "EaP ICT Innovation Map" into Start-up Europe web-based platforms**, notably the Start-up Europe Map and the Start-up Europe One Stop Shop;

e) **specified a common training package** for addressing the needs of the main groups of ecosystem stakeholders in the Partner Countries.

For the purposes of this study, “ICT Innovation” is understood as a wide range of possible innovations related to information and communication technologies: new methodological frameworks, new technologies, new organisational innovations in software development, ICT products servicing the previously non-covered business processes, innovative ICT-supported products in non-ICT industries or ICT-enabled services, as well as new models of cooperation with participation of ICT companies, or digital platforms. The purpose of this study was not to cover each of these innovations. Instead, the focus was put on the *infrastructure and composition of ecosystem enabling these diverse types of ICT-related innovations to be developed, diffused across the economy, deployed and exploited by both ICT and non-ICT companies*. *"Ecosystem stakeholders"* typically include policy-making authorities; policy implementation agencies; innovation service providers, such as incubators, accelerators, venture capital funds, business angels, technology transfer offices, and innovation players such as corporations, start-ups, universities, and research institutes. *"Enabling environment"* refers to the relevant legal and regulatory framework, best practices, ICT platforms, tools and services which are in place to ensure the proper functioning of the ecosystem and the growth of start-ups and innovative businesses.

Baseline for Study on "ICT innovation and start-up ecosystems" in the Eastern European Partner Countries

The rationale for the baseline survey and analysis of EU Member States was to identify the *enabling factors* and to describe the *functional structure* of the advanced and well-functioning ICT innovation and start-up ecosystems (further – ecosystems).

For the baseline study, the following EU countries were studied: Germany, Great Britain, Ireland, Sweden, Estonia, and France. Additionally, USA, Japan and South Korea provided examples of advanced ICT innovation services.

To identify the *enabling factors* of the advanced and well-functioning ICT innovation and start-up ecosystems, the baseline study has made an overview to the EU approach for creating and developing a European-wide ICT innovation and start-up ecosystem, followed by a country by country analysis. Finally, a-cross-country analysis was made for identification of common factors and key differentiators between different countries with a successful ecosystem.

To describe the *functional structure* of the advanced and well-functioning ecosystems, the benchmarking organisations (with a focus on innovation infrastructure organisations and cluster organisations providing services to support ICT innovations) were selected in each of the selected countries as those delivering the advanced ICT innovation services (the list of 53 benchmarked organisations is in Annex 1). Baseline study of the selected organisations was performed with a focus on general and specific functions needed to be performed (services to be delivered) by the ecosystem in order to enable the development of businesses based on ICT innovations. We have focused on those services that go beyond the typical tools of innovation infrastructure organisations and take into account the ICT specifics. The identified examples are neither claimed to be the top practices in EU, nor (taking into account the specifics of national innovation systems) the ideal examples to be transferred without adaptations to EaP countries. Both the businesses developing the innovative ICT-based solutions, and the businesses that seek to restructure their business and production model leaning on ICT innovation opportunities, are the target audience for these services.

In order to provide the logical framework for gap analysis, the range of baseline services, tools and infrastructures for ICT innovation were systematised according to the stages of the innovation process with account of specific needs of businesses and the comprehensive **ICT Innovation Service Map** was developed, reflecting the functional structure of the advanced and well-functioning ecosystems. The basic assumption of our approach was that on different stages of development, businesses tackle various needs, and for enabling the development of businesses, the ecosystem should be tailored to address these needs. The services enabling the resource base and the networking services are studied as separate blocks, since these services are important for businesses through the whole lifecycle.

This has enabled comparison of EU with EaP countries and allowed for making a gap-analysis and drawing conclusions and recommendations for individual EaP countries and the EaP region as a whole, on how to further stimulate and develop the ICT innovation and start-up ecosystems in their countries.

One of the general conclusions from analysing and comparing six EU Member States was that these countries have different profiles, characteristics, strategies, and different national innovation systems. Therefore, there is not a single recipe for a successful ICT innovation and start-up ecosystem; different countries have developed their own ecosystem that adapts to their local culture, needs and system. However, there are several lessons to be learned from these countries. First of all, they have national digitalisation strategies that complement existing national innovation strategies. Second of all, these strategies have clearly identified and linked policy measures to implement their digitalisation strategy. On institutional side, these six EU Member States all have strong policy advise organisations that provide long-term evidence and research-based advice to the government and/or relevant ministries involved in policy making on topics such as science & technology, entrepreneurship, innovation, economic development, digitalisation etc. Another important institutional common factor between these countries is that there are strong policy implementation actors that form a strong link between policy making organisations (ministries/government) and the ICT innovation actors such as industry, universities, start-ups, research institutes etc. These policy implementation organisations are the interface between policy making and ICT innovation actors. An additional common lesson is that these policy implementation organisations provide together a portfolio of relevant support services, ranging from advice, financial support to networking and support services. Furthermore, in each of these EU Member States studies in our baseline, there is a number of organisations provide both ICT specific support services and/or generic innovation support services. The availability of both ICT specific support services and of generic innovation support services could be an indication of a mature innovation system where different organisations provide different support services, enabling actors in the field to get access to a wide portfolio of support services that could provide significant help in their innovation activities.

State of play and gap analysis

Next, the ICT innovation ecosystems and enabling environments have been analysed in the EaP countries.

The **first stage** of work on describing the existing ecosystems was to identify the existing ICT innovation ecosystem stakeholders in EaP countries, including the following types of organisations, including those listed on the start-upEurope Map (universities; public organisations; incubators; accelerators; co-working spaces; influencers; corporates); those actors listed on the start-upEurope Map as investors, disaggregated for the purposes of our Study to

reflect the availability of funding for various stages of the business lifecycle (business angels; networks of business angels; venture capitalists; corporate venture capitalists; crowdfunding platforms); as well as the other relevant ICT Innovation ecosystem actors (policy-making authorities; scientific and research institutes; ICT training centres; high-tech parks; technology transfer offices; fablabs; business associations; professional associations; competence centres; digital innovation hubs).

During the field research, the data about 840 ecosystem actors in EaP countries was gathered, which were assessed as most relevant in terms of enabling ITC innovations. The scope of the collected data is comparable with the number of innovation support organisations registered at the start-upEurope Map.

Comparison of structure of samples of EaP and EU innovation infrastructure organisations reflects the basic difference in the ecosystems. In EU, the largest share of the ecosystem is taken by accelerators servicing the growth of the existing companies that have already started market operations. In EaP countries, the largest share is taken by the universities that service the resource needs of businesses.

Yet, the numbers about the number of organisations in particular EaP countries should not be interpreted for the purpose of championing the countries, because the differing size and the specialisation of the economic systems of the countries, and the institutional structure of the national innovation systems cause the differing needs in the structure of the institutional framework for innovations. Similarly, the numbers of organisations cannot be directly comparable because of very different size of the same types of organisations in different countries and regions. Finally, in many cases it was difficult to delineate the particular types of organisations in EaP countries because the *level of specialisation of the existing ICT innovation ecosystem is yet low*, and many functions that in EU countries are already distributed among specialised actors, in EaP countries are performed by the same organisations (i.e., a state agency hosting a business incubator, a technology transfer office and providing access to funds). In some countries, the definitions of recently emerging forms of innovation infrastructure organisations are even *not fixed in the legislation or differ from EU definitions*. This leads to a conclusion that the data about the number of existing organisations should not be directly compared with the number of similar organisations existing in the EU; rather, the functions actually performed by the existing organisations need to be studied in-depth.

That is why, on the **second stage**, the selected sample of 840 EaP ICT innovation infrastructure organisations was used to collect the field data about the scope of services that are actually suggested by the existing organisations to businesses seeking digital innovations. The **ICT Innovation Service Map** elaborated by the project team on the basis of the identified benchmarking EU practices was used as a logical framework.

The work on mapping particular organisations on the ICT Innovation Service Map was performed with account of the very differing terminology and aggregation level for differentiating the services used by the organisations both within and across the countries.

The data on services was collected based on the available public data. This approach was selected in order to reconstruct the practical situation and conditions of individuals looking for specific services for their business development (to find out whether the new business founders and the existing businesses can already find the information about potential suppliers of these services in the Internet). Following this approach, primarily the data published on the websites of the selected sample of nearly 900 ecosystem organisations was used. It was complemented with the existing published reports and information from other publicly available documented sources. The information about the services that are only planned to be delivered was included in those cases when these plans were supported by relevant published documents. The intentions of delivering some services not supported by documents have not been accepted as evidence and were not considered for mapping.

As a result, the particular **ICT innovation service landscapes** have been identified in the EaP countries.

The **gaps in the ICT innovation ecosystem between the EaP countries and the EU countries** are difficult to measure in the quantitative terms because for EU countries the statistics of the desired level of disaggregation of services is not available, and also in EU the services are also not delivered by 100% of relevant organisations. Thus, it is not recommended to compare directly the amounts of organisations of various types in EU and EaP countries.

In order to provide some comparability of the ICT innovation landscapes among EaP countries, not the absolute but the relative numbers have been used. For assessing the scope of the function of the country ecosystem to provide particular service, the share of organisations mapped as delivering such a service was estimated in among the total number of organisations collected as a sample in particular EaP country. This approach leans on the assumption that the balanced ecosystem is pursued. The best approximation that was achievable within the timeframe of this Study was to measure the balance in the ecosystem by the evenness of distribution of organisations providing the services.

This has allowed assessing the gaps in relative terms: not to compare the existing situation with an imaginary “ideal” level or with the differing EU level, but to identify the weakest links within the ecosystem of particular EaP country. On this basis, it was possible to identify the stages of the innovation process that are least developed in each EaP country and within the EaP region generally.

Assessing the scope of organisations delivering various services across the business lifecycle exhibits that In EaP countries generally, the relative strength of ecosystems is concentrated on

providing the resource base to innovative entrepreneurship and the networking opportunities (over 10% of organisations are involved into these services). Herewith, the start-up stage and the later stages of the innovation process remain very weakly serviced. Thus, *except for accompaniment after entering the market, all service groups need to be developed in EaP countries.*

The weakest areas of the ICT innovation ecosystems in EaP countries generally (below 5% as a share of the existing ecosystem) are the following ones:

- at the **start-up stage**: research and development; value proposition and business concept testing and validation; product and corporate design;

- at the **stage of entering the market**: marketing products and services; distribution channels and sales; innovation management / support of innovation processes.

- at the **growth stage** and during **business transformation**: business scoping up; business scaling up; thematic expertise.

Interpreting the structure of these data should be performed only in qualitative terms, keeping in mind that the certain balance between the *specialisation* and the *competition* of organisations on particular services is needed. This means, that the services should be delivered by more than one organisation in order to provide the competition among the organisations fostering them to improve their services. At the same time, it should not be expected that all the services (taken on the disaggregated level) are delivered by all or overwhelming part of organisations even of the same type (all business incubators or all technoparks), because specialisation of organisations is a natural consequence of competition.

A more detailed analysis across the EaP countries shows the relative strengths and weaknesses of some EaP countries in some service areas, which can be used for determining the EaP countries that are relatively better than others in particular services and could thus be leaders in the process of harmonizing ICT innovation infrastructures in EaP.

A more detailed view inside the landscapes of particular countries allows revealing the relative weaknesses and strengths that can be used for national EaP roadmaps on ICT innovation ecosystems.

The goal of the Study was not to rank the quality of the existing innovation infrastructure services or organisations, and the stocktaking work of national experts was not oriented towards this. However, the provided indicators can be used to measure the comprehensiveness, the maturity and the innovativeness of the **ICT innovation service landscapes** in each partner country, and to trace the dynamics.

From practical viewpoint, the thorough investigations of the ICT innovation ecosystems' maturity level might be very cost-intensive, while the assessment of the quality of services delivered will

still remain the major indicator of the ecosystem performance. *The main recommendations are that the business should be enabled the best access to the services via one stop shop, and that the web platform servicing as a gateway to ICT innovation services delivered by various organisation (also across borders) should have the functionality of assessment by businesses of the quality of the services received.*

Additionally, the specialised web-based platforms supporting ICT innovations in EaP countries were identified. They are studied as a separate group of tools, because they are usually co-owned, operated, or jointly updated by multiple organisations. Screening has shown that only Belarus, Georgia and Ukraine have some types of web-platforms supporting ICT innovations. While the need for development of such platforms for each particular country is disputable, we consider which types of platforms need to be developed to enable the smart specialisation of the country, and which are better to be developed as international scale platforms.

Taking into account the extensive field work executed within the Study, and the vast information on the existing organisations, it is recommended to continue with establishing a common EaP Service Map Platform, which can be also extended to a common EaP-EU platform.

A qualitative assessment of the ICT-related innovation infrastructure landscapes provided by national experts has allowed revealing the following problems common for most EaP countries.

General problems:

- The existing national innovation systems in EaP countries are fragmentary and incomplete.
- Although a number of policy documents on innovative development have been adopted, there is a huge need for a systemic and policy approach.
- Only a few mechanisms for encouraging the innovation activities are applied in EaP countries out of the large spectrum available in the EU countries.
- In spite of the large amount of innovation infrastructure organisations, there is still a gap in providing services for start-ups and innovative companies in general.
- The existing services are not targeted on the needs of particular branches of economy, particular blocks of the value chain; value chain as a whole; or circular economic processes.
- There is a significant lack of the comprehensive digital innovation framework and a lack of recognition of ICT as strategic sector.
- There is no single common innovation marketplace.
- Domestic markets for ICT innovations are held back by a lack of demand, limited ICT usage and low incomes.

The existing **good practices of services for ICT innovation in EaP countries** are described in more details in the **appendix 5 of the Study**, structured across various stages of business lifecycle.

The Study has also investigated the **specific legal framework relevant for ICT innovations**. It was not possible within the current study to make an in-depth comparison of particular issues covered by the legal acts, analyse their consistency with the EU legislation etc. However, the Study summarises the fact that some EaP countries have a complete lack of regulation on the issues important for businesses to start investing their time and resources into digital innovations.

The most well developed (available in all EaP countries) is the legislation on intellectual property rights and electronic digital signature and electronic documents. The most widespread gaps are regulations of cloud providers and the national legislation to set safe and fair contract terms and conditions for cloud computing contracts and the regulation on EDI-providers.

The Study has also mapped the ICT innovation systems in each of the EaP countries. In most of these countries, a strong policy advice body was missing with capacity, skills, knowledge, independent position and resources capable of developing policy recommendations in the field of ICT Innovation and/or start-up and entrepreneurship to relevant policy making organisations such as government and relevant national ministries. Furthermore, a fragmentation of policy development responsibility between different ministries was stronger in EaP countries where different ministries have responsibilities for different domains around the topic of ICT innovation and start-up ecosystems with no demonstrable coordination between the different ministries. This has resulted in some of the EaP countries with different, distinctive and independent national strategies regarding innovation, digitalisation, entrepreneurship, and economic development.

The Study also identified that there was a lack of strong policy implementation organisations that function as interface between the ICT innovation and start-up actors in the field and the policy making organisations. Additionally, there seems to be a lack of specific policy instruments designed specifically for the implementation of the national strategies. Often specific national laws are designed and approved by government; however no specific policy instruments are designed and implemented with dedication budget, resources, target group for intervention into the national ICT innovation and start-up ecosystem with the purpose of improving the conditions. Therefore, EaP countries have overall less dedicated ICT innovation specific and generic innovation support services in comparison to the six EU Member States studied in the baseline.

Roadmaps and Recommendations

Roadmaps

Based on the EU baseline and EaP study of *enabling factors* for ICT innovation ecosystems, the policy measures (mainly focused on legal and institutional changes) were proposed in the

roadmaps that were tailored to each individual EaP country, to improve their ICT Innovation and start-up ecosystems.

Additionally, some challenges in the ICT innovation and start-up ecosystems that were common to most or in some cases all of the EaP countries were identified during interview, desk research and data analysis. The Study has therefore dedicated a separate section on the identification and description of common challenges and has provided examples of policy measures that could be implemented to address these challenges. These examples of policy measures should be taken as examples for inspiration, not as a required prescription or as only possible solution. None of these policy measures will have the potential in isolation to solve the identified challenge, but each of them could (if suitable and adapted for each individual EaP county) contribute to addressing the common challenge. These policy measures introduced in the Study are taken from the six EU Member States studies in the baseline or taken from other EU Member States as examples.

A list of identified challenges that are common to all EaP countries is presented below. It is important to notice that this list does not claim to be conclusive or complete and that they are presented without any prioritisation or hierarchy:

- Brain drain– Many young highly educated talented people emigrating to find jobs in companies, universities and research institutions abroad.
- Different, and narrow understanding of “innovation” to “Research” or “High-tech”
- Lack of collaboration between industry and academia
- Lack of applied research and development investments from industry
- Fragmentation of public agencies involved in ICT innovation and start-up eco-system
- Fragmented policies, lack of implementation of policies
- Outdated research infrastructure
- Lack of Multinationals with strong research and development capacity
- Lacking uptake of ICT innovations in society
- Lack of reliable and comparable statistics
- Lack of Start-up culture and eco-system
- Lack of funding for research and innovation
- Fragmented disconnected donor programs
- Low awareness, knowledge and capacity to protect IP
- Procurement practices limit the role of public as launching customer for newly developed innovation within the country

Although the identified challenges might be on high aggregation level be common to all EaP countries, the manifestation of each of these challenges in each individual EaP country might be

very different. Therefore, this Study has not developed common recommendations to address all of the identified challenges. A specific tailored set of policy instruments that addresses the specific circumstances and conditions in each individual EaP country is needed to address particular challenges. Therefore, only suggestions for policy instruments are provided in the Study as inspiration for each EaP country to develop, design and implement their own solutions.

In the next section, a common Action Plan is presented where common EaP actions do provide an added value for joint actions.

Action Plan

The Second Eastern Partnership Ministerial declaration has approved specific targets for 2020 as part of a roadmap for future digital cooperation in the EaP, ensuring concrete benefits for citizens and businesses. The targets for 2020 in the area of ICT innovation are set as:

1. well-structured ICT research, innovation and start-ups ecosystems in place for all countries,
2. established connections among partners' ecosystems and with similar EU ecosystems.

To achieve these targets, six harmonisation pillars (domains) are suggested in the Action Plan, that represent the EU baseline in a strategic manner and are applicable to the entire region based on the gap analysis. The proposed pillars are:

1. ICT innovation training
2. ICT innovation networking
3. ICT innovation institutional framework
4. ICT innovation infrastructure
5. ICT innovation pilot projects for SMEs
6. ICT innovation services.

Each pillar contains specific project activities at each implementation level. The projects are formulated and assessed using the SMART objectives framework.

The abovementioned structure of activities addresses the key challenges common for all EaP countries. Action 1.1. „Customise the training package for each EaP partner by adding legislation specifics and taking into account the stakeholders' needs" can be performed with account of the training gaps identified for each EaP country. The Pillar 6 "ICT innovation services" common for all EaP countries can be complemented by activities on the development of services in accordance to the gaps identified specifically for these countries.

In the Action Plan, the key activities and projects are listed, addressing the key common problems of EaP countries in their ICT innovation ecosystems. The timeframe for their launch/implementation is indicated and the scope of the projects is marked.

The proposed harmonisation activities serve as an entry point for the next three years 2018-2020, especially during 2019-2020 when the support mechanism of the European Neighbourhood Policy (ENP) assistance instruments in relation to the Eastern Partnership becomes fully operational following mandatory tender procedures (planned for 2018). The proposed actions in ICT Innovation aim at creating a critical mass for wider and deeper cooperation after 2020. Their scope can be expanded through the engagement of other types of EU assistance, especially via twinning projects. Twinning can be used to share experiences and good practices. The ENP East twinning page mentions Armenia, Azerbaijan, Georgia, Moldova and Ukraine explicitly as eligible for twinning projects with the EU Member States. Besides regional networking and cooperation, much can be gained through strengthened collaboration/interaction with the existing EU associations (e.g. DIGITALEUROPE, Digital SMEs, EuroCloud, Eco.), organisations and projects (e.g. Cluster Collaboration Platform, Mittelstand 4.0, start-upEurope Map and One Stop Shop, Accelerators Assembly etc.) dealing with ICT innovation-related services.

It is also suggested to utilise fully the opportunities created by the EaPConnect project to improve ICT innovation infrastructure and services in the region thanks to the state-of-the art high-capacity broadband internet networks for research and education across the EaP Partner Countries. Pilot projects for SMEs demonstrating how the ICT innovation can be enabled by the infrastructure deployed in the EaP Connect project will demonstrate the opportunities for both the start-ups and the existing businesses in the traditional industries striving to digital transformation.

Utilisation of the multiple funding opportunities, including those provided by the international financial organisations, will allow to consequentially deploy the broad spectrum of services for different stages of the business lifecycle identified in the *ICT innovation service logframe* to enable building the well-structured ICT research, innovation and start-ups ecosystems in EaP countries, including through connections among partners' ecosystems and with similar EU ecosystems.

Herewith, it needs to be noted that the efficiency of these ecosystems will be impacted by the external environment (broadly taken national innovation systems, FDI policy, economic stability, educational system, the policy of the Eurasian economic union of which Belarus and Armenia are the members) that cannot all be addressed by the tools and institutions of the ICT innovation infrastructure.

Recommendations for a common EaP Training Package

The goal of this part of Study was to specify in detail the content and structure of a common training package for the EaP countries, to address the needs of the main groups of EaP ICT innovation ecosystem stakeholders in knowledge, skills and competencies related to ICT innovation and digital transformation. Digital transformation was understood in this project as application of modern information technologies for radical increase of productivity and value. Thus, the knowledge, skills and competencies related to ICT innovation and digital transformation

go beyond the software development skills and even beyond the running of a software development company. The appropriate training should intend to develop the following competencies of the target groups:

- Increase the understanding of policy-makers of the opportunities, limitations of digital transformation as well as advanced tools for fostering the technology- and innovation-driven economic growth; enhance their skills on practical development of digital innovation policies.
- Increase the understanding of ICT innovation infrastructure organisations on how to develop their specialisation when addressing the needs of businesses in ICT innovations; enhance their skills on practical implementation of relevant tools and services.
- Increase the understanding of businesses on digital markets and managing digital businesses; enhance their practical skills on finding the IT-enabled solutions to business problems and to the burning social problems, identifying and resolving the problems of digital transformation of the existing businesses.

To specify the training needs of different types of stakeholders, they were identified separately for each EaP country and in general for the EaP region.

Next, the roadmap related to ICT innovation training needs was drafted.

Finally, the specification of training packages separately for different groups of stakeholders was developed, that can be used as a ToR framework for development of particular courses.

Experts' estimations show that the gap among EU and EaP citizens as for the digital competences defined in accordance with methodology of The Digital Competence Framework 2.0 is not that big. However, when it goes for creation conditions for development of digital economy, much more specific competencies need to be estimated. The framework for estimation of these competencies was elaborated by the authors on the basis of the baseline analysis of best practices existing in the selected countries of EU and the world.

Training needs of policy makers.

The experts mark that the knowledge of **policy-makers** about the existing legal framework for digital markets in EaP countries is rather high and sufficient for developing strategic regulations and operative decision-making. However, in the other areas, some training is needed to better equip the regulators and state bodies for developing strategic regulations and operative decision-making. The worst is the estimated level of knowledge of regulators and state bodies on specific topics of digital technologies, digital markets and managing digital businesses - it is even not sufficient for initiating public discussions.

However, there is a big gap between the importance (8 out of 10) of skills/ knowledge concerning particular *technological trends* and on *digital business management* by policy-makers and state organisations, and the existing level of quantity and quality of training (4 out of 10) provided by

the country's eco-system for ICT and innovation (innovation infrastructure, universities etc.) on these topics.

The gap is the highest for:

- Developing digital business strategies and roadmaps
- Developing innovative business models based on digital technologies
- Innovation management, change management, risk management on digital markets
- Intellectual property management on digital markets
- Internationalisation specifics on digital markets.

Training needs of innovation infrastructure organisations for enabling ICT innovations.

Generally, it was estimated that there is a considerable gap among the need of businesses to be serviced across the stages of the full innovation process, and the quality of services (consultations) of innovation infrastructure organisations currently delivered to companies, with account for the *peculiar needs of innovative businesses at different stages* (seed, start-up, scale-up, consolidation, renewal). The same gap is observed as for spectrum of services delivered to innovative businesses in the country with account of digital market specifics and the contact persons.

In order to determine the particular knowledge domains where the innovation infrastructure organisations need most of training, the expert opinions have been collected by the national experts in two dimensions: to estimate the quality of services (consultations) of innovation infrastructure organisations currently delivered to companies, and the need from businesses for such services in each EaP country.

Most knowledge domains on technological trends and on digital business management have been estimated as highly important in all EaP countries due to high need of businesses in respective services, with an average score 9 out of 10. Herewith, the average quality of services offered by the innovation infrastructure organisations was estimated with a score 4 out of 10.

The knowledge domains on *technological trends* where the largest gap is observed include artificial intelligence; Big Data collection, aggregation, analysis, visualisation services; cybersecurity; eHealth, Industry 4.0.

The knowledge domains on *digital business management* where the largest gap is observed include: internationalisation specifics on digital markets; innovation management, change management, risk management on digital markets; recruitment and personnel management on digital markets; developing innovative business models based on digital technologies; developing digital business strategies and roadmaps; intellectual property management on digital markets.

Training needs of businesses for performing ICT innovations.

Generally, the businesses interrogated in the EaP countries have estimated that the level of knowledge on technical skills, soft skills and management skills of employees at the companies

in their countries are rather high. Due to resource and time limits, it was not possible to collect a data reflecting the needs of businesses in particular technologies and related knowledge: evidentially, there would be big differences observed not only across the branches of economy but also across the size of businesses and their areas of specialisation. Thus, the situation was only roughly assessed as for the general availability of knowledge on particular technological trends across the businesses.

According to rough expert estimations, the lowest level of knowledge of EaP businesses in *technological trends* (below 4 points out of 10) is observed for the following areas of knowledge: artificial intelligence; cyber currencies (e-money); distributed ledgers and blockchain; eHealth; eLogistics; gamification; Industry 4.0; Internet of Things; mobilisation, socialisation and omni-channelled service as trends of digital markets; robotics; smart contracts; smart grids; visualisation, virtual reality and augmented reality.

The knowledge on different aspects of *digital business management* is generally marked by EaP businesses of higher importance than the knowledge of particular technological trends, with an average score of importance equal to 8 out of 10. Herewith, the level of available knowledge was generally estimated at the level of 5 out of 10.

Generally, businesses possess the slightly better knowledge relevant for the initial stages of the innovation process comparing to business growth and internationalisation aspects; yet for all areas there is a clear need for direct business training and development of specialised consultancy services.

Topics of ICT Innovation-related training recommended for the EaP roadmaps.

Based on the results of the Study, the training modules have been identified, that can be considered a priority for *EaP-wide activities on ICT Innovation trainings*.

The identified gaps in knowledge of policy-makers, innovation infrastructure organisations and businesses of particular countries can also be considered as a priority for *training on a bilateral level (EaP country-EU)* and included into the topic recommendations to *EaP national roadmaps* on ICT Innovation-related training.

The Study has developed the specification of a common EaP training package for main groups of stakeholders: policy-makers, ICT innovation infrastructure organisations, and businesses.

Relevant training for **policy-makers** is targeted at increasing their understanding of the opportunities, limitations of digital transformation as well as advanced tools for fostering the technology- and innovation-driven economic growth. The main blocks of training for policy-makers include Module 1. Digital policy basics; Module 2. Practical applications of digital technologies (trained across the advanced technological and product trends in an easy-to-understand non-technical language; with focus of specific business processes in relevant industries); Module 3.

Digital business management basics (for regulators in charge of economic development and entrepreneurship).

The comprehensive training package for **innovation infrastructure organisations** follows the logics of the innovation process and differing needs of businesses at different stages of development. The training framework elaborated in this Study should be used to foster the specialisation of the ICT innovation infrastructure organisations.

The recommended concept of training for **businesses** is the modular-based training, so that particular topics can be picked up by the students depending on their needs. The comprehensive training on digital markets and managing digital businesses should include the minimal knowledge of all the stages of the innovation process and business development. It can be combined with particular modules on **technological and product trends** in a more flexible way, depending on the interest of students. This will enable the growing specialisation of digital specialists and the tuning of their skills to the market needs. Specialisation can also be developed by a combination of the **comprehensive training on digital markets and managing digital businesses** in a flexible way with knowledge on operation, typical business processes and typical challenges of particular industries of economy (agriculture, construction, logistics, trade, manufacturing, healthcare etc.).

1 BACKGROUND AND PURPOSE

1.1 Geographical scope

The Geographical scope of this study covers the 6 eastern European partner Countries: Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine.

1.2 Relevant background

The Declaration of the Riga EaP Summit (May 2015) welcomed the completion of the first HDM study and called for the establishment of the HDM Panel;

The Declaration of the 1st EaP Ministerial Meeting on the Digital Economy (June 2015) identified ICT-based infrastructures for education, research and innovation and as a key enabler for the digital economy and society and a priority topic for digital cooperation in the EaP.

On 5-6 October 2016, the 1st EaP workshop on ICT innovation and start-up ecosystems took place in Brussels. The participants discussed challenges and opportunities in the region and proposed the first draft of a joint Action Plan for 2017-2020.

The Joint Statement of the Ministerial level meeting on the Digital Community with the EaP partners (October 2016) endorsed the operational conclusions of the 2nd HDM Panel, including the lunch of the EU4Digital: ICT Innovation network, aiming to promote ICT research, innovation and start-up ecosystems in the Partner Countries, taking into account similar efforts in the EU, notably the "Start-up Europe" initiative and the "Horizon 2020" Programme.

The 2nd EaP workshop on ICT innovation and start-up ecosystems took place on 25 April 2017 in Salamanca, Spain, in the margins of the Start-Up Ole event which brought together over 2000 key innovation ecosystem stakeholders from 60 countries. Participants of the 2nd workshop discussed further and elaborated the joint Action Plan 2017-2020 which now reflects accurately the needs and priorities of the partners' ICT innovation and start-up ecosystems.

The participants identified the need for a study, to act as a basis for future work in this area, both at national level and jointly by the partners. The study will contribute to the following objectives of the EU4Digital: ICT Innovation network:

- Providing a forum for regular exchanges of information, best practices and expertise on issues relating to the promotion and development of ICT innovation and start-up ecosystems among the Partner Countries and with the EU;
- Facilitating the exchange of information and expertise with international organisations, other regional networks, authorities and experts in the promotion and development of ICT innovation and start-up ecosystems;
- Promoting in the Partner Countries the Start-up Europe framework;

- Preparing recommendations for new joint projects and regional initiatives.

1.3 Description of the assignment, objectives and expected results

1.3.1 Overall objective

The overall objective of the study was: to contribute to the improvement of the enabling environment for ICT innovation and start-up ecosystems in the 6 eastern European Partner Countries, drawing lessons from success stories in the EU and key third countries.

1.3.2 Specific objectives

In order to reach its overall objective, the study project has:

f) **assessed the needs** of different ecosystems in the Partner Countries, including the needs for skills, talent, competences and investment;

g) **issued recommendations** at national level ("country roadmaps") and at EaP regional level, for promoting ecosystem development, drawing lessons from the enabling environments in the EU and key thirds countries, and taking into account the platforms and services offered by GEANT and EaPConnect;

h) **registered and mapped the stakeholders** of the partners' ecosystems ("EaP ICT Innovation Map");

i) **incorporated the "EaP ICT Innovation Map" into Start-up Europe web-based platforms**, notably the Start-up Europe Map and the Start-up Europe One Stop Shop;

j) **specified a common training package** for addressing the needs of the main groups of ecosystem stakeholders in the Partner Countries.

1.3.3 Terms and definitions of ICT innovation

The “ICT Innovation” should be distinguished from “innovation” in a general meaning, since it covers only innovations related to information and communication technologies. For this study, “ICT Innovation” does not confine to new or improved software development, as all software products can be described as innovative. Rather, ICT innovation include a wide range of possible innovations: new methodological frameworks (innovative tools for software development), new technologies, such as: Internet of Things (IoT), Big Data, Cloud Computing, Predictive Analytics etc., new organisational innovations in software development (such as Agile and Scrum methodologies), ICT products servicing the previously non-covered business processes, innovative ICT-supported products in non-ICT industries (e.g. robotics and Industry 4.0) or ICT-enabled services (e.g. Smart House, Smart City, remotely piloted vehicles), as well as new models of cooperation with participation of ICT companies, or digital platforms.

Due to wide penetration of ICT in various fields of everyday life and extremely fast technological progress in ICT, it is not the purpose of this study to cover each of these innovations. Instead, the focus will be on the infrastructure and composition of ecosystem enabling these diverse types of ICT-related innovations to be developed, diffused across the economy, deployed and exploited by both ICT and non-ICT companies.

"Ecosystem stakeholders" - or simply "stakeholders" - typically include policy-making authorities; policy implementation agencies; innovation service providers, such as incubators, accelerators, venture capital funds, business angels, technology transfer offices etc and innovation players such as corporates, start-ups, universities, and research institutes.

"Enabling environment" refers to the relevant legal and regulatory framework, best practices, ICT platforms, tools and services which are in place to ensure the proper functioning of the ecosystem and the growth of start-ups and innovative businesses.

2 BASELINE FOR STUDY ON "ICT INNOVATION AND START-UP ECOSYSTEMS" IN THE EASTERN EUROPEAN PARTNER COUNTRIES

2.1 Methodology of Baseline

The purpose of this baseline study is to survey and analyse different successful enabling environments at EU level and different selected EU Member States in order to identify key lessons about which functions create a successful ICT innovation and start-up ecosystem (from here 'ecosystem'). ICT innovation and start-up ecosystems are defined as the business environment comprising various interlinked groups of stakeholders for whom ICT represents an important part of their operation, services or products.

For the baseline study at country level, the following countries were studied as the first priority: Germany, Great Britain, Ireland, Sweden, Estonia (as the EU countries with the highest rank in Digital Development Index), and France (benchmarking with its innovative start-ups support tools). USA, Japan and South Korea were added, to enrich the review of ICT innovation services. Baseline analysis at EU level was performed in consultation with relevant experts from the European Commission or other relevant institutions such as start-up OLÉ (platform for European start-ups, incubators, accelerators and investors); Digital Europe (association of digital businesses); EuroCloud (association of cloud providers) etc. The list of 53 benchmarked organisations is in Annex 1.

The rationale for the baseline survey and analysis of these EU Member States is to identify the enabling factors for a well-functioning eco-system and providing a framework to identify the gaps in the functional structure of the ICT innovation ecosystem (whether or not the required functions are performed) and the stakeholders' competence gaps in the EaP countries, rather than the need to rank the quality of the existing innovation infrastructure services or organisations.

The organisations studied here refer to ICT innovation ecosystem players with focus on innovation infrastructure organisations and cluster organisations providing services to support ICT innovations. Baseline study of organisations was performed with a focus on general and specific functions needed to be performed (services to be delivered) in order to enable the ICT innovations, going beyond the typical tools of innovation infrastructure organisations.

Both the businesses developing the innovative ICT-based solutions, and the businesses that seek to restructure their business and production model leaning on ICT innovation opportunities, are seen to be the target audience for these services.

Services were defined here as not something paid for directly by innovative businesses, but as something needed to enable the development of innovative businesses (the functions of the ecosystem). From practical viewpoint, some services may be paid for by the state, the other by

the customers, the yet another - by the existing companies that want to improve the quality of the market conditions (individually or through business associations).

Herewith, the identified examples are neither claimed to be the top practices in EU, nor (taking into account the specifics of national innovation systems) the ideal examples to be transferred without adaptations to EaP countries. They were selected as advanced practices in each of the selected country.

This baseline study consists of an introduction to the EU approach for creating and developing a European-wide ICT innovation and start-up ecosystem, followed by a country by country analysis. Finally, a-cross-country analysis is made for identification of common factors and key differentiators between different countries with a successful ICT innovation and start-up eco-system that will enable comparison with EaP countries and allow for making a gap-analysis and drawing conclusions and recommendations for individual EaP countries and the EaP region as a whole on who to further stimulate and develop the ICT innovation and start-up ecosystems in their countries.

2.2 Role of EU in supporting the development of a European-wide ICT innovation and start-up ecosystem

2.2.1 Overview

One of the principle modus of operandi of the EU is the subsidiarity principle, whereby the EU does not take action (except in the areas that fall within its exclusive competence), unless it is more effective than action taken at national, regional or local level. Therefore, the study and analysis of the role of the EU in supporting an ICT innovation and start-up ecosystem is in principle different from the analysis of EU Member States individually. The EU aims to complement policies and regulations at national level developed by individual Member States with additional policies and regulations that are aimed at European Union as a whole.

European Union (EU) is of critical importance to the development of innovation worldwide. EU is the largest market in the world, and currently runs the largest research support program: Horizon 2020. Furthermore, according to the INSEAD global innovation index, the first decile of the index is comprised of 7 EU members.

2.2.2 European most relevant stakeholders

The main research & innovation policies and regulations are developed by the European parliament and European Commission (EC). Within the European Commission, different Directorate-Generals contribute to different aspects of the research and innovation policies. Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs facilitates

innovation development in priority areas and in SMEs, mainly through Horizon 2020 fosters the broad commercialisation of innovation in the EU including Public Procurement for Innovation, Design for Innovation, Demand-Side Policies for Innovation, Public Sector Innovation, and Social Innovation develops sector policies to modernise the EU's industrial base and accelerate the market uptake of Key Enabling Technologies such as Workplace Innovation monitors innovation performance and innovation uptake in order to identify developments that require policy changes. Key methodologies include the European Innovation Scoreboards, Innobarometers; Business Innovation Observatory improves regulatory conditions for innovation with measures for start-ups, entrepreneurship, and access to finance, digital transformation, Single Market, intellectual property and standards.

The Directorate General for Communications Networks, Content and Technology, or "DG Connect" is responsible for managing the Digital Agenda and to develop a digital single market in order to generate smart, sustainable and inclusive growth in Europe. The DG develops and carries out the Commission's policies on: Digital economy and society, Research and innovation, and Business and industry. DG Connect develops and implements the policies required to create a Digital Single Market for more growth and jobs, where citizens, businesses, and public administrations can seamlessly and fairly access and provide digital goods, content and services. Furthermore, DG Connect identifies maps and connects different national strategies and policies for digitalisation of society, which includes both industry and public services.

European Regional Policy developed by the Directorate-General for Regional and Urban Policy, "DG Regio" targets all regions and cities in the European Union in order to support job creation, business competitiveness, economic growth, sustainable development, and improve citizens' quality of life. In order to reach these goals and address the diverse development needs in all EU regions, € 351.8 billion – almost a third of the total EU budget – has been set aside for Cohesion Policy for 2014-2020. Regional Policy is delivered through three main funds: the European Regional Development Fund (ERDF) and the Cohesion Fund (CF) and the European Social Fund (ESF). These policy instruments, together with the Smart Specialisation Strategy initiative, also affect the investment in regional development in different European regions which also include investments into the ICT innovation and start-up eco-system through investments into hardware, knowledge, broadband and competences

The Directorate-General for Research and Innovation (DG Research) defines and implements European Research and Innovation (R&I) policy. It monitors and contributes to the realisation of the Innovation Union flagship initiative and the completion of the European Research Area. It funds excellent Research and Innovation through Framework Programmes like Horizon 2020. Furthermore, DG Research it coordinates and supports national and regional research and innovation programmes.

European investment bank (EIB) and European investment bank are key implementation tools of European innovation policy. EIB is a multilateral development bank, created to provide finance to achieve EU objectives. Currently EIB is the world's largest multilateral lender and borrower. EIB is actively supporting innovation goals of the EU by financing innovation projects. European Investment Fund (EIF) is a similar organisation; however, EIF does not provide funds directly to the business entities, investing rather in funds. InnovFin is a joint initiative of EIB, EIF and EU commission. InnovFin is part of Horizon 2020 and is available across all eligible countries and sectors. InnovFin provides help to enterprises on all stages of development from early stage enterprises to large cap firms. The financing comes in form of debt and equity finance, and in terms of guarantees. Furthermore, InnovFin supports SMEs indirectly by providing funds to business angels, venture capital funds and funds of funds.

The European Research Council (ERC) is an EU body responsible for funding scientific and technological research conducted within the union. It was established by the EC in 2007 and is composed of an independent Scientific Council which is its governing body consisting of distinguished researchers, and an Executive Agency, which is in charge of the implementation. ERC is an integral part of the EU framework programs dedicated to R&I: Horizon 2020, which was preceded by the Seventh Research Framework Programme (FP7). ERC distributes funds through an open competition to innovative projects on a basis of scientific excellence on various stages of technology development. ERC grants are available both for standalone researchers, and research teams. Since 2007 ERC has funded more than 7000 projects and distributed budget is over €13 billion from 2014 – 2020 and comes from the Horizon 2020 programme, a part of the European Union's budget. Under Horizon 2020 it is estimated that around 7,000 ERC grantees will be funded, and 42,000 team members supported, including 11,000 doctoral students and almost 16,000 post-doctoral researchers.

2.2.3 European Union Strategies and Legislation impacting ICT innovation and start-up ecosystems.

This chapter will introduce some European Strategies and Legislation that have an impact on the European ICT innovation and start-up ecosystem. In no way, this chapter claims to have a complete overview. The overall aim of this chapter is to introduce some key EU policies that complement policies and strategies at national level in EU Member States and have a European dimension affecting ICT innovation and start-up ecosystems in Europe

2.2.3.1 Public procurement

The EU has significantly shaped the procurement practices in the member countries by introducing directives 2004/18/CE 24 and 2004/17/CE which were further replaced by Directives 2014/23/EU, 2014/24/EU and 2014/25/EU. The directives provide more transparent, fair and

competitive rules that will lead to increased business opportunities, greater competition, make it easier for SMEs to access public procurement markets, and boost jobs, growth and investment. Increased efficiency of European public procurement system would save billions in public money. The directive has 4 key parts relevant to ICT innovation: introduction of e-procurement; participation of SMEs; encouraging cross border tenders; and ensuring transparency.

E-procurement will be generalised and made mandatory by 2018. E-procurement can significantly optimise the way procurement is conducted by provoking greater competition across the EU Single Market. Among the measures, the directives will create a European Single procurement document and create E-certis platform to easily compare certificates. E-procurement is reported to help achieve savings between 5% and 20%. Given the size of the total procurement market in the EU, each 5% saved could return around €100 billion.

The reform also encourages SME participation in public tenders. The authorities will be encouraged to divide contracts into lots, making tenders more accessible to SMEs. Moreover, required turnover for participation in a tender will be limited, and documentation needed for a tender will be significantly decreased. Finally, the mandatory use of eProcurement will allow SMEs to exploit the full benefits of the Digital Single Market and will bring efficiency gains.

Simpler procedures for contracting authorities will open up the EU's public procurement market, preventing “buy national” policies. As a result, contracting authorities will obtain better value for money. With the help of the Internal Market Information System (IMI) public administrations can verify the information and documentation they receive from companies in other EU countries.

The new directives will ensure fair tender procedures by aiming at maximum transparency: having a proper framework for prior publication of tenders, clear and unbiased technical specifications, equal treatment of bidders in all stages of the process, and objective evaluation of tenders. Specifically:

1. Conflict of interest is defined at EU level, which makes it easier to identify and prevent fraud.

2. A company can be excluded from public procurement procedures if it unduly influenced the decision-making process or made false statements, and when convicted for fraud and corruption.

3. Records of contracts for higher value must be kept for the duration of the contract and made available to the public. Any public procurement award must be covered by a specific report explaining the main decisions and reporting any conflict of interests.

Pre-Commercial Procurement and Public Procurement of Innovation

In the EU, two mechanisms are increasingly used to this end, putting governments’ purchasing power to good use by pulling demand for innovation, creating a signalling effect and facilitating the diffusion of innovations. Public Procurement for Innovation (PPI) is used in challenges that can be addressed by innovative solutions close to commercialisation or already commercialised

in small quantity, while Pre-Commercial Procurement (PCP) is favoured when there are no existing near-to-the-market solutions and new R&D is needed. Since 2007, the EU has introduced the concept first of PCP and explain to relevant public organisations in the EU how PCP can be implemented in line with the legal framework. Since then, the European Commission has identified targets for innovation procurement in 2011 and has introduced EU co-finance for PCP and PPI as separate measures in Horizon 2020. In total, the EU is putting EUR 130 million on the table for PCP and PPI funding over 2016 and 2017.

2.2.3.2 Horizon 2020 framework programme for research and innovation

Horizon 2020 is the biggest EU Research and Innovation program ever with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract required for co-funding of projects. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market. Funding opportunities under Horizon 2020 are set out in multiannual work programmes, which cover the support available. The work programmes are prepared by the EC within the framework provided. The Horizon 2020 main pillars relevant for ICT innovation and start-up ecosystems are: Industrial Leadership and Excellence science, which will be presented below

Industrial leadership

Industrial leadership provides dedicated support for R&D, standardisation and certification for various fields such as ICT, nanotechnology, biotechnology and others. Industrial leadership consists of three objectives:

It consists of three specific objectives: leadership in enabling and industrial technologies, access to risk finance and innovation in SME.

Leadership in enabling and industrial technologies is aimed at new and breakthrough technologies and puts emphasis on areas of R&I with a strong industrial dimension. The objective is to achieve the EU Industrial policy goals, which represents an important component of the EU Strategy for Key Enabling Technologies (KET). The involvement of industrial participants and of SMEs in particular, is crucial in maximizing the expected impact of the actions.

Access to risk finance will aim to overcome deficits in the availability of debt and equity finance for R&D and innovation-driven companies and projects at all stages of development. The goal of the program is to support and facilitate access to sources of debt and equity financing by innovative companies of all sizes and also by research centres and universities, public-private partnerships, special-purpose companies or projects, and joint ventures.

Particular support is required for innovative SMEs. Innovative SMEs are the ones lacking financing the most as often present too large of risk for traditional finance providers in Europe: commercial banks. The availability of equity and debt-financing for SMEs in Europe is however

severely restricted. To address that issue, and to support innovative SMEs, EU launched several financing programs. The primary goal of the programs is to support innovative, internationally oriented SMEs. Programs at the pan European level are directed at building collaboration networks, facilitating cross-border activities and decreasing the risk for SME innovation financing. There are a number of programs supporting SMEs directly: COSME, SME Instrument, and Eurostars. These programs are multi-level support programs aimed at defragmenting the SME market, building networks between SMEs and investors. They provide debt and equity financing, guarantees; build networks and capacity among SMEs.

Excellence science

The Excellent Science is aimed to reinforce and extend the excellence of the Union's science base and to consolidate the European Research Area in order to make the Union's research and innovation system more competitive on a global scale. The pillar has four main objectives

- The European Research Council (ERC) will provide attractive and flexible funding to enable talented and creative individual researchers and their teams to pursue the most promising avenues at the frontier of science, on the basis of Union-wide competition.
- Future and emerging technologies support collaborative research in order to extend Europe's capacity for advanced and paradigm-changing innovation. They will foster scientific collaboration across disciplines on radically new, high-risk ideas and accelerate development of the most promising emerging areas of science and technology as well as the Union-wide structuring of the corresponding scientific communities.
- Marie Skłodowska-Curie Actions provide excellent and innovative research training as well as attractive career and knowledge-exchange opportunities through cross-border and cross-sector mobility of researchers to best prepare them to face current and future societal challenges.
- Research infrastructure (including e-infrastructures) develops European research infrastructure for 2020 and beyond, fosters their innovation potential and human capital, and complements this with international cooperation.

Societal Challenges

A challenge-based approach will bring together resources and knowledge across different fields, technologies and disciplines, including social sciences and the humanities. This will cover activities from research to market with a new focus on innovation-related activities, such as piloting, demonstration, test-beds, and support for public procurement and market uptake. It will include establishing links with the activities of the European Innovation Partnerships (EIP).

Funding will focus on the following challenges:

- Health, demographic change and wellbeing;
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bio-economy;
- Secure, clean and efficient energy;
- Smart, green and integrated transport;
- Climate action, environment, resource efficiency and raw materials;
- Europe in a changing world - inclusive, innovative and reflective societies;
- Secure societies - protecting freedom and security of Europe and its citizens.

2.2.3.3 Digital Single Market

Digital single market is a policy initiative prepared by the EC to address the fragmentation of the EU digital market. Currently European digital market is fragmented, which holds back innovation and business development. According to the EC, removing the fragmentation may result in gains of 415 billion to European GDP. A single market will provide better prices, offer more choice, create new employment and will let businesses to operate more efficiently.

The initiative has the following pillars:

• Better access for consumers and businesses to online goods and services across Europe – this requires the rapid removal of key differences between the online and offline worlds to break down barriers to cross-border online activity. Removal of differences would mean harmonisation of copyright law, contract law, and decreasing the VAT burden.

• Creating the right conditions for digital and telecom networks and services to flourish – this requires high-speed, secure and trustworthy infrastructures and content services, supported by the right regulatory conditions for innovation, investment and fair competition. This will mean removing of regulatory fragmentation, ensuring a level playing field, removal of constraints on changing platforms and further restriction of illegal content.

• Maximizing the growth potential of our European Digital Economy – this requires investment in ICT infrastructures and technologies such as Cloud computing and Big Data, and research and innovation to boost industrial competitiveness as well as better public services, inclusiveness and skills. The EC will remove the data flow restrictions, create European cloud certification, and contribute to better exchange of information between different European business registries.

2.2.3.4 start-up Europe

start-up Europe is a policy initiative under the Digital Single market strategy. It aims at connecting start-ups, investors, accelerators, entrepreneurs, corporate networks, universities and the media through an array of networks. start-up Europe not only connects ecosystems, but also creates cross border ecosystems and aims at creating a pan European start-up ecosystem. start-up Europe maps European start-ups, organises start-up events, and connects various local start-ups though connector projects. Furthermore, by providing advisory and trainings it enhances start-up their capacities to compete, thrive, and to create new products. Enhanced capacity and a diverse network will allow participating in external markets such as Silicon Valley or India.

start-up Europe has introduced start-up Europe Map and the start-up Europe One Stop Shop that enable the mapping, communication and collaboration between different local start-up ecosystems throughout Europe.

2.2.3.5 Relevant Legislation and Regulation in European Union

ICT Standardisation

A European Multi Stakeholder Platform on ICT Standardisation has been set up to advise the European Commission on matters relating to the implementation of ICT standardisation policy, including priority-setting in support of legislation and policies, and the identification of specifications developed by global ICT standards.

Additionally, the European Commission is financing the work of the following standardisation organisations: ETSI – the European Telecommunications Standards Institute, CEN – the European Committee for Standardisation, and CENELEC – the European Committee for Electrotechnical Standardisation.

Regulation

The EU's regulatory role has developed to keep pace with new technologies and market trends:

- introducing rules covering all electronic communications networks & services
- ensuring basic broadband for everyone in the EU
- encouraging competition by preventing the old national telecoms monopolies from maintaining a dominant position with respect to services like high-speed internet access.

Some examples of European Directives have that have some impact on the European ICT innovation and Start-up eco-system are: The Framework Directive 2002/21/EC, the Better Regulation Directive 2009/140/EC, the Access Directive 2002/19/EC, the Authorisation Directive 2002/20/EC, the Universal Service Directive 2002/22/EC, The Directive on Privacy and Electronic

Communications 2002/58/EC, and The Regulation on roaming on public mobile communications networks 2011/0187/COD

2.2.4 Clustering

2.2.4.1 33/17 European Cluster Collaboration Platform

https://www.clustercollaboration.eu/cluster-list

European Cluster Collaboration Platform database lists 233 cluster organisations in Digital Industries.

157 cluster organisations are engaged in Electronics, IT and Telecommunications.

All these organisations were studied in depth to identify the practices that have proved to be successful (justified by Silver and Gold Medals) as well as advanced practices to support ICT Innovation.

2.2.4.2 Cloud for Europe

http://www.cloudforeurope.eu/

The Cloud for Europe project was dedicated to adoption of a well-defined European Cloud Computing Strategy for the public sector (comprising public authorities, standardisation bodies and industry representatives). It has developed a services catalogue of cloud services for public sector; investigated the legal, standardisation and certification issues to enable the more informed decision-making by public authorities on cloud-based innovations.

2.2.4.3 EIT ICT

EIT Digital is a leading European digital innovation and entrepreneurial education organisation driving Europe's digital transformation.
EIT Digital delivers breakthrough digital innovations to the market and breeds entrepreneurial talent for economic growth and improved quality of life in Europe. It does this by mobilising a pan-European ecosystem of over 130 top European corporations, SMEs, start-ups, universities and research institutes.
As a Knowledge and Innovation Community of the European Institute of Innovation and Technology, EIT Digital is focused on entrepreneurship and is at the forefront of integrating education, research and business by bringing together students, researchers, engineers, business developers and entrepreneurs. This is done in our pan-European network of Co-Location Centres in Berlin, Eindhoven, Helsinki, London, Paris, Stockholm, Trento, as well as in Budapest and Madrid. We also have a hub in Silicon Valley.

EIT Digital invests in strategic areas to accelerate the market uptake of research-based digital technologies focusing on Europe's strategic, societal challenges: Digital Industry, Digital Cities, Digital Wellbeing and Digital Infrastructure.

EIT Digital breeds T-shaped entrepreneurial digital talent focused on innovation through a blended Education Strategy that includes a Master School, Doctoral School and Professional School.

EIT Action Lines are executed within the European ecosystem of top corporations, SMEs, start-ups, universities and research institutes and localised in our "Nodes" in Berlin, Budapest, Eindhoven, London, Madrid, Helsinki, Paris, Stockholm, Trento and a hub in Silicon Valley.

Each Node operates a physical "Co-location Centre" where most of the activities are carried out.

EIT Digital Academy includes:

- *Master School*
- *Doctoral School*
- *Professional School*
- *Summer Schools*
- *Online Education.*

EIT ICT Labs is one of the first Knowledge and Innovation Communities (KIC) set up by the European Institute of Innovation and Technology, as an initiative of the European Union. EIT ICT Labs' mission is to drive European leadership in ICT innovation for economic growth and quality of life.

Since 2010, EIT ICT Labs has consistently brought together researchers, academics and business people. By linking education, research and business, EIT ICT Labs empowers ICT top talents for the future and brings ICT innovations to life. EIT ICT Labs' partners represent global companies, leading research centres, and top ranked universities in the field of ICT.

EIT Digital Accelerator

The EIT Digital Accelerator supports European digital ventures to scale up their business in Europe and beyond.

Our goal is to accelerate the growth of promising digital technology start-ups and scale-ups by helping them secure target customers and raise capital.

International business development experience

Our dedicated team of international business developers – serial entrepreneurs, business consultants, industry experts – knows what it takes to bring your business to the next level. With years of international experience, a deep understanding of digital technologies as well as the cultural particularities of the various European markets, they can help you make the right decisions.

Together with you, our business developers create an individual support plan building on the following pillars:

Access to Market

Our Access to Market team supports companies with qualified lead generation via events, meetings and targeted warm introductions across Europe. They also help to develop and define the go-to-market strategy and softlanding[1] in new countries.

- **Go to market.** Hands-on advice to define your go-to-market strategy and assess your international expansion
- **Access to target customers in identified market segments.** We support you to identify the right target customers and market segments to address and make high-level introductions to potential customers
- **Access to showcase support services at international events.** Full support to attend up to five international trade shows and network events that suit your plans to increase your business visibility
- **Access to market developing support services to increase leads and make deals.** We help you identify leads cross borders and transform them with you into deals or collaborations
- **Access to market entry support services in different countries and launch your product.** International access-to-market knowledge and 'soft landing' support to ease new market entry and expansion, incl. office space.

Access to Finance

Our Access to Finance team provides European digital scale-ups with the fundraising guidance, preparation and investor connections they need to raise Series-A stage investment (€1-10M).

We Help You Raise Venture Capital for Growth

EIT Digital's Access to Finance (A2F) team works with European digital companies to secure capital and accelerate their growth. We get you ready for investment, connect you with the right venture capital and corporate venture capital investors, and help you raise the funding your company needs to scale and achieve its potential. The A2F team has already helped companies raise more than €80M.

Fundraising Experience

Our team of technology financing specialists knows what it takes for digital ventures to secure funding from professional venture capital investors. Our knowledge of the funding process and deep understanding of investors' exacting requirements make all the difference to your funding success.

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[1] Softlanding is a term that refers to the support services for companies that want to relocate or expand with a new legal entity in a new country. These support services aim to facilitate the market entry for the foreign company

A Pan-European network of investors

The pan-European team offers direct access to an unrivalled network of digital technology venture capital providers and corporate venture investors. Close relationships with European and global funds and corporates lets us connect you to the most appropriate investors, improving outcomes and dramatically reducing time and effort to get your financing done. We help you increase your chances to attract foreign investors, often the first milestone to scale your business globally.

Strong digital sector expertise

The focus of EIT Digital lies in the in-depth understating of the digital space and more specifically in the 5 well-defined verticals in which it specialises: Digital Industry, Digital Cities, Digital Wellbeing, Digital Infrastructure and Digital Finance. A thorough understanding of the business models in these sectors is paramount to help your company raise financing.

Access to Finance (A2F) Support Package

Get guidance, preparation and connections to raise €1-10M in Series A investment:

- Financing needs assessment and fundraising strategy
- A2F investment-readiness support and coaching
- Targeted connections to the right VC investors and corporate venture funds
- One-to-one calls and meetings with investors
- Access to exclusive match-making events with investors

Base services

- access to talent through Master and Doctoral Schools, where students with strong technical backgrounds and entrepreneurial skills are looking to join Europe's top tech companies;
- access to training through Professional School, offering blended learning courses for professionals working in digital technologies;
- support businesses' international growth with access to workspace in Co-Location Centres across Europe (subject to availability).

EIT helps businesses with Communications & PR and spread the word about the companies through its pan-European channels by leveraging a strong and unique business network made of 130+ prestigious corporations, research centres and universities across Europe.

The EIT Digital Accelerator has a team of more than 40 dedicated international business developers and technology financing specialists operating from 14 major cities across 10 EU countries and a hub in San Francisco. It is expanding our its reach to 16 EU countries through its partner network.

Digital Industry

The **Digital Industry Action Line** covers the seamless process from production to retail and the related supporting functions such as logistics and consumer engagement. The mission of the Action Line is to improve efficiency in production and retail, to better address customer needs, and to help save natural resources in manufacturing and logistics. Within this value chain, a large amount of data and knowledge is produced and shared. This data has an increasing share of the value of the whole business domain.

The Action Line targets value creation from big data collection, aggregation, analysis and visualisation services (and their enabling technologies) for decentralised production management covering the complete product lifecycle: design, simulation, production, operation, consumption, maintenance, and consumer relationship frameworks.

Value creation may also be achieved from dynamic and flexible omnichannel solutions for all kinds of commerce - physical, online or blended - which enable the seamless consumer experience in exploration, in choice of products, payment and delivery, as well as collection and analysis of consumer trends and insight for logistics, retail operations and customer relationship management.

Operate European Digital Industry with Products and Services - OEDIPUS

OEDIPUS (Operate European Digital Industry with Products and Services) is a High Impact Initiative (HII) belonging to the Digital Industry Action Line of EIT Digital and aimed at creating innovative solutions and business opportunities for European industrial players, corporations and SMEs. Read more

OEDIPUS (Operate European Digital Industry with Products and Services) is a High Impact Initiative (HII) belonging to the Digital Industry Action Line of EIT Digital and aimed at creating innovative solutions and business opportunities for European industrial players, corporations and SMEs.

OEDIPUS pursues the creation of digital industry innovation hubs acting as hot spots of the digital transformation of the manufacturing industry.

By the end of 2018, from the joint collaboration of 8 international partners (DFKI, CEA, Océ, Cefriel, Engineering, CRF, Atos, Siemens) and a number of SMEs working together across a newly established network of five European Innovation Centre, 5 new products will be commercialised, serving as "Lighthouse projects" to increase competitiveness and generate economic growth.

The outcomes of the High Impact Initiative will range from the creation of a System Integration Framework, to that of an Innovation & Collaboration Platform, a Predictive Maintenance Service for industrial printers and robots, a Robot IoT Interface, IoT Solution, and a product for Plant Condition Monitoring.

Overall, OEDIPUS represents a unique opportunity to create products and services for a "smart industry" and in particular, to explore the combination of Open Platforms with proprietary Industry

Cloud and Enterprise Systems and understand which new business models this combination could generate and support.

The "Operate European Digital Industry with Products and Services" High Impact Initiative is the latest example of EIT Digital's commitment to fostering European growth and accelerating the digital transformation in progress, for the betterment of society and the improvement of the lives of citizens.

Digital Infrastructure

The Digital Infrastructure Action Line is the core enabler of the digital transformation by providing secure, robust, responsive and intelligent communications and computation facilities. More specifically, it targets in networking: the mobile broadband infrastructure, network softwarisation, and the Internet of Things; in computing: cloud computing, Big Data, and Artificial Intelligence; in security: privacy, cyber security, and digital ID management.

A key aspect of the Digital Infrastructure Action Line is to catalyse cooperation across the networking, computing and security domains. This will create added value by the deep integration of technologies that typically are only very loosely coupled. Distributed cloud solutions that are secure and privacy aware for real-time processing based on close integration of networking, computing and security will support new industry segments that are latency sensitive, such as the automotive industry or process industry segments.

Advanced Connectivity Platform for Vertical Segments (ACTIVE)

ACTIVE, the Advanced Connectivity Platform for Vertical Segments High Impact Initiative provides a unified approach for developers and industry to support the widespread growth in IoT. ACTIVE addresses the Internet-of-Things market, which currently is in its early stages, and dominated by domain-specific platforms, proprietary architectures and vertically divided technology silos. ACTIVE enables crossing these divisions by offering a unified approach consisting of end-to-end components and solutions.

A special focus is set on connectivity, middleware, device management and privacy & security, which are provided as a set of Application Programming Interfaces (APIs).

The Advanced Connectivity Platform for Vertical Segments is the sum of the following tasks:

- Connectivity
- Middleware layer and APIs
- Management of devices and gateway
- Security and privacy modules and APIs
- Vertical Applications

The High Impact Initiative has active collaboration with and between the leading European companies, universities, research institutes, and start-ups, such as Aalto University, Bittium/SafeMove, Engineering, Ericsson, KTH Royal Institute of Technology, Politecnico di Milano, RISE SICS and Tampere University of Technology.

2.3 Synthesis of the role of EU on the European ICT innovation and start-up ecosystems

Overall the role of the EU and their policies/strategies and regulations has on the European ICT innovation and start-up ecosystem can be summarised into several main categories:

Creation of common European vision, and strategies regarding science, technology and innovation. Through the Innovation Union, Horizon 2020 and other initiatives, the European Union enables an EU wide dialogue among relevant European stakeholders leading to prioritisation, agenda setting, identification of common (so called 'grand') societal challenges and the identification of common research and technology priorities. The priorities identify and set by the work programmes of the Horizon 2020 frequently provide guidance and direction for the development national innovation strategies.

Creating international links between stakeholders. The join collaborative nature of Horizon 2020 and other funding programmes from the European Union result in the creation and strengthening links between various stakeholders such as: universities, businesses, public research organisations and public bodies and civil society. These links foster the spread of ideas, dissemination of new insights and foster faster scaling of new innovative solution to European level. Furthermore, they may result resource pooling for joint research programs that will allow to efficiently utilise national resources, and perform projects, otherwise unavailable at national level.

Creating links between individuals. Other European instruments, such as Erasmus and Marie Skłodowska-Curie programmes facilitate the mobility of students, researchers, and young entrepreneurs which results in experience sharing and peer learning and creation and strengthening of international personal networks.

Creating single market. The European Union initiatives to create a European single (digital) market is aimed at lowering the barriers for business to go beyond the national markets and have better access to the whole European Union as a market. Furthermore, digital single market will facilitate online, and digital cross-border purchases will encourage more businesses to sell online across borders and increase consumer confidence in cross border e-commerce. Increasing standardisation of certificates and patents will increase interoperability of new technologies and profitability of innovations.

A stronger telecom sector. A heathy ICT innovation environment requires strong, competitive and dynamic telecoms sector to carry out the necessary investments, to exploit innovations such as Cloud computing, Big Data tools or the Internet of Things. The removal of widely varying conditions and regulations and creation of consistent EU-wide objective will create scalability, encourage competition, reduce investment uncertainty, and facilitate investments in innovation and ICT infrastructure.

Better use of public procurement. Public procurement currently represents around 19% of EU GDP. Public procurement thus represents a large market for ICT innovations, especially with the development of e-government services. Additionally, European support for PCP and PPI has helped introduce these methods for using public procurement for innovation to individual Member States.

2.4 Estonia

2.4.1 Overview

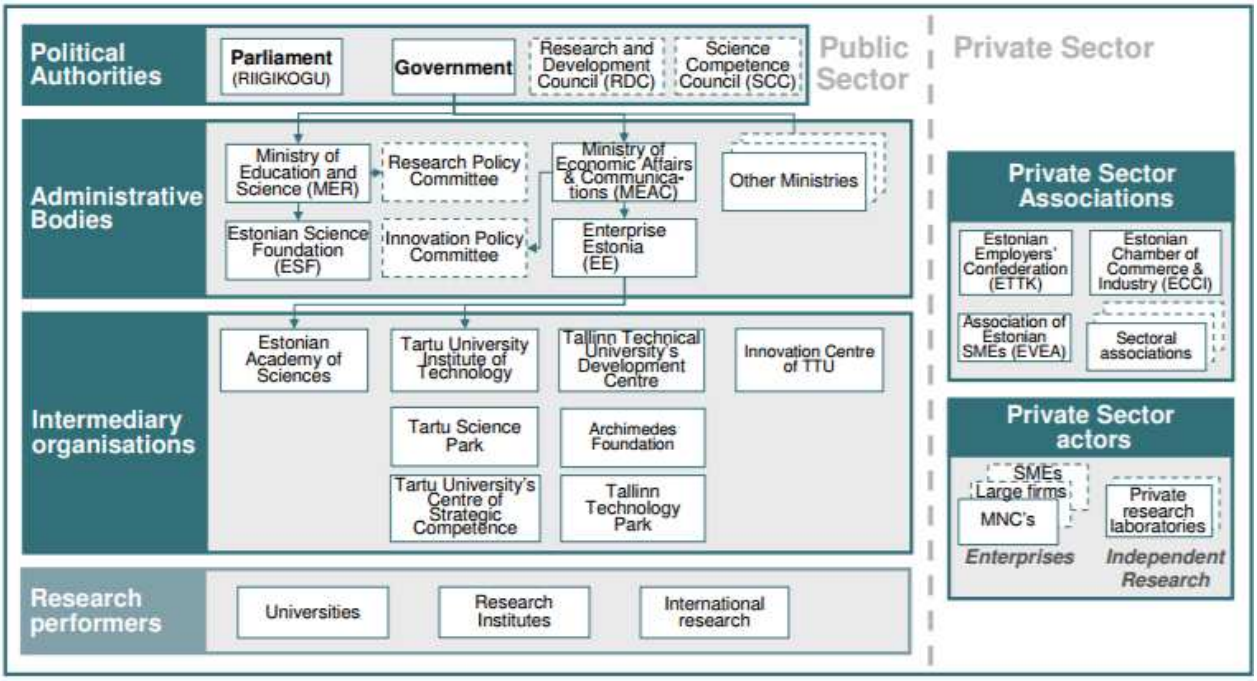
The Estonian economy is small, has high level of openness and its structure has remained remarkably stable during the 2010-2015 period. Estonia has a very favourable business environment, but it is faced with a short supply of highly qualified human resources due to ageing population, outward migration and lower attractiveness of research careers.

Estonia has been at the forefront of online public services for a few years now. According to the EC the overall level of GERD almost doubled in 2009-2011 (from 1.4% to 2.31%) but slid back to 1.45% in 2014. In 2015, it picked up slightly to 1.5%. Public allocation of R&D and R&D expenditure are above the EU average but the business investments (BERD) have recently dropped significantly.

An important aspect of the Estonian R&D system is its overwhelming reliance on competitive project-based policy measures, both in funding public universities and private companies.

2.4.2 Stakeholders

Figure 2.4. Estonian innovation system



2.4.2.1 Government bodies and agencies

The government of the Republic prepares national R&D development plans, submits them to the Riigikogu (Parliament), approves national R&D programs, ensures the cooperation between the ministries and enacts legislation.

- Policy and design are carried out by **Ministry of Education and Research (MER),** which is in charge of the national research and the **Ministry of Economic Affairs and Communications (MEAC),** which oversees technological development and innovation policy.
- There are 3 advisory governmental institutions: The **Research Policy Committee**, the **Innovation Policy Committee** and the **R&D Council**. All policy documents have to pass the R&D Council prior to being submitted to the Government for approval.
- Both MEAC and MER have their implementation agencies. The main implementing body under **MEAC** the **Enterprise Estonia** Foundation, which is responsible for managing business support, innovation and technology programs. Foundation **KredEx**'s facilitates improvement of the competitive strength of Estonian companies.
- At the same time, MER has three main implementation agencies. The **Archimedes** Foundation provides structural support in the field of R&D and supports mobility and marketing of Estonian higher education and research abroad. The **Estonian Research Council** concentrates the funding of R&D and achieve better functioning of the financing systems. This body consolidates different grants and types of funding and gives research more visibility in the society. The **INNOVE** Foundation supports measures in the fields of lifelong learning and active labour market policies

2.4.2.2 Universities

Universities play an important role in Estonian innovation environment, performing 77% of R&D expenditure in non-profit institutional sectors (higher education, government and non-profit private sectors) (Statistics Estonia 2016). Furthermore, from 19 positively evaluated R&D institutions 7 are universities (1 private and 6 public), 4 are private R&D institutions and 8 are public research organisations.

An important aspect of the Estonian R&D system is its overwhelming reliance on competitive project-based policy measures, both in funding public universities and private companies (Raudla et al 2015). This is particularly glaring in research where ca 80% of all funding is competitive (Raudla et al 2015). However, in 2016 the Government decided to allocate additional funding for basic funding of universities from 2017 thereby increasing the level of baseline funding vis-à-vis project-based funding.

2.4.2.3 Companies

Estonia is only researched country in which business does not account for most of the spending in R&D. BERD in Estonia was 0,63% of GDP which is 2 times lower than the EU average. According to the National Audit Office (2014), the structure of the Estonian economy is still

dominated low-tech SMEs whose need for R&D is limited and thus only a few of them are cooperating with universities. Private sector R&D is performed mostly in larger companies: around half of the private R&D investments are done by companies with more than 250 employees (Mürk and Kalvet 2014).

In 2014, the highest BERD spenders are the ICT, manufacturing (chemical, electronic and others) and energy sectors. In the business services sector ICT and professional, scientific and technical activities sectors are the top R&D spenders. The ICT sector witnesses the highest number of high growth innovative enterprises and the second highest number of employees among the most innovative sectors in the recent years. The number of ICT enterprises is quite significant in Estonia, but most of them have less than 10 employees. Manufacturing is characterised by contract manufacturing as a prevalent business model (Kaarna et al 2015). Contract manufacturing means that there are relatively low levels of in-house competences for design and development. (Kaarna et al 2015).

2.4.2.4 Clusters

Organisations aimed at creating and solidifying networks and linkages between various R&D system actors are rather poorly developed in Estonia. Estonia is ranked as having the lowest number of hotspots – sectoral clusters. This ranking indicates the overall cluster strength in a region. Estonia falls within the range of 19-27 stars, which is the lowest category (see Appendix 1).

Amongst IT and ICT clusters are:

Estonian ICT cluster: Estonian ICT cluster is the main force that supports ICT companies' cooperation and development in Estonia. It is a co-operation platform for ICT enterprises through which Estonian ICT cluster aims to foster the development of new solutions and products, and to improve the companies' competitive ability in the international market. The cluster is a joint platform to foster the export of ground-breaking e-solutions that have been developed and implemented in Estonia. Currently 42% of the total workforce of the ICT sector have been employed by the Cluster partners; the Cluster's partners have clients in 128 countries, the added value per employee is 50 000 EUR, 81 organisations participate in the Estonian ICT cluster.

Tallinn technology park: The Tallinn Science Park foundation is a science and business campus which aims to advance technology-based entrepreneurship in Estonia, bring scientists and entrepreneurs together and provide suitable conditions and a suitable environment for the realisation of breakthrough business ideas. Tehnopol supports the adoption of promising new technologies and accelerates the growth of technology-based companies. As of current, there are: 200+ companies operating in the park, 3500 people working for the companies, 14 000 students and 1300 scientists nearby.

2.4.3 Services of the stakeholders

The basic services provided by the main stakeholders of the R&I system are summarised below. Estonia has multiple levels of support for innovative start-ups and SMEs.

Table 2.4.1. Basic services provided by the main stakeholders in Estonia

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks/ Collaboration
R&I stakeholders					
The Research and Development Council	+	+	+		+
Estonian Research Council	+	+	+		+
KredEx			+	+	
Enterprise Estonia		+	+	+	+
Archimedes foundation			+		+
Innove					+
Estonian Intellectual Property and Technology Transfer Centre		+			
R&I stakeholders with a strategic focus on ICT					
start-up Estonia		+			+
Smartcap			+	+	
Baltic Innovation fund				+	+
Estonian Business angels network		+			+
Tallinn Technology Park	+	+			+

***For a more detailed description of each service, see Appendix 2**

2.4.4 Strategies

The two of the most relevant strategies to ICT innovation are Knowledge Based Estonia, and Entrepreneurship growth strategy. Both of the strategies closely match Horizon 2020 program and aim at smart specialisation of the Estonian Economy.

Table 2.4.2.: Relevant research, innovation and ICT strategies in Estonia

Strategies	
Knowledge Based Estonia 2014-2020	The overall aim of the development of RDI is to create favourable conditions for an increase in productivity and in the standard of living, for good-quality education and culture, and for the longevity and development of Estonia. This strategy establishes four main objectives for Estonia; • Research in Estonia is of a high level and diverse. • Research and development (RD) functions in the interests of the Estonian society and economy. • RD makes the structure of the economy more knowledge-intensive. Estonia is active and visible in international RDI cooperation.
Entrepreneurship Growth Strategy 2014-2020	The general goal of the strategy is to facilitate the achievement of the umbrella objectives within the competitiveness plan "Estonia 2020" to enhance productivity and employment. The strategy employs the following objectives: • To increase productivity per employed person to 80% of the EU average • To raise the employment rate in the age group 20–64 to 76%
Estonian Research Infrastructure Roadmap (2014)	The roadmap is part of the “Knowledge-based Estonia” strategy and it is updated every 3 years. The roadmap contains a list of nationally important research units, and those of needed modernisation. The latest 2014 roadmap has a focus on chemistry, life sciences and microbiology, physics and nanotechnologies.

2.4.5 Policies

In addition to different strategies, a number of policies directed at promoting research, innovation and ICT have been developed. The most relevant ones are provided in the table below.

Table 2.4.3: Relevant research, innovation and ICT policies

Policies	
Task force to strengthen innovation (2016)	Two task forces target the following areas: lower the administrative burden of reporting; strategic management of innovation and creativity in the public sector; co-creation practices and methodologies; supporting social entrepreneurship. 5 pilot projects (prototypes) will be generated during 2016 and 2017.
Task force on research funding and organisation (2016)	The "Report on the network and policies of Estonian universities and other R&D institutions and higher education institutions" led to the creation of a task force on research funding and organisation at the Government Office. The task force will discuss further consolidation, pooling of resources and changing the financing model of HEIs and should present its main recommendations in the 3rd quarter of 2017.
Creation of R&D officer positions in ministries through the RITA program	The aim is to increase the role of the state in strategic management of research and the capacity of R&D institutions in carrying out socially relevant research.
Estonian Development Fund closed down	The venture funding functions of the Estonian Development Fund are merged into KredEx and its foresight and monitoring functions were transferred to the newly created Foresight Centre of the Estonian Parliament.

The policy initiatives currently in place are not perfect but major shifts in the nature and content of the current set of policies would require radical change at the level of policy culture. Additionally, the number of intervening variables between R&I policies and the contexts that they seek to affect, make it difficult to state with any certainty that a given policy fosters innovation or strengthens the knowledge base and fundamental research.

2.4.5.1 Public-private partnerships (PPP)

Estonia engages in PPP both on local and national level. The Ministry of Finance is responsible for public procurement policy, drafting legislation, providing supervision and consulting. Currently, in the absence of a specific law regulating PPPs, projects are covered by Public Procurement Act, which is adapted to EU public procurement directives 2004/17/EC and 2004/18/EC. The law regulates procedures for the awarding of public contracts at both national and local levels. The Administrative Co-operation Act (2003) provides a set of rules and requirements for early stages and post-completion of PPP projects. The Competition Act (2001) together with the "Procedure for organizing a public competition for the granting of special or exclusive rights" (2001) covers the granting of special and exclusive rights for certain projects.

PPP have played have played crucial roles in emergence and further development of Estonian e-government. E-taxboard, for example, was the result of partnership between local banks and national government. The parties managed to utilise the closely related expertise of internet banking solutions, to create a service that did not exist anywhere in the world. Therefore, the main knowhow came from Estonian banks, instead of application of foreign best practices. Another example is the development of national ID cards. Estonian national ID card scheme is conducted via a PPP between Citizens Migration Board and 2 private partners SK, a joint-venture company, and TRUB Baltic AS. CMB issues the identity cards to citizens, SK manages the associated electronic services, and TRUB Baltic AS manufactures the card.

2.4.5.2 Public procurement on innovation (PPI) and pre-commercial procurement (PCP)

As mentioned before, public procurement is regulated by the Public Procurement Act, and is to be adapted to relevant EU directives. The Ministry of Finance is responsible for public procurement policy, drafting legislation, providing supervision and consulting. Furthermore, development of national procurement policy measures is addressed in the Implementation plan for the “Entrepreneurship Growth Strategy 2014-2020”. Policy measures aim to increase the role of the public sector as the leader of innovation in enterprises. The innovations include innovative procurements, development activities of enterprises under the leadership of the public sector, design of public services, public and private sector partnership, demonstration projects, as well as the infrastructure and information technology solutions required. In the framework of the general Development of national procurement policy measures a new measure “State as a smart costumer” is launched to improve demand-side innovation policies.

Examples of innovation support via public procurement are 'X-Road' and Estonian ID card. Both projects were set up by the government however the technological development was done by the private industry the procurement has provided the funding for the development and market introduction.

The X-road was the first in the world system to connect all governmental information systems. Currently, it is the spine of the Estonian e-government system. It provides an environment that enables secure data transfer between e-government databases and between individuals and governmental institutions. A two- stage negotiated procurement procedure with notification was used – the first stage aimed to identify eligible tenderers, while the second stage was focused on selecting the most cost- effective tender. A ‘points-based system’ was developed for awarding the contract, with technological completeness and value for money as criteria.

E-voting software was purchased via public procurement in 2004 and presents its analysis from the public procurement for innovation perspective provides additional insight into the success factors. E-voting demanded complicated risk management—involving technological, institutional (legal and political), and societal risks—and can, as such, be considered one of the most, if not

the most, ambitious applications of e-government. Estonia's success story, lies in effective risk management: addressing all expected risks by enhancing the capacities of the procurer, carrying out in-depth risk analyses, and endeavouring to generate trust through consistent dialogue and openness.

2.4.5.3 Public funding

The share of government sector investments as a percentage of GDP has been growing steadily in 2009-2013 (from 0.68% to 0.81%) but declined in 2014 to 0.71% and remained at roughly the same level in 2015 (0.7%). Still, GBAORD is above the EU average (0.64% in 2015) and as a share of general government expenditure it mildly declines for the past three years. The higher education sector performed 41% of GERD in 2015 which is above the EU average (EU28: 23%).

Estonian R&I funding is quite dependent on EU funds. In 2015, 12% of Estonian total GERD was funded from abroad. In the 2014-2020 15.2% of total structural funds allocation, is allocated to strengthening research, technological development and innovation (EC 2014). A significant amount of public RD&I funding is planned to be channelled into smart specialisation areas.

The public sector is the main recipient of government funded GERD. Government support to private sector R&D has mainly been in the form of direct funding via competitive grants. However, through the Estonian Entrepreneurship Growth Strategy, the government aims to shift to a more market-based approach, with more financial instruments, including loans, loan guarantees and venture capital. Unlike, Ireland or the UK, Estonia has no tax incentives for R&D and innovation investments.

2.4.5.4 Private funding

The business sector is the main funder of investment and it has been the main driver of changes. Business Expenditures on Research and Development (BERD) tripled between 2008 and 2011, and in 2011 it was 1.46% of GDP declined to 0.82% in 2013 and to 0.63% in 2014. However, in 2015 the trend reversed, and an increase of private R&D spending is observable (0.69%). It is noteworthy that in 2014 public funding of BERD in Estonia (ca 10%) was much higher than the EU28 average (ca 6%).

2.4.6 Clustering

Estonia hosts 2 cluster organisations in digital industries.

Estonian Connected Health Cluster, http://connectedhealth.ee/

Mission/Objectives:

Connected Health is a country-wide partnership between health-related stakeholders in Estonia, who are committed to accelerating the adoption of connected health solutions, on an international scale and on commercial terms.

Sectors:

- Biopharmaceuticals, Information Technology and Analytical Instruments
- Digital Industries, Medical Devices
- Biochemistry / Biophysics, Health information management, Bioinformatics
- e-Health (e.g. healthy ageing), Public health and well-being

Support services provided:

- Internationalisation support (= Access to third countries markets)
- Facilitation of collaboration between members
- Periodic Information dissemination
- Promotion of activities (marketing/ visibility)
- Innovation Management / Support of innovation processes (internal, external)

Estonian ICT Cluster, http://www.itl.ee/Eng

Mission/Objectives:

Estonian ICT cluster is the main force to support ICT companies' cooperation and development in Estonia. It is ICT enterprises co-operation platform, which objective is to increase the usability of ICT in other economic sectors of domestic and foreign markets. Through this, we aim to foster the development of new solutions, the creation of new products, and to improve the companies' competitive ability in the international market.

Sectors:

- Information Technology and Analytical Instruments
- Digital Industries, Logistical Services, Mobility Technologies
- Computer Software, Information Technology/Informatics, Internet of Things
- e-Government (e.g. e-Procurement, e-Participation), ICT trust, cyber security & network security,
- Computer programming, consultancy & related activities

Main activities of the ICT cluster include:

- organizing different export and internationalisation support activities;
- increasing the competencies of cluster partners;
- supporting cluster partners joint development projects;
- supporting cooperation with other economic sectors.

The project **ICT Meta Cluster** aims to **create a complete value chain** offering 400 ICT-oriented companies in Estonia, Latvia and Sweden **resources to generate first sales of their products and services at new markets, to expand the sales within the respective countries and regions, and finally to prepare for further expansion of the business activities**. By the end of the project, the ICT Meta Cluster is a validated **ecosystem for establishment and further business expansion into new markets**.

- Provide SMEs with an access and knowledge on the target markets' export analysis,
- SMEs get match-making results for their product in the target markets,
- SMEs have performed necessary adaptations of products and services,
- SMEs receive support with export/import regulations.

Next to these two clusters there is one science park with specific focus on digital technologies.
Tallinn Science Park Tehnopol

Start-up Incubator:

The Tallinn Science Park foundation is a science and business campus which aims to advance technology-based entrepreneurship in Estonia, bring scientists and entrepreneurs together and provide suitable conditions and a suitable environment for the realisation of breakthrough business ideas.
Invests up to 10 000€ worth of expertise to start-up companies in one year to find the first seed investment or reach export markets.

Key mentor. Each and every start-up in the program is assigned a key mentor, who becomes their go-to person if they need assistance. The key mentor knows all about the challenges and problems facing the company, monitors its progress and manages communication with other external business coaches and mentors.

One-on-one mentoring. The main competences of mentors include: business modelling and market analyses, marketing, (international) sales, public relations and media management, investor readiness and investor relations, legal and IP matters, product development and design, UX and UI development, customer acquisition and conversion (growth) hacking; recruitment and personnel management, etc. If the company is running the growth stage where specific help is required, the key-mentor will involve the outside expertise.

Expertise to:

- determine scalable business model
- build sales, marketing and PR strategy
- develop investor readiness and find investments
- reach out to significant contact network

Specific resources:

- 30+ business coaches working hands-on with start-ups
- 70+ trainings, investor panels, sales, pitching and networking events annually
- Co-working centre @ Tallinn Science park Tehnopol
- Access to 300 000€ prototyping fund PROTOTRON (prototron.ee).

Prototyping Fund Prototron

Prototron provides funding and advice to the amount of 10.000 € with smart ideas, inventions, gadgets and implement the solutions that make human's daily lives easier, better, more comfortable. Prototroni encourages smart and enterprising actors through financial injections for their ideas into real, tangible, and the prototype of big business to change. It has over nationwide ideas competition, the participants agree with the experts in the various fields of the idea and the Experts' team as well prepared. The best ideas will get additional feedback and guidance to € 10,000 cash and € 5,000 worth of Tehnopol's inkubatsiooniteenuseid carry out his idea.

SPRINGBOARD- business acceleration programs and B2B matchmaking

Central Baltic start-up Springboard supports the development of new start-ups in Turku, Tallinn and Riga and their cross-border collaboration. Springboard provides a supported path towards entrepreneurship by implementing three joint 10-week **business acceleration program** and coaching for the most potential teams. **Targeted B2B matchmaking activities** will also be organised in order to support already established early-stage companies.

By combining expertise across borders, it is easier to find potential business ideas and to establish globally competitive joint teams with versatile know-how and experience. The main result of the Springboard project is an increased capacity to **produce international start-ups** in the Central Baltic region. The Springboard will achieve 15 new joint or co-operating knowledge intensive Central Baltic companies aiming for rapid growth.

Business services for growing companies

For growing companies Tehnopol offers a value adding set of business development services that help to develop and expand more efficiently. All services are personal and in accordance with company's needs. Business development services are divided between two main areas: individual consulting and business development and also, business networking services.

BUSINESS DEVELOPMENT SERVICES:

- Selected information (events, technologies)
- Clubs, seminars, workshops
- Coaching – export, sales & marketing, product development

- Personnel search & organisation development
- Technology transfer, development and business partner search networks EEN and IASP.

NETWORKS:

- Tehnopol client companies
- Global (science parks, incubators, universities)
- Estonian sectoral communities & clusters
- International sector specific networks.

2.4.7 Performance

According to the European Innovation Scoreboard[2], Estonia is a Moderate Innovator. Over time, performance has declined by 3.6% relative to that of the EU in 2010.

- **Relative strengths** of the innovation system are in: 1) Finance and support (R&D expenditure in the public sector, venture capital expenditures); 2) Human resources (new doctorate graduates, population aged 25-34 with tertiary education, lifelong learning); 3) and Innovation-friendly environment (broadband penetration, opportunity-driven entrepreneurship).
- **Relative weaknesses** are in: 1) Innovators (SMEs with product or process innovations, SMEs with marketing or organisational innovations, SMEs innovating in-house); 2) Linkages (innovative SMEs collaborating with others, public-private co-publications, private co-funding of public R&D expenditures); 3) and Sales impacts (medium and high-tech product exports, knowledge-intensive services exports, sales of new-to-market and new-to-firm product innovations).

2.4.8 Challenges

Main research and innovation policy challenges are:

- **Addressing the asymmetry between the public and the private R&I efforts.** The Estonian science system follows very different specialisation from the business sector as it finances and supports mostly curiosity-driven basic research for which there is little immediate economic demand.
- **Promoting private investment in R&I by addressing the low pace of technological upgrading in industry.** Due to their contract manufacturing profile, most Estonian manufacturing companies are not very strong in design and development capacities, both

[2] http://ec.europa.eu/DocsRoom/documents/24163

in terms of in-house capabilities and networks they belong to, thus these companies have strong obstacles in climbing the value ladder.

- **Improving the unbalanced public-sector innovation effort.** Public sector innovation efforts since early 2000s have been firmly focused on the development of e-government infrastructure (x-road architecture, e-ID card) and less on service development (via co-creation with the civil society) and public procurement for innovative solutions.

2.5 Germany

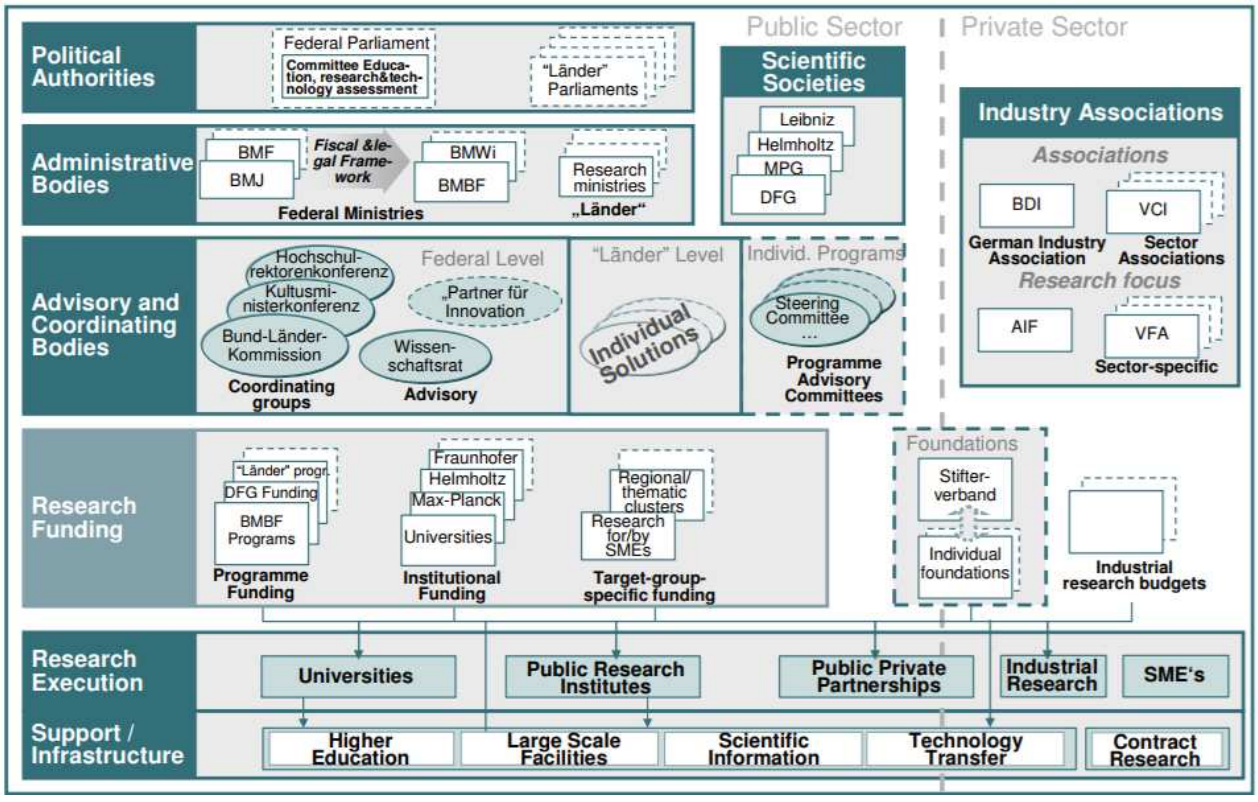
2.5.1 Overview

The German innovation system is a lot of times used as a benchmark. German system is characterised by its flat structure, involvement of regional governments, and by large research organisations. German R&I is mostly conducted in manufacturing industry. Germany has the largest R&I system in Europe and is described as an innovation leader in European innovation scoreboard.

Germany still has a strong human resources base underlying its R&I system. New doctorate graduates as share of population are more than double the EU average and the share of researchers in the total population is clearly above EU average as well.

2.5.2 Stakeholders

Figure 2.5.1. German innovation system



2.5.2.1 Government bodies and agencies

One of the unique features of the German R&I system is that it is a system of shared responsibility of the Federal Government and the 16 Länder. At the national level, the Federal Ministry of Education and Research (BMBF) covers most of the responsibilities for research policy. The

Federal Ministry of Economics and Energy (BMWi) is involved in some areas of innovation and technology policy. The Länder fund the universities in their state.

The federal parliament as well as the representation of the Laender have approved constitutional change in December 2014 with significant consequences for the German R&I system. The Federal Government is now in a position to make agreements with individual Laender and fund R&I in higher education permanently. Laender can still object agreements since the new law requires unanimous approval of all Laender (Deutscher Bundestag, 2014). A goal of the revised law to find agreements between Federal and Laender governments is to develop distinctive profiles in R&I.

Much of publicly funded research is conducted in the university system and in the non-university public research organisations which are co-funded by the Federal government and the Länder. Germany has dual research system where it has separate universities and institutes for applied science. The four major non-university research organisations are Max Planck Society (MPG), Fraunhofer Society (FhG), Helmholtz Association (HGF), and Leibniz Association (WGL). They provide a dynamic element to the German R&I system because of their ability to respond to changing research opportunities and requirements through internally competitive funding allocation mechanisms. The German Research Foundation (DFG) complements institutional funding with project funding for basic research, selecting the most promising research projects by scientists and academics at universities and non-university research institutions based on a competitive basis. In Germany 64% of funding goes as organisational funding, and 36% as project-based funding.

2.5.2.2 Universities

In 2015, the German Higher Education landscape counted about 400 institutions, including 110 universities and more than 230 universities of applied sciences. R&D performed by German HEIs represents about 0.50% of GDP and is funded through a combination of institutional funding and project funding (e.g. Initiative of Excellence, R&D thematic programs by BMBF) and contract research conducted for industry. R&D performed by academia and funded by the German private sector amounts to 0.07% of GDP. These shares are quite stable and have not changed much over the past years. The institutional funds received by universities are for both teaching and research and are largely provided by the Länder.

2.5.2.3 Companies

The car manufacturing industry clearly is the most important contributor to German business R&D, accounting for 35% of internal R&D (almost €22b in 2015 and up by 10% from 2014) expenditures in 2015 and 26% of R&D personnel (Stifterverband, 2016). Other industries within medium-high

tech manufacturing, such as machinery, electric equipment, chemicals as well as pharmaceuticals, are also large R&D investors. In 2015, eight of the 50 largest R&D investors worldwide were headquartered in Germany. At the same time, innovation performance of the particularly important SME sector in Germany decreased slightly over recent years (see chapter 5.1 "Reinvigorate innovation in SMEs").

2.5.2.4 Clusters

In Germany clusters are developed both on National and regional level. The "go-cluster" program is the cluster political excellence activity of The Federal Ministry for Economic Affairs and Energy and supports cluster management organisations with the development of their innovation cluster. Clusters included into the “go-cluster” program are vanguards of innovation and demonstrate how highly competent Germany is in different industries and technological sectors.

Germany has several policy initiatives to leverage geographical clusters such as the Leading-Edge Cluster Competition (‘Spitzencluster-Wettbewerb’) and the initiatives Entrepreneurial Regions (‘Unternehmen Region’) and ‘Zwanzig20 – Partnerschaft für Innovation’ of BMBF. Apart from these cluster initiatives, the German Federation of Industrial Research Associations (AiF) plays a crucial role in connecting research and innovation.

2.5.2.5 Services of the stakeholders

The basic services provided by the main stakeholders of the R&I system are summarised below.

Table 2.5.1. Basic services provided by the main stakeholders

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks / Collaboration
R&I stakeholders					
The Research and Development Council	+	+	+		+
Fraunhofer Society	+				+
Max Planck Society	+				+
Leibniz Association	+				+

German Research Foundation			+		
Association of Industrial Research Institutes	+		+		+
KfW Banking Group				+	
R&I stakeholders with a strategic focus on ICT					
ERP-EIF Fund		+		+	+
High tech start-up fund				+	+

For a more detailed description of each service, see Appendix 2

2.5.3 Strategies

In addition to different strategies, a number of policies directed at promoting research, innovation and ICT have been developed. The most relevant ones are provided in the table below.

Table 2.5.2.: Relevant research, innovation and ICT strategies

Strategies	
High Tech Strategy 2020	The initiative intends to create lead markets, further intensify partnership between science and industry, and continue to improve the general conditions for innovation. The High-Tech Strategy 2020 exists to establish Germany as a lead provider of science and technology-based solutions. The Action Plan identifies 10 "Future Projects" which are considered as being critical to addressing and realizing current innovation policy objective. Within these lighthouse projects, specific innovation objectives will be pursued over a 10 to 15-year time frame. A budget of EUR 8.4 billion has been allocated for the period 2012-2015 to implement the various measures of the Action Plan.
Excellence strategy	Federal and Länder governments reached an agreement for an Excellence Strategy to replace the current Excellence Initiative as from 2017. The initiative is endowed with €533m annually and financed by the Federal government (75%) together with the Länder (25%). Contrary to its predecessor, this new agreement is not limited in time. Following the change of the constitution in 2014 the Federal Government can now under certain circumstances fund R&I in higher education permanently.

Digital Strategy 2025(2016)	Digital Strategy 2025 is 10-point plan aimed at making Germany the global innovation leader, with developing infrastructure, supporting investments and fostering innovation. The Plan is expected to bring 1.3% annual growth to the ICT sector. The plan was introduced by Ministry for Economic affairs and includes the following major points: support for start-ups and venture capital, encouragement of networks and clusters, development of fibre networks, creation of digital agency, introducing lifelong digital education and others.

2.5.4 Policies

Table 2.5.3. Relevant research, innovation and ICT strategies in Germany

Policies	
"Innovative Higher Education Institutions" ('Innovative Hochschule') (06/2016)	Federal and Länder governments reached an agreement for a new joint funding initiative promoting research-based ideas, knowledge and technology transfer and the collaboration between institutions of higher education with business and society called "Innovative Higher Education Institutions" ('Innovative Hochschule') with a budget of €550m between 2018 and 2027 (GWK, 2016b).
Priority to SMEs ('Vorfahrt für den Mittelstand') (01/2016)	The new Ten Point Program for the Federal Ministry of Education and Research (BMBF) announces an increase of 30% in funding available to SMEs, reaching €320m in 2017. It addresses many of the shortcomings in public support to innovative SMEs identified by the Expert Commission on Research and Innovation in its report for 2016 (EFI, 2016). Recent data shows a significant increase in R&D expenditures by SMEs. In 2015, SMEs with less than 250 employees spent 16% more on internal research projects than in 2014. The call of the Expert Commission on Research and Innovation (EFI) for R&D tax credits remains unaddressed.
Priority to SMEs ('Vorfahrt für den Mittelstand') 2016	The new Ten Point Program for the Federal Ministry of Education and Research (BMBF) announces an increase of 30% in funding available to SMEs, reaching €320m in 2017. It addresses many of the shortcomings in public support to innovative SMEs identified by the Expert Commission on Research and Innovation in its report for 2016 (EFI, 2016). Recent data shows a significant increase in R&D expenditures by SMEs. In 2015, SMEs with less than 250 employees spent 16% more on internal research projects than in 2014. The call of the Expert Commission on Research and Innovation (EFI) for R&D tax credits remains unaddressed.

Public procurement on innovation (PPI) and pre-commercial procurement (PCP)

Innovation-oriented public procurement is part of the local and national innovation strategies such as Digital Agenda 2014-2017. On the other hand, there are no binding strategies or exact national targets for PCP or PPI. Public procurement in Germany is decentralised. Germany has more than 30 000 various procurement programs, which are managed at federal, Laender and municipality levels with municipalities accounting for most of the public procurement.

Federal ministry of economic affairs and energy BMWi set the general framework for public procurement, by creating national legal framework, and implementing EU directives. Currently, public procurement in Germany is regulated by several legal acts which include: The Act against Restraints of Competition; the Regulation on the Award of Public Contracts; the Sector Regulation; the Procurement and Contract Procedures for Supplies and Services; the Procurement and Contract Procedures for Freelance Services. Directives 2004/18/CE 24 and 2004/17/CE and the more recent procurement Directives 2014/24/EU, 2014/25/EU and 2014/23/EU were transposed into German law. In 2013, the ministry created competence centre of public procurement (KOINNO) to advise procurers at all levels of public administration increase awareness of innovation relevant public procurement. Furthermore, KOINNO has a database for showcase examples of successful public procurement for innovation. Funding for pre-commercial procurement is as well active in Germany, and PCP is part of the innovation grant and procurement schemes.

The largest challenge of German procurement for innovation is its decentralisation. A more centralised procurement system would have allowed to lower the procurement costs, tendering costs, have better information dissemination and provide a more strategic view on innovation procurement.

2.5.5 Funding

2.5.5.1 Public

Public funding of R&D has been increasing over past couple of years. In 2013, The Federal Government's spending has significantly increased, and currently corresponds to 29% of the GDP, which right around the EU average of 32%. (Eurostat). Government budget appropriations or outlays for research and development (GBAORD) amounted to €25.9b in 2015 which is about 5.5% higher than in 2012 and corresponds to about 0.85% of GDP (EU-28: 0.67%). At the same time in contrast to UK or Ireland, Public funding of research project in Germany is mostly organisational 64% and 36% project based.

Indirect funding for research is currently not practiced in Germany, and introduction of dedicated R&D tax credits is currently not part of the policy discussion

2.5.5.2 Private

R&D in Germany is market driven, with most of the expenditure coming from the private sector. Business expenditures on R&D (BERD) accounted for 2.06% of GDP in 2015 representing 69% of total R&D expenditures and are significantly above the average levels of EU-28 (2015: 1.30%). Germany remains the second largest destination country for R&D of foreign firms behind the US. With about a quarter of business R&D expenditures coming from foreign firms.

Manufacturing accounts for more than 80% of all R&D expenditure, with the following three sectors account for almost 60% of all business R&D expenditures: a) motor vehicles and parts; b) electrical equipment, computer, electronic and optical products and c) machinery and equipment (Eurostat, 2016) Contribution of service sectors to R&D has strongly increased in 2015: professional, scientific and technical activities increased from €3,1bn in 2014 to €5bn in 2015 (Stifterverband, 2017).

2.5.6 Clustering

Of the total list of the European Cluster Collaboration Platform, 23 digital cluster organisations are concentrating in Germany; 8 of them hold a Gold Medal of Excellence.

CyberForum e.V.

CyberForum e.V. is the largest digital cluster in Germany with 1100 members.

- Information Technology and Analytical Instruments
- Creative Industries, Digital Industries, Mobility Technologies
- CRM - Customer Relationship Management, Visualisation, Virtual Reality, Mobile Communications
- Cleaner environment & efficient energy networks (e.g. smart grids), Information service activities, Ageing societies

Support services provided:

- Internationalisation support (= Access to third countries markets)
- Access to public support (regional/national programmes, innovation vouchers, etc.)
- Access to private funding (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.)
- Facilitation of collaboration between members
- Support of knowledge transfer

Details of support services:

In its function as networking platform CyberForum arranges +140 events per year. Specific services & concepts have been designed for all developmental stages of the corporate life-cycle, from start-up consulting, mentoring & coaching to a business congress.

Relevant services

- Business Roaming Agreement (www.clusterize.org)
- Networking events (different formats)
- Organisation of workshops and conferences
- Own Business Angels Network
- Organisation of “Pitch Events” for entrepreneurs to find VC (also guiding entrepreneurs, pre-evaluation of idea etc.)
- Regular newsletters for dissemination (reach: 2.300 recipients per CyberForum newsletter; in cooperation with partners up to 10.000 recipients), social media presence
- Own PR and event management department with long-time experience
- Knowledge transfer platform (www.itlotse.de)
- Mentoring & coaching of entrepreneurs
- TeamUp – a matchmaking event for entrepreneurs
- CyberLab – Our own start-up accelerator in the premises of CyberForum
- CyberForum-intern trainings and workshops for innovation processes and other topics
- Its Knowledge transfer platform (www.itlotse.de) is a

The **CyberLab** is the IT Accelerator of the CyberForum for the state of Baden-Württemberg operated by the CyberForum.

Here promising start-ups from the IT and high-tech industry receive a tailor-made support - with a mentoring program that supports the start-ups in the construction of their company and an optimally equipped work environment. The founders work on the territory of the CyberForum, which opens up access to numerous companies and a dedicated business angel network.

The CyberLab offers talented founders the opportunity to bring their promising business idea to market maturity, to secure their financing, and, in addition, to establish valuable contacts with experienced entrepreneurs.

Infrastructure. In the CyberLab founders work under optimal conditions: workspace, internet, meeting rooms, mentors

The CyberForum gives founders access to a network of 1,000 members from the digital sector

Shared Services

The CyberTeam supports you in marketing, press work or sales.

The CyberLab working phase lasts six months and can be extended up to 12 months. During this time, the founders are supervised by the project management of the CyberLab, which extends its

own founding experience and entrepreneurial know-how. In organisational and administrative matters or PR matters, the team of the CyberForum is only one door away from the start-ups.

Low rental costs, no shares

Unlike other incubators, the CyberLab does not have to pay any shares and the rental costs of the office infrastructure are unbeatable.

Access to international markets

Networks are fundamental to business success, especially when it comes to opening up new target markets abroad. Because then cultural and legal differences can become insurmountable hurdles. What legal form do I choose when opening a branch abroad? How do I behave adequately at business meetings abroad? What should I pay attention to when dealing with employees?

The CyberForum helps companies from the digital economy to avoid such pitfalls. For more than 10 years, we have been involved in EU projects such as Be Wiser or UPSIDE, organise delegation trips to the Silicon Valley or India, for example, and are networked with 57 clusters across 32 countries worldwide via the Business Roaming Agreement.

The **Business Roaming Agreement "Clusterize"** supports small and medium-sized enterprises in their internationalisation projects. Clusterize currently connects approximately 60 clusters and cluster-like organisations across Europe, North and South America, Asia and Australia.

"Clusterize" allows founders to access the infrastructure of partner networks for a certain period of time, including meeting rooms. In this way, you can get to know the potential target market before opening your own branch office and make contacts with potential business partners. They are supported by local employees, who pass on their many years of know-how around the regional economy and provide business contacts.

automotive-bw

Mission/Objectives:

automotive-bw bundles the competences of the vehicle industry throughout the whole of Baden-Württemberg and in particular intends to *support small and medium-sized component suppliers in managing the structural transformation and in developing business models* which are fit for the future.

The aim is to systematically press ahead with the networking of the automotive industry in the country and to promote development co-operations. To the extent that OEMs and system suppliers form a network and cooperate worldwide, particularly small and medium-sized component suppliers should also be encouraged to bundle their forces by means of co-operations. The cooperation of the network partners, mostly regional business development agencies or initiatives of the Chambers of Commerce in the country, is coordinated by the RKW

Baden-Württemberg – it is the central funding organisation and office of *automotive-bw* and additionally also organises nationwide offers and events such as the annual "Component Supplier Conference Automobile". A close cooperation exists with the State Agencies e-mobil BW and Leichtbau BW.

Sectors:

- Automotive, Downstream Metal Products, Electric Power Generation and Transmission
- Digital Industries, Mobility Technologies
- Automation, Robotics Control Systems, 3D printing, Planning and security
- Advanced manufacturing systems, Advanced materials, Motor vehicles & other transport equipment

Services:

- Internationalisation support (= Access to third countries markets)
- Innovation Management / Support of innovation processes (internal, external)

Details of support services:

Working groups for innovative automotive solutions

To work together on future topics, which are of concern for the automotive industry: this possibility is offered by the *TecNet*-Groups of *automotive-bw*. The three *TecNets* electric mobility, lightweight construction and efficiency technology have existed for several years already; with *ConnectedCar* the fourth *TecNet*-Group was created in 2015. The State Agencies are also on board as cooperation partners: e-mobil BW supports the *TecNet*-Group electric mobility; lightweight construction BW shows its commitment in the *TecNet*-Group lightweight construction. In three to four working meeting per annum innovative subject areas are identified, co-operations are initiated and implemented in specific projects. Mentors from industry and research support and accompany the *TecNet*-Groups in the long term. This approach guarantees that the performed development work is also suitable for the market and satisfies the needs of the automotive manufacturers and system suppliers.

Seminars of *automotive-bw*

In the seminars of the series "Fit for Automotive" the participants acquire the tools in order to exist as a component supplier for the automotive industry. This also includes strategies in order to consolidate and improve their own position as component supplier and to securely assess opportunities and risks. The series of seminars is oriented to managing directors and executives.

Individual advice

With a broad-based offer of advice *automotive-bw* accompanies companies with their change in strategy and structure, provides support with the innovation and change management, with the introduction of new technologies or business fields. Not least a new offer gives companies the

access to the subject area that is becoming more and more important "Additive Manufacturing/3D-print".

Component supplier conference

In order to promote the dialogue between the component suppliers in the federal state, the 1st component supplier conference automotive took place in Baden-Württemberg in 1999 already. To date this event is the central module of the automotive component supplier initiative of the federal state – jointly carried out by the Ministry of Economic Affairs Baden-Württemberg and by *automotive-bw*. Experts from the automotive industry, from associations, from science and politics speak about developments and trends. The topics are looked at in-depth in workshops, the focus is placed on the exchange of experiences and discussions. In an accompanying exhibition companies, research institution and economic development agents present themselves with their offer of services. The annual meeting of the *TecNet*-Groups also takes place within the scope of the component supplier conference.

International cooperation

Automobiles are increasingly produced outside of Europe and close to the sales markets with strong growth: In addition to China and the USA the markets in Mexico, Brazil and India are also on a path of growth. Associated with this smaller and medium-sized component, suppliers also have to fact the topic of internationalisation. *automotive-bw* supports companies in Baden-Württemberg on this path. In close cooperation with the partner Baden-Württemberg International in addition delegation trips and trade fair visits at home and abroad are also planned and carried out.

What we do

- Central contact partner for Automobile Cluster Baden-Württemberg
- Organise specialist conferences, workshops, and seminars
- Initiate issue-specific workgroups – TecNets
- Mediate and/or establish targeted cooperation projects
- Offer basic and advanced training in innovative technologies and process-related issues
- Subsidise participation at trade fairs, congresses, etc. (joint presentations). Information and knowledge transfer in respect of current trends and technologies
- Provide information on current promotion programs
- Run an Internet platform for communication and marketing

Hamburg Aviation e.V.

Mission/Objectives:

Together with our members, Hamburg Aviation pursues common goals:

- Build aircraft

- Build cabins
- Optimise air transport systems
- Provide aviation services
- Specialise in aviation IT & communications

Sectors:

- Aerospace Vehicles and Defence, Metalworking Technology, Transportation and Logistics
- Digital Industries, Logistical Services, Mobility Technologies
- Aeronautical technology / Avionics, Aircraft, Materials, components and systems for construction
- Aeronautics, Civil engineering, Computer programming, consultancy & related activities.

The outstanding strength of the cluster results from the concentration of companies, universities and research institutions, from the proximity and close networking of Airbus, Lufthansa Technik and the airport, and from the resultant competencies in specific areas such as, for example, cabins and the air transport system, along the entire value chain. Other cluster strengths worthy to mention are the sustainable programmes for attracting the next generation of staff and developing specialist personnel, **HCAT** (platform for skills transfer) as a unique infrastructure for correlating teaching, practice, and research, **ZAL** as a new focal point for technological competence and application-oriented research, and the strong cohesion and solidarity of the community. All together, these factors lead to an outstanding market presence and high visibility. Representing the third largest aviation hub in the world, Hamburg Aviation offers:

- platforms for the networking of our members: aviation forums, workshops and symposia
- collaborations with international clusters and missions to international markets
- sustainable programs for attracting the next generation of specialist personnel
- support for the correlation of teaching, practice and research in aviation engineering
- high-reach marketing and PR measures

Virtual Dimension Centre (VDC)

Mission/Objectives:

The Virtual Dimension Centre (VDC) is Germany's leading competence network for Virtual Engineering. Technology and service providers, users, research institutions and multipliers work together in the VDC network along the entire value chain of Virtual Engineering- namely in 3D simulation, 3D visualisation, product lifecycle management (PLM), and Virtual Reality (VR). The VDC members gain improved innovation activity and a higher productivity by acquiring additional information and cost advantages.

Sectors:

- Information Technology and Analytical Instruments

- Digital Industries, Experience Industries
- Internet of Things, Simulation, Visualisation, Virtual Reality
- Computer programming, consultancy & related activities, Information service activities, Advanced manufacturing systems.

Services:

- Access to public support (regional/national programmes, innovation vouchers, etc.)
- Facilitation of collaboration between members
- Facilitation of cross-sectorial cooperation
- Trend-scouting (Ideas for innovative projects)
- Support of technology transfer

Pilots for the digitisation of planning and development processes.

Digitisation of planning and development processes (digital product development, digital production planning) is of vital importance for all manufacturing companies with sufficiently complex products - irrespective of company size. Costly errors in the development can be avoided and development processes be kept competitive thanks to extensive preliminary simulations and visualisations. With the automotive industry, mechanical engineering, plant engineering, aerospace and other relevant industrial sectors, Baden-Württemberg has exactly the same industries with highly complex products.

As part of the "Digitallotsen" project, small and medium-sized companies are informed free of charge about new business opportunities, they are provided with information and contacts in the field of digitised development processes and kept informed about trends in the fields of virtual reality, augmented reality and digitised development processes.

The project Digitallotse is implemented with the support of the Ministry of Economics, Labour and Housing Development Baden-Württemberg.

VDC offers in the Digitalpilot program the following services:

- Individual consultation hours
- Simulation plug-in letters
- Educational Atlas Virtual Engineering
- Application Atlas Virtual Engineering
- Getting Started Virtual Techniques
- Information Portal
- Simulation Fitness Check

Intuitive 3D User Interfaces

3D GUIde is a project for the development of intuitive and competitive 3D software: the project aims to develop a performance and solution offering that improves the intuitive interaction of 3D

software. Building on the results of the project, a consulting process for small and medium-sized 3D software manufacturers is also being developed.

Navispace, http://www.navispace.de/

Mission: to create ecosystems accelerating innovation and business.

Services:

- Innovation World Cup Series
- Exclusive Open Innovation Program
- Innovation Community
- Innovation Strategy and Management
- Campaigns and Marketing
- Innovation Events

Innovation Strategy and Management

We have a profound knowledge of upcoming technologies, trends, game changers, and new players that will enter the stage in different markets and industries and provide this expertise on a customised basis to many companies.

• Innovation Insights

• Expert Advisory Services

• Go-to-market and Market Entry Strategy

• Technology Search

• Innovation Strategy Workshops

Creative labs services:

- Corporate Design
    - Corporate Design
    - Corporate Identity
    - CD-Manuals
    - Business Stationery
    - Brand Development
    - Wording
- Creative Concepts
    - Conception
    - Campaign
    - Implementation
    - Marketing Mix

- Print & Online Communications
- Event Marketing
- Full-Service

Cloudzone –Messe Ltd, Germany, http://www.cloudzone-karlsruhe.de

A big international fair promoting the best practices in security, business models and strategies, collaboration models of private business and public sector, legal issues, as well as existing tools (like cloud security scorecard) and services for supporting SMEs in cloud computing.

Cloudscape Deutschland

A tool depicting the ecosystem of German SaaS, IaaS and PaaS providers.

EuroCloud Deutschland_eco e.V., http://www.eurocloud.de/

EuroCloud Germany_eco e. V. is the Association of the German Cloud Computing Industry. It is committed to the acceptance and on-demand provision of cloud services in the German market. The association is in constant dialogue with the partners of the European EuroCloud network. EuroCloud Germany_eco e. V. was founded in December 2009 and is affiliated to the eco e. V. - Association of the Internet.

EuroCloud Germany_eco e. V. acts as an independent industry association for the promotion of the cloud market and provides with guidance for more confidence in the cloud and a better market transparency. Its toolbox includes guidelines, specific tools for customers, practical recommendations and informative events, enabling users and providers of cloud services to find each other. It provides discussion platform and guidelines on data protection and security, interoperability and standards as well as law and compliance. Among other things, the Association of the German Cloud Computing Industry continuously works on legal and technical framework conditions at national and international level in order to further develop and harmonise these.

CLOUDING SMEs, http://www.cloudingsmes.eu/wordpress/

The CloudingSMEs support action is a joint effort of SME Associations, SMEs and clouding computing experts.

CloudingSMEs intends to act as a catalyst for the accelerated and more successful adoption of cloud computing by European SMEs, while at the same facilitating ICT SMEs in the development, deployment and promotion of their cloud computing solutions.

CloudingSMEst takes a comprehensive approach to the use of cloud computing by SMEs, which considers both the supply side (i.e. results and endeavours of ICT SMEs with expertise on cloud

computing) and the demand side (i.e. the adoption and use of cloud computing technologies by SMEs).

Along with the production of the road maps, the project will focus on short, medium and longer-term activities, which shall be undertaken by the SME communities, cloud computing communities and policy makers towards a smooth and successful migration to the vision.

The main activities and tools of the CloudingSMEs project are the following:

- mobilizing and coordinating an *SME-centric team of stakeholders* from both SME communities and cloud computing communities (including partners representing SME communities and other stakeholders), towards identifying, analysing and proposing solutions with regard to the key factors that inhibit the *penetration of cloud computing within SMEs*,
- *unifying and consolidating the requirements of SMEs in Europe regarding cloud deployment*,
- developing, documenting and promoting a set of *road maps* for pursuing the identified vision (by 2020 and beyond),
- creating a *toolbox for SMEs*, comprising a wide range of multilingual interactive services and techniques that can assist SMEs in their cloud related activities such as *selection of cloud vendor/provider, conduction of techno-economic analysis, assessment of data protection issues, successful confrontation of legal/contractual issues, negotiation of SLAs;*
- accompanying the *toolbox with a range of best practices associated with cloud-computing adoption, deployment and use, notably best practices derived on the basis of other SMEs experiences*, covering the following aspects:
    - Security Procedures
    - Certification
    - Standards and Regulations
    - Liability
    - Cloud Security Scorecard
    - Pricing
    - Pricing Options
    - Pricing TCO/ROI calculator
    - Legal
    - Data Privacy
    - Offer Specifications
    - Elements of Cloud contracts and SLAs
    - Location of Data
    - European regulation on data privacy.

- developing a number of *policy guidelines*, in terms of technical, technological, socioeconomic and legal issues associated with the cloud computing development and their take-up by SMEs,
- raising awareness about the cloud computing within SME communities, with a view to provide complete/integrated and neutral/objective information about cloud computing in way that is fully understandable by SMEs.

Mittelstand 4.0

The initiative "Mittelstand 4.0 - Digital Production and Work Processes" supports SMEs and skilled craftsmen in the digitisation, networking and implementation of Industry 4.0 applications. SME 4.0 agencies are working on overarching digitisation topics such as cloud computing, communication, trade and processes, and are spreading them through multipliers. Currently, twenty 4.0 Competence Centres for SME sensitise, inform and qualify companies and offer practical demonstration and testing opportunities.

There are also four Mittelstand 4.0 Agencies, each of which focuses on a specific issue of digitalisation and eBusiness. These agencies pass on their expertise to Mittelstand 4.0 Competence Centres and use multipliers to share it with companies:

- The Mittelstand 4.0 Agency for the Cloud provides support on the application and growing use of cloud computing technologies.
- The Mittelstand 4.0 Agency for Processes offers help with the use of digital process and resource management.
- The Mittelstand 4.0 Agency for Communication supports innovation management and helps raise the use of digital communication processes.
- The Mittelstand 4.0 Agency for Trade is there to answer questions on new technologies in digital trade, such as eBilling, and on production-related trade.

*Reference model for Industry 4.0: **RAMI 4.0***

A special tool was developed to support the digitalisation of SMEs: reference model for Industry 4.0: RAMI 4.0; providing a framework for systematisation of various technologies enabling the full-scale digital transformation.

The model is escorted with documentation, including the scenarios of application, the cases of using digitalisation technologies in the value chain and relevant examples of business models.

A special standard is developed (DIN SPEC 91345:2016-04), which explains how to provide access to information in the RAMI 4.0 architecture.

The scenarios described include:

• Production in accordance with specific orders;

• A factory capable of transformation;

• Self-organizing adaptive logistics;

• Services based on value added;

• Transparency and the ability to transform the already delivered goods;

• Support for applications in production;

• Intelligent product development for smart production;

• Innovative product development;

• A farm with a closed cycle.

In addition to systemizing knowledge of enterprises, the reference model of IT architecture helps developers to find their niche in the market and specialise in it.

2.5.7 Performance

According to the European Innovation Scoreboard, Germany is an Innovation Leader. Performance of Germany relative to EU average has mildly declined by 2 % from 2010 to 2017.

- **Major strengths** of the innovation system are 1) International scientific publications (more than twice of EU average); 2) New doctorate graduates 3) Non-R&D innovation expenditure
- **Major weaknesses** are: 1) lack of foreign doctorate students; 2) lack of venture capital investors; 3) level of tertiary education.

2.5.8 Challenges

Main research and innovation policy challenges are:

Reinvigorate innovation in SMEs. The contribution of SMEs to overall business R&D expenditures has been declining for years with more positive numbers in 2015. SMEs spent about 10% more on R&D in 2015 than the year before. Most of the obstacles to innovation for SMEs stem from shortages of financial and human resources. Public attention and resources are focused on the issue. It remains open whether current policies reach small SMEs and those with occasional R&D needs, i.e. the major contributors to the declining trend.

Capitalise on business opportunities from the digital economy. Germany is positioned in the midfield of countries benefitting from business opportunities in the digital economy. A large number of start-ups are coming up with innovative digital business models. Business model creation and innovation play a role in public support, but many existing measures are set up for supporting technological innovation.

Encourage entrepreneurship. The two innovation challenges above are both connected to shortcomings in entrepreneurship performance. Trends for entrepreneurship in Germany are negative in general as well as for the knowledge-intensive sectors in particular. The challenge originates from a mix of reasons including underdeveloped small venture capital markets, tax and regulatory obstacles, a lack of exit prospects for venture capital providers as well as demographics and a healthy labour market. Policy makers have demonstrated sensitivity to recent evaluation reports and improved procedures as well as framework conditions. The absence of a stock market segment for Initial Public Offerings (IPOs) for venture capital remains a disadvantage which is largely outside of the control of government.

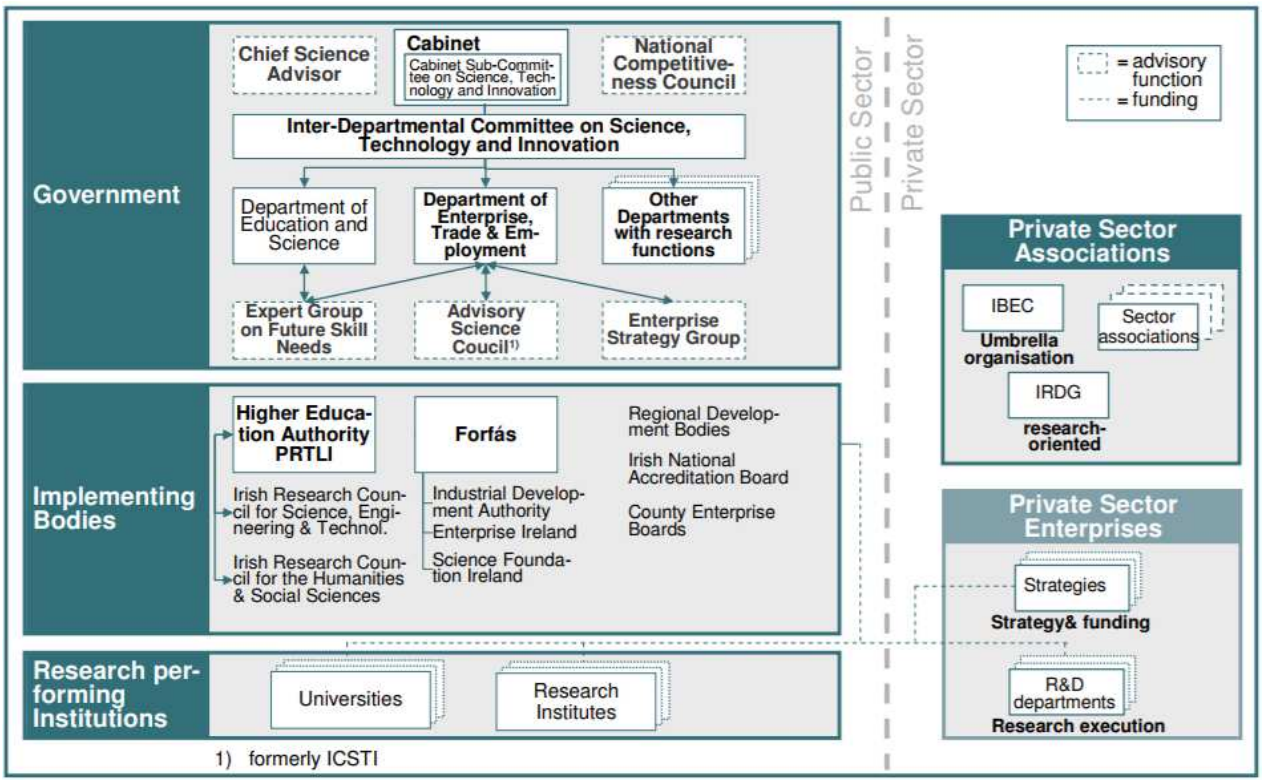
2.6 Ireland

2.6.1 Overview

Ireland is an open economy that has an innovation friendly environment. Ireland's Small Business Act (SBA) profile and performance has been strong and improving in recent years (EC, 2016d). Ireland features among the top performers with regard to "Skills & innovation of SMEs" and the "Single market" and is above the EU average for "Entrepreneurship", "Second chance" and "Responsive administration". To sustain the innovation ecosystem and further improve it, Ireland has introduced a nation- wide innovation support strategy, "Innovation 2020". The strategy focuses on enterprise innovation, education for innovation, innovation for social progress, the role of IP in innovation, and innovating with the EU and the wider world. Ireland's R&D headline target is to raise combined public and private investment levels to 2.5% of GNP or 2.0% of GDP. There is a concern that with GDP increasing rapidly unless there is a substantial increase in funding for R&D to accompany the new Innovation 2020 strategy then Ireland faces a risk of not achieving its 2020 headline target.

2.6.2 Stakeholders

Figure 2.6.1. Irish innovation system



The Irish R&I system is fairly centralised with the bulk of R&I budgets being controlled by ministries aka Government Departments. Still Irish R&I system is market driven as main research performers are the enterprise sector (of which foreign owned companies account for 65% of BERD) and the higher education sector (of which the seven universities account for over 80% of research contract income). The Public Research Organisation (PRO) sector is small by EU standards — R&D performed by the government sector within the EU28.

2.6.2.1 Government bodies and agencies

The Department of Jobs, Enterprise and Innovation (DJEI) and the Department of Education and Skills (DES) are responsible for R&I policy development and implementation. They accounted for 77% of GBAORD in 2013. To assist ministries in achieving the targets of the national innovation strategy, Innovation 2020 Implementation Group was created through the merger of the Inter-Departmental Committee on Science, Technology and Innovation, the Prioritisation Action Group and the Horizon 2020 High Level Group. The Chief Scientific Adviser is a member of the Group.

2.6.2.2 Universities

The main actors in the higher education sector (HES) are the seven universities, accounting for approximately 80% of research funding in the HES and are represented by the Irish Universities Association. The Institute of Technology Ireland represents the 13 Institutes of Technology. Dublin Institute of Technology (DIT) stands alone.

The HEA is an agency of the DES charged with the responsibility for the effective governance and regulation of the HES. It is also the funding body for the universities and Institutes of Technology. Knowledge Transfer Ireland5 is the national structure to promote technology transfer in the HES. The HES is the second largest research performing sector after the business sector (22% of total research performed in 2014). Research and Development Expenditure in the Higher Education sector (HERD), declined between 2009 and 2013 (€605) and increased again in 2014 to an estimated level of €631m, still somewhat lower than the 2012 value (€640m).

The Public Research Organisation (PRO) sector is small by EU standards. In 2014, R&D performed by the public research organisations amounted to 4.5% of GERD, compared with an average of 12% for EU-28.

2.6.2.3 Companies

Business sector is the main performer of research, with 73.5% of total R&D expenditure in 2014. The Irish BERD intensity was stable in the period 2009-2014 at around 1.1% of GDP in 2014. Services and manufacturing account for more than 95% of BERD expenditure. Services are the leading macro-sector of the Irish BERD at around 0.65% of GDP, BERD intensity in manufacturing has been around 0.4-0.5%.

A key feature of Irish enterprise sector is its duality: on the one side, it has a small number of large multinational companies, the majority of whom are in the medium and high-tech sectors while on the other side a large number of small and medium sized indigenous companies are active in the low and medium technology sectors. BERD is dominated by a very small number of mainly foreign owned MNCs (100 companies accounted for 70% of BERD in 2013) (CSO, 2015), which are concentrated in a number of high tech sectors such as life sciences and ICT.

On the other hand, the research activity of the indigenous business sector is small but growing. IBEC, American Chamber of Commerce Ireland and the Industry Research & Development. The Chief Scientific Advisor, is also the Director General of Science Foundation Ireland. The private non-profit sector in Ireland does not undertake research activity of any significance.

2.6.2.4 Clusters

Clusters in Ireland, are rather well developed. European cluster observatory gives Ireland 3 stars. Each cluster is getting 1 star for being in top 20% in Europe along each of the four dimensions: size, specialisation, productivity, and growth.

Dublin silicon dockis is an area of Dublin with high concentration of tech companies. Number of tech employees is around 7000, and the cluster involves such companies as, Google, Facebook, LinkedIn and others.

Irish software innovation network has over 500 members and is one of the main IT clusters in Ireland.

The digital hub: Since its launch in 2003 the digital hub is largest cluster for digital companies in Ireland. The Digital Hub is focused on providing a collaborative environment where digital companies can thrive. Structured support in the form of workshops and seminars complement the natural networking environment we encourage. The Digital Hub is managed by the Digital Hub Development Agency, an Irish state agency set up in 2003. The Digital Hub Development Agency runs The Digital Hub and implements its enterprise and campus development strategy. It also facilitates and contributes to urban regeneration in the Liberties area and pilot projects that are vital to the ongoing development of the digital sector in Ireland.

2.6.2.5 Services of the stakeholders

The basic services provided by the main stakeholders of the R&I system are summarised below.

Table 2.6.1. Basic services provided by the main stakeholders

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks/ Collaboration
R&I stakeholders					
Science foundation Ireland	+		+		
IDA Ireland	+	+	+		+
Strategic banking corporation				+	
Enterprise Ireland		+	+	+	+
Local Enterprise Boards			+		+
Irish Research council	+	+	+		+
Microenterprise loan fund				+	+
Research institutes under government departments	+		+		+
R&I stakeholders with a strategic focus on ICT					
National Digital Research Centre	+		+	+	+
Local Enterprise offices	+	+			

******For a more detailed description of each service, see Appendix 2*

2.6.3 Strategies

Table 2.6.2. Relevant research, innovation and ICT strategies in Ireland

Strategies	
Innovation 2020	Innovation 2020 is the new national RDI strategy, launched only in December 2015 (the previous RDI strategy ended in 2013). It sets out action terms of Ireland's current R&I policy specifying an ambitious target for GERD (2.5% of GNP by 2020) and for doubling the level of private support for R&D performed in the public research system. It focuses on enterprise innovation, education for innovation, innovation for social progress, the role of IP in innovation, and innovating with the EU and the wider world.
Enterprise 2025	Enterprise 2025 is the jobs and enterprise strategy. It aims to achieve productivity growth across the economy to levels ranking amongst the top five EU countries averaging 2.0-2.5% p.a. over the long term.
National Skills Strategy 2025	Launched in 2016, it aims at evolving towards an education system that fully supports lifelong learning and is more responsive to the changing needs of participants, enterprise and the community. It notes the need for a solid pipeline of research skills development that supports early-stage researchers, researcher mobility into industry and internationally, as well as the development, retention and attraction of advanced researchers.

2.6.4 Policies

In addition to different strategies, a number of policies directed at promoting research, innovation and ICT have been developed. The most relevant ones are provided in the table below.

Table 2.6.3.: Relevant research, innovation and ICT policies

Policies	
Knowledge Development box	Two task forces target the following areas: lower the administrative burden of reporting; strategic management of innovation and creativity in the public sector; co-creation practices and methodologies; supporting social entrepreneurship. 5 pilot projects (prototypes) will be generated during 2016 and 2017.
Update of the national IP protocol	In January 2016, the Department of Jobs, Enterprise and Innovation published an updated national IP protocol to assist companies to access knowledge in the public research sector.
Actions of Science Foundation Ireland	Development of challenge-based funding, open calls to support individual researchers at different career stages, the attraction of top talent to Ireland, and support the development of research capability in Advanced Manufacturing.
Various initiatives of Enterprise Ireland	Clustering Program (support for SMEs and MNCs to maximise the opportunities from collaboration), Business Innovation Initiative (support for developing new innovative business processes).
Launch of Health Innovation Hub	Seeks to encourage collaboration between the health services and the business sectors so as to facilitate the development and commercialisation of new healthcare technologies, products and services.

2.6.4.1 Public procurement on innovation (PPI) and pre-commercial procurement (PCP)

Ireland currently underutilises the use of PCP and PPI instrument to boost innovation in Ireland. Ireland further lacks a comprehensive strategy to facilitate innovation procurement. SMEs are supported via Small Business Innovation Research which is part of Enterprise Ireland. Some of the innovative projects include: Collaborative project to develop smart technology solutions to assist BER end users interpret the data and datasets available through the BER scheme

Three projects have been funded under the SBIR program and EI is planning ten new projects over 2016-2017. Among the funded projects was the public procurement of a system that allows residents to easily interpret and access data of Building Energy Rating. The project is aimed at making Energy rating more significant in purchasing or renting decisions.

2.6.5 Funding

Gross Expenditure on Research and Development (GERD) in Ireland increased steadily over the period 2012-2014. GERD amounted to €2.871b or 1,51 % of GDP in 2014, compared to EU average of Ireland's research intensity rate declined slightly from 1.54% in 2013 to 1.52% in 2014, compared to an average EU-28 intensity of 2.03% in 2014.

2.6.5.1 Public

Public funding in Ireland is on competitive basis. Most of the funding comes in form of project funding in contrast with other EU countries like Germany or Sweden. Public R&D capital expenditure has been declining strongly both in absolute terms (2008: €139mln, 2014: €85mln – Eurostat) and as a share of total public R&D (GOVERD+HERD), which declined below the EU28 average.

Furthermore, Ireland provides indirect funding via tax credit. The R&D tax credit scheme is a corporate profit tax credit of 25% of qualifying R&D expenditure. The Finance Act 2013 provided that the first €200,000 spending on R&D qualifies for the credit on a full volume basis. Ireland's knowledge Development Box (KDB) was introduced on 1 January 2016. Its total estimated exchequer cost for 2016 is €50m. The KDB involves the application of a preferential corporate tax rate of 6.25% on income from IP resulting from R&D carried out in Ireland. The amount of profits that can avail of the relief will be determined by the proportion that the Irish company's R&D costs bear to the total R&D costs incurred in developing the qualifying assets. In contrast to direct funding, the value of indirect funding was constantly rising from 2006 till 2014.

The OECD, in its Economic Review of Ireland 2015 (OECD, 2015a), noted that future innovation requires a stronger contribution by Ireland's domestic firms and suggested that the government can help by rebalancing its innovation policies towards direct support.

2.6.5.2 Private

More than half of funding for Ireland came private sector (ca 53%). At the same time, Ireland's BERD is 1.09% of GDP and is below the EU average of 1.3%. The business sector is the main fund provider of BERD, but the gap between the total BERD intensity and the business sector (BES) contribution has been increasing over time. This is a consequence of both the stagnation of the business contribution (at ca. 0.8% of GDP since 2009) and the increasing contributions from the government and from abroad (mainly EU funding).

Interestingly, around 19% of all R&D funding came from abroad, which is the result of the openness of Irish economy and its reliance on EU structural funds.

2.6.6 Clustering

Irish Software Innovation Network (ISIN)

http://www.isin.ie/

Mission: To make Ireland a Global ICT Powerhouse.

Objectives

- Brokering introductions to MNCs/Academia/Eco-System
- Mentoring organisations and helping them to scale
- Providing access to domain knowledge experts
- Delivering seminars and workshops on key industry topics
- Supporting local clusters and innovation hubs across the quadruple helix
- Driving collaboration between industry and academia

Sectors:

- Business Services, Financial Services, Information Technology and Analytical Instrument
- Digital Industries, Medical Devices, Mobility Technologies
- Computer Software, Data Protection, Storage, Cryptography, Security, Internet of Things
- e-Health (e.g. healthy ageing), ICT trust, cyber security & network security, Computer programming, consultancy & related activities.

Support services provided:

- Access to public support (regional/national programmes, innovation vouchers, etc.)
- Facilitation of collaboration between members
- Support of knowledge transfer
- Support of technology transfer
- Innovation Management / Support of innovation processes (internal, external)

Details of support services:

ISIN promotes collaboration between academic and industry by providing information and supports on Knowledge Transfer, Innovation and State Funding Schemes and in general creates awareness of various EU, State and inter industry opportunities to the cluster members. ISIN facilitates many opportunities for members to network and exchange domain knowledge via seminars, skill workshops and by supporting cluster member events.

- Support SMEs to engage with SMEs and SMEs with MNCs to leverage synergies and create new collaborative opportunities.
- Support the design and implementation of technology roadmaps to assist the scaling of companies in and out of Ireland.
- Support Research to Innovation to Commercialisation (R-I-C Model).
- Support the emergence of new value chains through cross cluster collaboration.

- Information about funding opportunities
- Information about IP Licensing
- Information about R&D Tax Credits.

+Cloud Arena

Cloud Arena was formed to provide a forum for interaction, knowledge exchange and networking for Ireland's evolving Cloud Computing community. CloudArena is not a membership-based entity and therefore welcomes everybody to build the Irish Cloud Computing Eco-System embracing the end-user, technical, business, the software development, the professional services, multinational and academic communities.

The main objectives are to:

- Enable an awareness of the benefits that modern technologies bring to business.
- Educate business as to the practicality of evaluating Cloud Computing as part of their business strategy, whilst addressing associated concerns.
- Bridge the gap of connectivity between the service and organisations that provide Cloud Computing services and the myriad of potential users who need that initial contact point and information seminar to help them take their possible adoption further.
- Identify how technology can create a competitive edge for the wider community.
- Facilitate an interactive environment for C-Level, business owners, SME's, solution providers and the larger community to engage in a professional manner.
- Contribute, collaborate and drive the Cloud Computing Eco-System in Ireland with the relevant stakeholders including by not limited to the Irish Software Innovation Network, Irish Software Association, ICT Ireland and Enterprise Ireland.
- Promote best practices for the successful deployment of Cloud Computing based services in organisations
- Events and breakfast seminars are hosted on a frequency basis throughout the year focussing on topical discussions that to-date have covered issues like, Security in the Cloud, BI and Analytics, Big Data and the Cloud, CRM, Data Protection and Legal Implications of Cloud Deployment. Annually we host our Cloud Computing Showcase to provide the opportunity for both the Irish indigenous and Multinational organisations to discuss the future trends and opportunities in this space. To-date all the events are free to attend thanks to the continuous sponsorship by many ICT and business organisations.

The CloudArena Technical Users Group (CATUG) meet at the National College of Ireland in the IFSC to discuss specific technical topics and everybody is welcome to attend regardless of what

platform his expertise is in, be it Azure, Force, Tivoli, Open Source, Ubuntu, Facebook and many more.

Financial Services Innovation Centre

The Centre provides the financial services sector with a unique resource combining autonomous research and development coupled with concept generation.

A board consisting of key leaders in the Financial Services Sector, acknowledged experts and senior representatives of relevant Government funding agencies oversees the running of the Centre. Organisations participating in the innovation alliance contribute to the centre's overhead costs. In return, participating organisations receive first option on new and innovative solutions and have a role in shaping the agenda of the centre. Partners are also given an option to licence sector-specific solutions developed in the centre. The partnership will also allow participating organisations to outsource organisation-specific development problems under non-disclosure agreements.

Partners are given first option to exploit project IP from research it has sponsored or collaborated in. In addition, partner organisations will be given an option to negotiate commercialisation for all IP owned solely by the University.

Activities include:

- *Executive Briefings and Workshops* - on the key elements of industry specific innovation and expertly led discussions of the implications for business.
- *Strategic Scenario Analysis* - to fully assess the strategic and financial impact of the innovation through developing likely scenarios of customer, competitor and financial impacts.
- *Innovation Workshops and Round Table Discussions* – to allow partner companies to discuss research, innovation and development issues with staff and network within the industry.
- *Services and Consultancy to Industry* - straight consultancy projects in industry driven applied research such as market sounding exercises.
- *Providing State Sponsored Research to Industry* – the FSIC collaborates with industry through various collaborative mechanisms such as those sponsored by the State development agencies Enterprise Ireland and IDA Ireland through Innovation Partnerships and Technology Centres as well as the Innovation Voucher scheme.
- *Pilot/Beta Testing Product and Process Prototypes* - the FSIC assists with product and process prototypes that might include new hardware, software or services.

- *Industry Specific Conference Organisation* – the FSIC has organised numerous co - operation and business events. In organising and promoting industry events, the Centre oversees the concept and programme scheduling from beginning to end.
- *White Papers* - the FSIC has been called upon to produce custom Whitepapers to assist clients the improve positioning of products or services with customers and has also developed reports for the Financial Services Consultative Consumer Panel.
- *Promoting Cooperation and Business Events in Financial Services* - the FSIC is active in providing forums for thought leaders in academia and business related to innovation in finance banking, insurance funds, regulation technology, and consulting. The Centre hosts an annual series of research seminars and workshops, where staff present research findings and invited key note speakers address emerging topics in this sphere.
- *FP7 Projects* – The FSIC represents UCC's participation in the major EU Framework Programme (FP7) through *FuturICT*: *"The FuturICT Knowledge Accelerator: Creating Socially Interactive Information Technologies for a Sustainable Future"* and also PACITA*: 'Parliaments and Civil Society in Technology Assessment'* projects.
- *High Level Stakeholder Engagement and Industry Alliances* with the Irish Software Association (ISA), the Irish Software Innovation Network (ISIN), Financial Services Ireland (FSI), Industry Research and Development Group (IRDG), Association of Compliance Officers (ACOI).

Irish Data and Cloud Cluster

Mission: Representation, Support and Increased Global Competitiveness for Data and Cloud Companies in Europe

Services:

- Member Representation and National Policy
- International Branding and Marketing
- Winning International Business
- Establishing Technology Research Centres
- Foreign Direct Investment & Establishment Support
- One-Stop Shop in Ireland
- Small to Medium Enterprises Scaling and Expansion Support
    - A one stop shop consultation service, advising them on set up and expansion and helping them navigate the process of applying for state supports
    - A solution for hosting their data in Ireland
    - Access to national scaling supports from Enterprise Ireland

- Access to exporting supports
- Assistance with establishing RD&I activities for the first time
- Assistance with expanding RD&I activities
- Assistance with seeking national and European collaborations for Enterprise Ireland or Horizon 2020 funding
- Government representation
- State Agency or European Agency Application Fill Out Support

- Industry Collaboration and Innovation Support
- Industry Knowledge Dissemination & Learning.

Digital Hub

The Digital Hub is an enterprise cluster for growing technology companies. The Digital Hub is the largest cluster of digital media, technology and Internet businesses in Ireland, providing a space for indigenous enterprises to scale and grow. The Digital Hub is committed to improving digital inclusion in Dublin 8. Since 2003 The Digital Hub has run and been a partner on hundreds of programmes devoted to improving digital literacy amongst young and old people, people with disabilities and people who are unemployed, upskilling and job seeking. These digital learning programmes provide skills, motivation and access. Current programmes include the Future Creators programme and the D8 Surfers Club.

The Digital Hub Development Agency is the government agency established to develop and manage The Digital Hub - an international digital enterprise.

1 Office space and facilities
2 Networking

WESTBIC Business and Innovation Centre

Cluster Organisation to support and champion the practical needs of start-ups with tailored assistance through market validation, business modelling, sourcing capital, incubation & networking.

VALIDATING PROJECTS

Proof of this potential for interested investors, as well as for the promoter themselves, is a critical element of the business planning process. We work with promoters to validate business

assumptions at an early stage, not only to reduce investment risk but to also reduce your overall time and resources.

Market validation is one of the most exciting and critical phases of business development. You get to find out what people really want, and it provides you with a practical guide on the route to market, based on realistic primary and secondary market research.

INVESTOR READY BUSINESS PLANNING

A business plan provides three key functions namely: a framework for forward planning, a mechanism to attract investors and a benchmark to evaluate performance. WESTBIC takes an individual tailored approach to business planning, whether with High Potential Start-Ups or established enterprises.

25 years of business planning experience has given WestBIC an in-depth knowledge of the engagement process, how to maximise a promoter's strengths and compensate for gaps in their business model. Our clients also find that the discipline of preparing a structured business plan assists them to learn new skill sets and how to establish clear business strategies.

SOURCING FINANCE

Funding is essential to accelerate the international growth of start-up companies. Funding is available from an ever-increasing range of sources, including government support agencies, private sector seed and venture capital funders, business angels and also through crowd funding options.

The challenge for start-ups is to have their business plan and financial model validated so as to allow you secure the right type and level of funding for your needs.

We assist start-ups with the development and proofing of their financial models and also connect you to the most appropriate sources of funding.

WestBIC seeks to match private investors with pre-screened investment opportunities in start-up, early stage and developing businesses. Through the Halo Business Angels Partnership, WestBIC seeks to match private investors with pre-screened investment opportunities in start-up, early stage and developing businesses.

INCUBATION

WestBIC support start-ups by providing access to incubation facilities and services in a number of sites throughout its region.

Serviced office space and/or hot desk/virtual office services are available in a flexible manner so that start-ups can have access to the right level of services at any given time. These services are complimented with on-site business development support provided by the WestBIC team to help start-ups to develop their ideas, link with enterprise support agencies and private sector investors.

HALO BUSINESS ANGEL NETWORK

The Halo Business Angel Network is a joint initiative between Enterprise Ireland, InterTrade Ireland and the Irish Business and Innovation Centres.

The Halo Business Angel Network matches private investors with pre-screened investment opportunities in start-up, early stage and developing businesses. The partnership can be of enormous benefit to investors, to companies, and to professional advisors such as accountants and solicitors and will be an essential part of the entrepreneurial business network.

INTERNATIONAL PARTNERING

WestBIC supported Entrepreneurs have access to a network of around 150 quality certified EU/BICs to support the development and growth of innovation entrepreneurs, start-ups and small to medium size enterprises (SMEs).

This provides practical international market validation, access to additional routes to market, technical know-how, raw materials & European partners.

2.6.7 Performance

According to the European Innovation Scoreboard, Ireland is a Strong Innovator. Over time, the performance of Ireland has been varying and from 2010 to 2017 has increased by moderate 3% relative to the EU 28 average.

- **Relative strengths** of the innovation system are: 1) human resources (tertiary education levels, new doctorate graduates); 2) Innovation friendly environment (broadband penetration); 3) innovators (SMEs innovating in-house, SMEs with marketing innovations); 4) employment and sales impacts (employment in knowledge-intensive-activities, knowledge-intensive services exports, sales of new-to-market and new-to-firm product innovations)
- **Relative weaknesses** are in: 1) Intellectual assets (design, patent and trademark applications); 2) finance and support (public R&D expenditure, venture capital); 3) Linkages (private co-funding of public R&D expenditures); 4) and Sales impacts.

2.6.8 Challenges

Main research and innovation policy challenges are:

- **Improving the take-up and performance of R&D by indigenous enterprises.** Ireland performs relatively well in terms of innovation outputs. However, BERD is dominated by MNCs. A relatively high share of SMEs has a limited capacity to innovate and to absorb innovations. A range of recent policy responses aim to increase the number of indigenous enterprises engaged in R&D activities.

- **Increasing R&D in the FDI sector.** The engagement of MNCs needs to be deepened so that they move up the value chain. Attracting new MNC investments in R&D is an important policy objective. Developing the research base and fostering closer enterprise-HES linkages may be key policy responses.
- **Increasing public sector funding of R&D** (addressed also by the European Council, CSR 2016). Reductions in the public R&D budget weighed heavily on the HES via falling numbers of R&D personnel and PhD enrolments. As a response, the government has focused on maximizing the impact of public research funding, getting the highest possible return from Horizon 2020 and eliminating duplications in research funding.
- **Business-academia collaboration and knowledge transfer.** The low degree of business–academia collaboration has been recurrently highlighted. A range of direct funding schemes targeting collaborative research are provided. Yet, Ireland would benefit from the rationalisation of the wide range of small scale grant-based schemes. There is also a need to invest in near-to market research centres/RTOs to address gaps in the provision of RDI support.

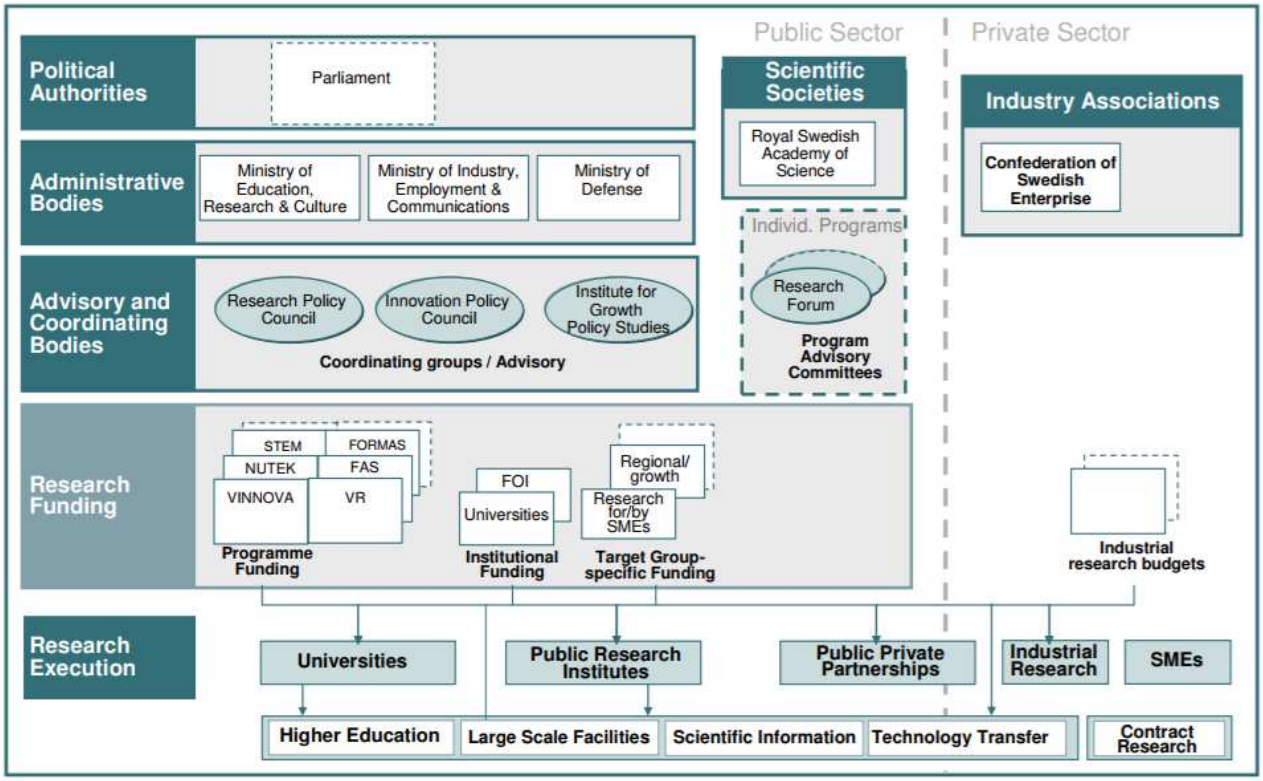
2.7 Sweden

2.7.1 Overview

According to the European Innovation Scoreboard Sweden is the most innovation economy in the EU, having the highest scores for human resources, research systems and innovation friendly environment. Furthermore, Sweden has 7th place in the UN e-government survey, indicating high level of digitalisation of public services. Sweden is also successful in facilitating innovation in the private sector, as business expenses on R&D relative to GDP are the highest in the EU.

2.7.2 Stakeholders

Figure 2.7.1. Innovation system in Sweden



Public agencies such as VINNOVA, the Swedish Energy Agency and the Swedish Research Council are key actors in the policy system:

- **VINNOVA** is the central coordinating actor for innovation policy, charged with the implementation of the National Innovation Strategy and reporting to the Ministry of Enterprise and Innovation.
- **The Swedish Research Council** is the principal actor for funding basic research, providing advice on the research system to the government and reporting to the Ministry of Education and Research.

- **The Swedish Defence Research Agency** is a government agency that reports to the Ministry of Defence.

There are several other public research funding agencies for instance, the energy agency, the Research Council (FORMAS) and the Research Council for Health, Working Life and Welfare (FORTE). FORMAS is an increasingly important player with the strong emphasis put on climate in the recent government research bill. In addition, there are several hybrid public-private non-profit research foundations, such as the Knowledge Foundation and the Foundation for Strategic Research.

This general trend of promoting collaboration continues and has been further strengthened in the latest R&I bill. There are a number of ongoing initiatives intended to increase the intensity of cross-sectoral mobility focusing primarily on getting university researchers to spend time in the public sector or in firms performing specific collaborative projects.

The research institute sector in Sweden has been traditionally small, as some of the tasks traditionally performed by applied institutes in other countries fall within the remit of universities in Sweden. The most important actor in the non-university research organisation sector is **RISE** (Research Institutes of Sweden), a network of research and technology organisations. RISE is however not a public research actor but a private consortium that is partly owned by the government.

Research in the private sector is performed primarily by a few large multinational companies. However, there are ongoing efforts focused on an incremental industrial restructuring to reduce dependence on a few large actors by supporting growth in high-tech firms and improving framework conditions for SMEs.

According to the annual report on higher education in Sweden, the Wallenberg Foundation is the most significant private non-profit funder.

Table 2.7.1. Basic services provided by the main stakeholders in Sweden

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks/ Collabo-ration
R&I stakeholders					
Wallenberg Foundation	+	+	+		+
FORMAS		+	+	+	+

RISE					+
Swedish Research council			+		+
VINNOVA			+		+
Swedish International Development and Cooperation Agency			+		+
Norrlands Fonden		+	+	+	
R&I stakeholders with a strategic focus on ICT					
Association of Swedish incubators and science parks	+				+
ALMI		+		+	+
InlandsInnovation		+		+	+
Fourirertransform		+	+	+	
Industrifonden			+	+	

2.7.3 Strategies

Table 2.7.2. Relevant research, innovation and ICT policies in Ireland

National innovation strategy, Sweden 2020 (2012)	The strategy is a roadmap that aims to improve human capital, higher education, framework conditions and infrastructure for innovation. An important aspect is the special focus of the strategy on innovation in public services, and using public procurement as means of innovation.
Digital agenda for Sweden	Aim of the strategy is to make Sweden best in the world exploiting the opportunities of digitalisation. The agenda focuses on the benefit of ICT within public administration, healthcare, social services, democracy, teaching and entrepreneurship. Among other measures, the government is going to relax the rules of tax support and the reform of secondary education system.
Strategy for public procurement	This strategy points to the innovative and creative potential of functional procurement when compared to specific requirements for goods or services. It does not set however any concrete target values for innovation procurement. Particular emphasis is put on ensuring that SMEs can effectively bid and secure public procurement contracts.
Smart Industrialisation strategy	This new strategy prioritises four focus areas (Industry 4.0, Sustainable production, Industrial skills boost and the creation of attractive innovation environments ("Test beds").
Strategic programs intended to address societal challenges	The five strategic programs are collaborative and include the public sector, university and business actors. The programs are intended to address societal challenges and increase the country's competitiveness. They cover clean transportation, smart cities, circular and bio-based economy, life science, and connected industry & new materials,

2.7.4 Policies

The national research and innovation system is governed through the Research Bill, the Energy research Bill (both released every four years), and the 2012 National Innovation Strategy intended to provide guidelines for innovation policy up to 2020.[3]

Table 2.7.3. Relevant research, innovation and ICT policies in Sweden

Policies	
New Research Bill (11/2016)	The new Bill entitled 'Collaborating for knowledge, for society's challenges and strengthened competitiveness' to be decided by the Parliament presents the Government's view on the direction of research policy with a ten-year perspective, focusing in particular on measures for the period 2017–2020. Cornerstones of the bill include increased basic appropriations to higher education institutions, initiatives in research linked to global societal challenges and increased resources to strengthen Sweden's innovative capacity. There are indications that research on climate, health and life sciences, as well as digitalisation, will be prioritised in the future.
Two new funds for demonstration facilities and companies in early stages (01/2016)	The government announced the creation of two new funds for demonstration facilities and companies in early stages. A couple of additional initiatives have also been discussed such as the establishment of Saminvest AB. The amount of funding remains unclear, although a first proposal mentions circa €160m for demonstration facilities and about €40m for the seed fund. In addition, the European Investment Fund (EIF), Almi Företagspartner (Almi) and Svensk Exportkredit (SEK) have signed guarantee agreements to increase lending to innovative Swedish SMEs.
Formation of Innovation council	In 2015 an innovation council chaired by the prime minister was formed. The prime of the council is advising the government on developing of digital transformation, environment and life sciences.
5 Strategic innovation partnership programs	The five strategic programs are collaborative and include the public sector, university and business actors. The programs are intended to address societal challenges and increase the country's competitiveness. They cover clean transportation, smart cities, circular and bio-based economy, life science, and connected industry & new materials, including cloud computing, robotics and 3D printing.

[3] https://rio.jrc.ec.europa.eu/en/country-analysis/Sweden/country-report

2.7.4.1 Public procurement on innovation (PPI) and pre-commercial procurement (PCP)

Public procurement is governed by the Swedish Public Procurement Act (2007) which is largely based on the EU Directives 2004/18/EC and 2004/18/CE. The act was changed to adopt the new directives 2014/24/EU, 2014/25/EU and 2014/23/EU.

The Swedish public sector has longstanding experience in technology procurement of innovative solutions. The public sector's role as a driver for innovation is being promoted through the "Swedish Innovation Strategy" (2012), even though Sweden does not have any exact national targets.

Public procurement was further changed when the government announced a new strategy for public procurement in 2016. The document points to the innovative and creative potential of demanding function rather than specific requirements for goods or services but does not set any concrete target values. New regulatory framework helps SMEs to effectively bid and get public procurement contracts.

The body responsible for monitoring the progress and providing guidelines for public agencies is National Agency for Public Procurement. The National Agency for Public Procurement is the public agency charged with developing and disseminating knowledge about methods and data for purchasing analysis and contract management. This agency provides information on procurement and sustainable procurement to the general public and to other public agencies. The Agency also works closely together with VINNOVA via a joint agreement and an action plan. Under the "Innovation Capacity in the Public Sector" umbrella, VINNOVA launched its "Innovation Procurement" program in 2011. VINNOVA acts as catalyst supporting public procurers during an innovation procurement process (e.g. technology procurement or pre-commercial procurement). Joint efforts of both agencies create a large market for ICT innovation. Furthermore, the new legal framework is beneficial to the ICT innovation within the SME sector, as it helps start-ups to secure public procurement contracts.

2.7.5 Funding

2.7.5.1 Public[4]

The most significant developments that will affect the allocation of public R&D expenditure are the new bills on Research and Energy Research. Both are expected to entry into force in 2017.

[4] https://rio.jrc.ec.europa.eu/en/country-analysis/Sweden/country-report

They outline the focus of funding and research priorities for the years 2017 – 2020: climate, health and life sciences, as well as digitalisation.

The current Research Bill (issued in 2012) proposed to increase the public budget for research by approximately €127m every year over the period 2013-2016. In 2015, GERD was the highest in the EU summing up to 3.26% of GDP, compared to an average of 2.04% for EU-28. However, Swedish expenditure on R&D has been in decline when expressed as share of GDP since the early 2000s (from 3.61% of GDP in 2003). GERD performed by the higher education sector has traditionally been among the highest within the EU, amounting to 0.88% of GDP in 2015 (EU-28: 0.47%).

In 2014, about 45% of the total funding to Swedish universities was allocated as institutional funding, the remaining 55% were allocated as third-party funding. In 2012 the ratio was still 47% and 53% respectively, reflecting the growing importance of third party funding (Swedish Higher Education Authority Annual Report 2015).

2.7.5.2 Private[5]

Swedish BERD intensity is among the highest in Europe and stood at 2.27% in 2015, corresponding to slightly above 2/3 of total R&D investments in Sweden. One can observe, however, that BERD intensity as share of GDP was a bit higher during the second half of the past decade (still 2.45% in 2009) and has been fluctuating around 2.2% of GDP since 2010. However, BERD has not declined in nominal values and this downward trend in BERD intensity is explained by the high growth of Swedish GDP, as well as the relocation of some of the R&D units of large Swedish and foreign-owned enterprises.

The manufacturing of computers, electronic and optical products, pharmaceutical industry, manufacturing of other machinery and equipment, and vehicle manufacturing together account for an important share of Swedish business R&D expenditures. In terms of individual companies, Ericsson and Volvo are the top performers in R&D investments, both ranking among the EU's top 20 in the R&D Industrial Scoreboard for 2015. The Swedish knowledge-intensive service-sector is relatively large (both as share of employment and value added) but has not grown between 2010 and 2015 (between 2014 and 2015, it even showed a slight decline).

Over the past two decades there have been substantial efforts focused on incremental industrial restructuring to reduce dependence on a few large actors by supporting growth in high-tech firms and improving framework conditions for SMEs. In 2014, the previous government introduced a limited tax incentive scheme for small businesses hiring R&D staff as part of an effort to increase BERD. Swedish governments still prefer to avoid the introduction of a broader tax credit scheme.

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5 https://rio.jrc.ec.europa.eu/en/country-analysis/Sweden/country-report

Policy action has also been taken with regard to improved financing conditions for start-ups and SMEs in 2016. It remains to be seen to what extent this improvement in the supply of public venture capital will leverage private investments and business sector spending on R&D.

2.7.6 Clustering

Sweden hosts 10 cluster organisations acting in digital industries.

Future Positon X

Mission/Objectives:

Future Position X is in charge of the ten-year long innovation and research program Geo Life Region. The work is based on the locations impact of health and well-being as well as the human impact on the location and environment. This new area of knowledge is called Geo Health. Future Positon X wants to make the Gävle Region an international centre for research and advancements within this new area of expertise.

Future Positon X creates environments where experts within geographical information technology and researchers within working environment, medicine, genetics, behavioural science, sports science and public health can meet. By connecting various skill sets Future Positon X sees growth in new knowledge, new solutions and new business areas. Cross fertilisation leads to new innovations, products and services, new and growing businesses and more job opportunities.

We are constantly looking for volunteers or so-called “Health Pilots” who voluntarily participate in future research projects. Anyone can apply and be offered to collect health data in our research projects.
The program is based on three pillars - innovation, internationalisation and research. Geo Life Region is primarily funded by Vinnova.

Sectors:

- Communications Equipment and Services, Information Technology and Analytical Instruments,
- Transportation and Logistics
- Digital Industries, Medical Devices, Mobility Technologies
- Sensors & Wireless products, Internet of Things, Citizens participation
- e-Health (e.g. healthy ageing), Intelligent inter-modal & sustainable urban areas (e.g. smart cities),
- Social innovation with regard to health, well-being and elder care.

Services provided:

- Internationalisation support (= Access to third countries markets)
- Access to public support (regional/national programmes, innovation vouchers, etc.)

- Direct advisory services
- Facilitation of collaboration between members
- Promotion of activities (marketing/ visibility)

Compare - Competence area ICT

Mission/Objectives:

Compare is an ICT- cluster in the region of Värmland in Sweden. It has 100 ICT companies in collaboration, to stimulate growth in Värmland. This is to create an environment of companies working together, making business and increase job opportunities.

Its main focus is to find a way to match the ICT companies with small- and middle-sized enterprises that wants to develop their business through digital transformation. This is also a challenge in the public sector in which Compare is working closely with the municipality of Karlstad and the county of Värmland to find ways to have the ICT companies support the public sector when implementing digital technology in their organisations.

We also work for the need of support of competence for the companies in the cluster. We do this by collaboration with the university in Karlstad, other schools with IT education and networks around the region. We are focusing on a way to integrate the refugees, with a university degree or great experience in IT, into the Swedish ICT companies to increase the diversity and create new business opportunities through new networks and new knowledge.

We are also working on ways to interest women to the ICT enterprises. Women are still not represented in the same amount as men and we are looking at ways to help the companies to find ways to change this.

Compare is working with young people to support them when developing their business ideas, with a digital touch, to start their own business in the municipalities in the region of Värmland.

The foundation Compare consists of 11 employees and it has its mail office in Karlstad but operates in most municipalities of Värmland. It is looking into an international collaboration to develop its organisation and the companies that are members of Compare.

1. Information Technology and Analytical Instruments
2. Creative Industries, Digital Industries, Mobility Technologies
3. Digital Systems, Digital Representation, Information Technology/Informatics, Knowledge Management, Process Management
4. Basic broadband: coverage in rural areas, E-Commerce & SMEs online, e-Health (e.g. healthy ageing)

   Services:

5. Access to public support (regional/national programmes, innovation vouchers, etc.)

6. Access to technology services
7. Facilitation of cross-sectorial cooperation
8. Innovation Management / Support of innovation processes (internal, external).

A digital matching service to help companies to be digitised - the prototype is now produced (not active)

Compare wants to develop a prototype of a web platform that inspires the small and medium enterprises to better solutions through digitisation.

Dataföreningen i Norr

http://www.dfinorr.se/

Mission: Skelleftea shall be a leading actor regarding digitisation of society. Digitisation will be the region's main growth engine based on close cooperation with business, research, government and citizens.

Strive for increased recruitment to the industry by increasing young people's interest in ICT and helping universities to develop existing and new programs.

Work with business development, internationalisation and innovation - cross-fertilisation between members and other lines of business by taking part in development projects and collaboration with municipality, region and other clusters.

Create publicity for the ICT industry by promoting the industry locally and putting Skellefteå and its ICT industry on the European map.

Develop existing resources within the industry by organising joint training, inspiration lectures, seminars and conferences.

Sectors:

1. Information Technology and Analytical Instruments
2. Creative Industries, Digital Industries, Mobility Technologies
3. e-Government, Visualisation, Virtual Reality, Network Technology, Network Security
4. e-Government (e.g. e-Procurement, e-Participation), Intelligent inter-modal & sustainable urban areas (e.g. smart cities), Computer programming, consultancy & related activities

Support activities:

1. Access to public support (regional/national programmes, innovation vouchers, etc.)
2. Facilitation of collaboration between members
3. Trend-scouting (Ideas for innovative projects)
4. Periodic Information dissemination
5. Provision and facilitation of access to training for members

Fiber Optic Valley

http://fiberopticvalley.com/

Mission:

Fiber Optic Valley in Hudiksvall has over ten years worked to bring Sweden's development forward. In the areas of broadband and fibre technology, it has supported and driven the successful projects by bringing together business needs with researchers' excellence. In this way, it has created innovations and helps start-ups in their entrepreneurial process. It has expertise in innovative leadership and lucrative gender-aware leadership strategies which have given companies in the network advantage and higher returns. **Partnered close international research centre STC at Mid Sweden University and research institute Acreo Swedish ICT.**

Sectors:

6. Communications Equipment and Services, Information Technology and Analytical Instruments
7. Creative Industries, Digital Industries, Mobility Technologies
8. Analysis Risk Management, Environment Management Systems, Broadband Technologies
9. Development of regional cultural & creative industries, Intelligent inter-modal & sustainable urban areas (e.g. smart cities), Scientific research & development

Services:

6. Access to the European Internal market
7. Internationalisation support (= Access to third countries markets)
8. Access to private funding (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.)
9. Access to technology services
10. Facilitation of collaboration between members.

Hudiksvalls Hydraulikkluster

http://www.hhk.world/

Mission:

HHK strengthens the competitiveness of the member companies and attracts resources to the region by offering an inclusive, innovative environment to create cooperation. It is focused on developing products and solutions in the areas of hydraulics, mechanics, electronics and software development, amongst other areas. The member companies all have laboratories specialised to meet the needs of their respective applications. Due to HHK's collaborative nature, the laboratories can be seen as a cluster of different areas of expertise that members can consult.

Hiab leads the way with the most extensive lab resources thanks to its large R&D-facilities concentrated in Hudiksvall.

Sectors:

- Automotive, Production Technology and Heavy Machinery
- Digital Industries
- Internet of Things, Construction engineering (design, simulation), 3D printing
- Civil engineering, Automated driverless vehicles, Scientific research & development

Services:

- Facilitation of collaboration between members
- Facilitation of cross-sectorial cooperation
- Promotion of activities (marketing/ visibility)
- Support of knowledge transfer
- Location promotion / attraction of Foreign Direct Investment
- Commercialisation of innovations
- Internationalisation and market development
- Marketing of existing products
- Cooperation between industry and academia
- R&D-driven technology and product development
- Skills development and skills sourcing
- Driving regional development

HHK creates joint efforts for research funding and it has developed **Open innovation tools for collaboration between members, to facilitate knowledge sharing and knowledge transfer**. Due to the industrial diversity in HHK we also facilitate cross sectoral cooperation. The recent membership of Linköping University means that HHK now has created ties to scientist within the aerospace industry. HHK promotes Hudiksvall by displaying the total number of member companies available to work for in the region. HHK also markets the cluster members as a whole on large international trade shows, such as Bauma and IAA.

Media Evolution Southern Sweden

Media Evolution is a cluster and a member organisation that enables organisations and individuals to share, learn, think in new ways and adapt together in the age of digital transformation. To achieve that, it runs projects and offers services within Community, Competence and Collaboration.

Sectors:

1. Communications Equipment and Services, Marketing, Video Production and Distribution

2. Creative Industries, Digital Industries, Mobility Technologies
3. Computer Games, Computer Technology/Graphics, Meta Computing, Internet of Things
4. Creative, arts & entertainment activities, Development of regional cultural & creative industries,
5. New media & easier access to cultural contents (e.g. heritage)

Services:

- Internationalisation support (= Access to third countries markets)
- Facilitation of collaboration between members
- Innovation Management / Support of innovation processes (internal, external).

One of interesting projects is **"Lean Landing -> The Fast Track to New Markets"**.

Lean Landing is designed to get small businesses quickly into new European markets. It allows to test whether the products or services can be sold abroad and to look for new European partnerships.

The Lean Landing network consists of 26 partners, accelerators and incubators from across the North Sea Region, i.e. Denmark, Sweden, Norway, Germany, Holland and UK. Together, they have boots on the ground in all six countries, enabling founders to get quickly in touch with new customers and partners. Critically, the Lean Landing network gives hands-on **knowledge and local insight into anything from business laws to cultural etiquette in markets far from home**. Joining the Lean Landing programme also allows to use the **office facilities at incubators** and accelerators across the North Sea Region.

Media Evolution arrange partner and customer meetings for business in their country of choice, to get fast feedback from potential customers or partners and perform a real-time test of the potential of your products and services in a new European market. That way, you avoid traditional market analysis and get quick, solid feedback to act on via practical encounters.

It's free to join, and 50% of travel costs are co-financed by Interreg North Sea Region.

Mobile Heights

Mobile Heights is an industry driven networking community founded by Ericsson, Sony Mobile, Telia Company and the Regional council of Skåne and the universities of Lund, Malmö and Blekinge. Today a large number of companies and organisations from multiple industries cooperate to boost the business within the area of connected technologies. By investing in research, open innovation and entrepreneurship, the common vision is to maintain and strengthen the region as an international hotspot for connected technologies.

Sectors:

1. Communications Equipment and Services, Information Technology and Analytical Instruments
2. Digital Industries
3. Embedded Systems and Real Time Systems, Computer Software, Mobile Communications
4. e-Health (e.g. healthy ageing), Intelligent inter-modal & sustainable urban areas (e.g. smart cities)

Services:

- Access to public support (regional/national programmes, innovation vouchers, etc.)
- Access to private funding (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.)
- Facilitation of collaboration between members
- Promotion of activities (marketing/ visibility)
- Possibility to engage in relevant research programmes
- Networking in member-exclusive hackathons, conferences, seminars and workshops
- Access to innovation and expertise through Power Hour (industry executives meet start-ups)
  and bespoke VC pitch events
- Participation in multi-disciplinary innovation projects on the European arena
- Matchmaking and access to information channels within the Mobile Heights community

Mobile Heights members have exclusive access to high quality seminars and tailor-made business focused workshops.

Mobile Heights is providing its members with a database about current IoT research projects at our member universities Lund University and Malmö University. The database selection is based on Mobile Heights areas of interest and does not represent an all-embracing database.

ProcessIT Innovations

Mission:

Bring together actors focused on the 4th industrial revolution in challenge-oriented research and innovation collaborations.

Process IT Innovations is a collaborative centre for process and engineering industries, universities and IT companies, mainly in Norrbotten and Västerbotten, to develop new technological solutions based on the primary industry needs.
ProcessIT Innovations is a business accelerator for industrial IT and an innovation hub for the regional innovation and growth system, established as a research centre at Luleå University of Technology and Umeå University.

In addition to the universities, a number of other partners support ProcessIT through a collaboration agreement. These organisations are County Administrative Boards in Norrbotten and Västerbotten, the municipalities of Umeå, Skellefteå, Piteå and Luleå and the companies of ABB, Boliden, Komatsu Forest, LKAB, SCA and Skellefteå Kraft.

ProcessIT Innovations' strategic concept is to create projects where researchers and IT companies, along with process industries and their supplier companies, can tackle the IT and automation challenges that this process industry is facing.

The initiative for Process IT Innovations came from the business community in the region. Today the process and engineering industries, IT companies and universities of Umeå and Luleå are involved. In addition, there are four coastal municipalities and the counties of Västerbotten and Norrbotten. A strong cooperation is also developed with businesses in northern Finland and Norway.

The strength of Process IT Innovations strategic concept lies in the commitment and the power held by these actors in the innovation system.

The Centre operates on the basis of regularly updated needs analysis to identify promising new technologies with great potential for the parties involved, including the market. In this way participants achieve better results faster than if they undertake corresponding development projects on their own.

http://www.processitinnovations.se/Sve/Nyheter/Filer/ProcessitInnovations2016_en.pdf

Sectors:

- Information Technology and Analytical Instruments, Metal Mining, Paper and Packaging
- Digital Industries, Environmental Industries, Mobility Technologies
- Automation, Robotics Control Systems, Digital Systems, Digital Representation, Cloud Technologies
- ICT trust, cyber security & network security, Computer programming, consultancy & related activities, Telecommunications

Services:

- Access to public support (regional/national programmes, innovation vouchers, etc.)
- Facilitation of collaboration between members
- Innovation Management / Support of innovation processes (internal, external)

2.7.7 Performance

According to the European Innovation Scoreboard[6], Sweden is an Innovation Leader. Over time, performance has increased by 2.3% relative to that of the EU in 2010.

- **Relative strengths** of the innovation system are in: 1) Human resources (new doctorate graduates, population aged 25-34 with tertiary education, lifelong learning); 2) Innovation-friendly environment (broadband penetration, opportunity-driven entrepreneurship); 3) and Attractive research systems (international scientific co-publications, top 10% most cited publications, foreign doctorate students).
- **Relative weaknesses** are in: 1) Sales impacts (medium and high-tech product exports, knowledge-intensive services exports, sales of new-to-market and new-to-firm product innovations); 2) Innovators (SMEs with product or process innovations, SMEs with marketing or organisational innovations, SMEs innovating in-house); 3) and Linkages (innovative SMEs collaborating with others, public-private co-publications, private co-funding of public R&D expenditures)

2.7.8 Challenges[7]

Main research and innovation policy challenges are:

- **Improving the links between research and innovation.** Since the late 1990s Swedish research and innovation policy has been focused on increasing the links between research and innovation. The dominant policy approach has focused on supply side measures such as funding instruments, which promote cross-sectoral collaboration. One of the more persistent subthemes in the Swedish debate on innovation policy has been the notion that Sweden has an innovation output that is somewhat lower than expected when compared with the volume of R&D investment.
- **Reducing the dependence of BERD on multinational companies**. About 80% of Swedish business R&D is performed by a few large multinational companies. Most of it is concentrated in firms with more than1000 employees. The thrust of policy efforts for promoting increased business investment in R&D by SMEs has been linked to support of high tech firms with public venture capital schemes and university-firm collaborative schemes aimed at upgrading SMEs competence and supporting knowledge-intensive innovation.

6 http://ec.europa.eu/DocsRoom/documents/24163

7 https://rio.jrc.ec.europa.eu/en/country-analysis/Sweden/country-report

- **Sustaining the high quality of the public research base**. The 2008 and 2012 Research Bills brought significant increases in research funding to allocated to universities. However, the limited impact of these efforts suggests that institutional governance at university level is an important consideration for future policy.

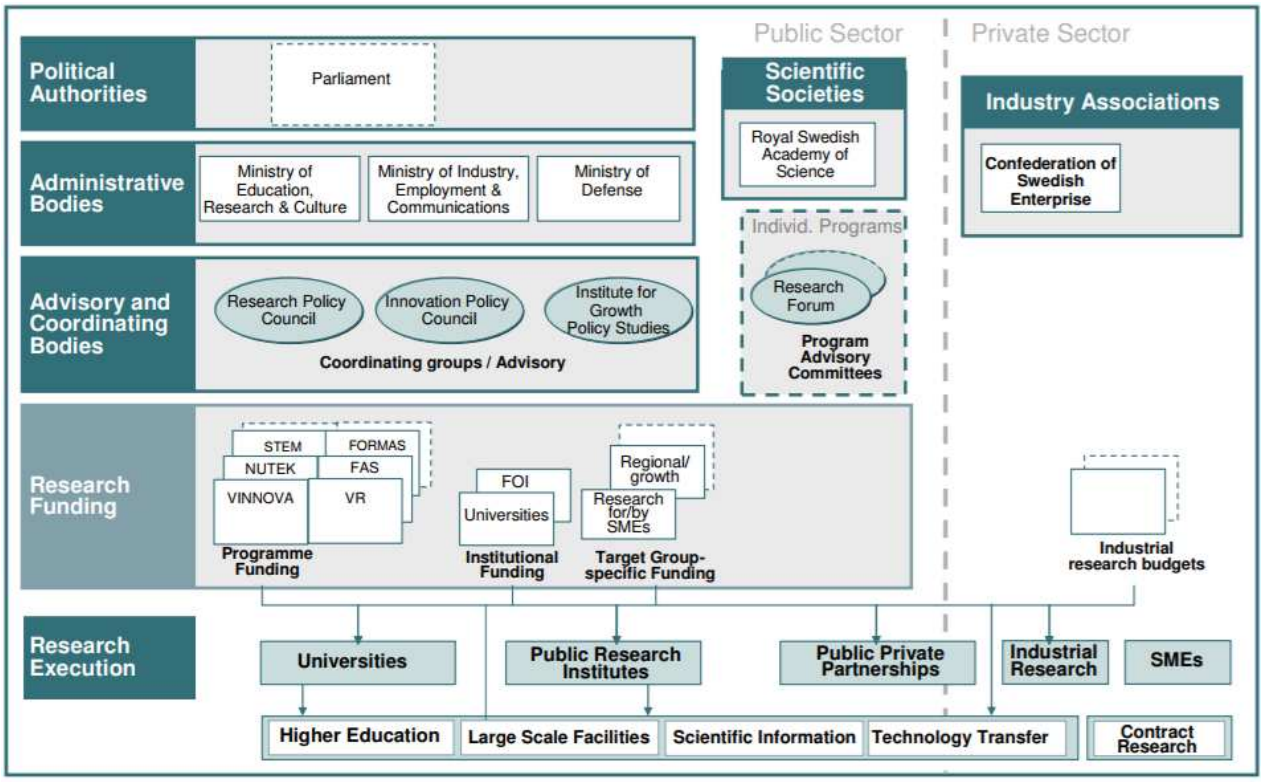
2.8 United Kingdom

2.8.1 Overview

The UK is recognised as one of the world's most innovative countries. EU innovation scoreboard places the UK as an innovation leader, while the UN's E-government index, at number 1 in terms of developed digital public services. Innovation system of the UK has distinct features. First, both central government and regions are developing innovation policies. Each of the countries of the UK have their own innovation strategy which while being in line with the national innovation strategy have different implementation mechanisms and priorities. Thus, innovation policy is bottom-up and focused on excellence. The UK provides most of the funds via competitive funding and has the lowest public spending on R&D among the researched countries.

2.8.2 Stakeholders

Figure 2.8.1. UK innovation system[8]



2.8.2.1 Government bodies and agencies

The UK research system is largely centralised, although regional autonomy for innovation policy has been increased in recent years. The Devolved Administrations of Scotland, Wales and

8 http://ec.europa.eu/invest-in-research/pdf/download_en/psi_countryprofile_uk.pdf

Northern Ireland have responsibility for aspects of health and education funding. Each of the regions has accepted its own innovation policy, and its own unique set of measures that are set in line with the larger national strategy of the UK.

The Department for Business, Innovation and Skills (BIS) plays the lead executive role in research issues and is the home of the Government Office for Science (GO-Science), headed by the Government's Chief Scientific Adviser (CSA). GO-Science plays the lead role in improving the quality of science in the UK. The CSA reports directly to the Prime Minister and the Cabinet. The CSA also chairs the principal high-level national policy making and coordination body, the Council for Science and Technology (CST), which in turn draws on policy advice from a range of bodies both within and outside the Government structure, including dedicated committees in both the upper and lower houses of Parliament. High-level UK science policy making also places particular emphasis on the use of systemic reviews and evaluations (Cunningham, 2015).

Innovate UK is one of the main tools of governmental support for private sector innovation. Innovate UK provides funds advisory and networks, to the companies selected on competitive basis. As a mean of financing innovation UK mainly provides grants and loans, however recently the government announced plans to gradually decrease the share of grants in favour of loans.

At the local level, some innovation policy and related activities are coordinated by Local Economic Partnerships. These are consortia of regional actors such as key businesses and councils and have the remit to determine local economic priorities and lead economic growth and job creation within the local area.

2.8.2.2 Universities

Higher education spending on research and development (HERD), accounted for 0.46% of the GDP, and around a quarter of all gross expenditure on research and development (GERD). That is very much in line with the EU average of 0.48%. As of August 2014, there were 160 Higher Education Institutions (HEIs) in the UK of which 115 were universities (this includes federal universities such as those of London and Wales, which are counted as a single entity). These employ over 128,000 full time academic staff (2013/14). They vary considerably in size from around 300 students to the University of Manchester with over 38,000 students.

2.8.2.3 Companies

UK BERD has been rather stable, fluctuating only slightly in a 0.1% of GDP "band" in the last decade, between its 2005 level of 1% and its 2014 level of 1.11% of GDP. Manufacturing and services were its major components, together accounting for more than 95% of the BERD expenditure in the period under scrutiny and with the latter out-pacing systematically the former

with around 0.2% of GDP. The highest BERD spenders in the manufacturing sector are high-technology (computer, electronic and optical products), or medium-high tech (automotive industry, and the machinery and equipment sector) sectors. In the business services sector, professional, scientific and technical activities, ICT, as well as wholesale & retail are the top BERD receivers in this order.

2.8.2.4 Services of the stakeholders

The basic services provided by the main stakeholders of the R&I system are summarised below.

Table 2.8.1. Basic services provided by the main stakeholders

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks / Collaboration
R&I stakeholders					
Innovate UK	+	+	+	+	+
Global Challenges Research fund			+		
British Business Bank				+	+
National Endowment for Science, Technology and Arts			+		
Higher Education funding council			+		+
Small Business research initiative		+	+		
Research councils			+		+
Industrial strategy challenge fund			+	+	
UK Innovation Investment fund			+	+	

Innovation and knowledge centres	+				+
R&I stakeholders with a strategic focus on ICT					
Public Sector Broadband Aggregation	+				
Alcarity foundation	+	+		+	+
Business Angel Co-Investment Fund				+	
UK Business Angels Association					+
Launchpads	+				+
Venture capital trusts				+	

For a more detailed description of each service, see Appendix 2

2.8.3 Strategies

Table 2.8.2.: Relevant research, innovation and ICT strategies

Strategies	
Industrial strategy	Industrial strategy outlines 10 pillars where government will facilitate improvement. The government specifically mentions that it does not aim directing economy, but rather aims at exploiting the competitive strengths of the UK and its industries. The 10 pillars will entail: investment in science, developing skills, upgrading infrastructure, supporting businesses, improving procurement, encouraging trade, delivering clean growth, cultivating world leading sectors,
Scotland Can Do; Innovation Wales, Northern Ireland Innovation strategy	These are regional innovation facilitation strategies aimed at boosting regional innovation performance. The strategies are comprised of the following points: t is comprised of 4 points: 1) encourage business innovation by more involvement in the scale up program and improving communication between business and research community; 2) use public sector needs to encourage innovation. Ensuring that public procurement acts as a catalyst of innovation, creating mission-oriented challenges including public sector challenge fund; 3) support

	innovation across sectors; 4) make best use of university knowledge. Help young entrepreneurs and help to converse academic knowledge into business growth.
Eight great technologies	The UK government as outlined 8 key areas to facilitate innovation which are: 1) big data 2) space 3) robotics and autonomous systems 4) synthetic biology 5) regenerative medicine 6) agro science 7) advanced materials 8) energy
The plan for growth	It is an all-encompassing national innovation strategy that sets out the following areas for improvement. Investing in scientific infrastructure via investment in laboratories, universities and individual research projects. Vast majority of this sum will be invested via competitive funding.

2.8.4 Policies

In addition to different strategies, a number of policies directed at promoting research, innovation and ICT have been developed. The most relevant ones are provided in the table below.

Table 2.8.3. Relevant research, innovation and ICT strategies in the UK

Policies	
Innovation vouchers (2012)	Innovation Vouchers program was formally launched to enable start-ups and SMEs to access advice and expertise from universities, research organisations or other private-sector knowledge providers. That is a small line of credit (up to 5000 GBP) to explore a business opportunity or problem with a registered knowledge provider.
Creation of British Business bank	Created in 2013 British Business bank is a national development bank aimed to increase the supply and diversity available for UK SMEs.
Catapult program	Catapult program established independent physical innovation centres which perform are designed to: they create networks by connecting businesses with the UK's research and academic communities; help to commercialise the investments. Each innovation centre specialises in a different area of technology, but all offer a space with the facilities and expertise to enable businesses and researchers to collaboratively solve key problems and develop new products and services on a commercial scale.

Creation of national productivity investment fund	The fund was created in 2017, aimed at upgrading infrastructure of the UK by 23 billion GBP of investments. The investments will include, 2,6 million allocated to transport projects, 740 million to broadband fibre connections,
Introduction of balanced scorecards to public procurement	To support small businesses and encourage innovation, all procurement over 10 million GBP will now undergo a process of. The scorecard will ensure the impact of procurement on the growth of small business and UK supply chains, skills and apprenticeships is taken into account when considering the value for money of different bids.
Industrial strategy challenge fund	The fund is aimed at employing the government industrial strategy and will provide 4.7 billion GBP to businesses and researchers through competitive project-based funding. The fund has selected the following areas will receive support: healthcare, robotics and AI, clean energy, manufacturing and space technology.
Small or Medium Sized Enterprise (SME) Scheme:	R&D relief offers a deduction from corporation tax liability for R&D expenditure. The deduction rate has increased in the past five years. Currently, it offers SMEs a 125% deduction (e.g. for every £ 100 spent on R&D, a firm can deduct another £125 from its pre-tax corporate income). Furthermore, in case a firm did not make any profits, it can receive a tax refund of 24.75% from the amount of expenditure on R&D. The scheme includes an indefinite carry forward facility and the maximum amount of total amount of government support that one R&D project can receive is £7.5m.
Large Company Scheme:	Currently two schemes coexist for large companies investing in R&D: the optional Above the line (ATL) scheme and R&D relief for large companies. The design of the latter one that will cease in April 2016, is essentially the same as for the SMEs, offering a lower rate of 30%. The ATL, that will become mandatory for all large companies after April 2016, offers a 10 percent taxable credit on the amount of firm‘s R&D activity set against corporation tax liabilities. For firms without corporation tax liabilities, the credit is fully paid out net of tax with a cap equal to the total sum of Pay-as-you-earn (PAYE)/National Insurance Contributions (NIC) liabilities. No minimum amount of investment in R&D is required and firms can carry forward losses indefinitely.34

The policy initiatives currently in place are not perfect but major shifts in the nature and content of the current set of policies would require radical change at the level of policy culture. Additionally, the number of intervening variables between R&I policies and the contexts that they seek to affect, make it difficult to state with any certainty that a given policy fosters innovation or strengthens the knowledge base and fundamental research.

Public procurement on innovation (PPI) and pre-commercial procurement (PCP)

PPI is encouraged in the UK and the Government has produced guidelines under the concept of Forward Commitment Procurement (FCP), a tool introduced in 2006. That is an early market engagement instrument aimed at overcoming demand side barriers to commercialisation of innovative goods and services. It collects expertise and best practice from the private sector innovation communities and procurement teams.

Small Business Research Initiative is the main support scheme that focuses on demand side issues. It was established in 2001, as a part of Innovate UK, and involves several government departments in supporting innovation procurement solutions from SMEs. Its main function is to increase access of SMEs to public procurement, and to support the procurement of R&D with an option in the R&D contract to acquire created innovation.

Furthermore, in spring 2012 Procurement Compacts, a procurement scheme created by the Department for Business, Innovation and Skills (BIS) started its functioning. According to the scheme, large private and public entities jointly purchase products that would help to decrease their carbon dioxide emissions. Bundled demand sends a clear signal to the industry, and can help to facilitate innovation in needed fields, for example in ICT.

As an example, the initiative supported “nquiringminds” a local firm that helps the cities to collect and store and analyse data to run more efficiently. Currently the system is used by the councils of Hampshire, Liverpool, Cambridge and Southampton. The procurement occurred as a result of a competition for smart cities solutions. The business owner indicates that without the innovate UK, he would not have been able to enter the smart city market and the procurement has taken out significant amount of risk. The procurement has helped to validate the product, as the city councils otherwise might not have partnered with a small size company.

2.8.5 Funding

2.8.5.1 Public

Public funding of R&D has various distinct features in UK. First, majority of funding is done via competitive funding, which is designed to increase the efficiency of funding. Another feature is the growing importance of indirect funding, which is increasingly used as an effective and cost-efficient measure of supporting R&D. Government funding of R&D is around 29% of all funding, which is below EU average of 32%.

The Department for Business, Innovation and Skills (BIS) is the major provider of research funds for the public sector. It is also responsible for the allocation of the UK Science Budget via the Research Councils. The Research Councils, which in turn support R&D and research training both in HEIs and their own institutions, provide research grants for both programs, projects and research centres. Substantial funds are also allocated in the form of block grants to UK

universities from the Higher Education Funding Councils and their equivalents in the devolved administrations. These block grants are made on the basis a peer review process which assesses the research outputs and research impacts of university 'research-active' staff.

Not surprisingly, the public sector is the main recipient of government funded GERD. Funding received by the public sector, although it followed similar trend, has not increased proportionally. This is due to the fact that the funding given by the government to the business sector is gradually increasing (with an exception in 2012). When fixed to 2005 constant prices, the decline of total government funding (and its component allocated to the public sector) from 2010 to 2012 are clearly emphasised.

Funding for private sector takes the forms of competitive funding, tax credits and public procurement. Indirect funding is the largest source of private R&D. Direct funding is done via Innovate UK by providing grants and loans.

2.8.5.2 Private

The private sector is the main funder of the UK BERD. Given that both the external (abroad) and the government sector was a rather stable funder (0.09% of GDP - government, 0.24% of GDP – external sector) fluctuations in BERD stem mainly from variations of the funding from the private sector. This has been on a very slightly ascending path from its 2005 level of 0.65% of GDP reaching 0.77% of GDP in 2014. An important share of business R&D in the UK is conducted by foreign-owned companies.

Overall, funding from abroad is an important contribution to the GERD whereof it represents a fluctuating share of between 16%-20%. The business sector is the major funder of UK GERD from abroad (around 70% of the total external R&D funding). The EC is the main external public funder and it has been monotonically increasing its share of the GERD from 2009 onwards.

Private-non-profit sector forms a major source of funds for the public-sector research base. Comprising a range of charities and foundations, the largest funders are the medical research charities, such as Arthritis Research UK, Breast Cancer Campaign, the British Heart Foundation, Cancer Research UK and the Welcome Trust In 2012, the sector provided some £1,277m (c €1,600m) of research funds, some of it to Public Sector Research Establishments and private research facilities, some to its own research facilities, but the largest share (£1,022m/c €1,278m) went to support research in the HE sector.

2.8.6 Clustering

ICT clusters in the UK are very well established and scattered all over the country. As of 2016 digital tech clusters generated more than 161 billion turnover and provided more than 1.5 million jobs. Three largest clusters in the UK by revenues are London, Reading and Bristol.

The home of 13 tech 'unicorns' (USD 1bn valued businesses), the capital is most significant tech cluster in the UK. London tech cluster provides a whopping 35.9 million GBP value added. London tech cluster provides jobs to around 330 000 people and has more than doubled in size since the beginning of the decade. Main strengths of the hub are the abundance of venture capital firms, access to graduate level talent, and access to local well-established networks.

Reading & Bracknell is the second largest tech cluster in the UK. It has a value added of 6.4 billion GBP and employs 40000 professionals Reading specialises in Enterprise software cloud computing and data management. The cluster is driven by international talent, with 29% of businesses stating they employ non-EU citizens – the highest figure in the UK. The University of Reading and a high level of experienced industry talent have also made the cluster attractive internationally. It has a reputation for innovation in science and enterprise and recently received funding for a multi-million-pound big data analytics centre, created to address environmental problems. Incubators and collaboration hubs are helping the community.

By having revenues over 1.8 billion GBP Bristol & Bath is one of the largest and fastest growing clusters in the UK. It is recognised by Centre for Cities and McKinsey & Company as one of the two globally significant digital tech clusters in the UK. With a history in aerospace and digital software, the cluster's specialisms now include Telecommunications & networking, Gaming, Virtual reality, and Cloud computing. Local networks TechSPARK and High-Tech Bristol & Bath are thriving; 81% of local business owners stated collaboration as a benefit. Local hubs are also supporting the growth of digital tech businesses.

North East Automotive Alliance Limited

http://www.northeastautomotivealliance.com/

Mission:

To overcome Barriers to Growth by providing:

- A network to sharing best practice, benchmarking and tackle common issues.
- Access to business excellence, skills and training
- Drive innovation and adoption of new technologies & processes
- A focal point for collaborative projects and access to funding
- A voice for the sector & interface with Government bodies
- Promote sector regionally, nationally and internationally
- Align to regional and national strategic objectives (i.e. Re-shoring)

Sectors:

- Automotive
- Digital Industries, Experience Industries, Mobility Technologies
- Automotive electrical and electronics, Automotive engineering, Body and main parts

- Automated driverless vehicles, Advanced manufacturing systems, Motor vehicles & other transport equipment.

Support services provided:

- Facilitation of collaboration between members
- Promotion of activities (marketing/ visibility)
- Support of knowledge transfer
- Support of technology transfer
- Provision and facilitation of access to training for members

Details of support services:

The NEAA is led by a strong Executive and Advisory Board who represent the diverse nature of the automotive industry. NEAA member companies find benefit from leadership and co-ordination of activities, which have mutual benefit and the membership creates a collaborative network, which is a more compelling and attractive environment for investors.

The **industry-led working groups** focus on these issues and opportunities and member companies can engage in activity around working groups, which include:

- Business Excellence
  - Benchmarking across agreed KPIs
  - Sharing Best Practice (BP) through BP visits
  - Focus Groups – Natural progression from topics raised at best practice visits where companies continue to collaborate on specific areas
    - Productivity
    - Energy
  - One to one company collaboration
- Skills - Activities centred around 4 key pillars
  - Current workforce – a working group identifying and sharing current best practice in training delivery, people and organisational development
  - Graduates – a working group which looks to build stronger relationships with Universities and industry by promoting placements, internships and increasing graduate retention in the region
  - Apprentices - a working group to increase the number of companies taking on apprentices
  - Future workforce – provide a framework for members to help ensure they have a suitably trained, competent and optimised workforce in the short, medium and long-term.
- Innovation & Technology
  - Showcase latest technologies
  - Improve links with Universities
  - Provide funding advice and support
  - Coordinate collaborative project grants
  - Help commercialise new products and technologies

- Trade & Investment
  - Develop investment portfolio
  - Supporting existing NE operations to win new investment
  - Identify & promote the NE re-shoring opportunity
  - Working with regional partners to attract investment
  - Internationalisation of SMEs

Members also benefit from additional services and the promotion of the North East automotive sector's capabilities on regional, national and international levels and the network's ability to connect the supply chain to business opportunities.

Membership benefits include but are not limited to:

- A network which generates business and collaboration opportunities, hosts regular networking and knowledge transfer events and shared intelligence
- Publicising your business and the regions capabilities on a global level through:
  - NEAA website Members Directory (ability to manage and edit through a unique login)
  - Ability to post company news, events and jobs through the NEAA website
  - Access to the NEAA exclusive Members' Area for sharing knowledge, information and business opportunities, plus use of the M2M direct messaging feature
  - Coverage in the quarterly NEtwork magazine (free ½ page editorial and consideration of member news thereafter)
  - Monthly NEAA e-newsletter submissions as required
    - above is worth over £3,000
- Member to Member introductions
- Increased profitability through:
  - NEAA Business Competitiveness programme and sharing of best practice
  - **NEAA Insurance Scheme** – guaranteed saving of at least 15%, plus enhanced policy *coverage and market leading risk management advice*
  - **NEAA Energy Scheme** – reducing utility costs through purchasing at lower rates whilst helping companies to significantly reduce energy consumption.
  - **Club Nissan Employee Car Scheme** - save thousands on a brand-new Nissan vehicle
  - Other member to member offers
- Impacting on skills by addressing current gaps, attracting talent, apprenticeships and links to education - through the Skills working groups;
- Insights into latest technologies and stimulating innovation - through the Technology & Innovation working groups;
- International Trade, New Business Opportunities & Supply Chain Connections;
- Support for your regional investments with technical & funding advice;

- Marketing support;

A single unified voice for the North East automotive sector to key stakeholder groups.

2.8.7 Performance

According to the European Innovation Scoreboard, the UK is an Innovation Leader. Performance score of the UK relative to EU average has mildly increased by 2 % from 2010 to 2017.

- **Major strengths** of the innovation system are 1) International scientific publications (more than four times the EU average); 2) Broadband penetration 3) Innovative SMEs collaborating with others, 3) new doctorate graduates 4) sales of new-to-market and new-to-firm innovations 5) competed tertiary education
- **Major weaknesses** are: 1) In-house innovating SMEs; 2) Private co-funding of public research projects; 3) design application; 4) public R&D expenditure

2.8.8 Challenges

Main research and innovation policy challenges are:

Increasing public and private sector R&I investment. The UK has experienced a sustained, long-term pattern of under-investment in public and private research and development (R&D). It ranks 18th on public expenditure and 14th for private expenditure, investment in non-R&D innovation is ranked 29th (IUS, 2015). The UK invests the least in R&D compared with similar advanced economies, and while UK foreign-owned firm R&D is high, UK owned firm R&D is a concern. Although UK science is highly productive in some areas – it ranks 4th for exports in knowledge intensive services, has one of the highest shares of high-impact publications in the world and several universities at the forefront of global university league tables - it is uncertain that these R&I outputs can be sustained amidst stagnating or declining investment.

R&D specialisation and commercializing public research. The UK increasingly competes on the basis of its innovation capacity because its comparative advantage is disproportionately derived from R&D and innovation intensive sectors. At the same time, the UK shows weak investment in non-R&D innovation which may contribute to weaker productivity growth in the economy. A greater targeting of investments and prioritizing key areas could increase economic growth and societal well-being. While the UK's basic science is strong in a number of areas, commercialisation of publicly funded research into commercial products, process and services remains an important focus for improvement.

Boosting support to scale-ups, including innovative, high-growth companies. While the UK performs well overall in many composite innovation rankings, the efficiency of UK R&D inputs to outputs puts it in 10th place, despite a strong improvement since 2014 (placed 18th) (Edquist & Zabala-Iturriagagoitia, 2015). It registers weaker performance on SMEs and innovation, with average-to-low levels of new-to-market innovations, and low numbers of innovative SMEs, ranking 23rd for SMEs introducing product or process innovations (IUS 2015). Supporting the scale-up of high growth enterprises, including SMEs is gaining attention in the UK, along with improving innovation in the public sector through procurement, as part of policy efforts to address the broader problem of weak productivity. At the same time, the UK has a relatively strong share of exports of medium and high-tech products and in services and a high share of exports in knowledge intensive services.

Ensuring the future supply of human resources in S&T. Addressing the future skill needs of industry, particularly in regard to high-end and complementary skills sets is a challenge for the UK. Recent analysis indicates that demand for high-level skills will rise in coming years with an additional 2 million jobs projected by 2022 (further exacerbated by an increasingly ageing workforce), and the share of employment in almost all occupations shifting in favour of higher level qualifications.

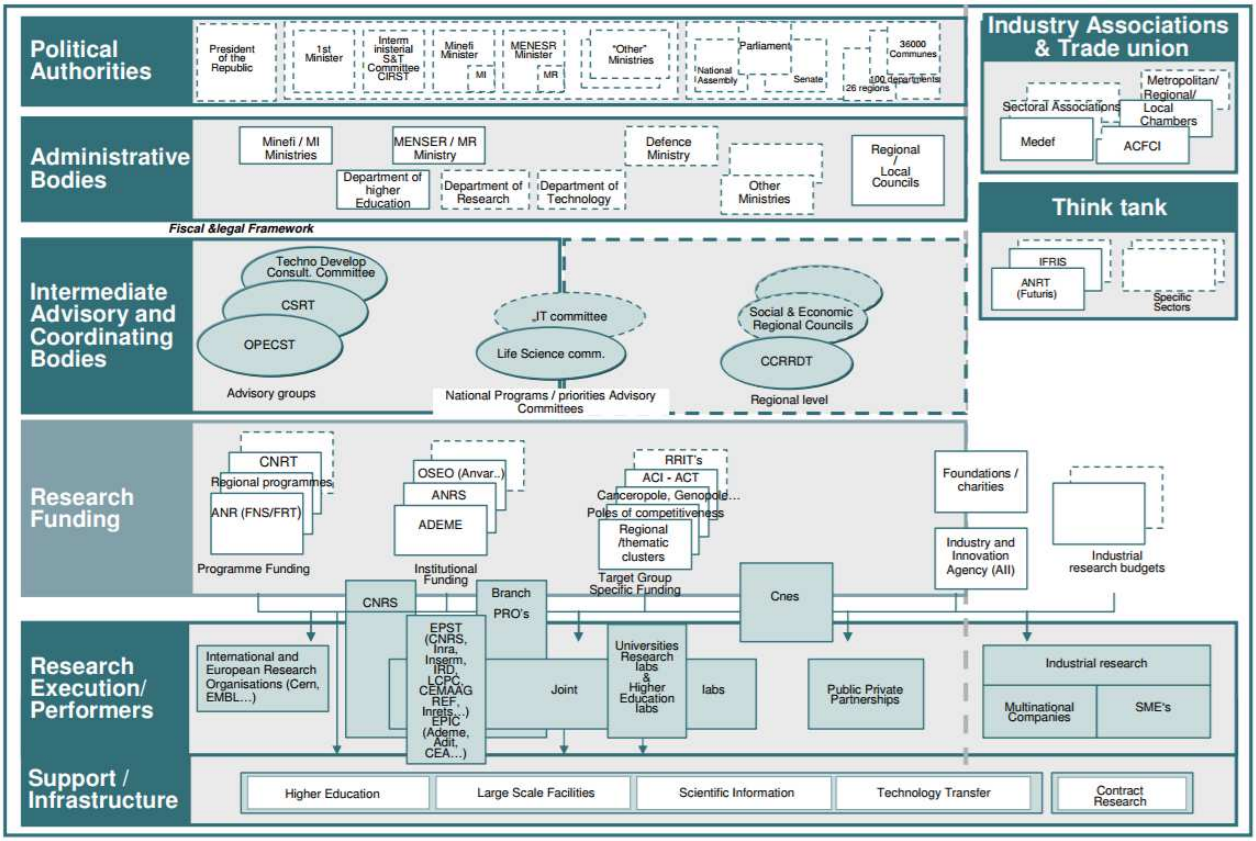
2.9 France

2.9.1 Overview

One of the largest economies in Europe, France is one of the most important contributors to innovation in the EU. EU innovation scoreboard places the France as a strong innovator, while the UN's E-government index, at number 10 in terms of developed digital public services. At the same time World banks doing business ranking, places France at 29th place which is the lowest among the researched countries. France has a fairly centralised innovation policy making and offers one of the most generous tax regimes for R&D.

2.9.2 Stakeholders

Figure 2.9.1. Innovation system in France[9]



2.9.2.1 The government[10]

At policy level, two main ministries share the responsibility for research and innovation policy in France. The Ministry for Education, Higher Education and Research (MENESR) designs and coordinates interministerial research policy on the basis of a committee including all research contributing ministries, main PROs and their clusters (Alliances), and the biggest research-oriented industries. The Prime Minister is assisted by a consultative body: The Strategic Research Council. The Ministry for the Economy, Industry, and Digital Affairs is responsible for industrial research and plays a specific role on the subject of business R&D. Innovation policies are shared by the two ministries.

At operation level, the French research and innovation system is structured around a number of agencies. Among the main agencies, the National Research Agency (ANR) was created in 2005 to fund research projects on a competitive basis and through public-public and public-private

9 http://ec.europa.eu/invest-in-research/pdf/download_en/psi_countryprofile_france.pdf

10 http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/oecd-science-technology-and-industry-outlook-2014_sti_outlook-2014-en#.WVntrsaB2Rs#page323

partnerships. The ANR covers basic research, applied research, innovation and technology transfer. In addition to research agencies, BpiFrance (which replaced OSEO), the public investment bank (as of 31 December 2012), provides support for R&D and innovation projects to businesses, especially SMEs.

2.9.2.2 Academia and research institutes[11]

Higher education institutions (HEIs), which is a group of 80 universities (2012-2013) and "Grandes Ecoles". The latter are a specific trait of the French higher education system; in parallel to universities, Grandes Ecoles are allowed to select their students through a competitive type of recruitment process, whereas universities cannot select students. In 2014, HEIs including National centre for scientific research spent roughly €9.9b on R&D, which amounted to slightly below 21% of GERD, and comprised around 0.46% of GDP, which is roughly the EU average. On the other hand, government sector's research represented €6.3b, i.e. circa 13% of GERD. Institutes and research centres in this latter group are of foremost importance to French research. They often collaborate with HEIs. The National Centre for Scientific Research (CNRS) had a budget of €3.3b in 2014, while the budget for civilian research of the Alternative Energies and Atomic Energy Commission (CEA) amounted to €2.6b in 2014. Other large PROs include the National Institute for Agricultural Research (INRA), the National Institute for Computer Science and Automation (INRIA), and the National Institute for Health and Medical Research (INSERM). The new Law on Higher Education and Research encourages university grouping, so French higher education system would most probably consist of 30 larger universities in the coming years.

2.9.3 Strategies

Table 2.9.2.: Relevant research, innovation and ICT strategies

Strategies	
La French Tech	French tech strategy aims at building French tech hubs to group French to accelerate growth of domestic start-ups and promoting France as an attractive business location. To achieve that it launched a €15 million French Tech international promotion platform, to highlight and showcase France's innovation prowess. Furthermore, it introduced French Tech Tickets by proving young entrepreneurs by providing a welcome pack (residence permit, individual grant,

[11] Mercier-Laurent, E. (2011). Innovation Ecosystems. Doi: 10.1002/9781118603048

	accommodation, and customised advice) to help them set up and expand their business.
Investments of the Future	The Investments for the Future programmes are strategic initiatives which aim to boost French competitiveness by investing in research, higher education and vocational training, in industry and SMEs, in sustainable development and in expanding sectors such as digital technology, biotechnology and nuclear energy. National Research Agency will be in charge of management of the research and higher education component of the programmes.
The French Digital Plan for Education	This is a large-scale digital plan for education to introduce digital technology to education system, with priority given to the first secondary school classes. In order to succeed in transforming teaching and learning practices with digital technology four pillars have been identified: training, equipment, resources and innovation. For that aims, 1 bn EUR is to be spent from 2016 till 2019.
Usine du Futur	A reference framework for the Factories of the Future (Usine du Futur), a common practical guide titled "Factories of the Future, stakes and panorama of solutions". The main objective of the framework is to provide answers to company managers, to assist them in the design and development of their new, innovative plants. This framework aims to encourage the growth and development of more modern, more connected plants, where technologies become the engines of competitiveness and export development - in short, factories of the future.
National Investment Program	The "National Investment Program", launched in 2010 managed by the General Investment Commission, aims to boost France's competitiveness by encouraging innovation. Initially, a budget of €47 billion was drawn up to finance innovative and promising investment in France**,** under the principle that each project would be co-financed.

2.9.4 Policies

A number of other governmental and non-governmental bodies and initiatives are contributing to the ICT innovation ecosystem in France. The most important ones are outlined below.

Table 2.9.3. Relevant research, innovation and ICT strategies in the UK

Policies	
Law on higher education	The law had several provisions. First, it proposed the acceptance of "externals" as voters – the list of which may evolve over time – for the election of the president of the university. In addition, an Academic Council is established (chaired, or not, by the president of the university. The Academic Council is

	responsible for the allocation of resources, the adoption of rules for examinations and rules of evaluation of research and university administration. Then, the law also proposes grouping of smaller universities, into larger universities, with the aim of creating clusters.
Digital transition	Launched by the French government in 2012, the "Digital Transition" project helps microbusinesses and SMEs boost their competitiveness by appropriating and integrating new digital technologies. Entrepreneurs can receive support from several hundred public-sector digital advisers located all over the country, together with private-sector consultants. These advisers provide microbusinesses and SMEs with information, documentation and training in digital best practice.
French Young Innovative Enterprise scheme	The French Young Innovative Enterprise scheme aims at supporting R&D and innovation activities of new SMEs through tax cuts and, above all, exemptions from social contributions for highly skilled employees. In 2015, 3,500 enterprises benefited from the JEI scheme, mainly in the digital and scientific sectors. Enterprises benefit from the scheme for an average of four years. Nearly 80% of them have fewer than 10 employees, most of them assigned to R&D activities.
The Social Innovation Fund	The Social Innovation Fund, with 40 M€ dedicated since 2015 to promote innovative solutions regarding unsatisfied socials needs.
Launch of Health Innovation Hub	The policy seeks to encourage collaboration between the health services and the business sectors so as to facilitate the development and commercialisation of new healthcare technologies, products and services.

Table 2.9.4. Services provided by the main stakeholders

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks/ Collaboration
R&I stakeholders					
Instituts Carnot	+				+
French Government Investment Fund			+	+	
BPIFRANCE	+	+		+	+
Higher education and research institutions and university clusters	+				+
National research agency			+		+
Societies for acceleration of technology transfer	+				+
Business France		+	+		+
R&I stakeholders with a strategic focus on ICT					
Alliance Industrie du Futur	+	+			+
Technology Research Institute	+		+		+

National Institute for computer science and automation	+	+			+
Digital ambition fund				+	

2.9.4.1 Public procurement on innovation (PPI) and pre-commercial procurement (PCP)

The French policy regarding PPI-related policy actions is managed at national level through two main channels: the launch in 2014 of an internet platform for innovation dedicated to innovation procurement by SMEs and the use of the centralised public purchasing body (UGAP) to lever public procurement for innovative SMEs. Furthermore, the French government publishes roadmaps and organises meetings between procurers and companies which inform business of public innovation needs and focus sectors, both on national and local level.

Furthermore, the Law on the modernisation of the economy provides the promotion of participation of innovative SMEs in the procurement of high technology, R&D. SMEs were granted preferential treatment if the amount of their purchase was lower than the threshold of competitive bids. In 2012, the rapport Gallois required to assign 2% of all procurements to SMEs. This measure may allow innovative SMEs and start-ups to fully utilise public procurement.

Organisation of frequent meetings between companies and public procurers helps to establish a dialogue and focus the innovative potential of the industry on sectors most important to France.

2.9.5 Funding

The three main sources of R&D funding are: the business sector (€26,669 M, 2014), the government sector (€16,573 M, 2014), and the foreign funding (€3,731 M, 2014). The public sector is the main recipient of government-funded GERD.

2.9.5.1 Public funding

The vast majority of public funding of research originates from a single inter-ministerial budget, the MIRES. It encompasses ten large programmes; half of them are being run by the Ministry for Education, Higher Education and Research, while the budget is 3 implemented through hundreds of “operators”. France spends around 0.29% of GDP on R&D funding which is above EU average of 0.26%.

In addition to direct funding, France offers research tax credit, allowing companies to benefit from a tax reduction for a large range of research related spending (exemption from corporate and

capital gains tax, total exemption from various employer social security contributions, etc.). The tax credit covers up to 30% of R&D expense. As such, taking into account this indirect measure, the public share in the funding of R&D activities gets close to 50%, when it reaches 30% for other comparable European countries (Germany, UK). This measure has made the French tax credit scheme one of the most generous in the world.

2.9.5.2 Private funding[12]

Business R&D increased from 1.27% to 1.45% of GDP between 2005 and 2015. Manufacturing performed a bit more than half of French business R&D in 2014, while services have since 2007 constantly increased their R&D intensity from 0.49% GDP to 0.67%. Within manufacturing, the sub-sector of computer, electronic and optical products is the most important research performer and accounts for about €3,669m of BERD expenditure in 2013. Aerospace and defence on the one hand and automotive on the other are the other main branches of R&D in manufacturing, accounting for about €5,297m in 2013. As far as the services are concerned, two most important sectors are sectors of (1) information and communication (BERD of €3600m in 2013) and (2) wholesale and retail trade; repair of motor vehicles and motorcycles (BERD of €1600m in 2013).

2.9.6 Clustering

France is very diversified in the number of clusters. According to the European Cluster Collaboration platform, France has a very varied number of hotspots – sectoral clusters[13]. This ranking indicates the total number of stars in a region where stars are defined for the 51 Sectoral Clusters, thus capturing the overall cluster strength in a region. Different regions of France have different number of stars and the scores range from 18 to 96. The highest number of stars can be observed around the region of Paris and in the Rhône-Alps, Provence-Alpes-Côte d'Azur, Aquitaine, and Pays de la Loire provinces (see Appendix 1).

Paris is establishing itself as a mature ecosystem for fledgling businesses, supported by an effective financing system, renowned research institutions, a growing number of shared workspaces and business accelerators, and a government focused on digital challenges. The French capital has fostered the emergence of a number of unicorns, which completed France's biggest fundraising round of 2015, totalling €177 million. Paris has a total of 21,267 start-up hubs, being the 6th largest start-up hub city in Europe.

This study has identified 32 cluster organisations acting in digital industries; of them 11 hold a Gold Medal.

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12 http://www.finsmes.com/2017/01/france-the-new-wave-of-venture-capital-funds.html

13 https://www.clustercollaboration.eu/cluster-mapping

Aerospace Valley

Mission/Objectives:

Created in 2005, with today 827 members from both industry and academia, Aerospace Valley is the most significant innovation competitiveness cluster in France in the field of aeronautics, space and embedded systems. With offices in Toulouse (HQ) and Bordeaux, the cluster covers the two geographically adjacent regions of South-West France, Occitanie and Nouvelle-Aquitaine. With 124,000 industrial employees, Aerospace Valley represents around 1/3 of the French aerospace workforce. Similarly, 8,500 researchers and scientists are active within the Aerospace Valley territory, thus representing 45% of French national R&D potential in the aerospace sector. As of October 2016, Aerospace Valley has obtained funding for 474 R&D projects representing an accumulated value of 1.1 billion Euro covering most scientific and technical fields related to the sectors of aerospace. Within the framework of the general French “pôle de compétitivité” program, which aims at stimulating employment by fostering local and regional competencies in technical and economic areas, Aerospace Valley strives to create an ambitious 35-40,000 new jobs by the horizon year 2025.

Sectors:

- Aerospace Vehicles and Defence, Information Technology and Analytical Instruments
- Blue Growth Industries, Digital Industries, Mobility Technologies
- Embedded Systems and Real Time Systems, Aeronautical technology / Avionics, Satellite Navigation Systems
- Transport & logistics, Advanced materials, Micro/Nano electronics

Services:

1. Access to public support (regional/national programmes, innovation vouchers, etc.)
2. Access to private funding (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.)
3. Facilitation of collaboration between members
4. Facilitation of cross-sectorial cooperation
5. Trend-scouting (Ideas for innovative projects)

Cap Digital

http://www.capdigital.com/

Mission/Objectives:

Cap Digital was created as a result of a public policy for the development of economic sectors with strong growth potential located in the same geographical area. Since 2009, the cluster has been implementing the Paris Region's strategy for digital content and services, supporting innovative SMEs in this field.

1000 members of Cap Digital are primarily innovative SMEs but also major universities, higher education establishments, research labs, and corporations focused on a specific technology-driven industry (Triple helix cluster).

Its members represent French digital industry's most active players.

Cap Digital's expertise is expressed through:

• Specialised committees, sector-specific communities and experts from its members;

• A highly-qualified team

• An information system that enables capitalisation on knowledge within the ecosystem and related technological domains.

Missions

• Cap Digital promotes competitiveness within the digital and media industry

• Cap Digital provides members with essential information, networks, and resources. Those include ongoing competitive intelligence, training, partnerships, funding solutions and project reviews.

• Cap Digital is at the core of national R&D and innovation projects through its label accreditation program.

Sectors:

- Communications Equipment and Services, Distribution and Electronic Commerce, Information
- Technology and Analytical Instruments
- Creative Industries, Digital Industries
- Internet of Things, E-Publishing, Digital Content, Visualisation, Virtual Reality
- Creative, arts & entertainment activities, Development of regional cultural & creative industries,
- Intelligent inter-modal & sustainable urban areas (e.g. smart cities)

Services:

- Access to the European Internal market
- Internationalisation support (= Access to third countries markets)
- Access to public support (regional/national programmes, innovation vouchers, etc.)

- Access to private funding (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.)
- Facilitation of collaboration between members

Details of support services:

- Eight key markets are addressed by CAP DIGITAL members: tourism, education, media & telecommunications, marketing & communication, digital business/e-government, healthcare, retail and smart living. Given the highly demanding nature of the cutting-edge ICT Cap Digital's ecosystem, nine key technologies were implemented in order to leverage the activities in the eight markets enumerated above: data, rapid prototype techniques for the globalisation of production, innovative software using contributive economy methods, gamification, Internet of things & design, definition of standards for interoperability, mobile services, UX and robotics.
- CAP DIGITAL provides its members with intelligence, training, matchmaking/networking, funding solutions, project reviews, business development and internationalisation services. In this scope, it provides aid for small companies to transfer their digital/technological innovations and tools to big institutions and vice versa, aiding the big institutions to gain access to cutting edge technologies developed by small companies.
- CAP DIGITAL acts at regional, European and international level (non-exhaustive list): organisation of regional think tanks and working groups, participation in European networks and projects, support to their SMEs to enter international markets through the participation in international trade shows. It could, therefore, actively contribute to the capacity building, the policy making and the influence of all the involved stakeholders in a transnational and trans-sectoral level, fostering future cooperation in the field.

Cap Digital's coaching design allows you to benefit from:

- Expert analysis of your product / service / technology during Design Reviews
- Contact with experts selected by Cap Digital: senior designers in the definition of innovative strategies, services and innovative products
- Leverage on an individualised coaching service.

EMC2, http://www.pole-emc2.fr/

Mission/Objectives:

EMC2 is a French competitiveness cluster created in 2005 in the framework of a national initiative for industry competitiveness, operating in the Pays de la Loire region on advanced manufacturing technologies.

The association gathers all the actors of innovation around key markets and technologies to foster the emergence of collaborative projects of R&D. The aim is to reinforce the innovation territorial

ecosystem by structuring 4 sectors – aeronautics, naval, ground transportation and energy – in a common and transversal approach: the advanced manufacturing of the technologies. The vision cluster is to promote business development through collaborative innovation, building an innovation path mixing skills, markets and technologies to make innovation R&D projects emerge. EMC2 activities are enhanced by the IRT Jules Verne (Research and Technological Centre) created two years ago at the initiative of the cluster.

EMC2 leads a network of 330 members composed of SMEs, major industrial groups such as Airbus, STX Europe, DCNS, Solvay, Dassault… as well as research and training centres. At the end of 2016, the global budget of R&D reached 1.395 bn € for 230 projects launched, including 523M€ of public funds.

Key markets and technologies:

- Aerospace Vehicles and Defence, Metalworking Technology, Production Technology and Heavy Machinery
- Blue Growth Industries, Digital Industries, Experience Industries
- Aeronautical technology / Avionics, 3D printing, Composite materials
- Aeronautics, Blue renewable energy, Advanced manufacturing systems

Services:

1. Access to the European Internal market
2. Internationalisation support (= Access to third countries markets)
3. Access to public support (regional/national programmes, innovation vouchers, etc.)
4. Facilitation of cross-sectorial cooperation
5. Periodic Information dissemination

Details of support services:

The heart of EMC2 activities is to facilitate and enhance the innovation of its ecosystem's members, via collaborative R&D projects on topics encompassed in its strategic thematic scope. Various activities are then deployed:

1. [idea factory] making project ideas emerge and organising networking activities among which technical workshops, academic meetings, major groups presentation of R&D strategies, business conventions (e.g. Composites Meetings), Task Force Europe and other networking events for the members of the ecosystem (more than 15 events per year).
2. [project factory] turning ideas into R&D collaboration projects: project managers assist the project leaders into elaborating their projects and access to funding for R&D, from regional, national or European sources.

On top of these activities, EMC2 represents its members at various national and international events, such as the JEC Europe, Paris Le Bourget, EU Brokerage Event Advanced Manufacturing… and works on developing relationships with specific partners able to provide effective solutions to different needs of companies and their R&D strategies including Intellectual

and Industrial Property, consortium agreement, writing project proposals, proposing bank facilities,…

Minalogic, http://www.minalogic.com/en/home

Mission/Objectives:

1. Minalogic is a global innovation cluster for digital technologies serving France's Auvergne-Rhône-Alpes region. The cluster supports the region's leading innovators by facilitating networking, fostering collaborative R&D, and providing companies with personalised assistance throughout all phases of business growth. The products and services developed by our members address all industries, from ICT and healthcare to energy and advanced manufacturing.

Minalogic was founded in 2005 and today boasts more than 330 members, including 280 companies. The cluster has certified 450 projects that have secured total government funding of €805 million of the more than €2 billion in total R&D spending these projects represent. The 56 projects completed to date have resulted in 37 products (either on the market or in the process of being prepared for market release) and generated €1.25 billion in revenue.

- Communications Equipment and Services, Information Technology and Analytical Instruments
- Digital Industries, Medical Devices, Mobility Technologies
- Micro and Nanotechnology related to Electronics and Microelectronics, Digital Systems, Digital Representation, Internet of Things
- Industrial biotechnology, Micro/Nano electronics, Photonics

Services

- Internationalisation support (= Access to third countries markets)
- Access to public support (regional/national programmes, innovation vouchers, etc.)
- Direct advisory services
- Facilitation of collaboration between members
- Facilitation of cross-sectorial cooperation

MOV'EO, http://pole-moveo.org/

Mission/Objectives:

Mov'eo is a Mobility and Automotive R&D competitiveness cluster, which since 2006 has been mobilizing its energies at the service of its members to meet the objectives assigned by the State to competitiveness clusters: to foster the development of collaborative projects between members, to contribute to development in the regions of companies, in particular SMES, and to promote innovation in the sector.

MOV'EO Missions:

a. **To foster** collaborative research and development projects
b. **To anchor and develop** research activities in our regions
c. **To support SMEs/SMIs** in their approach to innovation
d. **To enhance** the international competitiveness of firms and regions
e. **To prepare** the skills of tomorrow and respond to the needs of our members today
f. **To anticipate** trends, shortages and expectations to guide R&D more exactly and thus improve the relevance of the supply.
g. **To support** our members in marketing their products and services
    - Automotive, Transportation and Logistics
    - Digital Industries, Logistical Services, Mobility Technologies
    - Component integration, Planning and security, System and transportation
    - Automated driverless vehicles, Computer programming, consultancy & related activities, Road transport & related services

Services:

- Access to the European Internal market
- Internationalisation support (= Access to third countries markets)
- Facilitation of collaboration between members

Details of support services:

The Mov'eo competitiveness cluster's mission is to facilitate access to public and private joint funding for projects through labelling.

Mov'eo SME seeks to promote the involvement of SMEs in collaborative projects and to streamline their relations with major industrialists, via targeted actions, and to support SMIs/SMEs in their innovation approach from project to market:

- Enhanced communication for SMEs on Mov'eo communication channels and media, including the SME bulletin "Mov'eo Make or buy"
- Access to the decision-makers of major industrialists via operational "open innovation" actions
- Access to the EIP label and direct contact with investors specialising in eco-mobility
- Access to the ESSEC Ventures Chèque-conseils (advice chequebook)
- Visibility via the Mov'eo community on the national "Financer sa boîte", platform etc.

MOV'EO International

Through Mov'eo International, our team actively supports members in their R&D development and international business:

- Organisation of four thematic missions per year to the USA, Canada, Brazil, China, Japan, Korea, etc.
- Access to contacts and contracts in the whole of Europe through partner clusters such as SAFER in Sweden, Bayern Innovative in Germany or ISMB in Italy

- Support in building European projects

Europe: conquering new markets

Mov'eo provides help for its members to access European funding (Horizon 2020, COSME, ERDF …). Participating in European projects means opening up to new markets and networks, accessing new technologies, benefiting from significant funding (up to 100% of R&D subsidised) and a recognised label of excellence. Mov'eo provides daily support to its members in their European moves

Secured Communicating Solutions cluster, http://en.pole-scs.org/

Mission/Objectives:

Develop the first European and one the 3 leading worldwide ecosystems on 3 Smart Specialisation Areas: **contactless technology**; **networks, IoT & mobile services**; **security & digital identity.**

Sectors:

- Information Technology and Analytical Instruments
- Digital Industries, Mobility Technologies
- Micro and Nanotechnology related to Electronics and Microelectronics, Smart cards and access systems, Mobile Communications
- ICT trust, cyber security & network security, Telecommunications, Micro/Nano electronics

Services:

- Access to the European Internal market
- Access to public support (regional/national programmes, innovation vouchers, etc.)
- Access to private funding (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.)
- Facilitation of collaboration between members
- Promotion of activities (marketing/ visibility)

Details of support services:

- Pole-scs has developed a portfolio of 37 services covering the 4 major growth phases of SME : products & services development, business planning & readiness, visibility & notoriety, customer engagement.
- The overall set of services can be found : http://en.pole-scs.org/les-services-du-pôle/parcoursdecroissance
- Networking meetings involving SMEs, large groups and academics Fund raising: selection and support process to structure SMEs business plans and introduction to the investors: business angels, venture capitalists, banks… « Go to Market »: help SMEs to SMEs maximise their preparation with regard to strategic

thinking

« Growth » : help SMEs to structure their strategic development plan over a period of 18 month in order for them to grow faster (consultants) International: partnership agreements with international clusters and large groups partnerships (organisation of missions), support in the preparation of European projects, participation in trade shows with SME: MWC, CARTES, SEMICON

SCS Cluster: A Growth Accelerator

A Pallet of Services from Birth to Maturity

Within the framework of its mission around the innovating collaborative projects, the SCS Cluster accompanies entrepreneurs throughout their project thanks to a set of services active from emergence of the project until the accompaniment with the marketing and the utilisation of the results by the project.

Emergence and information Projects

For the projects in emergence, the SCS Cluster proposes companies to inform themselves on the various devices of public finance of collaborative research, to help them in their searches for partners, to advise them on the definition of the contour of a project, etc…

Accompaniment and Certification of the Projects

The SCS Cluster accompanies businesses in the process of certification and deposit of the project near the funder requested in order to give the best chances of success to the project.

Project financing

Once the project is selected, the SCS Cluster contributes various services to help assemble financing adapted to situation and to the context of the project.

Follow-up of the execution of the projects

Within the framework of its mission and at the request of the supervisory authorities, the SCS Cluster carries out twice a year an audit of the projects selected for financing and in the course of execution.

Project development

In order to emphasise the actions and work of the members of the SCS Cluster, a certain number of communications tools are regularly activated to increase the visibility of the innovating ecosystem of the territory.

Accompaniment for the plan of marketing of the products/services resulting from the projects: The Pop program

The SCS Cluster proposes Pop program the ": Project with the Product "which aims at accompanying SME for marketing by the products/services resulting from the projects from R & D. The Pop program also makes it possible to prepare the shutter "prospects for marketing" which will be presented to the public funders during the meeting of closure project.

Accompaniment after the end of the project

After the end of the project, the SCS Cluster proposes actions for the analysis of the results of the project.

Systematic Paris-Region

Mission/Objectives:

The Systematic Cluster for International Competitiveness in the Paris Region brings together more than 800 key players in the sectors of industry, SMEs and science at the intersection between eight technological markets with a strong social dimension (Transport, Energy, Telecoms, Security, Health, Smart Cities, Information Systems and the Factories of the Future) and two areas of technology (Free & Open Source Software and Complex Systems).

Sectors:

- Communications Equipment and Services, Information Technology and Analytical Instrument
- Digital Industries, Mobility Technologies
- Embedded Systems and Real Time Systems, Optical Networks and Systems, Signal Processing
- ICT trust, cyber security & network security, Telecommunications, Computer, electronic & optical products

Services:

- Access to the European Internal market
- Internationalisation support (= Access to third countries markets)
- Access to public support (regional/national programmes, innovation vouchers, etc.)
- Access to private funding (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.)
- Innovation Management / Support of innovation processes (internal, external)

The Cluster maintains the activities of thematic groups:

- Automobile & Transports
- Digital Trust & Security
- Free and Open Source Software
- Health & ICT Initiative
- Smart Energy Management
- System Design and Development Tools

- Telecoms

Through its nine Technology Groups, Systematic Paris-Region manages a whole community and deploys its expertise to encourage collaborative innovation. To date, Systematic Paris-Region has facilitated the development of nearly 460 R&D projects, representing an overall R&D investment of approximately 2.5 billion euros and a total of 820 million euros in subsidies from the French State, development agencies (ANR, EUREKA, FEDER, bpifrance) and territorial bodies.

In addition to collaborative R&D, Systematic Paris-Region's mission is also to develop an ecosystem for growth that is conducive to the development of SMEs into middle-market companies (Entreprises de Taille Intermédiaire – ETIs), through its AMBITION PME program. This ecosystem brings together more than 800 SMEs, accounting for more than 35,000 jobs in the Software, Systems, Optics and Electronics sectors.

Systematic Paris-Region is also committed to increasing the attractiveness of the region, the Cluster, its area of specialisation and its key players to foreign investors in order to attract skills and companies, encourage and support export initiatives by member SMEs and ensure that the Cluster and its members play a key role in developments at European level.

SUPPORT GROWTH INNOVATIVE SMES

For the coming years, Systematic is not only committed to developing new R&D projects but also to increasing productivity and to creating new businesses within the cluster specially for SMEs. Systematic stands on an ecosystem made of 800 SMEs which represent more than 35 000 jobs in the fields covered by the Cluster. The Cluster’s objectives towards SME consist in contributing to the emergence of global leaders and consolidating existing SMEs.

The aim is to **create optimal conditions for the development of innovative international SMEs** focused on 5 axes:

Business: connect SMEs to their future key accounts

• Organisation of B2B meeting
• Study report on key account’s needs and expectations

Raise funds: help SME’s to raise funds

• Set up meeting between SME and investors

• Coaching and certification “Label Entreprise Innovante des Pôles“ recognised by investors
• Workshops on specific thematic

Export: assist SMEs development in export markets

• Workshop to get to know their export markets
• Organisation of “discovery seminars” including B2B meeting in Boston and Beijing

Human Resources: help SME's to recruit, train, manage and adapt the skills

• Manage the skills already available in company
• Study report on training needs for complex systems engineers
• Facilitate contact between SME's and potential qualified employees

Innovation strategy: enhance SME's innovation strategy and improve their competitiveness

• Anticipate technological and economic evolution through business intelligence
• Coaching to define SME's innovation strategy

LEAD AN INNOVATIVE ECOSYSTEM FOR A BETTER INTERNATIONAL ATTRACTIVENESS

Accredited as a "World Class" cluster by the French Government in 2005, Systematic is awarded "Cluster Organisation Management Excellence Label Gold" and is a member of EIT ICT Labs (nodes: Paris, Berlin, Stockholm, Helsinki and Trento).

Systematic focuses its development on European and international scene on three priorities:

- attract capital and talents to the Paris Region,
- help laboratories and companies export their patents and products,
- face the challenge of growing global competition from large systems integrators, low cost software development and new players in embedded systems.

The Cluster benefits from recognised experience in cooperation between its members and their European partners. Systematic is already involved in European networks, such as:

• DSP Valley -Belgium
• BICC-NET - Germany
• Point-One - Netherlands
• Maroc Numéric Cluster - Morocco
• Ciatec (Campinas) - Brasil
• CPqD (Campinas) - Brasil
• Centre of Engineering and Technology Transfer (CETT) - Kazakhstan
• Imagine IT Hanoi - Vietnam

Systematic has opened technological hubs for the benefit of its members in key places on the globe: USA (Boston-Cambridge, MIT), China (Beijing, Z-Park), Tunisia (Tunis, Technopark Elgazala), India (Bangalore planned for 2013) with a view to:

- promote Systematic (the cluster, the Paris region and its members);
- facilitate international partnership projects;
- support SME export drive.

ViaMéca

Mission/Objectives:

ViaMéca is devoted to design, production and integration of intelligent mechanical systems. Its members (SME's and groups, research and/or education bodies) bring skills that are coordinated and highlighted in 4 thematics : **Surface Engineering and Processes, Advanced Manufacturing, Intelligent Systems and Robotics, Engineering driven by Uses and Services.**

ViaMéca is located in the first French region on mechanical engineering regarding either scientific strength devoted to system engineering (cnrs statistic) or business in industrial outsourcing in the field of mechanics.

Since 2005 **ViaMéca** labelled more than 415 R&D collaborative projects. More than 200 were funded : they involved more than 499 companies and 342 labs. 60 funded projects are deeply linked with the « factory of the future » domains (in the light of EFFRA's roadmap).

On the international aspects, we are looking for collaborations into European projects (H2020 ICT, FOF, NMP, Eurostars, Eureka...) for our members, and new interclustering relationship that could be reinforced through Interreg or Innosup projects for example

Sectors:

1. Metalworking Technology, Production Technology and Heavy Machinery
2. Digital Industries, Mobility Technologies
3. 3D printing, Surface treatment (painting, galvano, polishing, CVD), Engineering
4. Automated driverless vehicles, Advanced manufacturing systems, Machinery & equipment n.e.c.

Services:

5. Innovation Management / Support of innovation processes (internal, external)

ViaMéca collaborative projects as well as scientific knowledge deal with :

- Surface Engineering
- Advanced Manufacturing Processes
- Intelligent Systems and Robotics
- Engineering driven by Uses and Services

2.9.7 Performance

According to the European Innovation Scoreboard[14], France is a Strong Innovator. Over time, performance has increased by 2.8% relative to that of the EU in 2010.

- **Relative strengths** of the innovation system are in: 1) Human resources (new doctorate graduates, population aged 25-34 with tertiary education, lifelong learning); 2) Attractive research systems (international scientific co-publications, top 10% most cited publications, foreign doctorate students); 3) and Innovation-friendly environment (broadband penetration, opportunity-driven entrepreneurship).
- **Relative weaknesses** are in: 1) Linkages (innovative SMEs collaborating with others, public-private co-publications, private co-funding of public R&D expenditures; 2) Finance and support (R&D expenditure in the public sector, venture capital expenditures); 3) and Innovators (SMEs with product or process innovations, SMEs with marketing or organisational innovations, SMEs innovating in-house).

2.9.8 Challenges[15]

Main research and innovation policy challenges are:

- **Simplify and improve the efficiency of innovation policy.** France presents a wide range of policy instruments and public organisations to foster innovation but shows an average performance in terms of innovation outputs. This mismatch between the number of policy instruments and their actual outputs has led to the implementation of a number of policy initiatives aimed to simplify and improve the efficiency of innovation policy.
- **Promote R&I policy evaluation.** Over the past 15 years, priority for innovation has led to a multiplication of policy instruments without sufficient stability and clarity of objectives. In that context, the lack of evaluation of the complete portfolio of policy instruments in support of research and innovation has been a repeated concern. This lack of regular evaluation induces difficulties for policy makers to assess their past decisions and ground their future policies. To tackle this issue, several evaluating organisations were recently created and stand as a step forward in the development of an evaluation culture.
- **Increase the quality of the public research base**. The average performance of public research is considered as a factor of continuing concern as the French scientific output has been moderate when compared to similar countries for the last ten years. Many reforms have recently been implemented to modify the public research structure.

[14] http://ec.europa.eu/DocsRoom/documents/24163

[15] https://rio.jrc.ec.europa.eu/en/country-analysis/France/country-report

Successive governments have made substantial efforts to further influence research orientations, to increase the role of universities and foster the use of project funding

2.10 Conclusions

Comparing the different countries and their ICT innovation and start-up ecosystems, several different conclusions can be drawn. First, it is noticeable that the countries diverge in the way the innovation policy is crafted and implemented. Germany and the UK are largely driven by regional innovation policy and have bottom up approach. At the same time, countries like Ireland and Estonia have centralised innovation policy with little focus on regional policy. There are also divisions in the way the government supports R&D. Some countries have competitive systems (Ireland, UK), while others prefer block funding (Germany, Estonia). When it comes to indirect funding, Estonia and Germany have currently no tax deductions and indirect funding, while other 4 researched countries, have a significant portion of funding channelled via tax credits and deductions.

However, there are a lot of similarities between the countries that could lead to initial conclusions what these successful countries have in common and could lead to preliminary recommendations to EaP countries.

First conclusion: All of the researched countries have special policies and bodies to support innovation in higher education sector and in business sector.

2.10.1 Support to businesses and SMEs

Business sector and especially the SMEs are the cornerstone of ICT innovation. These are the features of innovation systems that facilitate ICT innovation in the business sector:

- Direct support to SMEs throughout their lifecycle
- Indirect support to SMEs by supporting venture capital funds
- Existence of development banks and funds
- Multilevel support to businesses by financing and advisory
- Have diverse and well-functioning networks linking businesses to innovators

Innovative SMEs have the largest need for public support. SMEs often lack track record, collateral and resources, therefore, innovative projects in SMEs result in the amount of risk that is usually unbearable for commercial banks, which are traditional finance providers in Europe and EAP countries. As a result of that, innovative SMEs are left without financing. To tackle that issue, innovative countries have a diverse network of public bodies providing support on multiple levels. SME are directly supported by advisory, network building, loans and grants, and at various enterprise development stages. Organisations like Business France, Enterprise Estonia support

network building, provide advisory and competitive grants to MSMEs based on criteria defined in national strategy and policies. Development banks such as KfW in Germany, or British development bank, utilise market mechanisms such as loans and guarantees to support the start-ups and SMEs. At the same time, not only SMEs, but also private investors are supported. All six countries have measures to support venture capital organisations. The measures include directly funding venture capital firms, co-investing, investment guarantees and others.

The activity of such organisations significantly improves the start-up and ICT innovation ecosystem by bringing multiple benefits. Having specialised SME support bodies, allows to use the expertise of such organisations to channel assistance through competitive schemes to the most innovative and financially viable enterprises. At the same time, supporting the venture capital funds help to significantly decrease the riskiness of venture capital investment, increasing the financing available to start-ups and SMEs. As some of the risk is taken by the public bodies, private investors are able to provide more funds to the innovative projects. Finally, enterprise support bodies create a collaboration network, that helps the SMEs to find partners for innovative projects and is able to inform the government on challenges faced by the SME community.

Second conclusion: All of the researched countries have strong dedicated support for HEI and involve research representatives in the development of national RD&I policies, ensuring an alignment between the research policies and priorities and the national innovation strategies and priorities.

2.10.2 Support to Higher Education institutions

Higher education institutions and research organisations are the cornerstone of R&I framework in the researched countries. These are the features of higher education institution environment in the researched countries:

- High level of expenditure of HEI on R&D
- High level of internationalisation of HEI
- Financial support provided by research councils

As can be seen in the table below. Higher education for expenditure (HERD) for research and development is high among the countries and is roughly the EU average. Furthermore, when studying the EU innovation scoreboard, it can be easily seen that all of the countries score highly on human resources and research systems. Most of the countries have more than double the EU average of international scientific publications and lifelong learning. This shows international recognition and openness of higher education institutions in the researched countries. Part of the success of higher education institutions and research organisations are research councils. Research councils, are present in all six countries and allow to efficiently support higher education institutions and research organisations. Research councils are able to bring research institutes

together for various large-scale projects which increases the efficiency of research, brings together businesses and academic community, and allows implementation of projects which were restricted due the lack of capacity of individual research institutes. Research councils provide a platform for communication between researchers, therefore the research councils are able to communicate the challenges of the research community to the regulating bodies.

Table 2.10.1. Overview of expenditures on R&D

		GERD	BERD	Gov Exp. on R&D	HERD
	EU	2,0	1,3	0,25	0,48
Innovation leader	Germany	2,89	1,95	0.43	0,51
Moderate innovator	Estonia	1,45	0,63	0,16	0,64
Strong innovator	Ireland	1,5	1,1	0,07	0,35
Strong innovator	France	2,24	1,45	0,29	0,46
Innovation leader	Sweden	3,15	2,1	0,1	0.91
Innovation leader	UK	1,7	1,1	0,1	0,4

Third conclusion: a pro-active role in e-government services, electronic public procurement and measures for public procurement of innovation is in common for all countries that were studied.

2.10.3 E-government and public procurement

A well-functioning public services system plays an essential role for a well-functioning innovation ecosystem. Below are the features of public services systems in the researched countries:

- High level of digitalisation of public services
- Use of e-procurement
- Use of procurement for ICT innovation

All of the mentioned countries are characterised by high level of public services digitalisation and have scored high on the UNs e-government ranking. High level of digitalisation of public services leads to a number of benefits. As the public services are digitalised it becomes easier to track them, which results in higher accountability and ability detect areas of inefficiency to optimise their services.

Digitalisation allows further to improve the communication between the public bodies, and other stakeholders. For instance, once the data is submitted to the authorities, a proper data management system, will allow to reduce the burden of filling out the same date, thus improving the quality and effectiveness of public services. Better communication with business and academic community helps creating innovation friendly regulations, and facilitates information

dissemination regarding various innovation support schemes, or public tenders. That makes it easier for SMEs to participate in tenders, and in communication with the government.

Furthermore, digitalisation of public services creates a market for innovative ICT companies, who can develop the skills and competences in building the electronic public services, which will strengthen the national ICT industry.

Public procurement is an important tool used to encourage innovation in all the researched countries as public procurement currently represent 19% of the EU GDP. The introduction of electronic tenders creates more transparency and can help fighting corruption in the public sector and can contribute to an increase in the efficiency of allocation of public goods. This results in a more innovation friendly environment, as transparent and accountable government and additionally lower the burden for (innovative) SMEs to participate in public tenders, which in return lead to a lower level playing field.

Pre-commercial public procurement and procurement of innovation are two measures that enable public organisations to procure innovative services that are not available on the market yet. Both instruments together provide funding for the development of innovative solutions tailored to a specific societal problem or public unmet demand. Additionally, the public procuring organisation is in effect a launching customer for the innovative product or services that is being developed by these instruments, which helps the innovative company developing the solution to create revenues supporting further development and business growth. Finally, having public organisations as launching customer provides credibility to the solution and will help creating more demand for the innovative solution being procured.

Fourth conclusion: a broad portfolio of public services for different stakeholders, both for generic innovation support as well as dedicated public services tailored for support of ICT innovation.

2.10.4 Comparison of national ICT innovation and start-up policy support

As can be seen from the graph below, all of the countries have a wide variety of instruments to support research financing, business development financing, provide advice and infrastructure and build networks. However, not all of the countries have dedicated ICT research centres. Furthermore, when it comes to tax incentives its only UK and France that provide tax incentives to finance research.

Table 2.10.2. Overview of availability of generic innovation support services

Generic innovation support Services	Estonia	France	Germany	Ireland	Sweden	UK

Access to infrastructure						
Technology parks	+	+	+	+	+	+
University clusters	+	+	+	+	+	+
Access to high performance computing	+	+	+	+	+	+
ICT labs	+	+	+	+	+	+
Advice and consulting						
Consulting on grants	+	+	+	+	+	+
Business consulting	+	+	+	+	+	+
Training	+	+	+	+	+	+
Research funding						
Financing universities	+	+	+	+	+	+
Financing PROs	+	+	+	+	+	+
Grants for researchers	+	+	+	+	+	+
ICT Innovation public procurement	+	+	+	+	+	+
Business funding						
Tax incentives		+				+
Grants	+	+	+	+	+	+
Loans	+	+	+	+	+	+
Guarantees	+	+	+	+	+	+
Equity	+	+	+	+	+	+
Funding venture capital funds	+	+	+	+	+	+
Networks						
Enterprise network	+	+	+	+	+	+

start-up network	+	+	+	+	+	+
Investor networks	+	+	+	+	+	+
University network		+	+	+	+	+
ICT research network		+		+	+	

Another conclusion that can be drawn is that the studies countries all have next to broad generic innovation support services additional innovation support services that are either dedicated to ICT innovation and/or have ICT as one of the priorities. These dedicated innovation support services allow for more tailored support services to the specific needs of ICT innovation and are likely another key successful attribute for the development of a successful ICT innovation and start-up ecosystem in these countries.

Table 2.10.2. Overview of availability of ICT innovation specific support services

ICT specific innovation support Services	Estonia	France	Germany	Ireland	Sweden	UK
Access to infrastructure	+	+		+	+	+
Advice and consulting	+	+	+	+	+	+
Research funding	+	+		+	+	
Business funding	+	+	+	+	+	+
Networks	+	+	+	+	+	+

3 EASTERN PARTNERSHIP COUNTRY REPORTS

3.1 Armenia

3.1.1 List of abbreviations:

EIB- European Investment Bank

EIF – Enterprise Incubator Foundation

ISTC – Innovative Solutions and Technologies Centre

ITDSC – Information Technologies Development Support Council

MoES – Ministry of Education and Science

MEDI – Ministry of Economic Development and Investments

NAS – National Academy of Sciences

PPP- Public Private Partnership

R&D – Research and Development

R&I – Research and Innovation

SCS – State Committee of Science

SMEDNC – SME Development National Council

3.1.2 Overview

Armenia is a small economy located in the southern Caucasus. Through the recent years Armenia has made significant progress in developing and improving the innovation policies and framework. Certain aspects for future progress are in place such as strategic vision and high-level government assistance. The government has a strategic objective of transforming Armenia into an R&D hub of high-tech MNCs; and views innovation as a key leverage to strengthen competitiveness, employment and prosperity. Key strengths of Armenia rely on its international cooperation with various countries, the diaspora and strong traditions and knowledge base in certain areas. However, the fragmentation of the innovation system, partly its reliance on external funding and weak linkages between academia and businesses pose significant challenges to the development of the Armenian innovation ecosystem. Overall, a number of key linkages necessary to achieve an efficient and fully operational national innovation system are yet in state of development.

3.1.3 Stakeholders

The Armenian innovation ecosystem is characterised by a relative lack of intermediary organisations, a range of public-private partnerships and high degree of independence from the government. The Ministry of Education and Science is responsible for research through a dedicated autonomous agency, the Ministry of Economic Development and Investments is responsible for innovation policy, while the Ministry of Transport, Communication and Information Technologies is responsible for ICT development.

In recent years, the Armenian innovation ecosystem has been changing rapidly with appearance and disappearance of new actors.

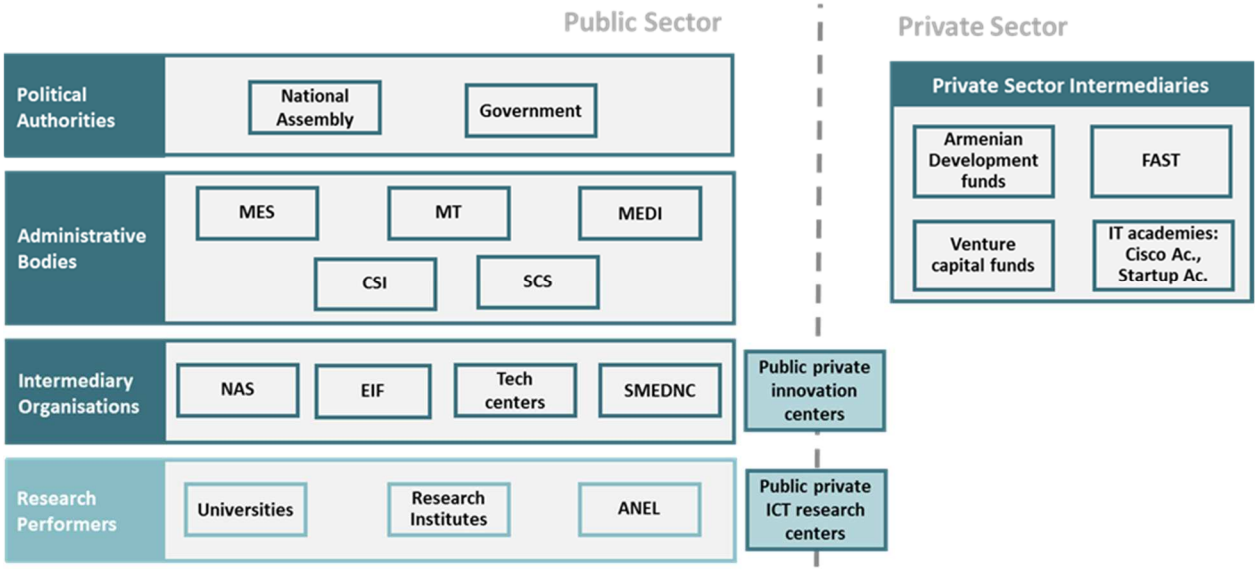
A number of high-level councils mainly headed by the Prime Minister are in place as consultative bodies for policy coordination - Science and Technology Council; Industrial Council; Information Technology Development Support Council; Business Support Council; SME Development Council. These platforms involve representatives from state bodies along with stakeholders from business, academia and civic society. Information Technologies Development Support Council is designed to consult the government on IT development policies.

The Enterprise Incubator Foundation (EIF) initially was aimed at the ICT sector, but currently its programs cover general support to innovation in high-tech sectors. It is one of the most active participants of the Armenian innovation system. A PPP in itself, EIF, brings together public and private sector, attracting international development financing, and international private sector financing. As a result of the work of the Enterprise Incubator Foundation, Armenia has a number of PPP which provide co-working spaces, trainings, funding and networking. The initiatives are various, and usually include development finance, and a large private international participant (IBM, Microsoft etc.). Therefore, the vast majority of business support organisations are created under projects of international development organisations (World Bank, EIB, GIZ etc.).

The Technology Transfer Association has been in operation since 2001, aimed at Armenian firms that have designed advanced scientific and technological technologies. The Association is targeted at providing assistance in spheres of technology transfer.

The National Centre of Innovation and Entrepreneurship has been aimed to provide innovation assistance services. It was established in 2009 by the RA Government's decision under the RA Ministry of Economic Development and Investments. Nevertheless, it has yet to develop to effectively achieve its mission.

Figure 3.1.1. Armenian ICT Innovation Ecosystem



3.1.3.1 Government bodies and agencies

The government approves national R&D programs, ensures the cooperation between the ministries and enacts legislation.

The main state structures responsible for research and innovation activities in Armenia are the **Ministry of Economic Development and Investments** (MEDI) and the **State Committee of Science** (SCS). The former is in charge of developing and implementing innovation policy and the latter - for national research. The Intellectual Property Agency operates under the Ministry of Economic Development and Investments. The **Ministry of Transport, Communication and Information Technologies** is in charge of designing and implementing ICT industry policy.

State Committee of Science: The government resolution of 2007 established the State Committee of Science. While being within the structure of the Ministry of Education and Science, the SCS was empowered with wide-ranging responsibilities as the leading public agency for the governance of science, including the drafting of legislation, rules and regulations on the organisation and funding of science. It regulates and distributes financing for R&D via basic financing, contractual/thematic funding and targeted programs. Basic funding is the largest financing instrument of the SCS and provides financing for basic and applied research for different sets of institutes according to their capabilities. A portion of basic funding covers also the maintenance costs and upgrade of scientific infrastructures. The Targeted Programs financing is given on competitive basis via the applications provided by the scientific institutions. Grants are provided for specific scientific topics for research. This funding has dropped over the years in relative terms. Overall, SCS is also the lead agency for the development and implementation of research programs in Armenia.

The advisory institutions relevant to ICT innovation are the **Centre for Strategic Initiatives** and **Information Technologies Development Support Council.**

Centre for Strategic Initiatives: Established by the Government of the Republic Armenia and operating as a public-private partnership, it is meant to initiate and accompany the long-term strategic reforms, as well as facilitate the implementation of reforms already in place and going by consolidating and analysing the existing strategies. The ultimate goal of the process is to work to attract long-term and sustainable foreign investments into the country and increase Armenian exports.

The main implementers of the ICT innovation policy are **Enterprise Incubator Foundation, SME Development National Council (SMEDNC).**

An important implementer of the government innovation programs is the EIF. The Enterprise Incubator Foundation (EIF) was founded jointly in 2002 by the government and the World Bank and has since become one of the driving force of Armenia's ICT sector. It acts as a 'one-stop agency' for the ICT sector, dealing with legal and business aspects, educational reform, investment promotion and start-up funding, services and consultancy for ICT companies, talent identification and workforce development. EIF is one of the main actors in ICT sphere and has implemented a variety of projects with international companies such as such as Microsoft, Cisco Systems, Sun Microsystems, Hewlett Packard and Intel. One of the projects is the Microsoft Innovation Centre, which offers training, resources and infrastructure, as well as access to a global expert community. In parallel, the Science and Technology Entrepreneurship Programme helps technical specialists bring innovative products to market and create new ventures, as well as encouraging partnerships with established companies. Each year, EIF organises the Business Partnership Grant Competition and Venture Conference.

The Small and Medium Entrepreneurship Development National Centre is aimed at enhancing SME development and innovation via information services, training and consulting and a range of financial toolset (e.g. credit guarantees for loans).

3.1.3.2 Universities

The National Academy of Science is in place since Soviet times bringing together around 35 research institutes and scientific centres in five main disciplines - Mathematical and Technical Sciences; Physics and Astrophysics; Natural Sciences; Chemistry and Earth Sciences; Armenology and Social Sciences.

Formal education structures play a central role in Armenian innovation structure, as the National Academy of Sciences (NAS) remains the largest research performer. Armenia has a well-established system of tertiary education that encompasses 22 state universities, 37 private universities, 4 universities established under intergovernmental agreements and 9 branches of

foreign universities. Universities in Armenia have a high degree of autonomy in formulating curricula and setting tuition fees. Armenia joined the Bologna Process in 2005 and universities are currently working to align the standards and quality of their qualifications. With only a few exceptions, universities tend to focus almost exclusively on teaching and do not engage in, or encourage, research by staff.[16] Armenia ranks 69th out of 139 countries for higher education and training (WEF, Global Competitiveness Report, 2017-2018). Armenia ranks better for tertiary enrolment (65th out of 139 countries), with 44.3% of the workforce possessing tertiary education (as of 2015). It performs poorly, though, according to extent of staff training (96th out of 139 countries, WEF), primarily due to gaps in availability of training and lifelong development infrastructure and generally low corporate culture of providing staff trainings and development.

Interestingly, the Global Competitiveness Report 2017-2018 further indicates that Armenia rank 33rd on quality of math and science education, however it only ranks 106th when it comes to the quality of management schools. This further creates a divide between researches and companies, as skilled management talent is needed to commercialise the innovations.

3.1.3.3 Companies

Information Technologies is the leading industry in Armenia involved in innovation and is a priority industry as stated by the government. It is driven by young dynamic Armenian enterprises with solid connections with international companies. The industry has attracted certain global brands such as Synopsis, which located considerable part of its R&D functions in Armenia. Most of the foreign owned firms are involved in offshore programming, serving foreign HQs.

A group of successful start-ups have emerged in IT industry that have received global financing and have moved into global IT market such as Picsart that attracted USD 35m capital (including from Sequoia). Large-scale acquisitions in the industry include that by Monitis (acquired by GFI Software in 2011), VMWare (acquired Integrien, ~ USD 100m), Oracle (acquired LiveLook aimed at becoming a regional R&D hub).

Along with the IT industry, *Engineering (Precision Engineering)* industry has been dynamically progressing in last years. The industry is yet sub-scale (about USD 25m by 2015) compared to the IT industry, yet the presence and successful operations of global firms such as National Instruments and IBM state an important role in shaping a headway. This is accompanied with the state development strategy for the industry (part of the Export-led Industrial Strategy of the RA) aimed towards attraction of production and R&D units of MNCs positioning Armenia as a R&D centre.

[16] http://unesdoc.unesco.org/images/0023/002354/235406e.pdf

Unfortunately, private sector in Armenia is not an active participant in performing innovation. The majority of the corporate sector (with few exceptions such as a segment of the IT industry) carries out very little R&D activities. Most corporate R&D is channelled towards adapting imported machinery and equipment and to a lesser degree product development and commercialisation of novel scientific or engineering ideas. Global Competitiveness Report 2017-2018 ranks Armenia 71st out of 137 countries on company spending on R&D and 88th on university-industry collaboration, lagging behind peer countries. [17]

ICT sector in Armenia, in 2015 generated around 5% of GDP, having a 20% annual growth from 2010 to 2015, on average. Currently Armenia has more than 580 ICT companies, most of which are SMEs having a revenue up to 1 million in EUR and generating an average annual growth of 10%. The number of companies has been steadily growing, further accelerated in 2014, after the introduction of tax relief regulation targeted at technological start-ups. Most of the revenues - 54%, have been generated by companies with revenues of more than 1 million in EUR. However, the share of the smaller firms has been growing, recording an increase from 35% to 46% from 2014 to 2015[18].

Foreign enterprises comprise 35% of all of the companies. Foreign enterprises conduct 22% of total R&D in ICT sector. There are certain distinctive features of foreign enterprises. They have 50% higher labour productivity, pay higher salaries, are larger in size, and make up three quarters of all ICT exports.[19] These facts lead to a conclusion that foreign enterprises in Armenia operate more efficiently and are able to produce higher quality products competitive on a global market. This is accounted by efficient management structures, knowhow and ease of access to international markets.

3.1.3.4 Clusters

In recent years, innovation support infrastructure in the form of free economic zone, technoparks, innovation centres, educational labs and other enabling platforms have emerged.

ICT clusters in Armenia are yet to be developed. Contributed by EIF, and realisation of Armenian ICT strategy, ICT clusters developed in recent years. Amongst the main IT and ICT clusters are: IBM Innovative Solutions and Technologies Centre (ISTC) and Gyumri and Vanadzor Technology Centres (GTC and VTC). In 2011, Microsoft Innovation Centre was launched by the combined efforts of the Government of RA, USAID, Microsoft Corporation and Enterprise Incubator Foundation to enhance the small and medium IT firms and start-ups to build up technological

[17] http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf

[18] http://www.eif.am/files/1958/Armenian-IT-Industry-Report-/2015-ICT-Industry-Report_eng.pdf

[19] http://www.eif.am/files/1958/Armenian-IT-Industry-Report-/2015-ICT-Industry-Report_eng.pdf

competencies. In 2013, the pioneer Regional Nokia Mobile Application Laboratory for Eastern Europe, South Caucasus, and Central Asia was founded in Armenia. It is targeted at integrating education, research and the business in IT industry. The goal is to strengthen the competitiveness of local and regional mobile solutions in global markets.

Armenian National Engineering Laboratories (ANEL) was created at the National Polytechnic University of Armenia, in 2013. About 30 educational and research labs facilitate enhancing the engineering education and research to international standards. The project of USD 6.2m was conducted via public-private partnership in the form of cooperation with the RA Government, USAID, technology MNC National Instruments and the National Polytechnic University of Armenia.

Sun Microsystems Development and Testing Laboratory was founded jointly by Sun Microsystems Inc., USAID and the EIF. It targets the development of the skillset of university graduates and the formation and development of advanced R&D, testing, integration and educational infrastructure in Armenia.

The ICT Armenian-Indian Centre for Excellence was founded in 2011 as a joint initiative by the Armenian and Indian Governments. It provides targeted infrastructure and high-performance facility for implementing ICT training and R&D programs. These targets generating new opportunities for the development of the skillset of local ICT human resources.

ISTC. ISTC is a solid example of PPP in ICT innovation, being a joint project by IBM, the Government of the RA, Enterprise Incubator Foundation and USAID. The Government of the RA, IBM and USAID are resource partners and EIF is an implementation partner. The aim of the institution is to develop educational capacity of Armenian HEIs in IT/High-Tech, to enhance their research potential, as well as creating a favourable environment for business formation. The ISTC is located at the Yerevan State University. However, all the resources are available for the faculty members and students of all Armenian universities and the private sector.

ISTC focuses on two main activities:

- *Enhancement of IT Education and R&D*, which includes upgrade of curricula of Armenian HEIs, collaboration between local and US tech universities and R&D promotion and commercialisation.
- *Business Aggregator*, which incorporates supporting technical and managerial workforce to form viable teams by providing mentorship and access to financing, development and provision of customised software solutions for SMEs and promotion of local technology products in global markets.
- Armenia is the first country in the region that introduced IBM Watson technologies in academic studies and for the promotion of start-up acceleration.

Synopsys has invested in microelectronic education and has launched a set of successful academic programmes at major universities (National Polytechnic University of Armenia, Yerevan State University, Russian-Armenian Slavonic University, European Regional Academy).

Also Oracle R&D CJSC was established in Yerevan.

Gyumri technology centre. GTC (in Shirak region) has been established by the Enterprise Incubator Foundation, the RA Government and the World Bank. The goals of the Centre include development of technical and business skills, promotion of technological entrepreneurship, commercialisation of innovative research undertakings, creation of new technology companies, attracting of foreign investment and others. The mission of the Centre is to turn the city of Gyumri into a regional and international centre of information and high technologies through creating an enabling environment of opportunities and services that would promote job creation, will support talented youth and provide incentives for innovative business ideas and companies ultimately contributing to the sustainable growth of the region. The centre provides the following services: office space and technical equipment, research labs, consulting, incubation services for existing enterprises and start-ups, trainings in collaboration with the local HEIs, matchmaking and grants.

Also, Vanadzor Technology Centre (in Lori region) was established. On the technological map of Armenia, both technoparks have a stance, as regional technological hubs targeted to support regional economic development. In Yerevan, the Viasphere Technopark and IT Business Park operate as private technoparks, providing infrastructure and respective services to start-ups and international ICT enterprises.

A free economic zone in two locations in Yerevan is in place aimed at production and export in knowledge-driven industries such as of precision engineering, electronics, information technologies, alternative energy, pharmaceuticals and biotechnology, industrial design and telecommunication.

3.1.4 Services of the stakeholders

The basic services provided by the main stakeholders of the R&I system are summarised below. An important feature of the Armenian stakeholders is their diversity and the prevalence of private sector. Public sector agencies and institutions are quite few, while the majority of institutions are either PPP or fully private organisations. Furthermore, because of a great variety of partners for PPP (World Bank, EBRD, USAID etc.) and of private organisations there are number of foundations and agencies which duplicate efforts.

Table 3.1.1. Basic services provided by the main stakeholders

Type of service*	Access to research and	Advice and	Financial instrument	Financial instruments	Networks /

	infrastructure	consulting	s for research	for business development	Collabo-ration
R&I stakeholders					
State Committee of Science			+		
Granatus Ventures		+		+	
Hive Ventures		+		+	
ANEL	+	+	+		+
National Academy of Sciences	+	+	+		+
Foundation for Armenian Science and Technology			+		+
Enterprise Incubator Foundation	+	+	+	+	+
Luys Foundation			+		+
R&I stakeholders with a strategic focus on ICT					
Gyumri/ Vanadzor Technology Centres	+	+			+
Microsoft Innovation Centre	+	+			+
Innovative Solutions and Technologies centre	+	+	+		+
Smartgate		+		+	
Union of IT Enterprises					+
SMEDNC		+			+
Armenian start-up Academy		+			+

***For a more detailed description of each service, see Appendix**

3.1.5 Strategies

The importance of research and innovation is defined through a set of strategic documents.

The Concept Paper on the Initial Strategy for Formation of the Innovation Economy (2011) defines strategic development horizons by 2020. In the medium-term (by 2017), priorities involve the development of international standards in the industry and engineering education, progress of systemic national science and technology structures, development of novel innovative enterprises and upgrade of current businesses. Long-term objectives (by 2020) include founding an internationally competitive engineering university and national science labs, turning to a main location for conducting R&D, and enhancing the internationalisation of Armenian technological enterprises. So far, the most successful policies have fallen under this strategy, where a large amount of initiatives where undertaken. The projects include creation of Microsoft Innovation Centre, Granatus Ventures capital fund, Innovative Technologies Centre, introduction of tax relief for small-scale tech start-ups. The latter privilege provided by the legislation has led to increased creation of new start-ups.

The Strategy on the Development of Science in Armenia 2011-2020 features the following vision: "By 2020 Armenia is a country with a knowledge-based economy and is competitive within the European research area with its level of fundamental and applied research". The chief goals of the strategy are the development of a system upholding sustainable growth in science and technology; enhancement of science infrastructure and development of scientific potential; strengthening fundamental and applied research; development of a synergistic ecosystem of education, science and innovation. The strategy was coupled by Action Plan on Development of Science, which included retaining talented researchers, developing international cooperation and improvement of science and innovation conditions. Within the framework of Strategy on the Development of Science, Law on National Academy of Sciences was adopted that augments the proportion of competitive funding for NAS and calls for reforms in the governance structure.

Armenia Development Strategy 2014-2025 – the main state policy document as of now - defines Armenia's long-term goal to transform to knowledge-intensive economy, driven by innovation and production of high-value goods and services.

In 2011, Export-led Industrial Strategy was introduced which has innovation as one of its main platforms. The strategy is targeted at transforming Armenia's export pattern from resource-based industries to skills- and eventually to knowledge-based industries.

In 2008 a 10-year Strategy on Development of Information Technologies Sector was adopted by the Government of RA.

Currently the Digital Transformation Agenda of Armenia 2018-2030 is under discussion with relevant stakeholders. A new Armenian innovation strategy with a roadmap is under development based on international best practices, it is planned to be approved in 2018.

Table 3.1.2 Armenian Innovation Strategies

Strategies	
Innovation Strategy 2011-2020	Innovation strategy 2011-2020 was one of the most influential strategies approved by the government. The strategy involved developing private public partnerships, e-society, ICT technoparks, free economic zones, and building capacity of local research institutes.
Strategy on Development of Science 2011-2020	The strategy was approved by government in 2010. The goal of strategy is to make Armenia a knowledge based economy and competitive within **European Research Area.**
SME Development Strategy 2016-2018	Approved on 2015, SME development strategy is a general strategy on the improvement of the SME climate in Armenia. The strategy has the following pillars: 1) Development of SME boosting ecosystem; 2) Access to finance for SMEs; 3) Development of Entrepreneurship culture; 3) SME competitiveness development; 4) Public-Private Dialogue improvement; 5). Strengthening SME support institutions; 6) Support of female entrepreneurs.
Science and Technology Development Priorities 2015-2019	The priorities were approved by the government in 2014. Priorities include: 1) Armenology, 2) Life sciences, 3) Secure and efficient energy, 4) **Key enabling technologies including ICT,** 5) Basic researches for key problems of scientific and socio-economic development.
Digital Transformation Agenda (in progress)	The Centre for Strategic Initiatives with the support of the EU is in charge of developing the agenda. The Digital Transformation Agenda of Armenia is expected to be finalised and approved in2018. The strategy will have the following cornerstones: e-government, private sector digitisation, institutional framework, cyber security, e-skills.
Innovation Development Strategy and Roadmap (in progress)	Funded by EU – GIZ SMEDA project, the Ministry of Economic Development and Investments of RA is in charge of developing the strategy and presenting it to the Government, it is planned to be approved in 2018
ICT Development Strategy (in progress)	It is under development by the Ministry of Transport, Communication and Information Technologies of RA. and planned to be approved in 2018

3.1.6 Policies

Dedicated policy framework for research and innovation is in place. To address the approved strategies, a number of policies directed at promoting research, innovation and ICT have been developed.

The Law on Scientific and Technological Activity (2000) coordinates the interaction of scientific and technical entities, public bodies, their relations and usage of scientific outputs. The Law on State Support for Innovation Activity (2006) provides the base for innovation policy implementation and the pattern of state assistance to innovation. The main goal is to enhance required economic, legal and organisational preconditions for effective innovation performance. Specific policy goals involve support to the introduction of new technologies within the business, enhancing efficient innovation infrastructure, developing legal framework and financing structures for cooperation between the industry, scientific research institutes and HEIs. The Strategy on Protection of Intellectual Property Rights was introduced in 2011.

Table 3.1.3. Relevant research, innovation and ICT policies in Armenia

Policies	
Action Plan on Development of Science 2011-2015	The Action Plan had the following points: • Improving the science and technology management system and ensuring adequate conditions for the sustainable development • Measures on increasing the number of young and talented specialist involved in research, education and technological development, upgrading of research infrastructure • Creating adequate conditions for the development of integrated science, technology and innovation system • Developing international cooperation
Actions under Innovation Strategy 2011-2020	Innovation Strategy 2011-2020 produced a number of policies, and initiatives. Among the most important are: Development of Armenian National Engineering Laboratories, Vanadzor and Gyumri Technology Centres, Innovation Matching Grants, Microsoft Innovation Centre, and establishment of free economic zone targeting knowledge-intensive production and research and high technologies. Policies were largely financed by the World Bank and EU.
Law on State Support to Information	The law defines tax privileges for newly established start-ups that have less than 30 employees to have a tax relief. The relief includes a 0% profit

Technology Sphere (2014)	tax rate and 10% income tax rate. Since 2015 more than 439 start-ups and 1867 jobs were created.
Law on National Academy of Sciences (2011)	In accordance with the law, National Academy of Sciences is defined as the highest self-governing scientific organisation and as having a special status. It is directly subordinated to the Government, and the President of the Academy participates in government sessions. The Academy's basic funding is specified in a separate line of the state budget. However, for the remaining share of public funding received (thematic, target, etc.), NAS has to participate in the competitive calls organised by the State Committee of Science, alongside other Armenian research institutes. The law allows the academy to carry out wider business activities concerning the commercialisation of R&D results and the creation of spin-offs; it also makes provision for restructuring the National Academy of Sciences by combining institutes involved in closely related research areas into a single body.

3.1.7 Public Private Partnerships (PPP)

A notable feature for Armenia is the relatively large number of PPP in ICT innovation and development sector. EIF is responsible for a large part of the PPP carried out in the ICT sector. Most of the PPPs in Armenia involve participation of an international development bank or agency, some participation of Armenian government, and a large multinational corporation. As of current, some of the most notable PPP are: the establishment of EIF and the Armenian National Engineering Laboratories, establishment of an Interdepartmental Chair on Microelectronic Circuits and Systems by Synopsys with the State Engineering University of Armenia.

3.1.8 Public funding

Armenia provides various types of public funding for research. Armenia is one of the few countries that uses indirect funding for innovative companies, providing tax relief for information technologies (IT) start-ups which have below 30 employees. Furthermore, through SMEDNC innovative Armenian SMEs are able to get loan guarantees. Direct funding in Armenia is directed to both the businesses and academia. The most innovative and successful SMEs receive innovation matching grants from Enterprise Incubator Foundation and the Armenian Government.

Academia is supported by public funds, with a large participation of EU and external funding. Through the FP7 program Armenia has received around 4 million EUR. Armenia has joined the Horizon 2020 in 2016.

Armenia has a low spending on innovation. Even though GERD has been gradually increasing, it is still low in Armenia, representing 0.3% of GDP in 2015.[20] This is only around one-third of the ratios observed in Belarus and Ukraine. The share of R&D funding from the state budget has increased since the 2008–2009 financial crisis and accounted for 84% of GERD in 2015. In parallel, the number of researchers in the public sector has dropped by 27% since 2008, to 3 870 in 2013. Basic general funding remains the key source of funding accounting for more than 73% of the total funding. In 2016 thematic funding of specific research areas accounted for 13% of the total government state budget. [21]

A Pilot Survey on Innovation Activity of Legal Entities and Entrepreneurs[22] conducted in Armenia published in 2017 found that around 10 % of enterprises reported to be implementing or have been implementing innovation related activities.

A crucial peculiarity of the conceptual framework of Armenia's industrial and innovation policy – also systematically translated into policy implementation measures – is the focus on attracting external funding from both official donors and private sources for co-financing. With few exceptions, the majority of instruments and programs in place rely, some almost exclusively, on external funding. Initially, this was mainly driven by a lack of domestic funding for innovation policy. There were also benefits, with private or external co-financing an indicator of policy relevance to the private sector, and donors bringing expertise. However, such a policy orientation also carries risks in long term sustainability.

3.1.9 Private funding

Private sector funding of R&D in Armenia interestingly is as active as government funding. Obtaining figures for business expenditure on R&D is hardly possible for Armenia, even UNESCO Institute of Statistics allocated 24% of GERD to unknown sources and only 2% to sources from abroad in 2015[23]. However, expert analysis suggests that most of the business expenditure on R&D is done by foreign companies. Domestic ICT companies, with a few exceptions, in Armenia are still small to be able to fund R&D projects.

Most important developments in private funding of innovation are: investment funds and private development foundations. Innovative SMEs in Armenia can currently apply to 2 Armenian venture capital funds: Granatus Ventures and Smartgate. Granatus ventures was established in 2013, with the help of the Government of RA and private investors. The government owns 50%stake in

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[20] http://uis.unesco.org/en/country/am?theme=science-technology-and-innovation

[21] http://evconsulting.com/sites/default/files/attachments/pdf/National%20Competitiveness%20Report%20of%20Armenia%202017_eng.pdf

[22] http://armstat.am/file/article/rep_inov_2017_eng.pdf

[23] http://uis.unesco.org/

the fund. The fund focuses on later stage companies. Smartgate is a fully private fund which focuses on smaller scale companies, providing up to 85 000 EUR financing.

An interesting feature, of Armenian ICT ecosystem is the presence of private development and innovation facilitating funds, which are comparable in size to public funds. Two most innovative schools, Dilijan UWC and AYB school, were fully financed by private investors, mostly by diaspora Armenians. Furthermore, Tumo centre, which is a school of applied knowledge, is also private funded. Alumni of Tumo have recently won the global robotics Olympiad, which indicates that the school is efficiently functioning. Interestingly, Armenia, has no public development bank, but has a private development foundation. IDeA Foundation, is fully financed by an Armenian diaspora billionaire, Ruben Vardanyan. The foundation sponsored the creation of Dilijan World College and invests in Armenia's infrastructure. Through Foundation for Armenian Science and Technology it funds Armenian science projects.

3.1.10 Performance

When comparing Armenian Innovation system globally, Armenia is on an equal footing with other Eastern Partnership countries. Armenia has relatively high market sophistication, has a strong science base and is already populated by a number of international companies. Those results stem from strong foundation of science since the Soviet Union, and an entrepreneurship culture. Furthermore, because of its diaspora, Armenia has developed strong international ties with the US and the EU. According to INSEAD global innovation index, Armenia is ranked 59th out of 127 countries.

- **Relative strengths** of the innovation system are in: 1) innovation output: number of citable researches, exports of ICT services, patents, scientific and technical articles. 2) market sophistication: large number of VC deals, microfinance loans, loan guarantees etc. 3) strong science base: Armenia has relatively high tertiary education rate, around 44% of the workforce possessing tertiary education; 4) presence of international companies and good international connections.
- **Relative weaknesses** are in: 1) poor linkages between research institutions and businesses; 2) lack of coordination between governmental, semi-governmental and private bodies; 3) the absence of digitisation strategy; 4) lack of business knowledge and business intermediaries.

3.1.11 Challenges

Main research and innovation policy challenges are:

- **Weak linkages between researchers and business.** Linkages between researchers and businesses are undeveloped. Research is mostly conducted in research labs and via

research institutes where it is hardly commercialised. Recent initiatives on bringing private sector such as ISTC and Gyumri and Vanadzor technology centres are only partially resolving the problem as the key issue is the gap between academia and business world.

- **Lack of business support organisations.** Armenia lacks properly functioning business support organisations such as: entrepreneurship development organisation, digitisation organisations. In 2017 the Government of RA established a 'Digital Armenia' foundation that will be in charge of Armenia's digital agenda implementation, particularly, elaboration of a new digital strategy, formation of a united digital environment in all the spheres of state government, modernisation of government systems to provide better services to citizens and businesses. SME development national council according to the national experts surveyed is essentially not part of ICT innovation in Armenia. Business support organisations are critical for Armenia, as Armenian companies are rich with engineering and scientific talent, however severely lack business skills and experience. At the same time, successful scale up of start-ups is essentially impossible without proper business knowledge. Development Foundation of Armenia (Business Armenia), Business Support Office and Small and Medium Entrepreneurship Development National Centre (SMEDNC) actively work in this field in Armenia. However, the lack of high quality business support services for innovative companies still prevails. It precludes Armenian innovative companies from getting quality advise and impedes the process of successful innovation commercialisation. .
- **Lack of early stage financing.** Early stage Armenian companies do not have a lot of means for early stage financing. Angel network in Armenia is poorly developed, while the venture capital fund focuses on later stage companies. Introduction of innovation matching grants by EIF has helped to address the issue, even though that project is small-scale to bring large changes.
- **Fragmentation.** ICT innovation system in Armenia is highly fragmented. Fragmentation is present in performing the research and funding the research. Currently, there are a number of initiatives from various players. The reason for the fragmentation is the absence of common framework for innovation with clear responsibilities set within the agencies. This leads to duplication of efforts, and inefficient use of resources. Large scale ICT innovation projects (artificial intelligence, big data etc.), a lot of time require vast amount of resources. For example, Armenian stakeholders currently do not have access to high performing supercomputers, which restricts the ability to perform ICT innovation. Creation of large scale ICT innovation research centres, would have helped to address that problem. Furthermore, because of the fragmentation dialogue between innovators and the government is yet to be developed. Larger scale institutions would have helped to collect

and aggregate opinions of innovators, helping the government in making more efficient policies.

- External funding. Some of the policy instruments are conducted with the attraction of foreign financing, and some of the business support organisations are created by using external funds.

3.1.12 Gap analysis

When comparing Armenia to Baseline countries, there are a number of notable differences. Armenian ICT innovation ecosystem undergoes rapid changes, and in general Armenia needs to have a new innovation strategy. Higher education and research is not well developed and is detached from business. Business support organisations are to function more efficiently.

The country does not have a common set of research funding mechanisms and a stable innovation ecosystem. Digitisation frameworks are to be developed. Therefore, Armenia lacks coherence in its innovation path. Existing institutions operate to a large extent chaotically, making projects without properly communicating to each other, and without adhering to a common innovation strategy and framework. Therefore, some functions are duplicated, and initiatives are not able to generate expected impact as they are implemented separately. The new innovation development strategy and roadmap aim to address these issues and suggest new approaches to overcome challenges generally existing in innovation sphere.

Another important gap that differentiates Armenia from the baseline countries is lack of its own financing of projects and policies. As of 2016 Armenia spends 0.3% of its GDP on R&D, while baseline countries spend around 2%[24]. In baseline countries, the government has a specific long-term vision, to implement which it creates specific policies and projects, mostly financed by the government itself. Private sector or external participation is used as a support for government's initiatives. Armenia has a number of donor organisations that it receives funding from: EU, EIB, World Bank, USAID, GIZ and many others. Sustainable innovation development can only be achieved, when the already allocated budget would be expanded in order to finance the innovative initiatives as long as needed and use external funding and projects as a support for its long-term vision.

Absence of funding or support provided to venture investors and early stage companies. All of the researched baseline countries have mechanisms to directly and indirectly support investors and early stage companies. For instance, Estonia directly supports venture capital funds by having a public fund of funds, which invests in venture capital firms, thus providing them with additional liquidity to invest. Granatus ventures, is a good example of Government support (50 %

[24] http://uis.unesco.org/en/country/am?theme=science-technology-and-innovation

investment from Armenian government) when creating the first venture fund in Armenia jointly with private investors, that also promote the creation of the 2nd VC in 2017 (SmartGate). Furthermore, all of the baseline countries provide funding to start-ups as well. The funding can take the forms of a loan guarantee or a grant. Armenia currently has a program of innovation matching grants, that currently relies on funding of GIZ and EU4Business and is administered by EIF, STEP program implemented by the Government and EIF, and formally has the loan guarantee scheme administered by SMEDNC. The loan guarantee program is used to a tiny extent by innovative companies.

Armenia lacks middle level institutions. Baseline countries, like Ireland, or Estonia, have multiple business support organisations which promote entrepreneurship and help to commercialise innovations. At the same time Armenia mostly utilises EIF to build yet another PPP project with a private sector co-investment. Entrepreneurship promotion agencies and innovation promotion agencies would have helped the companies to develop and commercialise innovations. Primary function of EIF is not advisory, while SMEDNC has mainly SME development function. Countries with developed innovation systems, researched in the baseline, have separate agencies for entrepreneurship promotion and innovation support. Moreover, public business support organisations not only help businesses to grow and develop but are also key implementers of government's innovation policy. Due to the lack of capacity and middle level institutions, policies are not always successfully integrated. Responsibilities of Armenian business support organisations are not clearly divided, and a number of such organizations is to be expanded. Finally, in baseline countries BSOs are not only implementing public policy but are also counselling the government on policy creation. BSOs are the communication bridge between the government and businesses. Proper functioning BSOs can help the government to address the most important and acute business challenges.

Armenia lacks ICT clusters. Nearly all of the baseline countries have well-developed ICT clusters. In contrast Armenia has very few ICT clusters. Organisations like ANEL are a great start; however, ANEL has no particular focus on ICT but rather on engineering in general. At the same time, technology centres in Gyumri and Vanadzor are in remote locations and are out major ICT innovation centre: Yerevan. According to EIF report, 88% of all ICT companies are located in Yerevan, just like the major universities. Therefore, proper infrastructure has to be continually developed in Yerevan and regions. [25]

Underutilisation of public procurement for innovation. PPI has to be addressed first on legislative level. The upcoming digitisation strategy of Armenia should include the plans to further transform Armenia into an e-society. That can create an opportunity for public procurement for

[25] http://evconsulting.com/sites/default/files/attachments/pdf/National%20Competitiveness%20Report%20of%20Armenia%202017_eng.pdf

innovation. In baseline countries PPI creates additional market for innovation ICT solutions. In a small country like Armenia PPI may be of great importance, to some extent mitigating the problem of the small local market.

Table 3.1.4. Stakeholder analysis

Services	Estonia	France	Germany	Ireland	Sweden	UK	Armenia
Access to infrastructure							
Tech parks	+	+	+	+	+	+	+
University clusters	+	+	+	+	+	+	
Access to supercomputers	+	+	+	+	+	+	
ICT labs	+	+	+	+	+	+	+
Advice and consulting							
Consulting on grants	+	+	+	+	+	+	
Business consulting	+	+	+	+	+	+	+
Training	+	+	+	+	+	+	+
Research funding							
Financing universities	+	+	+	+	+	+	+
Financing PROs	+	+	+	+	+	+	+
Grants for researchers	+	+	+	+	+	+	+

ICT Innovation public procurement	+	+	+	+	+	+	
Business funding							
Tax incentives		+				+	+
Grants	+	+	+	+	+	+	+
Loans	+	+	+	+	+	+	
Guarantees	+	+	+	+	+	+	
Equity	+	+	+	+	+	+	
Funding venture capital funds	+	+	+	+	+	+	
Networks							
Enterprise network	+	+	+	+	+	+	+
start-up network	+	+	+	+	+	+	+
Investor networks	+	+	+	+	+	+	
University network		+	+	+	+	+	
ICT research network		+		+	+		

3.1.13 Roadmaps and Recommendations

To address the gaps and the challenges, Armenia has to develop a coherent long-term innovation strategy, to which it should adhere. Furthermore, the government should play a larger role in the innovation system, supporting the businesses and researchers.

- Creation of a coherent single ICT innovation and digitisation strategy, which will help to combine the capabilities of separate actors.

- Greater focus needs to be assigned to integrating Armenian R&D institutes and businesses into global value and supply chains by further developing co-operation with leading producers as a specialised supplier of components.
- Financing PhD studies in Armenia, providing grants for students.
- More allocation of budgetary resources towards R&D, and innovation to decrease dependency on external financing.
- Develop a more R&D friendly taxation, where the procurement of innovative solutions and/or investment into R&D would be tax deductible.
- Better data collection and statistical base will help to evaluate culture make it difficult to obtain a clear picture of technological capabilities; this poses clear challenges for evidence-based policy making.
- Creation of middle level organisations for entrepreneurship promotion, (e.g. Enterprise Estonia, Enterprise Ireland) and Armenian Innovation agency with clearly defined set of responsibilities.
- Increase the funding of education, and innovation both through direct and competitive funding.
- Further promote internationalisation of higher education institutions, create specific programs to facilitate cooperation and promote Armenian universities overseas. A particular focus should be assigned to business and management schools, as currently they are the most underdeveloped in Armenia.
- R&D institutes could be restructured and aligned to increase the efficiency of resource allocation to R&D, such as by turning some of them into technical institutes supporting knowledge-intensive SMEs. These institutes should rely on a combination of public and commercial funding.

3.2 Azerbaijan

3.2.1 List of Abbreviations

BEEPS V	Business Environment Enterprise Performance Surveys
CIS	The Commonwealth of Independent States
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on Research and Development
ICT	Information and Communications Technology
IMF	International Monetary Fund
R&D	Research and Development
R&I	Research and Innovation
S&T	Science and Technology
SME	Small Medium Enterprise
UN	United Nations

3.2.2 Overview

Azerbaijan is resource rich country and the largest economy of Southern Caucasus. With the main focus on industrial economy and infrastructure, innovation & start-up ecosystem traditionally has not been greatly developed. Therefore, Azerbaijan currently ranks 82nd of 127th in the global innovation index. Furthermore, according to World Bank, expenditure on R&D in Azerbaijan remains lower than in EU and other CIS countries and in 2015 it accounted for 0.22% of GDP. Other factors that inhibit growth of innovation are quality of governance and bureaucracy, limited competition, small market, lack of supportive regulatory regime, low quality of business management, limited access to capital[26], lack of risk capital.

However, current trend of development of ICT and innovations ecosystem is positive in Azerbaijan. ICT sector has been growing at a rate of 25-30% per year in 2005-2012. The main drivers of growth are government policies on liberalisation of the sector, digitalisation of the

[26] Doing Business, 2017.

society, modernisation of the telecom sector. Azerbaijan ranked 8th among 144 countries for "index of progress on governmental support for ICT" and 9th place by "expected place of ICT in prospects of government"[27]. According to the Azerbaijan's national innovation strategy Azerbaijan 2020, ICT sector should become one of the main contributors to non-oil GDP in Azerbaijan. Share of ICT sector in non-oil GDP accounted for 3.3% in 2013 and is expected to account for 9% of total GDP in 2020.

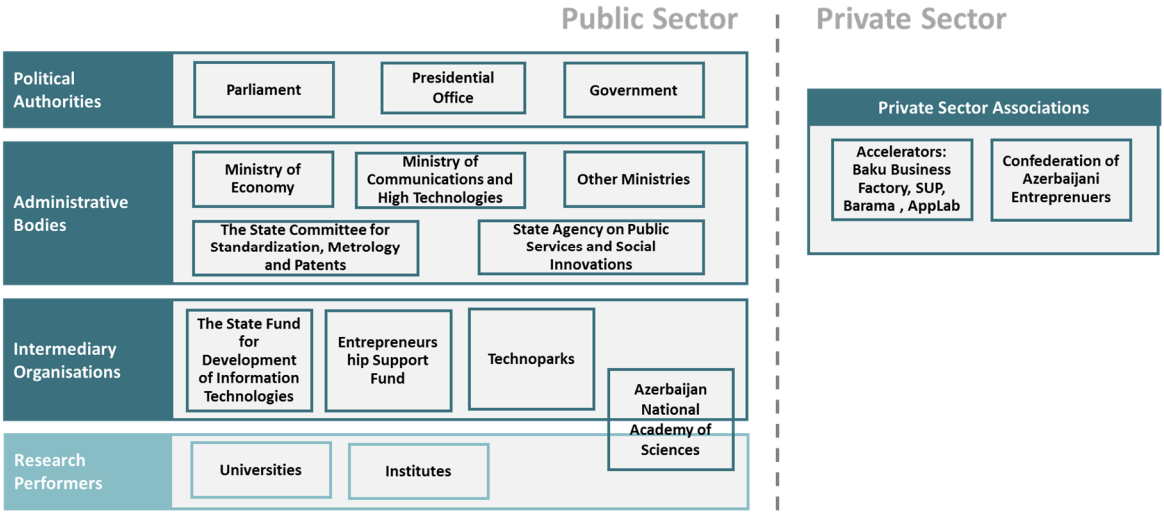
To sustain the trend and achieve the goals, Azerbaijan has to overcome the following challenges:

- Limited access to finance.
- Weak entrepreneurship culture.
- Quality of governance and bureaucracy.
- Weak innovation linkages.

3.2.3 Stakeholders

Innovation and start-up ecosystem binds different stakeholders together through information flows and responsibility sharing. Healthy ecosystem consists of number of players from Public and Private Sector, including institutions at intermediary organisations level. Linkages between political authorities, administrative bodies and research performers are developed and well-functioning. The map of Azerbaijan's innovation system stakeholders is presented below.

Figure 3.2.1. Azerbaijan's innovation system



[27] World Economic Forum, "Global information technologies 2013"

3.2.3.1 Government bodies and agencies

The government of the Republic of Azerbaijan prepares national R&I development plans, submits them to the Parliament, approves national R&D Programs and ensures the cooperation between the ministries and enacts legislation.

- Formulation and implementation of unified state policies in the field of communication and high technologies are carried out by **Ministry of Communications and High Technologies of the Republic of Azerbaijan.** The ministry also conducts state regulations in the field of communications and high technologies, with relevant government bodies implements measures to strengthen the capacity of high technologies sector, to encourage development of a competitive high technologies, knowledge-intensive, low-cost products and services and innovative businesses.
- **The State Fund for Development of Information Technologies**, operates under the Ministry of Communications and High Technologies of the Republic of Azerbaijan. It was established in 2012 and its goal is to stimulate innovation and development in the field of information and communication technology. It also provides financial support for applied scientific research in the field. Financing is provided through investment, low-interest loans, and grants.
- **Ministry of Economy of the Republic of Azerbaijan** takes part in the formation of national innovation and S&T policies and strategies. Ministry is also responsible for creating favourable business environment to support entrepreneurship and creation of innovative economy.
- **Entrepreneurship Support Fund** was established under the Ministry of Economy of the Republic of Azerbaijan with the goal of supporting SME's. It provides financial aid to the development to entrepreneurs, especially SME's, share the expertise to increase exports of SME's and attract other form of financing.
- **The State Agency on Public Services and Social Innovations under the President of the Republic of Azerbaijan (ASAN)** operates as "one-stop-shop" where 10 government entities and about 30 private companies provide services in a public-private partnership. ASAN has an innovation division which works closely with state authorities, academia and international business community to introduce innovative solutions which are mostly within the public services.
- In order to save scientific-technical potential in the country, **Science Development Foundation under the President of the Republic of Azerbaijan** was established. Main objectives of the foundation are to enlarge scientific information and innovation reserves of the state, to prompt productivity of conducted researches, to represent Azerbaijan in

world scientific arena, to learn and implement foreign practice and build collaboration with non-governmental and other institutions.

- **Azerbaijan National Academy of Sciences (ANAS)** is the main state research organisation and the primary body that conducts research in the fields of science and social sciences in Azerbaijan. ANAS coordinates the scientific research in all state research and educational centres. It is a supreme public body implementing science and technology policy in the country (there is no other public body with functional responsibilities on science and technology).
- **The State Committee for Standardisation, Metrology and Patents** is the body that implements public policy and regulation in standardisation, metrology and quality control. It is also responsible for the protection of industrial property rights. Its functions are directly related and affect country's environment for innovation activity.

3.2.3.2 Universities

Expenditure on R&D in universities is relatively low in Azerbaijan and accounted for 8,6% (from all R&D expenditure in the country) in 2015 while in baseline countries it varied from 17% in Germany to 41% in Estonia[28]. However, the share of R&D investments is gradually growing as in 2011 it was 4.3%. It is believed that because majority of science, technology and innovation are concentrated in ANAS, universities have failed to develop strong R&D links with business enterprise sector. Most of universities in Azerbaijan are public as expansion of private universities is constrained by national legislation[29].

Several universities in Azerbaijan have established Fab Labs and incubators, such as the Social Innovations Lab at the Baku Engineering University, Next Step Innovation Centre in Azerbaijan Oil and Industry University and the Innovative Business Incubator at the Architecture and Construction University where students can work and develop their ideas. However, current higher education system does not fully meet the requirements of employees in ICT sector[30]. Many experienced education professionals have left the country after 1990s and now there is a shortage of specialists qualified in ICT, business management and entrepreneurship. Curricula in universities is quite outdated and theory based, yet serious efforts have been taken seeking to modernise the higher education in the country through provision of financial and governance autonomy to several universities.

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[28] http://uis.unesco.org

[29] Unesco Science Report, 2015.

[30] "IT Sector and IT skills in Azerbaijan: Challenges and Opportunities", World Bank 2016.

3.2.3.3 Companies

The role of SME's in Azerbaijan is very limited. According to IMF, in 2012 SME's had a small share of GDP – less than 10%, while in other Central Asian countries it is already around 30-45% and EU average is around 50%[31].

Private sector receives very limited support for R&D. According to UNESCO, business enterprises accounted only for 5% of GERD by sector performance in 2015. It has been gradually falling since 2008 when it was 23%. However, private support for R&D increases and in 2015 it accounted for 32% of total expenditure (in comparison, in 2010 it was 9,6%). Moreover, collaboration among industry and research experts is almost non-existent. Even high-growth firms perform very little R&D activities. However, such situation is slowly changing. Two biggest telecom operators Azercell and Bakcell, which are partially owned by the state, have established their start-up labs where selected and most promising students develop apps and gadgets.

Overall development of the country's ICT industry has been generated mostly by the telecom industry, especially its mobile segment. However, ICT sector remains dominated by two state-owned enterprises. Therefore, one of the main industry goals is to encourage private investments in ICT which would ensure healthy competition and sustainable growth.

3.2.3.4 Clusters

The development of clusters in Azerbaijan is at an early stage. In the only clusters in ICT industry are the techparks:

High-Tech Park: it is a Limited Liability Company under the Ministry of Communication and Information Technologies of the Republic of Azerbaijan. Its goals are to stimulate the ICT development in the economy and increase the competitiveness of national technological market, create modern infrastructure for further pursuit of R&D and implementation of new technologies in the country and ICT development based on modern scientific and technological achievements.

BEU (Baku Engineering University) Technopark: Technopark supports young entrepreneurs through different programs. It aims to support growth of sustainable economy including non-oil sector in Azerbaijan, improve relations between businesses and universities, encourage the creation and production of advanced technological products through scientific researches application.

In 2016, development of ANAS High Technology Park was confirmed. The park will provide the necessary infrastructure for developing the results of the scientific research and developments into industrial and commercial applications.

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[31] http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review-2016_en

Industrial clusters are also not yet present. The first industrial cluster in Azerbaijan will appear in Sumgait and Balakhani settlement in 2018. The cluster will be formed around the SOCAR Polymer petrochemical complex in the Sumgait Chemical Industrial Park.

In conclusion, currently Azerbaijan's ecosystem is still at the development stage. Government and administrative bodies are involved in formation of ecosystem and has established number of public agencies to support innovations. The main difference of Azerbaijan's ecosystem from baseline countries is low number of Intermediary organisations and stakeholders from private sector.

3.2.4 Services of the stakeholders

Azerbaijan has a number of stakeholders of the R&I system, some of which are focused on ICT industry. While some services are provided by many organisations some services lack support. Azerbaijan has limited number of stakeholders supporting innovative start-ups and SMEs. The basic services provided by the main stakeholders of the R&I system are summarised below.

Table 3.2.1. Basic services provided by the main stakeholders in Azerbaijan

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks/ Collaboration
R&I stakeholders					
Entrepreneurship Support Fund				+	
Science Development Foundation			+		
Azerbaijan National Academy of Sciences	+				+
Confederation of Azerbaijani Entrepreneurs					+
Azerbaijan Microfinance Association		+			+

UNEC Technology Transfer Centre		+			+
Baku Business Factory		+		+	
SUP		+		+	
Khazar Ventures		+		+	+
Infipro		+		+	+
R&I stakeholders with a strategic focus on ICT					
The State Fund for Development of Information Technologies				+	
Training Innovation Centre		+			+
High Technologies Park of ANAS	+	+			+

For a more detailed description of each service, see Appendix 1

To conclude, many stakeholders in Azerbaijan provide advice and consulting as well as help grants access to networks and helps in establishing collaboration among different stakeholders. However, there are only few stakeholders which provides access to research and infrastructure and provide financial instruments for research.

3.2.5 Strategies

Azerbaijan places a strong focus on national strategies for research, innovation and ICT, and has been ranked as the 8th country according to the index of progress and government support of ICT[32]. The country has four main strategies, which are outlined in the table below. These strategies are directed at the development of an information society and innovative and well-educated competitive labour force, transition to an innovative, knowledge-based economy, and sets digital priorities.

[32] Karimov, R. (2015). Development of Non-Oil Sector in Azerbaijan: Tendencies and Opportunities

Table 3.2.2.: Relevant research, innovation and ICT strategies in Azerbaijan

Strategies	
Azerbaijan 2020: Vision of the Future	The main goal of the strategy is for Azerbaijan to become a developed country with high competitive potential. ICT is one of the pillars of the strategy, setting tasks such as transition to the information society, establishment of knowledge based innovative economy, development of export-oriented IT capacity and human resources, creation of innovation zones and techparks for engineering. In addition, the strategy focuses on entrepreneurship and sets tasks such as stimulating and supporting the production of competitive goods, development of innovative entrepreneurship and creation of conducive environment.
Azerbaijan Strategic Roadmap for National Economy	The strategy outlines Azerbaijan's transition to innovative economic structure from 2025 and onwards, which shall be based on innovative and well-educated competitive labour force. It states that during the innovation driven economic growth phase, investment attractiveness of innovative sectors and initiatives aimed at cluster creation will be supported. The roadmap sets specific tasks, such as supporting access to information communication systems and ICT skills in education and research entities and improving the physical and technological infrastructure that supports human capital development.
National Strategy on Development of Information Society in the Republic of Azerbaijan for 2014-2020	The strategy focuses on the development of an information society by establishing key directions, namely: 1) ICT infrastructure and services; 2) Development of high technologies sector; 3) Strengthening the scientific-technical potential for the development of high technologies; 4) Development of “E-government”; 5) ICT – as a development factor of the society: e-education, e-health, e-citizen; 6) Human Resource Development; 7) Provision of information security; 8) Development of national content.
Strategic Roadmap for Development of the Telecommunication and ICT	This strategic roadmap has the following strategic priorities related to national digital strategy: 1) Creation of the independent Telecom and ICT regulatory entity; 2) Liberalisation of the Telecom Market. In addition, it sets several other priorities: 1) Expansion of digital payments; 2) Increasing knowledge and skills in ICT field; 3) Improvement of ICT systems in state organisations; 4) Improvement of e-services of the state organisations; 5) Creation of integrated real-time e-health infrastructure.

3.2.6 Policies

There is no comprehensive national innovation policy in place in Azerbaijan. Instead, innovation policies are scattered across a number of state programmes and policy documents, which are

outlined in the previous section. Despite this, Azerbaijan has introduced a number of initiatives to boost innovative entrepreneurship, most of them focused on the ICT sector. The most relevant ones are provided in the table below.

Table 3.2.3. Relevant research, innovation and ICT policies

Policies	
The State Program for 2016-2020 for the execution of the National Strategy for Development of the Information Society	This state program is developed for execution of the National Strategy. The envisaged actions are directly related to innovation and ICT development, for example, the development of ICT infrastructure, the expansion of the country's transit information corridor potential to ensure high-speed internet connection, strengthening scientific-technological potential and expansion of scientific research, etc.
Development of public e-services	An e-government portal was created in 2012 and currently offers 463 e-services, including filling of tax reports, company registration, business licencing. This portal offers an example of best practice for the region and beyond. In addition, the country has a smart-card based electronic signature for public institutions, legal entities and physical persons, and efficient property registration system.
Establishment of State Fund for Development of Information Technologies (ICT Fund)	The fund was established in 2012 and it is financed entirely from the state budget. The fund supports innovative ICT projects by: 1) Contributing concessional loans through authorised banks; 2) Providing equity and venture capital for the development of new projects, technologies, software, equipment and commercialising innovations; 3) Awarding grants for the development of software products, innovative infrastructure projects, and development of e-services.
Establishment of ICT technology parks	Two ICT technology parks one in Pirallahi Islands and one in Minheschevir are established under the High Technology Park. The parks provide tax benefits to hosting companies, including start-up projects that are receiving grants from the ICT fund.
Establishment of Innovation Centre	The Centre has been established to enable social innovation in Azerbaijan, and to work closely with state authorities, academia and international business community in order to introduce innovative solutions within the public services and beyond. The centre works with other public institutions in Azerbaijan providing innovative solutions within the sphere of ICT and public service.

Despite the above progress, innovation activities would benefit from more emphasis on technology transfer, commercialisation of innovations, and closer innovation networks, including research institutes.

3.2.6.1 Public-private partnerships (PPP)

Despite the government support, there is no general policy framework for improving the legal environment and promoting PPPs. Azerbaijan does not have a separate concessions law, which makes it one of a few EBRD countries without a designated piece of legislation regulating concessions.

Although the lack of robust legal framework slows down the process, some positive elements for future development of PPPs are noticeable. In 2010, Azerbaijan's President approved the "Republic State Investment Programme formation, implementation, monitoring and evaluation", which incorporates a regulatory framework for infrastructure development.

3.2.6.2 Public procurement on innovation (PPI) and pre-commercial procurement (PCP)

The Law on Public Procurement sets the basis for procurement, rules of tenders and other methods of public procurement, and selection of contractor and complaints procedures. Sector-specific laws do not appear to regulate concessions.

New amendments to the legislation create the necessary regulatory conditions for the full introduction of an electronic procurement system. The Public Procurement Agency runs a helpdesk for SMEs and provides regular training in Baku and the provinces, although these do not focus specifically on SMEs.

While the possibility of cutting tenders into lots is not stated in the legislation, it is common practice in the majority procurement procedures. Contracting authorities may allow companies to submit joint bids. It could not be verified whether there is a law governing late payments to contractors or legal provisions to ensure proportionate qualification levels and financial requirements for SMEs. There are no provisions governing late payments to contractors, and discounts for local material and workforce, if applied in practice, do not allow best value for money, which could lead to increased public spending and reduced competition.

3.2.6.3 Public funding

The share of government sector investments into R&D as a percentage of GDP has remained stable during 2006-2015, being fixed at 0.2%. Nevertheless, even though government funding as a share of total funding has decreased slightly during 2006-2015 (from 79.7% to 65.7%), it still remains the major source of GERD funds. Most of GERD (86.1%) is used by the government itself, while the second largest sector is higher education (8.6%).

The government's main financial support mechanism for research, development and innovation for the private sector is provided by three main bodies:

- The Science Development Foundation provides targeted funding through grants for the fundamental, applied and research innovation programs and projects, and other scientific events. The funding is targeted at micro and small companies for research.
- The State Fund for Development of Information Technologies makes equity investments, debt investments through concessional lending and grants for start-up projects or competitions. The fund finances ICT project development and commercialisation for SMEs.
- National Fund for Entrepreneurship Support provides concessional lending for SMEs for development and commercialisation of their products.

In addition, the state provides tax incentives for R&D and innovation investments. Scientific research and development activities of firms are deductible from the revenue and firms which receive investment promotion certificate are exempt from custom duties and VAT taxes and get 50% concessions on their income taxes. The state also promotes R&D investments through the techparks and special zones, since the resident firms are exempt from taxes for the duration of 7 years, while the managing partners of these zones are exempted from most of the taxes.

3.2.6.4 Private funding

Azerbaijan lacks private supporting institutions for venture capital such as incubators or angel investor networks. In the absence of such private sector organisations, the government has taken the leading role in trying to spur the development of private equity and venture capital. Currently, the business sector is the second largest funder of investment. Business enterprises contributed to 32.2% of GERD by source of funds in 2015, growing modestly from 18.2% in 2006.

The European Investment Bank has granted a EUR 20 million in senior loan to AccessBank in 2017 to finance projects promoted by SMEs in Azerbaijan[33]. However, the use of loans among SMEs remains low regardless of sector and size, with 93% of BEEPS V firms relying on internal funds for working capital, which is the highest ratio in Eastern partnership region. In fact, micro-finance institutions continue to be an important source for SMEs and their reach is growing. The use of other financial instruments, such as leasing, and factoring appears to be limited (2%-4% of SMEs). The cost of finance remains significantly higher than the EU benchmark and can be excruciating burden for many SMEs in expanding their business.

[33] http://www.accessbank.az/en/page/bank_history/

3.2.7 Performance

Azerbaijan ranked as 47th (in 2008 Azerbaijan was only 89th) in UN e-government index in 2016. Index is based on the e-government survey which identifies patterns in e-government development and performance as well as countries and areas where the potential of ICT and e-government has not yet been fully exploited and where capacity development support might be helpful.[34] According to INSEAD global innovation index, Azerbaijan is 82nd out of 127 countries in 2017 and improved a lot since 2013 when was ranked as 105 out of 142. According to the reports, *t*hese are the relative strengths and weaknesses of Azerbaijan:

- **Relative strengths** of the innovation system are: 1) Business environment (ease of starting a business; ease of resolving insolvency; ease of paying taxes); 2) Information and communication technologies (ICTs) (ICT access; ICT use; government's online service; online e-participation); 3) Ecological sustainability (GDP per unit of energy use; environmental performance); 4) Online creativity (generic top-level domains (gTLDs); country-code top-level domains (ccTLDs); Wikipedia yearly edits).[35]

- **Relative weaknesses** are: 1) Innovation linkages (University/industry research collaboration, state of cluster development, GERD financed by abroad, joint venture/strategic alliance deals, patent families filed in at least two offices); 2) Knowledge impact (growth rate of GDP per person engaged, new business density, total computer software spending, ISO 9001 quality certificates, high-tech and medium high-tech output); 3) Knowledge absorption (Intellectual property payments; high-tech imports; ICT services imports; foreign direct investment, net inflows); 4) Regulatory environment (regulatory quality; rule of law; cost of redundancy dismissal). [6]

3.2.8 Challenges

Main research and innovation policy challenges are:

- **Lack of tax incentives.** Currently there are 2 tax credits supporting R&D activities in Azerbaijan and they are mostly benefiting large industrial enterprises and technology parks. There are no tax credits or reliefs supporting start-ups in Azerbaijan. Cost of licensing and patents are high and there are no incentives helping start-ups to reduce or partially cover this cost.

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[34] UNDESA, 2005.

[35] https://www.globalinnovationindex.org/

- **Limited access to finance.** It is difficult for private sector in Azerbaijan to get access to capital. That is why 4.7% companies reported financing their working capital through banks while 92.8% financed it through internal funds which was the worst result in the region.[36] This problem remains unsolved due to the lack of legislative support regarding financing.
- **Weak innovation linkages.** Activities of science technology and innovation are executed by one organisation - Azerbaijan National Academy of Sciences. Therefore, universities have not developed strong expertise in R&D. Most of R&D studies are not applied and cannot be commercialised. Private sector is not involved in R&D activities.
- **Human Capital:** The private sector suffers from the shortage of high-quality management with modern management experience or business education. The main backbone of the private sector management does not come with modern education or competition experience. High quality engineers, researchers and managers are in short supply.

3.2.9 Gap analysis

Analysis of ICT innovation and start-up ecosystem has disclosed that Azerbaijan is already working on improving its ecosystem. There are approved policies and strategies which are aimed at promoting the growth of innovations and entrepreneurship in the country. Nevertheless, Azerbaijan is still facing a number of challenges. The main gaps, which slow down the ecosystem's development, in comparison to EU baseline countries were identified:

- **Involvement of private sector**. Neither local nor foreign private companies are keen to invest into R&D activities. Therefore, most of the investments are coming from the state. Due to introduced tax credit which allows companies to deduct R&D investments from revenues, private investments into R&D have been growing in the last years. However, it is still far behind the EU average. Moreover, there is a low number of private organisations and associations, such as business incubators, start-up or sector associations in Azerbaijan's innovation ecosystem which would be involved in policy making or implementation.
- **Limited funding opportunities for businesses.** In Azerbaijan start-ups and SME's are mostly self-funded as it is difficult for private business to get credits with attractive conditions. Interest rates are around 18-20%[37] in comparison to 4-6% in euro area[38]

[36] EBRD, 2014.

[37] http://www.accessbank.az

[38] https://www.euro-area-statistics.org

(depending on the loan size and length). Limited access to capital is especially important for start-ups as they struggle to collect budget for innovation development, licensing, patents and scale-up. Existing funding opportunities are smaller in comparison to EU.

- **Limited funding opportunities for universities**. Universities rely on support from government and income from tuition fees. As analysis indicated, government support for R&D is low in comparison to EU and other CIS countries. Therefore, universities perform little research. Moreover, even though universities understand the need and benefits of establishing innovation labs and business incubators, government support for such activities is limited. Cooperation among universities, research centres and businesses is not very strong either. Therefore, it is difficult for universities to establish and sustain innovation labs and business incubators with current funding.
- **Highly concentrated ecosystem management**. In Azerbaijan, only few governmental bodies are involved in ecosystem management and policy making. Major decision-making power and authority depends on only few bodies: Presidential Office, Ministry of Economy of the Republic of Azerbaijan and Ministry of Communications and High Technologies of the Republic of Azerbaijan with Azerbaijan National Academy of Sciences being the only implementation body. Intermediary organisations mostly provide funds (The State Fund for Development of Information Technologies, Entrepreneurship Support Fund) rather than advisory and coordinating services. Unlike EU countries, Azerbaijan does not have well-functioning innovation agencies which would be responsible for implementing innovation strategies and action plans.
- **Indirect funding.** Azerbaijan has introduced tax incentives to encourage R&D activities and development of techparks. However, these incentives are mostly helping big enterprises instead of creating incentives for start-up support.
- **Start-up culture.** Azerbaijan has underdeveloped start-up-up culture in comparison to baseline countries. Currently, there 2 venture capital funds are operating in Azerbaijan. However, they do not invest in start-ups as they do not have funds or portfolio. Unlike in EU, VC funds do not receive financial support from government. Azerbaijan also lacks well-functioning business incubators and accelerators as current accelerators are supported only by telecom companies.

Table 3.2.4. Stakeholder analysis

Services	Estonia	France	Germany	Ireland	Sweden	UK	Azerbaijan
Access to infrastructure							

Tech parks	+	+	+	+	+	+	+
University clusters	+	+	+	+	+	+	
Access to supercomputers	+	+	+	+	+	+	
ICT labs	+	+	+	+	+	+	+
Advice and consulting							
Consulting on grants	+	+	+	+	+	+	+
Business consulting	+	+	+	+	+	+	+
Training	+	+	+	+	+	+	+
Research funding							
Financing universities	+	+	+	+	+	+	+
Financing PROs	+	+	+	+	+	+	+
Grants for researchers	+	+	+	+	+	+	+
ICT Innovation public procurement	+	+	+	+	+	+	
Business funding							
Tax incentives		+				+	+

Grants	+	+	+	+	+	+	+
Loans	+	+	+	+	+	+	+
Guarantees	+	+	+	+	+	+	
Equity	+	+	+	+	+	+	
Funding venture capital funds	+	+	+	+	+	+	
Networks							
Enterprise network	+	+	+	+	+	+	+
start-up network	+	+	+	+	+	+	
Investor networks	+	+	+	+	+	+	
University network		+	+	+	+	+	+
ICT research network		+		+	+		

Gap analysis revealed that the biggest gaps of Azerbaijan when comparing to EU is low involvement of private business in R&D and start-up support as well as insufficient funding from the state. The main gaps of services provided by stakeholders in Azerbaijan in comparison to EU baseline countries, as presented in Table 4, include lower access to infrastructure, smaller business funding and lesser networks available. Roadmaps and recommendation of how to fill in the gaps are provided in section 1.9.

3.2.10 Roadmaps and Recommendations

In order for Azerbaijan to continue successful development, reduce the gaps and overcome challenges discussed in sections 1.7 and 1.8, these recommendations and roadmaps are proposed:

- Ecosystem management should be less centralised and improved. More advisory bodies, consisting of public and private stakeholders should be established and be involved in

policy making processes. Government should also support creation of industry associations and clusters which in the long term would ensure closer collaboration among private and public sector. Associations should also be involved in policy making and provide their advisory making sure that policies consider the industry needs. Institutions which are assigned for implementing the country's strategies should have different means and be capable of implementing these strategies.

- Azerbaijan should strengthen the partnership between public and private sector by creating schemes, providing funding and support for joint projects. This would tighten the relationship between universities and enterprises ensuring that R&D results can be applied and commercialised.
- Azerbaijan strongly needs to improve business financing. Venture Capital funds and angel investors should be used to provide funding for innovative start-ups. In order for VC and angel investors to be active, venture capital and angel investment legislation should be improved. It should create the exit opportunities for VC investors through IPOs as a way to increase the available national and foreign risk capital for start-ups. VC funds could be partially funded by the government and private investors. The incentives for large corporates to join such funds should be created. Corporates could fund or acquire innovative start-ups to boost the innovation eco-system. Networks with venture capital and start-up eco-systems in the USA and Europe shall be substantially increased to provide more opportunities for local start-ups and funds to connect with their peers in the USA and EU. Active VC and angel investors would provide seed and early stage financing opportunities for start-ups and innovators.
- Azerbaijan should strengthen its entrepreneurial culture. The education on entrepreneurship should start from the secondary school in partnership with universities and business accelerators. University students and teachers should be educated about business processes.
- The quality of business, IT and engineering education shall be substantially modernised and enhanced to generate the necessary and highly-capable human capital to generate innovative ideas, establish and grow start-ups and innovative technologies.
- Universities should be more involved in fostering innovations and start-ups. It is advised for universities to act in line with government's strategies of creating conducive environment for entrepreneurs and set up individual or joint start-up incubators or accelerators to help worthy start-ups in scaling up. Universities should also organise and fund training for start-ups and SME's about innovation and business acceleration, establish business advisory and consulting.
- The cost of financing for SMEs and start-ups should be substantially reduced through increasing the amount and access to affordable financing. This could be done through

providing loans with low interest rates, creating tax incentives or by substantially increasing existing funds such as The Entrepreneurship Development Fund.

- The government needs to develop and adopt new regulatory regime to enhance the regulatory environment and reduce the cost of doing business for start-ups in the country. To this end, the Government may develop and adopt the Innovation Technologies Licensing regulation to allow Fintech and Technology companies to test and refine their business models and technologies in a lightly regulated and low-cost environment.

Some of the challenges and gaps were already identified and addressed by Azerbaijan's government. Country has set the promising strategy and policies which positively affect the development of ICT and start-up ecosystem development, such as establishment of innovation centres and techparks, creation of funds to support innovation development. These initiatives should be developed further to see the greater impact on ICT ecosystem. However, some of the challenges such as highly centralised decision making, dim entrepreneurship culture and lack of regulatory frameworks has not been addressed yet. Therefore, the overall recommendation is to improve and develop ICT and start-up ecosystem on different levels addressing more challenges than it is being addressed now.

3.3 Belarus

3.3.1 List of Abbreviations

BSU	Belarusian State University
EU	European Union
GBAORD	Government budget appropriations or outlays for research and development
GDP	Gross domestic product
GERD	Gross domestic expenditure on research and development
HEI	Higher education institution
HTP	Belarus High Technologies Park
ICT	Information and communications technology
KPI	Key Performance Indicator
R&D	Research and development
R&I	Research and Innovation
SME	Small and medium-sized enterprise

3.3.2 Overview

Historically, Belarus was one of the most technologically advanced republics of the former Soviet Union, when most of the computers and computers' components were being produced in the country. Thanks to the interdisciplinary education system in Belarus, local ICT specialists have deep knowledge in mathematics, engineering, physics and other sciences and can be very creative at solving complex problems.

ICT sector plays a key role in the Belarusian economy. Belarus's ICT sector has avoided falling despite all-encompassing recession in the economy. In 2012-2016, the ICT sector was flat in

contrast to the GDP, which was declining by 7%[39] per annum over the same period. As of 2016, the gross value added of the Belarusian ICT sector amounted to 1.9 billion EUR or 4.5% of Belarus's GDP[40]. This exceeds several traditionally large sectors including "Financial and insurance activities" (4%) and "Hotels, restaurants and catering" (0.8%).

It is crucial to mention that Belarus has already made a considerable progress in terms of ICT and Innovation. During past two years, Belarus has been highly ranked by many international rating agencies. The World Bank placed Belarus 37th out of 189 economies in 2017 Doing Business Report (in comparison with 2011 Belarus rose in the ranking by 54 positions). In its E-Government Survey 2016 on "E-Government in Support of Sustainable Development", the United Nations ranked Belarus 49th among 193 countries. According to this survey, the country was placed into the group with high e-government development index (EGDI). In its "Measuring the Information Society Report 2016[41], the International Telecommunication Union placed Belarus 31st out of 175 countries. This year's results also show that Belarus has the highest ranking among neighbouring countries.

However, Belarus still suffers from underinvestment in R&D, as well as legislation gaps and volatility. In the Insead GLOBAL INNOVATION INDEX[42] Belarus ranks 88th of 127 economies. In 2016, expenditures on the R&D reached only 0.51% of the GDP[43], which is considerably lower than in 2010 (0.67%) and is small comparing with neighbouring countries. In EU, the share of GERD in GDP amounted to 2% in 2016.

3.3.3 Stakeholders

Belarusian stakeholder innovation system is characterised by abundance of state authorities and administrative bodies and relative lack of intermediary organisations.

The key stakeholders of the R&I system are mapped below.

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39 In USD terms

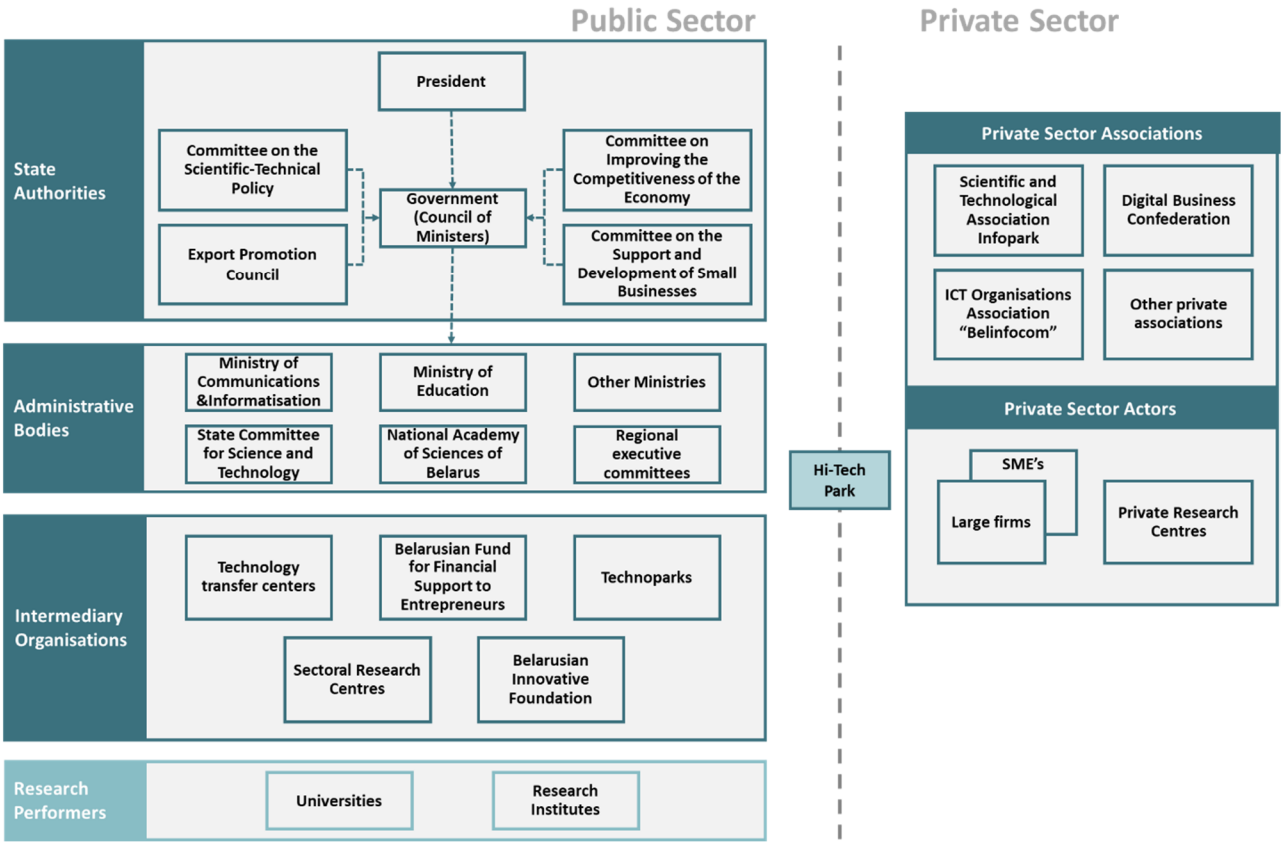
40 According to the Statistical book "INFORMATION SOCIETY IN THE REPUBLIC OF BELARUS" published by the National Statistical Committee of the Republic of Belarus

41 https://www.tu.int/en/ITU-D/Statistics/Documents/publications/misr2016/MISR2016-w4.pdf

42 https://www.globalinnovationindex.org/gii-2017-report

43 http://www.belstat.gov.by/en/ofitsialnaya-statistika/social-sector/science-and-innovation/graficheskii-material-grafiki-diagrammy/domestic-r-d-expenditure/

Figure 3.3.1. Belarusian ICT Innovation System



3.3.3.1 Government bodies and agencies

The National Innovation System of the Republic of Belarus is managed by the President of the Republic of Belarus, the Council of Ministers, republican governments, the state governing bodies, the National Academy of Sciences of Belarus, other state agencies, local governing bodies and self-governing authorities within the limits and in accordance with their powers.

The President of the Republic of Belarus:

- approves priority areas of scientific-technical activities in the Republic of Belarus;
- approves priority areas of innovation policy;
- approves very important innovation projects;
- approves (coordinates) innovation programs;
- decides on the establishment of scientific-practical (production) centres;
- regulates other important issues related to the management of the National Innovation System.

The Council of Ministers:

- approves priority areas of fundamental and applied researches of the Republic of Belarus;
- approves priority areas of creation and development of new and high technologies;
- approves lists of state programs: comprehensive target programs of scientific-technical, fundamental and applied researches; scientific-technical programs;
- ensures the implementation of the state innovation policy.

Administrative bodies (Ministries, the National Academy of Sciences of Belarus, other state organisations):

- develop proposals on the priorities of the state innovation policy involved in the program formation and implementation of various levels and innovation projects;
- act as state customers of the scientific-technical programs and the programs of fundamental and applied researches;
- establish scientific, engineering and design and project organisations;
- monitor the implementation of innovation programs and projects financed by the national budget and the target use of these funds;
- involved in the creation and development of innovation infrastructure.

Scientific-technical programs are developed in the following way. The State Committee on Science and Technology of the Republic of Belarus (SCST) oversees preparing the projects of national scientific-technical programs in cooperation with the National Academy of Sciences of Belarus and introduces drafts to the Council of Ministers. The Council of Ministers approves national scientific-technical programs, while the SCST exercises control over the programs implementation.

Currently, there are no full-fledge private VC funds in Belarus. However, there are several state-owned alternatives such as the Belarusian Fund for Financial Support to Entrepreneurs and Belarusian Innovative Foundation.

3.3.3.2 Universities

Belarus joined the Bologna Process in 2015 and universities are currently working on standards and curriculum alignments.

As for 2017, Belarus' higher education system includes 43 public and 9 private educational, research and governing institutions that use common official standards and regulations in the

process of teaching, assessment and research[44]. Most of the institutions are located in Minsk (29 HEI's).

21 out of 43 higher educational institutions are under the supervision of the Ministry of Education, which is responsible for the accreditation and licensing of higher education institutions and developing and implementation of the educational standards.

Universities play a significant role in Belarusian R&D environment. Their participation in procurement procedures as suppliers of high-tech goods, products and services, expands the scope of commercialisation R&I products in the universities, as well as improves the efficiency of the internal and external markets.

In terms of STEM , Belarus is at the bottom of the rankings with a share of 11.5%[45]. For comparison, in Finland, STEM graduates account for about 21.9% of the all the graduates; Lithuania figure is 18.2%, Estonian one is 13.5%. STEM skills are associated with advanced technical skills, which are strong drivers for technology and knowledge-driven growth and productivity gains in high-tech sectors, including ICT services. The growing digitalisation of occupations and working tasks has a major impact on the demand for skills of STEM professionals.

3.3.3.3 Companies

In Belarus, R&D expenditure in the business sector accounts for 67% of the total R&D expenditure. However, public funding contributes 31.3% to the total R&D investment in the business sector. According to the National Statistical Committee of the Republic of Belarus's indicators calculated according to the Innovation Union Scoreboard methodology, R&D expenditure in the business sector as a percentage of GDP amounted to 0.34% of GDP[46], which is almost four times below the EU average of 1.3%. BERD represents 67% of the total domestic R&D expenditure[47]. One can observe, however, that BERD as share of GDP has decreased since 2012 (0.34% in 2016 vs 0.45% in 2012).

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[44] http://edu.gov.by/sistema-obrazovaniya/vysshee-obrazovanie/index.php

[45] STEM graduates as a share of total graduates; calculated based on the data provided by the National Statistical Committee of the Republic of Belarus

[46] http://www.belstat.gov.by/en/ofitsialnaya-statistika/social-sector/science-and-innovation/osnovnye-pokazateli-za-period-s-__-po-____gody/selected-indicators-for-the-republic-of-belarus-calculated-according-to-the-innovation-union-scoreboard-methodlogy/ (2.1.1.)

[47] 0.51% of GDP

It also worth noting that only one in every five (21.7% of 2016[48]) companies in Belarus have some forms of technological, organisational or marketing innovations.

In the Republic of Belarus, many large companies face the problem of insufficient equipment modernisation. According to government agencies, most of the organisations belonging to the large state sector are using the technologies of the mid-twentieth century. One of the main reasons for the reluctance to engage in innovation is related to the overall low level of competition in the market.

3.3.3.4 Clusters

Today we may also see the process of clustering in the Republic of Belarus.

The High-Tech Park (HTP) and INFOPARK[49] are likely to be the most well-known IT clusters in Belarus. Such companies as Viber, Gett, Wargaming, etc. are the members of the HTP and operate R&D centres in Belarus. In 2015, the HTP Business Incubator was established on the basis of the HTP. The HTP business incubator is intended to aid start-up companies which develop their own products and build a special innovative environment in its co-working space designed for communication, learning, exchange of ideas and joint creativity. In 2016, the HTP business incubator in Minsk hosted 55 events (conferences, workshops, contests, hackathons, etc.) which attracted more than 9 thousand participants (in 2015, there were 12 events and 2 thousand participants). Besides, there are many technological parks, as follows:

- “Technological Park Mogilev”
- Scientific and Technological Park of the BNTU "Polytechnic”
- “Scientific and Technological Park of Polotsk State University”
- “Minsk City Technopark”
- “Brest Scientific and Technological Park”
- “Minsk Region Technopark”
- “Scientific and Technological Park of the Vitebsk State Technological University”.

In 2012, China-Belarus industrial park "GREAT STONE" was created with a view to creating a territorial entity for innovative companies. Currently, the park is still in the process of attracting companies. The park aims to attract more than 200 innovative companies, which will employ over 120 thousand people.

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48 http://www.belstat.gov.by/en/ofitsialnaya-statistika/social-sector/science-and-innovation/osnovnye-pokazateli-za-period-s-__-po-____gody/innovation-indicators-in-the-republic-of-belarus/

49 More detailed description is provided in 1.5.1. Public-private partnerships (PPP)

Meanwhile, attempts are being made to create an industrial cluster. For example, such companies as "Adani", "Izovak", "Regula", "Polimaster", "Solar", "Technoton" publicly announced[50] the plans to create an innovation and industrial cluster of high technologies, aimed at implementing joint projects and assisting each other in promoting to the new markets.

Belarus also has a few start-up incubators. One of the most active organisations is start-up hub Imaguru. Since Imaguru was opened in 2013, more than 250 start-ups started its activities in Imaguru and around 10 thousand entrepreneurs visit Imaguru every month. The hub is financed by United Nations Development Programme. Other notable incubators and accelerators:

- "Insight"
- "TechMinsk"
- Incubator of "NPO Centre OJSC"
- Zubr Capital

Also, the ICT cluster on the base of the BSU is being developed. It is expected to help the education institution to cooperate with the private sector more efficiently.

3.3.4 Services of the stakeholders

The basic services provided by the main stakeholders of the R&I system are summarised below.

Belarus has 11 main stakeholders of the R&I system, 4 of which are exclusively focused on ICT industry. Belarus has limited number of stakeholders providing an access to research and infrastructure and offering financial instruments for business development.

Table 3.3.1. Basic services provided by the main stakeholders in Belarus

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks / Collaboration
R&I stakeholders					
Belarusian Fund for Financial Support to Entrepreneurs				+	+

[50] https://myfin.by/stati/view/7376-belorusskie-priborostroiteli-hotyat-sozdat-klaster-po-primeru-pvt

School of Business and Management of Technology of BSU	+	+	+		+
Belarusian State University of Informatics and Radioelectronics	+	+			+
Belarusian Innovative Foundation			+	+	
Scientific and Technological Parks	+	+	+		+
Belarusian Business Angels Network BBAN		+		+	+
Igamuru Start-up Hub		+			+
SI "Belarusian Institute of System Analysis and Information Support of Scientific and Technical Sphere" SI "BelISA"	+	+	+		+
R&I stakeholders with a strategic focus on ICT					
Institution Central Information and Analytical Centre of the Ministry of Education		+			+
Belarus Hi-Tech Park (incl. Business Incubator)		+	+	+	+
Infopark association		+			+
United Institute of Informatics Problems of the National Academy of Sciences of Belarus	+		+		

To summarise, most of stakeholders in Belarus provide advice and consulting as well as help grants access to networks and help in establishing collaboration among different stakeholders.

However, there are only few stakeholders which provides access to research and infrastructure and provide financial instruments for research.

3.3.5 Strategies

The two relevant strategies to ICT innovation are the Strategy on the Development of Informatisation in the Republic of Belarus for 2016-2022 and the National Strategy for Sustainable Social and Economic Development of the Republic of Belarus for the period up through 2030. Both are described in the table below.

Table 3.3.2. Relevant research, innovation and ICT strategies in Belarus

Strategies	
The Strategy on the Development of Informatisation in the Republic of Belarus for 2016-2022	The purpose of the Strategy is the enhancement of the conditions promoting the transformation of spheres of human activities connected with ICT, including the formation of a digital economy, development of information society and enhancement of electronic government.
The National Strategy for Sustainable Social and Economic Development of the Republic of Belarus for the period through 2030	It is a long-term strategy defining goals, stages and directions of the transition of the Republic of Belarus to a post-industrial society and innovative development of the economy, while guaranteeing the all-round development of the individual, raising standards of human life and ensuring a favourable environment.

The Strategy of the Development of Informatisation in the Republic of Belarus for 2016-2022[51] is the most relevant in terms of ICT. A more detailed description of it is provided below.

The Strategy was published in 2015 by the government. As a result of the implementation of this strategy, Belarus will be able to achieve the following results (KPI's) in the selected areas of development by 2022:

- development of an effective and transparent system of public administration;
- improvement of communications between the state, business, and citizens;
- development of the national information and communication infrastructure;
- introduction of ICT in the real sector of the economy;
- informatisation of the health system;

[51] http://e-gov.by/zakony-i-dokumenty/strategiya-razvitiya-informatisacii-v-respublike-belarus-na-2016-2022-gody

- informatisation of the education system;
- development of own information technology industry.

Each strategic objective is described in the following sub-sections below (A, B, C, etc.).

A. Development of an effective and transparent system of public administration:

- to improve Belarus's position in the rating by the readiness index for e-government and join the group of developed countries (by the UN classification) (as for now, Belarus ranks 49th)[52];
- to raise the share of administrative procedures and public services provided in electronic form up to at least 75% (in 2016, the proportion of government agencies providing electronic services using the National Automated Information System totalled 15.3%[53]);
- to increase the share of electronic document circulation between state bodies in the total volume up to 95%.

B. Improvement of communications between the state, business, and citizens:

- to bring the number of public data sets and to 100;
- to improve Belarus's position in the E-Participation Index up to 50th (now it is 76th)[54].

C. Development of the national information and communication infrastructure[55]:

- to bring the number of Internet users per 100 inhabitants to 65 (in 2016, the indicator totalled 71);
- to bring the number of subscribers and users of fixed Internet access to 36.5 per 100 inhabitants (as for now, it is 32);
- to increase the number of subscribers and users of wireless broadband Internet access up to 85 per 100 inhabitants (currently the number is 67).

D. Adoption of ICT in the real sector of the economy:

- to increase the share of innovative organisations in the total number of organisations up to 25% from the current 20.4%[56].

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[52] https://publicadministration.un.org/egovkb/en-us/Data/Compare-Countries

[53] According to the statistical book "Information society in the Republic of Belarus" published by the National Statistical Committee of the Republic of Belarus

[54] https://publicadministration.un.org/egovkb/en-us/Data/Compare-Countries

[55] According to the statistical book "Information society in the Republic of Belarus" published by the National Statistical Committee of the Republic of Belarus

[56] http://www.belstat.gov.by/en/ofitsialnaya-statistika/social-sector/science-and-innovation/osnovnye-pokazateli-za-period-s-__-po-____gody/main-indicators-of-innovation-activity-in-industry/

E. Informatisation of the health system:

- to increase the share of medical documentation submitted in electronic form up to 100%;
- to increase the share of healthcare organisations connected to a single corporate network of healthcare organisations to 100%;
- to raise the proportion of the population provided with electronic medical records up 100%.

F. Informatisation of the education system:

- to increase the share of open electronic educational resources up to 80%;
- to stimulate the development of national electronic content;
- to increase the share of mass media that can be accessed via the Internet up to 100%;
- to increase the share of electronic documents in library stock of public libraries up to at least 30% (in 2016, the share amounted to 0.2%)[57]

G. Development of own information technology industry:

- to increase the share of gross value added of ICT sector in GDP to 3.8-4% (as of 2015, the share exceeded planned, amounting to 4.5%[58]).

To sum up, the purpose of the State's Strategy is the enhancement of the conditions that promote the transformation of spheres of human activities connected with ICT, including the formation of a digital economy, development of information society and enhancement of electronic government.

3.3.6 Policies

In addition to the strategies presented above, several policies directed at promoting research, innovation and ICT have been developed.

The most relevant ones are provided in the table below.

Table 3.3.3. Relevant research, innovation and ICT policies in Belarus

Policies

[57] According to the statistical book "Information society in the Republic of Belarus" published by the National Statistical Committee of the Republic of Belarus

[58] According to the statistical book "Information society in the Republic of Belarus" published by the National Statistical Committee of the Republic of Belarus

State program "Innovative development of the Republic of Belarus for 2016-2020"	The program is aimed at achieving the priorities of the social and economic development of the Republic of Belarus for 2016-2020 in the field of effective investments and accelerated development of innovative sectors of the economy. It is the main document ensuring the implementation of the most important areas of the state innovation policy.
Sub-program "The development in the production of new and high technologies" within the State program "High technologies and equipment" for 2016 - 2020	This sub-program is aimed at realizing the priorities of the social and economic development of the Republic of Belarus in terms of ensuring effective employment, efficient investments and accelerated development of innovative sectors of the economy on the basis of updating the production and technological base of organisations and setting up production lines for new import-substituting and export-oriented products.
State Program "Development of the Digital Economy and the Information Society for 2016-2020"	The goal of this Program is to improve conditions conducive to the transformation of spheres of human activity under the influence of ICT, including the formation of a digital economy, development of the information society and improvement of the electronic government.

On December 2017, the law "On the Development of a Digital Economy" was signed by the president. The law is introducing tax benefits for high-tech companies and start-ups, liberalisation and tax removal of cryptocurrency mining and initial coin offering activities[59]. The law is also expected to create better conditions for foreign investment and establishment of venture capitals.

The policy initiatives currently in place are not perfect, but major shifts in the nature and content of the current set of policies would require a radical change at the level of policy culture. Additionally, the number of intervening variables between R&I policies and the contexts that they seek to affect, make it difficult to state with any certainty that a given policy fosters innovation or strengthens the knowledge base and fundamental research.

3.3.6.1 Public-private partnerships (PPP)

Since the 1st of January 2016, the law on "Public-Private Partnership in the Republic of Belarus" has been in force. This law aims at facilitating the private sector development through the formation of additional legal provisions focusing on protection of private investments, improvement of the role of the private sector in rendering public services, and mobilisation of extra-budgetary resources to develop the infrastructure.

[59] East Wse Digital News: Startup investment and Innovation in Emerging Europe, 2018.

One of the success cases of PPP is the High-Tech Park (HTP). HTP was created in 2006 as an innovative IT cluster with the primary goal to support the development of software industry. The Hi-Tech Park regime is a particular legal regime that provides various benefits and preferences for developing software, information and communication technologies and other new and high technologies in Belarus. Particularly, the HTP residents and enjoy the following benefits:

- exemption from corporate profit tax;
- exemption from VAT on the sale of goods or services or the transfer of property rights;
- exemption from land tax (up to three years) within the HTP during the construction by the HTP residents of buildings and structures for their activity in Belarus;
- exemption from real estate tax on properties which are in the HTP;
- personal income tax rate of 9% is applied to the income of an HTP resident's employees (except for administrative staff and individual entrepreneurs who are the HTP's residents;
- the social security contribution is calculated based on an amount which is not exceeding the average salary in Belarus for the preceding month (except for administrative staff);
- payments by the HTP residents to foreign companies in the form of dividends, royalty, and interest are subject to withholding tax at a rate of 5%;
- the lease rates for state-owned immovable property are half the general rates;
- dividend payments are not subject to an offshore duty;
- the requirement to sell foreign currency revenue received from the activities does not apply to the HTP residents.

The number of the HTP members increased 1.5 times from 118 in 2012 up to 164 in 2016, while the number of employees almost doubled over the same period.

Another success case of the partnership is the **scientific and technological association "INFOPARK".** INFOPARK was created in 2001 as a union of software developing companies in the Republic of Belarus under the Presidential Decree № 234. Nowadays the INFOPARK's members are 38 small-sized companies, 23 medium-sized companies, and 8 large companies. The majority of INFOPARK's members are also residents of the HTP.

INFOPARK develops cooperation with several IT-associations and organisations in Russia, Ukraine, Latvia, Lithuania, the Czech Republic and other countries. In 2008, INFOPARK became a member of the European ICT Association (EICTA, now DIGITAL EUROPE). In 2012, the Association joined the World Information Technology and Services Alliance (WITSA).

Main projects of INFOPARK association includes a number of IT events (forums, conferences, etc.) in different areas such as banking (Bank IT); customer services and marketing (CRM Conference); insurance (IT insurance); logistics (IT2TLT); manufacturing (Prom IT), etc.

3.3.6.2 Public procurement on innovation (PPI) and pre-commercial procurement (PCP)

In accordance with the Law of Republic of Belarus of July 13, 2012 № 419-3 "On state procurement of goods, products and services", public procurement of goods, products and services is carried out on electronic trading platforms on a competitive basis.

The statistical data on the size of public procurement that can be compared to Eurostat or OECD data is not available in Belarus. However, it can be roughly estimated based on the data provided by the National Statistical Committee of the Republic of Belarus. The Committee reports that intermediate government consumption and gross fixed capital formation amounted to 6.5%. To compare Belarus's figure with OECD data, social transfers in kind needs to be added. The total volume of social transfers amounted to 9.6% of GDP in 2015[60].

According to this analysis, we assume that the share of public procurement in Belarus is about 16% of GDP, which is below the share of public procurement in only a few EU economies (the Netherlands, Finland, Slovakia, Sweden, etc.)[61].

3.3.6.3 Public funding

In Belarus, public funds are the main source of investments in R&D. In 2015, 44.7%[62] of R&D investments were contributed by the government from the budget, which is amounted to 0.23% of Belarus's GDP. Although government funding as a share of total funding decreased slightly during 2010-2015 (from 48% to 44.7%), it still remains the major source of GERD funds. Most of GERD (45.9%) is used by the business sector, while the government itself was the second largest sector with a share of (39.4%).

It worth noting that professional, scientific and technical services account for more than 76.9% of all R&D expenditures made by public sector.[63]

However, measures have been taken to develop the Belarusian system for financing R&D and innovation. To provide financial support mechanism for research, development and innovation for the private sector the government has created by three main organisations:

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[60] Calculated based on http://www.belstat.gov.by/ofitsialnaya-statistika/makroekonomika-i-okruzhayushchaya-sreda/natsionalnye-scheta/godovye-dannye_11/schet-pereraspredeleniya-dohodov-v-naturalnoi-forme/ and http://www.belstat.gov.by/ofitsialnaya-statistika/makroekonomika-i-okruzhayushchaya-sreda/natsionalnye-scheta/godovye-dannye_11/valovoi-vnutrennii-produkt-po-istochnikam-dohodov/

[61] http://www.oecd-ilibrary.org/governance/government-at-a-glance-2017/general-government-procurement-spending-as-a-percentage-of-gdp-and-total-government-expenditures-2007-2009-and-2015_gov_glance-2017-graph119-en

[62] According to the statistical book "Science and innovation activity in the Republic of Belarus" published by the National Statistical Committee of the Republic of Belarus

[63] According to the statistical bulletin "About scientific and innovation activity in the Republic of Belarus in 2016" published by the National Statistical Committee of the Republic of Belarus

- *The Bank for Development of the Republic of Belarus* was created, which is to become the first channel for financing projects within the framework of state programs, including possible innovative investment projects. With regard to financing SMEs, credit lines for 11 partner banks have been opened to finance SMEs, and at the end of 2015 a new product was introduced, aimed at supporting start-ups in the form of loans, which are usually designed for five to seven years.
- *The Belarusian Innovation Fund (BIF)* was created. As for the BIF, the latest changes are related to the adoption of a number of new Presidential decrees aimed at improving the financing of the last stages of the innovation process (i.e. commercialisation, entering the market), as well as creating new tools to support the first stages of the innovation process (i.e. grants and vouchers), which are provided free of charge.
- *Republican Centralised Innovation Fund* was also established to under the State Committee for Science and Technology (SCST) to finance innovation. Particularly, its activities cover four primary areas:
  - financing of innovative projects;
  - financing R&D aimed at creating new products, services and technologies;
  - financing of innovation infrastructure development;
  - financing the development of industrial laboratories.

3.3.6.4 Private funding

The access to venture capital in Belarus is constrained by the lack of private supporting institutions such as incubators, business angel networks or venture funds. The search for investments forces companies to register business in other countries to improve the image and simplify the attraction of funds.

In the Republic of Belarus, the business sector contributed to 19.1% of GERD, up only slightly from 2010 (17.9%)[64]. The share of private sector investments into R&D as a percentage of GDP amounted to only 9.7% in 2015.

Manufacturing industry accounts for 53.4% of the total public R&D expenditure with the processing industry accounting for 94.7% of all R&D expenditures in the manufacturing industry. Also, the Republic of Belarus relies on the banking sector, in which state institutions predominate, with most decisions on financing innovations taken by the state authorities of the country. The private sector is still underdeveloped.

[64] According to the statistical book "Science and innovation activity in the Republic of Belarus" published by the National Statistical Committee of the Republic of Belarus

3.3.7 Performance

According to the Insead global Innovation index[65], Belarus ranked 88th out of 127 countries in 2017. The relatively low position in the rating is due to the even worse position (109th) in the Innovation Output Sub-Index, which provides information on elements that are the result of innovation within an economy.

To identify the strengths and weaknesses of the innovation system in Belarus in more detail, a series of innovation indicators in Belarus[66] have been compared with EU[67] average ones. All the Belarus's indicators below are calculated by the National Statistical Committee of the Republic of Belarus in accordance with the Innovation Union Scoreboard (IUS 2016) methodology.

- **Relative strengths** of the innovation system are in the following groups of indicators:
  - Human resources (the availability of a high-skilled and educated workforce):
    - The share of new doctorate graduates (ISCED 6) aged 25-34 among the total population totalled 0.06%, which is three times lower than in EU (0.19% in 2016).
    - Percentage population aged 30-34 having completed tertiary education 28.4%. In EU, 38.2% (2016) of the population aged 30-34 have completed tertiary education on average.
    - Percentage youth aged 20-24 having attained at least upper secondary level education is equal to 92.6%, which exceeds EU average of 83.2%
- **Relative weaknesses** are in the following groups of indicators**:**
  - Innovators (measures the number of enterprises that have introduced innovations onto the market or within their organisations):
    - The share of SMEs introducing product or process innovations in the total number of SMEs was equal to 2.97%, which is considerably lower than in the EU average of 30.9% (in 2014);
    - The share of SMEs with marketing or organisational innovations totalled 0.6% in the total number of SME. In EU, the share amounted to 34.9% in 2016.
    - The share of SMEs innovating in-house remains at 3.41%. In EU, the share of SMEs innovating in-house is much higher and is equal to 28.8%.

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65 https://www.globalinnovationindex.org/gii-2017-report

66 http://www.belstat.gov.by/en/ofitsialnaya-statistika/social-sector/science-and-innovation/osnovnye-pokazateli-za-period-s- -po- gody/selected-indicators-for-the-republic-of-belarus-calculated-according-to-the-innovation-union-scoreboard-methodlogy/

67 http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en

- Firm investments (measures the efforts firms make in order to generate innovations)
    - The share of R&D expenditure in the business sector in Belarus's GDP was 0.34% in 2016. In EU, the share is almost four times higher, totalling 1.3% in the same year.
    - The share of non-R&D innovation expenditures in total products (works, services) shipped was 1.09%, which is higher than EU-average of 0.76%.
- Linkages (measures entrepreneurial efforts and collaboration efforts among innovating enterprises and with the public sector):
    - The share of innovative SMEs collaborating with others totalled 0.43%, which is more than 20-fold lower than in EU countries, where the share amounted to 11.2% in 2016.
- Sales impacts (captures the economic success of exports, and sales due to innovation activities)
    - The share of medium and high-tech product exports in the total service exports 32.7%, while EU-average is 56.2% in 2016.
    - The share of knowledge-intensive services exports in the total service exports, 34.9% which is twice less than in EU (69.3%).
    - The share of sales of new-to-market and new-to-firm product innovations in the total turnover (the total volume of products shipped) amounted to 15.3% in 2016. Current indicator for Belarus exceeds EU average of 13.4%.

3.3.8 Challenges

Main R&I policy challenges are:

- *Weak legislation in the sphere of entrepreneurship*, which leads to low level of innovations in SMEs. In particular, venture financing laws are undeveloped. Belarus law doesn't contain clear provisions regarding venture financing, and as a result the concept of venture activity is not set up by law. As a result, there are currently no private venture funds registered in Belarus.
- *Weak academia-academia collaboration and knowledge transfer.* The absence of university networks and ICT research network has been recurrently identified. Collaboration between universities (especially between interdisciplinary ones: e. g. BSUIR and BNTU) can improve efficiency of the research, addressing many current problems requires input from researchers across various disciplines.
- *Underdeveloped mechanisms of perception of innovations* (lack of intermediary organisations in the Belarus's innovation system). There are several barriers to collaboration of academic (universities, Research institutes) and industry (mainly high-

tech enterprises). The universities and industrial companies have different business models. Universities focus on educating people and in creating new knowledge and excelling in existing know-how, while companies concentrate on mastering the challenges of a competitive environment and are striving for market success. The intermediary organisations such as Technology Transfer Offices, University Incubators, and Collaborative Research Centres are usually established to mitigate such barriers. In Belarus, the lack of intermediary organisations hampers commercialisation of R&D results.

- *Relatively low share of non-state financing of R&D.* Despite the fact that 67% of all the R&D activities are carried out in business/private sector, most of them are financed by public funds (from the budget). The share of private sector investments into R&D as a percentage of GDP amounted to only 9.7% in 2015. In EU, this indicator was five times higher amounting to 55.5% in 2015[68].
- *Lack of transparency in the system of public procurement.* Although public procurement currently represents around 16% of Belarus's GDP and innovation-oriented public procurement is part of the national innovation strategy for 2016-2022, there are no binding strategies or exact national targets for PCP or PPI.

3.3.9 Gap analysis

Comparing with European countries, Belarus has low expenditures on R&D (0.5% compared to 2% in the EU). The main gaps constraining the development of innovation system in Belarus have been identified as follows:

- *Lack of financial instruments for research*

On the basis of available data, Belarus also has a rather high level of innovative development by the number of the conducted research but is considerably falling behind on the amount of science financing, even comparing with developing countries.

- *Lack of financial instruments for business development*

Financial instruments for business development includes providing finance through all phases of the establishment of a business – from ideas with potential growth in the early stages to existing companies that are investing in growth and expansion. In Belarus, this group of services is provided by only four stakeholders: Belarusian Fund for Financial Support to Entrepreneurs, HTP Business Incubator, Belarusian Business Angels Network BBAN and Belarusian Innovative Foundation. It is also worth noting that all these stakeholders are located in Minsk, while regions are considerably lagging behind. Also, risk is very limitedly allowed by the state funding bodies.

[68] http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsc00031&language=en

- *Constrained access to research and infrastructure*

Access to research and infrastructure is referred to as providing access to direct access centres, shared facilities, research knowledge, scientists, etc. Access to research and infrastructure relevant to ICT innovation is provided only by few stakeholders including Belarusian State University, Belarusian State University of Informatics and Radioelectronics, Scientific and Technological Parks, SI "Belarusian Institute of System Analysis and Information Support of Scientific and Technical Sphere" SI "BelISA" and the United Institute of Informatics Problems of the National Academy of Sciences of Belarus.

- *Weak academia collaboration (lack of university and ICT research networks)*

As can be seen from the Table 4, the group of indicators "Networks" is the weakest one in Belarus; Particularly, it is characterised by a lack of university networks and ICT research network. The importance of University network in that they create a strong hub of like-minded people allowing them to cooperate on R&D.

Table 3.3.4. Stakeholder analysis

Services	Estonia	France	Germany	Ireland	Sweden	UK	Belarus
Access to infrastructure							
Tech parks	+	+	+	+	+	+	+
University clusters	+	+	+	+	+	+	+
Access to supercomputers	+	+	+	+	+	+	+
ICT labs	+	+	+	+	+	+	+
Advice and consulting							
Consulting on grants	+	+	+	+	+	+	+
Business consulting	+	+	+	+	+	+	+
Training	+	+	+	+	+	+	+
Research funding							
Financing universities	+	+	+	+	+	+	+
Financing PROs	+	+	+	+	+	+	+
Grants for researchers	+	+	+	+	+	+	+
ICT Innovation public procurement	+	+	+	+	+	+	+
Business funding							

Tax incentives		+				+	+
Grants	+	+	+	+	+	+	+
Loans	+	+	+	+	+	+	+
Guarantees	+	+	+	+	+	+	+
Equity	+	+	+	+	+	+	+
Funding venture capital funds	+	+	+	+	+	+	+
Networks							
Enterprise network	+	+	+	+	+	+	+
Start-up network	+	+	+	+	+	+	+
Investor networks	+	+	+	+	+	+	+
University network		+	+	+	+	+	
ICT research network		+		+	+		

3.3.10 Roadmaps and Recommendations

When forming national innovations infrastructure of Belarus, it is necessary to take in consideration global tendencies and trends. The same mechanisms concern the sphere of science and R&D. The national strategy, directed to increase the efficiency of R&D, must be based on analysis of tendencies of innovative policy of developed countries to define of the most perspective directions and to introduce the relevant indicators of measuring innovations in Belarus.

The government is already addressing different challenges in the area of innovation. In particular, a decree on the regulation of ICT is in preparation and planned to come into force at the beginning of 2018. This decree is expected to address the gaps related to the legislation. However, there are many challenges and gaps not related to the legislation. In order to reduce the gaps and overcome challenges mentioned in sections 1.7 and 1.8, several roadmaps and recommendations are proposed as follows:

- Further improvement of national legal base (to address the challenges in the areas of intellectual property and venture financing laws) and its harmonisation with the international legislation.

- Creation of the favourable framework to improve entrepreneurship as a main segment for sustainable development of innovative economy. It includes the improvement, creation and development of the stock market, the system of financing of start-ups at early stages (implementation of such mechanisms as venture funding, convertible loans, crowdfunding and others), as well as creation of incentives for Small and Medium Enterprises (SME) (e.g. tax incentives) and the involvement of private investment in R&D.
- Establishing of the stable international scientific cooperation to overcome a lack of university networks and ICT research network (which means carrying out of joint research or offshore research, international transfer of scientific knowledge, mobility of scientists, adoption of successful foreign scientific results).
- Modernisation of national system of intellectual property protection to improve the commercialisation of R&D results.
- Development of mechanisms of perception of innovations by creating (or by creating incentives for their creation intermediary organisations in the Belarus's innovation system: engineering companies, centres of monitoring and a transfer of innovative technologies, advice centres for perception of external innovative research.
- Diversify the instruments for promoting the international collaboration and establishing the stable international scientific cooperation (which means carrying out of joint research or offshore research, international transfer of scientific knowledge, mobility of scientists, adoption of successful foreign scientific results).
- Fine-tuning the mechanism for electronic public procurement, in particular, by making it more transparent and accessible.

All these roadmaps and recommendations are links of one chain and will contribute to the creation of innovative digital economy in Belarus. Most of innovative processes is based on the development of information and communication technologies and better exploit of ICT-based innovative trends - main drivers that foster innovation, economic growth and progress. That's why the international cooperation and effective interaction in the field of digital transformation of economy, modernisation of national legislation and system of industrial standards, harmonisation of digital markets are main pillars of Belarus digital agenda.

3.4 Georgia

3.4.1 List of abbreviations:

GITA – Georgia's Innovation and Technology Agency

DEA – Data Exchange Agency

EDA – Enterprise Development Agency

FAS – Financial Analytical Centre

MCF – Ministry of Finance

MOESD – Ministry of Economy and Sustainable Development

MOJ – Ministry of Justice

NAS – National Academy of Sciences

R&D – Research and Development

RIC – Research and Innovation Council

PPP – Public Private Partnership

SRNSF – Shota Rustaveli National Science Foundation

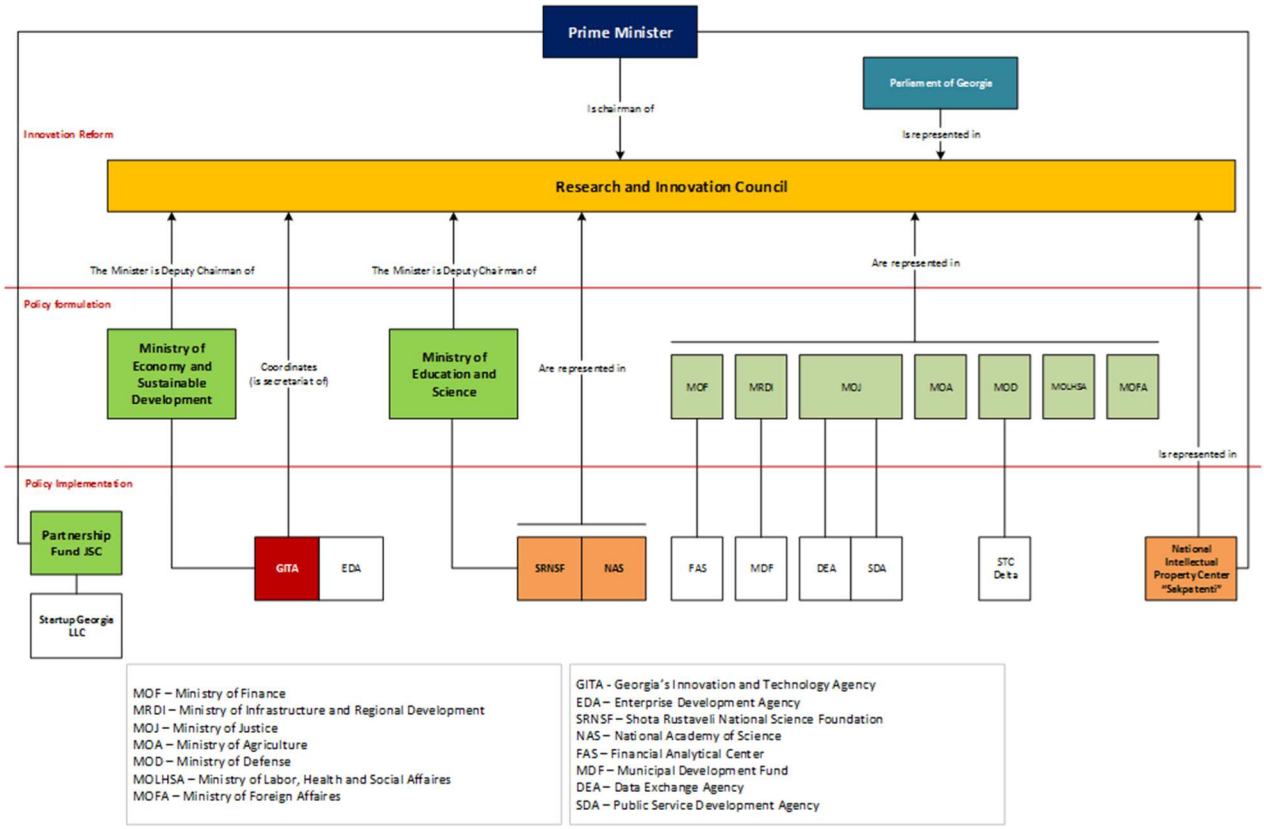
3.4.2 Overview

Georgian innovation system has been experiencing rapid changes, in the past years. Largely the changes are due to signing Deep and Comprehensive Free Trade Area agreement with the European Union. The agreement allowed to incorporate EU best practices in Georgian innovation ecosystem. Even though, Georgia is moving in the right direction, there are number of challenges that have to be overcome in order to have efficiently functioning ICT innovation ecosystem. The challenges include lack of financial market sophistication, lack of specialists, and poor quality of research institutions.

3.4.3 Stakeholders

Georgian innovation ecosystem, is starting to resemble ecosystem of EU baseline countries. In the recent year's institutions such as Georgia's Innovation and Technology Agency, (GITA), Enterprise Georgia, start-up Georgia and Participation fund have been created. Even though Georgia has a number of functioning governmental bodies, it still lacks private sector involvement and ICT clusters.

Figure 3.4.1. The map of innovation policy public stakeholders



3.4.3.1 Government bodies and agencies

The government of Georgia ("GOG" hereafter) coordinates and approves national R&D development plans and national R&D programs, ensures the cooperation between the ministries and enacts legislation.

The government is advised by the **Research and Innovation Council** ("RIC" hereafter) chaired by the Prime Minister. The council was established in 2015, with the purpose to identify economic priorities and major trends for innovation policy development. It is composed of representatives of ministries (all economic block ministries are represented), state agencies, business and academia. The RIC is assigned to: elaborate recommendations on economic growth, define the stages of RDI development and map out needed resources; facilitate development of knowledge/innovation-based economy, and export oriented intellectual products; promote the implementation of priorities in compliance with national innovation strategy; support the creation of an innovative ecosystem, the commercialisation of knowledge, the development of innovative start-ups, and attract financial resources.

Policy design and formulation are led by the **Ministry of Education and Science (MOES),** which is in charge of the national research, science and education, and the **Ministry of Economy and Sustainable Development (MOESD),** which oversees business development, technological

development and ICT industry policy. Other ministries, represented in RIC, contribute to policy development within their competence.

A key implementing body (also playing the role of the secretariat of RIC) is **Georgia's Innovation and Technology Agency (GITA)** - the agency under MOESD**.** GITA, established in 2014, is the main coordinator and mediator in the process of building the innovation ecosystem. The agency is formally in charge of innovation policy elaboration and implementation. Main directions of building the innovation ecosystem are: formation of legal framework; provision of infrastructure (Tech parks, Fab Labs, Incubators etc.), capacity building on entrepreneurship and innovative skills, promotion of entrepreneurship, enabling access to finance, and support for commercialisation of innovative projects. GITA is the secretary of the **Research and Innovation Council**.

Another notable body is the JSC **Partnership Fund (PF)**, established in 2011. The fund is a 100% state-owned investment fund and is positioned as a private equity and venture capital arm of Georgian government, providing direct and fund of fund investments. Formally positioned as a management agency of state-owned enterprises, the fund additionally provides direct financing by buying equity (both from start-ups and later stage companies), and by providing mezzanine loans and guarantees. In 2016, the Partnership Fund established a subsidiary fund – the **start-up Georgia LLC**, which is positioned as a venture fund with mandated to invest in innovative Georgian start-ups by providing equity investment and grant financing to start-up companies at their early stage of development. The fund was created within the national **start-up Georgia program** (start-up.gov.ge), jointly managed by PF and GITA since 2016. Initial allocation to the fund was 5 million EUR, however the fund will be gradually increased to 16 million EUR. The fund is mandated to support innovative start-ups directly through the local market.

Other important state stakeholders of the public infrastructure are the **Georgian National Intellectual Property Centre (Sakpatenti)**, **Shota Rustaveli National Science Foundation (SRNSF)**, and **National Academy of Science (NAC)**, all represented in RIC, in line with **Enterprise Development Agency** under the MOESD, not directly represented in the council, but contributing to development of the innovative ecosystem by providing additional financial support for tech start-ups on their further development stage.

Sakpatenti is in charge of elaboration of intellectual property (IP) policy and legislations, as well as registration of IP rights. Sakpatenti contributes for implementation of the innovation strategy by providing consultancy support to tech start-ups (jointly with GITA), as well as delivering of educational activities in the IP area. Shota Rustaveli National Science Foundation, the agency under the Ministry of Education and Science, is in charge of issuing grants for scientific research, and is an implementing partner of GITA in several initiatives.

Georgian National Academy of Science (NAS) is also presented in RIC. The plans of establishment of the bio-technology transfer centre in close collaboration of NAS and GITA is on agenda.

In addition to above mentioned stakeholders, several state agencies directly or indirectly contribute to innovative ecosystem. Among them, the most important are: Data Exchange Agency (DEA) and Public Service Development Agency (SDA) under the Ministry of Justice, providing infrastructure correspondingly for data exchange and electronic signature, stamp and ID; Financial Analytical Service (FAS) under the Ministry of Finance, providing registration of status of the Virtual Zone Participant for IT companies; Municipal Development Fund (MDF) under the Ministry of Infrastructure and Regional Development, which is in charge of management of infrastructural project.

Recently SDA has launched the Innovative Service Lab, which assists public and private organisations in designing and implementing new, modern and innovative services. The concept of Innovative Service Lab envisages the planning of the entire product cycle – from generating ideas to concrete steps to implement them.

One more important player in the innovation ecosystem is the **State Military Scientific-Technical Centre Delta** (Delta STC, a state-owned enterprise Delta International LLC), managed by the Ministry of Defence. STC Delta is engaged in Defence Industry and provides technical support for Georgian Armed Forces. One of the main tasks of the centre is design-implementation in production up-to-date and innovative military technology. The company owns extensive R&D infrastructure inside the enterprise and is presented in the RIC by the Ministry of Defence.

3.4.3.2 Universities

In last decade, around 100 research institutes (more than half of which belonged to the NAS) became independent entities with a legal status of legal entities under the public law (LEPL) and were given the choice: to either proceed their activities under this new status and compete for grants of Rustaveli foundation; merge with each other to join capacity and efforts; integrate into the universities structure; or close down[69]. Today, more than 80% of institutions are under the auspices of public universities, some of them merged and established research centres, a few institutes have kept their independent status, and others were closed down. Nowadays, scientific research in Georgia is conducted by 31 public and private universities and several institutes acting independently as LEPLs[69]. Besides, some private institutes are focused on applied/project-oriented activities. Since 2011 a major part of research institutes (around 50) have been integrated into the main seven public universities. Besides, some 20-25 non-governmental

[69] IncrEAST, 2016.

organisations are mainly involved in RDI supporting projects, political analyses, socioeconomic studies, statistical observations, eco-monitoring, etc[69].

Several state universities (Iv. Javakhishvili Tbilisi State University (TSU), State Academy of Art, Georgian Technical University (GTU), and Ilia State University) has been financially supported by GITA, as well as by the Tbilisi municipality in establishment of Fablabs at their facilities. In addition to Fablabs, the Ilia State University manages the Technology Commercialisation Office (TCO), established in 2012 with support of Sakpatenti, as well as manages the business incubator. Technology Commercialisation Office (TCO) is positioned as a "management and commercialisation centre of Intellectual Property created in the field of science and is one of the leading universities in Georgia. TCO's aim is to develop communication process between research institutes and commercial companies by linking scientific innovations to market demand and providing a source of additional income for further research and development". However, the services of TCO still are not fully adequate and the centre shows no particular results.

Several private universities (among which are Free University, University of Georgia, Business and Technology University) own the infrastructure, supporting innovation, like Fablabs (6 in total), iLabs or/and business incubators, but are mainly oriented on students, rather than researchers. In 2017, the University of Georgia established its own technology transfer office. Private universities usually do not receive financial support from the state but are in close cooperation with GITA by the means of promoting entrepreneurship and innovation culture among the students.

VET institutions are also engaged in the innovation ecosystem. In addition to Fablabs, established on the base of Universities, there are 14 Fablabs, functioning at facilities of VET institutions. 2 Fablabs are based in Techparks. All projects are financially supported by the Ministry of Education and Science. in close cooperation with GITA.

3.4.3.3 Companies

Most of the R&D in Georgia is conducted by research institutes and universities. Unfortunately, private sector innovation is not well developed and is detached from academia. Companies lack needed know-hows and capacity to conduct the innovations. Recent report by GIZ indicated that the largest impediment in developing in house innovation solutions are lack of project management skills and corporate culture. Global Competitiveness Report 2017-2018 ranks Georgia 67th out of 137 economies and 119th on university industry collaboration. However, the researches done by the academia are demanded by the foreign businesses: it is a common situation when the research institutes and/or laboratories are elaborating research for international corporations (are providing outsourcing R&D services).

In Georgia context, the most outstanding case is state-owned enterprise STC Delta (see Government bodies and agencies" section), which is military support-oriented manufacturer with well-developed R&D infrastructure and extensive R&D expenditures.

Another exceptional case is AzRy LLC – one of the leaders of IT industry in Georgia, providing both customised software development and embedded systems engineering services. The last area includes extensive R&D effort in the field of microcircuits and chips.

3.4.3.4 Clusters

GITA is managing 3 Techparks in different locations: Tbilisi, Kutaisi and Zugdidi.

The TechParks are presented with innovation and fabrication laboratories equipped with high technology, co-working and training facilities and business incubator. The facility works with one-stop-shop principle, it provides different types of services, access to technology, supporting interested people to transfer their ideas into businesses. The facility attracts foreign direct investments, international tech-based organizations and start-ups to open their representations in Georgia.

GITA's Innovation infrastructure project is being extended throughout the country by creating **Innovation Centres (ICs)** in relatively small cities. The aim of the project is to increase competitiveness of the region, raise awareness on the modern technology and knowledge, improve digital literacy and entrepreneurial skills; support formation of the new start-ups in the regions; develop new business approaches. 3 Innovation Centres were opened in Kharagauli, Choporti and Bagdati. Within the WB Genie project 2 Innovation Centres and 1 Innovation Hub will be opened in 3 different regions. GITA plans to launch technology transfer program, including establishment of the national Technology Transfer Office (TTO) with aim to commercialise R&D projects from academy (universities and research institutes). The Office will provide assistance to commercialise ready to market solutions/products either by licensing deals or by creating start-up (spin-off) companies.

Georgia has wide network of start-up incubators and accelerators. For example, Impact Hub Tbilisi provides a co-working space for start-ups and individuals, holds various networking events. GITA has in-house Business Incubator program, which enables innovative business ideas to be successfully developed. Program encompasses trainings for start-ups, that helps them to turn their ideas into the final product. It also includes legal and financial support from key players of the industry. Additionally, GITA provides industry-specific mentorship opportunities for start-ups. In order to eliminate financial barriers, GITA offers mini grants for prototyping and free access to the co-working space in Tbilisi Techpark. start-up Marani is another active player in start-up ecosystem. It connects entrepreneurs with investors, helps to raise capital. start-up Marani also has established Venture Capital fund "Green Capital". Other notable incubators and accelerators:

- IHUB Tbilisi
- Smart up Georgia
- VEGA Lab
- FABLAB MSDA

3.4.4 Services of the stakeholders

Stakeholders in Georgia provide a range of services. A number of institutions are newly created and have started their operations not that long ago. The table clearly shows the abundance, of public agencies and their functions, but lack public private cooperation projects.

Table .4.1. Basic services provided by the main stakeholders*

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks/ Collaboration
R&I stakeholders					
Georgian co-investment fund				+	
Georgian SME Association		+			+
Fablab tech parks	+	+			+
Partnership fund				+	
Enterprise Georgia	+	+	+	+	+
Technology commercialisation office					+
start-up Marani		+		+	+
Shota Rustaveli National Science Foundation			+		
R&I stakeholders with a strategic focus on ICT					
Georgian tech start-up association					+

Techparks in Tbilisi and Zugdidi	+	+			+
Tech park Georgia	+	+	+	+	+
GITA	+	+	+	+	+

For a more detailed description of each service, see Appendix 2

3.4.5 Strategies

The main strategy of the country is Social-Economic Development Strategy of Georgia "GEORGIA 2020", paying significant attention to development of business sector and innovation development. All other sectoral strategies are developed under the framework of the Georgia 2020. Two strategies – Digital Georgia and Georgia's SME Development Strategy are linked to Georgia 2020 and providing more highlights to overall view of digitalisation of the Georgian economy and support of innovative businesses. The Innovation strategy is currently under development (is drafted by GITA and is under preparation for discussion and approval).

Table 3.2. Innovation strategies of Georgia

Strategies	
Social-Economic Development Strategy of Georgia "GEORGIA 2020[70]"	An overarching document defining economic development strategy for years 2015-2020. The following is planned in order to facilitate innovation and technological development: • Raising the level of innovation and technological sophistication • Improving access to funding for R&D and the facilitation of its commercialisation • Developing infrastructure needed for innovation • Strengthening the protection of intellectual property • Facilitating the broad use of ICT technologies in the economy • Attracting FDI oriented towards modern technologies The following targets are introduced to monitor the progress in the innovation and technologies area: Knowledge Economy Index - with the goal to go from

70 Government of Georgia, 2014.

	rank 68 in base year to 45 in 2020; Global Innovation Index - with the goal to go from 73 in base year to 60 in 2020; TFP (annual, %) - with the goal to go from 2.7% in base year to 3.2% in 2020; Innovation Capacity Index - with the goal to go from 44 in base year to 36 in 2020; Global IT Index - with the goal to go from 65 in base year to 50 in 2020
Digital Georgia[71]	The document provides a framework for societal changes enabled by Information and Communication Technology (ICT). Main goals of the strategy are: • To increase accessibility and demand for secure and effective e-Services for citizens, businesses and non-governmental sector based on reliable and trustworthy infrastructure. • To build durable trusted channels for exchange of information, information systems in state agencies, municipalities and private organisations. • To further a competitive and innovative business environment and to support entrepreneurship, partnerships between civil society, as well as the public and private sector in the field of ICT. • To establish effective information security protecting against cyber threats. Main policy implementations will be: • Digitalisation of government services and open government. E-accessibility of G2C, G2B/B2G, and G2G e-services. Provision of a Health Management Information System, and a public finance management system. Systems will result in modernisation and management of planning, collecting and spending of public finances. • Setting legal frameworks for PPP, communication and data exchange between business and government. • Building ICT trainings via education system needs and raising awareness regarding the e-services and encouraging public discourse for take-up and successful use of e-Services
SME Development Georgia[72]	The goal of Georgia's SME Development Strategy is to create a favourable environment for SMEs, increase their competitiveness and innovation

[71] Data Exchange Agency and Ministry of Justice of Georgia, 2013.

[72] Government of Georgia, 2016.

	capabilities. To achieve that goal, the following strategic directions were defined: • Improvement of legal and institutional environment. The provisions include improvement of insolvency procedures; improvement of enterprise statistics; strengthening SME supporting institutions; strengthening the dialogue between public and private section; and finally, the creation of Regulatory Impact Assessment System for priority economic legislation. • Improving access to finances: Improvement of financial education; improving the investment environment by raising SME capacity and increasing funding via private investments and grant financing • Development of skills and promoting entrepreneurial culture. The provision includes the assessment of the needs of labour market and trainings needs for SMEs. The assessment will result in the introduction of continuous entrepreneurial training at all levels of education system (including vocational education and non-formal education); • Internationalisation of SMEs: Supporting enterprises in adaptation to DCFTA requirements; Stimulation of export-oriented activities; Supporting the establishment of linkages between foreign investors and SMEs. • Stimulating R&D: facilitating innovations in SMEs; developing effective schemes for innovations and R&D funding; support of commercialisation of Innovations and R&D; improvement of ICT skills in entrepreneurs; development of infrastructure for innovations.

3.4.6 Policies

In addition to different strategies, a number of policies directed at promoting research, innovation and ICT have been developed. The most relevant ones are provided in the table below. Main policy developments of Georgian innovation system have been the law of Georgia on Innovations, the Law of Georgia on Grants, and the Law on Tax Code.

Table 3.4.7. Innovation policies in Georgia

Policies

The law of Georgia on innovations	The aim of this law is to create and perfect the ecosystem of national innovations necessary for socio-economic development of Georgia, to build an economy based on knowledge and innovations in the country, to promote technologies in Georgia created in other countries, to promote the introduction and export of intellectual property and technology created in Georgia, to penetrate advanced technologies into all fields of science and economy to increase the competitiveness of these fields. The law determines responsible body (Georgia's Innovation and Technology Agency LEPL) for adoption state strategy in the sphere of innovations, defines infrastructure that facilitates innovative activity, establishes rules for financing innovative activity, also, regulates commercialisation issues for the innovative projects financed by the state.
The law of Georgia on electronic document and electronic trust services (2017)	According to the law, properly created electronic documents may be used in all legal relations, where documents are required in a written form. Moreover, all public authorities, including courts, are obliged to accept such electronic documents. In B2B relations, the form of the contracts is a subject of agreement between parties. The law if fully harmonised with relevant EU regulations.
Law on e-commerce (under development)	According to the MoESD information, “the draft law on E-Commerce is being elaborated for development of e-commerce in the country and according the eCommerce directive and the obligation, taken from DCFTA to define rights and commitments of intermediary service providers (ISP) in Georgian legislation. By adoption of the law will be established the European regulations of e-commerce, which will promote consumer rights protection during the process of electronic commerce on the Internet and determine the terms and conditions of signing electronic agreement during the information transmission and storage which is obligation of Intermediate service providers etc”.
The law of Georgia on copyright and related rights	This Law regulates relations associated with the property and personal non-property copyright that arise upon creation and use of scientific, literary, and artistic works (copyright), relations associated with copyright related rights of performers, producers of phonograms, and videograms, and broadcasting organisations ('the related rights'), as well as relations associated with the rights of database producers. The Law determines property rights in computer programs and databases, issues related to free use of a computer program (decompilation) and a database, limitations to the rights of computer program and database owners, rights of a database producer, validity term of the rights

	of a database producer, protection of the rights of a database producer and other related issues.
The Law of Georgia on Grants	The Law of Georgia on Grants introduces the scope and definition of the grant, as well as procedures for issuing the grants. Law of Georgia on Grants was amended in 2016 following to GITA's recommendations. According to this new regulation, commercial legal entity became receiver of grants, but only for the purposes of grants issued according to the Georgian Law on Innovations. The grants, issued by the GITA for financing of innovation projects, the research grants, issued by the Shota Rustaveli National Science Foundation, grants, issued by the Enterprise Georgia, are considered as a subject of the law.
The Tax Code of Georgia	According to newly introduced provision, companies are liable to pay profit tax only upon distribution of profits or on transfer of a similar nature (non-economic costs), without calculating allowable costs. This provision indirectly stimulates companies to invest in R&D activities. Georgian Tax Code was amended in 2016, in particular Article 99, according to which profit tax exemption applies to the grants received by the commercial legal entities.

3.4.7 Public funding

Main governmental bodies responsible for funding of the innovative projects are GITA, Shota Rustaveli National Science Foundation under the Ministry of Education and Science, Enterprise Georgia and Partnership Fund.

Ministry of Education and Science provides basic funding, while GITA, Shota Rustaveli Foundation and Partnership Fund provide financing based on competition.

In 2016, Ministry of Education provided funding for around 10 million EUR to research and innovation system. Most of the funding of the ministry of education was directed to support universities, while the other 2 top recipients where public research institutes and national academy of sciences.

Shota Rustaveli foundation, provides competitive funding, via competitive grants. In 2016, the lion share (75%) of funding was allocated to science and research funding, which supported applied research, and fundamental research. Other top recipients of funding are infrastructure building, and support to young scientists.

On the other hand, GITA focuses not on the research institutes but on the researchers, and innovative companies. Its budget grew gradually from ~1.9 million in EUR in 2014, to ~2.7 million in EUR million in 2016 In 2017 the budget of GITA is ~1.7 million EUR.

GENIE: The World Bank has allocated 40 million US dollars financial resources for national innovation ecosystem financing. The project consists of three components:

1. Creation and development of innovation infrastructure in the regions

2. Provision of Innovation services for innovative and entrepreneurial skills development;

3. Matching Grants Program for start-ups and innovative projects financing.

The total funding of USD 7 million will be distributed through a matching grants program (start-up matching grants to companies in the early stage of innovative product development, up to USD 30,000 and 10% of co-financing from other sources, and innovation matching grants for SMEs that are aiming at developing or adopting innovations that have market potential - the maximum amount of USD 250,000 shall be complemented by 30-40% of co-funding).

Additionally, GITA issues micro grants of up to GEL 5,000 for financing prototyping, travelling, registration of IP rights, and organizing innovative events. 56 grants were issued in 2017. Out of 56 grants, 21 grants have been issued to make prototypes, 22 for participation in international events/competition, 11 for organizing events in Georgia and 2 for getting the patent.

start-up Georgia: As mentioned in the section above, the start-up Georgia LLC is a public venture capital fund, founded by JSC Partnership Fund with the aim to incentivise the development of Georgian start-up companies. The investments by the fund are divided into two parts: (1) Partnership Fund finances directly innovative start-ups for the local market, (2) GITA finances high-tech globally scalable start-up projects having potential to go global. The total amount of funds already allocated by the fund is GEL 11 million, however plans to increase investments up to GEL 35 million. In total, 79 companies were financed in both components in 2016-2017, among them 20 high-tech projects received up to GEL 100,000 venture financing with a 5% equity composition. GITA further invested USD 10 000 in each winner team, by granting them personal US Silicon Valley mentors.

Horizon 2020: Horizon 2020 - the largest multinational program dedicated to research and innovation, with a budget of EUR 77 billion for 2014-2020, in which Georgia is a third participant country, opens up new opportunities to universities, research institutions and enterprises.

3.4.8 Private funding

Data on private funding of research in Georgia is severely restricted. However, most of the funding of research and innovation in Georgia is funded publicly. Private sector is not an active participant of the innovation ecosystem but is rather a follower.

The first private sector player, implemented the start-up financing program was JSC Liberty Bank: the subsidiary of the bank, the Smartex Group, launched a start-up incubator for Georgian entrepreneurs in 2013. The interest of the group was focused on e-commerce, telecom and

electronic payments. Overall investment (mainly investment in equity of already established businesses) exceeded one million GEL and included 12 projects. Currently, investment activities of the group are slowed down. However, taking into account the nature of the financed project, the R&D component was not a key issue here.

The Vega start-up Lab, launched in 2014 jointly by bank of Georgia and Bank of Georgia University, was designed to help entrepreneurs get both knowledge and the money. The program launched 6 start-ups but is completely inactive nowadays.

start-up Marani is a project, launched by the Start Business Solutions - a business consulting company. start-up Marani is a project aimed at connecting entrepreneurs and investors. Until now, there have been four supported projects with up to USD 100,000 in total funding. However, the program mainly supports traditional businesses and R&D component is not crucial here.

In addition to above mentioned programs, some financial organisations (commercial banks and microfinance organisations) are proving loan financing of start-ups. **TBC Bank, ProCredit Bank, Bank of Georgia** and **MFO Crystal** are offering loan/leasing financing programs for start-ups. The programs usually include some educational components. The programs are not always specially focused on hi-tech business, provide loans/leasing for capital investments, mainly to fixed assets (rather than R&D) and are dedicated for already launched businesses. In most cases, the driver of financial institutions to run programs is establishment of SME clientele rather than support for development of the innovation ecosystem. However, it should be mentioned, that the banks are supportive to finance projects (at development or commercialisation stage), initially launched with support of GITA and Partnership Fund.

Another significant player is the Georgian Co-Investment Fund ("GCF"), which is represented in RIC by its CEO. GCF is a USDUSD 6bn private investment fund, with the mandate to provide investors with access to opportunities in Georgia through a private equity structure. However, currently GCF is heavily focused on large infrastructural projects (investment of 25 – 75% of the total equity investment, with a minimum size of USDUSD 5m) with no particular focus on hi-tech projects.

Finally, the interesting player of the ecosystem is a recently created Georgian Business Angels Association (established in March 2017 under the program of Private Sector Development Strategies of Swedish International Development Cooperation Agency) with the ultimate goal to promote funding on the early stage start-ups by strengthening communication with investors. However, the association is at its early stage and shows no particular results so far.

3.4.9 Performance

One of the key strengths of ICT ecosystem in Georgia is that the Government of Georgia underlines the importance of innovation and technology development, which is highlighted in all

strategy documents. In the recent years, Georgia was able to improve public sector transparency and efficiency, thus creating strong public institutions. Reforms also allowed to create market friendly economy. However, Georgia still lack high quality research institutions and has low activity of business innovation. According to INSEAD global innovation index, Georgia is ranked 68th out of 127 countries.

- **Relative strengths** of the innovation system are in: 1) institutions: regulatory and political environment 2) market friendly economy: protection of minority investments, open trade environment 3) knowledge outputs: number of patent applications, number of new businesses, number of articles published;
- **Relative weaknesses** are in: 1) low spending on research, 2) low capacity to attract talent 3) Poor linkages between research institutions and businesses; 4) low expenditure on education and quality of higher education

3.4.10 Challenges

To have a successful ICT innovation framework, Georgia has to overcome a number of challenges. Georgian businesses lack qualified staff and financing, while research institutes are underfunded and not well performing.

Low quality of higher education and scientific research institutions. Georgia ranks 127th and 125th on the quality of research institutions and availability of scientists and engineers in Global Competitiveness Report 2017-2018. Most of the innovation effort in Georgia was directed towards the development of informal tacit knowledge however, universities and research institutes are still underfunded. This neglecting may result in qualified labour shortage, and lack of capacity to produce R&D as research institutes are able to provide the capacity, while the small innovative companies may lack capacity to make large scale research projects.

Weak links between researchers and businesses. Private sector is inactive in Georgian innovation ecosystem. According to the Global Competitiveness Report 2017-2018, Georgia ranks 122nd on company spending on R&D. The challenge occurs due to slow development of businesses as well as research institutions. Georgian businesses currently do not have high capacity to absorb innovation. Unfortunately, businesses are not yet active participants of Georgian innovation ecosystem. To have successfully functioning in ICT innovation ecosystem, it is vital to ensure that private sector takes active part in that. Otherwise, the research may not be applicable for the market, while the innovations may be hard to commercialise. Georgian government has to create more links between universities and businesses.

Lack of qualified labour force. As a result of brain drain, and not improving education sector, Georgia currently lacks qualified labour force. In the Global Competitiveness Report 2017-2018, lack of qualified labour force was mentioned as one of the major challenges challenge. Georgian

innovation ecosystem further lacks management and business talent. Even though Georgia has talented researchers and engineers, which come up with start-up ideas. However, in order for start-ups to scale up and access international markets, it is essential to have talented business developers and business managers. Even though Georgian business schools are relatively well developed, they are focusing on teaching functions of management rather than entrepreneurship. Moreover, there is a big gap among education of business and technology. The curricula of technology are poor, oriented towards the use of technology, rather than developing new innovative technology. . Therefore, a number of Georgian start-ups have difficulties in scaling up.

3.4.11 Gap analysis

When comparing Georgia to Baseline countries, there are a number of notable differences. Georgian ICT innovation is led by public sector, where private sector is an inactive follower. Georgia lacks high quality research institutes, and links between researchers and innovators. Performed research is a lot of times detached from business. Business financing is still not available to smaller scale companies, and there is a lack of business talent. Interestingly, in terms of existence and services of governmental agencies, Georgia closely matches Baseline countries. Georgian government is an active participant of the innovation framework development, directs and facilitates research.

However, the largest gap in Georgia research and innovation ecosystem and its European peers, is the quality of research institutions. Georgian universities and research institutes are underfunded, and therefore, are not able to fully develop. Georgia currently focuses on informal educational institutions, that provide executive training. However, developed university system is vital to bringing large number of talents to the labour market, as well as performing quality research. Universities in the EU countries, are the central hub of innovation, with a large part of the research in the universities being funded by businesses. Lack of funding, depletes universities from talented researchers, as a large part of them leaves abroad.

To become an ICT hub Georgia needs to establish high capacity research institutes to be able to develop big data, AI or other top trending technologies that require capability to conduct large scale research. Quality of institutions is important as it will allow to create business and academia cooperation. The existence of specialised institutes, will allow businesses to outsource some of their research. In the EU baseline countries, such major research institutions as Fraunhofer institute, cooperate with large companies to make applied research.

Moreover, Georgia lacks financing availability for innovative companies. Currently Georgian companies rely mostly on banks for the provision of finance. However, banks in a risky country like Georgia are reluctant to provide financing for innovative projects. Therefore, debt financing is largely unavailable for innovative projects. Equity financing is restricted as well, with few exceptions like GITA, because venture capital and angel investing is still in its early stages, and

therefore, are not available to Georgian companies. Therefore, Georgian companies, are than forced to use their own retained earnings. As most of the companies are small, retained earnings may not be enough. In comparison, EU baseline countries have seed financing organisations, while also providing a number of early stage financing assistance: grants, loan guarantees etc. In Georgia these activities are carried out only by GITA, Enterprise Georgia and Partnership Fund. Nevertheless, the seed financing is not sufficient. As Georgia is only moving in that direction, innovative companies are still largely lacking financing. Innovations can further be co-financed with the government or research institutes.

Furthermore, Georgian system does not have enough large companies to perform innovation. Even though start-up environment is improving, it is of utmost importance to help the companies to scale up. Currently the scarcity of second stage finance severely restricts that.

Another important gap is insufficient spending of private sector on innovation. This results in difficulties while seeking private investments. Seed and pre-seed funding is still hard to obtain in Georgia. A significant increase of government funded grants, may mitigate the issue. Private investors are not yet active participants in the market, as innovative SMEs mostly obtain governmental financing. Furthermore, market acceptance and market viability of innovations may be impeded if the innovations are fully led by the public sector.

Georgia lacks public procurement for innovation. In its EU peers, PPI plays an important role in creating market for innovative technologies. Development of the e-government and e-society is a great starting point for introduction of PPI as provision of such solutions can be tendered and the most innovative companies selected. For a market like Georgia this can be very important, as public procurement will allow to create larger market for innovations. Baseline countries, are utilizing PPI to a large extent. France goes as far as organizing roundtables, where the government and businesses discuss possible tenders, and decide on the best options to cooperate within PPI framework.

Table 3.4.4. Stakeholder analysis

Services	Estonia	France	Germany	Ireland	Sweden	UK	Georgia
Access to infrastructure							
Tech parks	+	+	+	+	+	+	+
University clusters	+	+	+	+	+	+	+
Access to supercomputers	+	+	+	+	+	+	

ICT labs	+	+	+	+	+	+	+
Advice and consulting							
Consulting on grants	+	+	+	+	+	+	+
Business consulting	+	+	+	+	+	+	+
Training	+	+	+	+	+	+	+
Research funding							
Financing universities	+	+	+	+	+	+	+
Financing PROs	+	+	+	+	+	+	+
Grants for researchers	+	+	+	+	+	+	+
ICT Innovation public procurement	+	+	+	+	+	+	
Business funding							
Tax incentives		+				+	+
Grants	+	+	+	+	+	+	+
Loans	+	+	+	+	+	+	+
Guarantees	+	+	+	+	+	+	+
Equity	+	+	+	+	+	+	+
Funding venture capital funds	+	+	+	+	+	+	+

Networks							
Enterprise network	+	+	+	+	+	+	+
start-up network	+	+	+	+	+	+	+
Investor networks	+	+	+	+	+	+	+
University network		+	+	+	+	+	+
ICT research network		+		+	+		

3.4.12 Roadmaps and Recommendations

- Georgia needs to increase its funding of education and research. Currently even compared to peer from southern Caucasus, formal education and research structures are underfunded. Funding for research should be increased both via competitive funding and via direct basic funding.
- Improvement of IT education system. IT education system in Georgia is at satisfactory level, however to keep up with the growing demand for IT specialists, it is essential to further develop IT training centres.
- Increasing the number of ICT clusters. Even though Georgia is moving in the right direction, there is a shortage of ICT clusters in the country. Therefore, it is important to build ICT clusters in the regions with the most economic potential. Tax subsidies, or development of free economic zones, can be one of the options.
- Creation of specialised research institutes. Specialised research institutes would be able to perform more efficiently and focus on specific ICT areas. Furthermore, creation of specialised institutes will help developing links between businesses and research institutions, as businesses would easier find a research partner for ICT research initiatives.
- Further promote internationalisation of higher education institutions, create specific programs to facilitate cooperation and promote Georgian universities overseas. A particular focus should be assigned to business and management schools, as currently they are the most underdeveloped in Georgia. Internationalisation would allow to import knowledge from abroad. As mentioned, foreign companies are far more efficient than

Georgian, therefore, know-how would benefit the innovation system. Management and business schools, currently do not receive a lot of funding from Georgian government, where funding is rather directed at scientific projects, or informal business education. However, internationalisation and support of business schools and universities, would help to create management and business professionals who would be able to successfully commercialise the investments and scale up start-ups.

- Introduction of public procurement for innovation. Development of the e-government and e-society is a great starting point for introduction of PPI as provision of such solutions can be tendered and the most innovative companies selected. PPI may be especially important in small economies such as Georgia, as market is insufficient for the scale up of the companies. Public procurement will create additional market and help to scale up the companies. PPI further gives smaller companies credibility to obtain other clients. Backing of municipality of the government, may provide additional trust to the solutions.
- Extending tax breaks for innovators. Georgia has introduced tax relief for some of the businesses cooperating with GITA as well as for companies that receive grants. However, the tax breaks can be extended to include larger number of businesses and larger number of eligible activities. That would further incentivise the companies to invest in innovation.
- The introduction of a system of international evaluation could serve as a basis for integrating complementary university research departments and research institutes, in order to make savings that could be used gradually to raise expenditure on education; the criteria for selecting centres of excellence would give equal weight to the institution's international and local relevance.
- Creating more public private partnerships. PPPs would help to address the issue of lack of involvement of private sector. PPPs would help to attract large businesses to important innovative activities such as: IT education, entrepreneurship, and co-financed innovation activities.

3.5 Moldova

3.5.1 List of abbreviations

AGEPI – State Agency of Intellectual Property

AITT – Agency for Innovation and Technology Transfer

CFCFA – Centre for Fundamental and Applied Research Funding

CIP – Centre of Intellectual Projects

CNAA – National Council for Accreditation and Attestation

EC&S – Ministry of Education, Culture and Science

FEN – National Environmental Fund

HEI – Higher Education Institutions

MAERG – Ministry of Agriculture, Environment and Regional Development

ME&I – Ministry of Economy and Infrastructure

MF – Ministry of Finance

ODIMM – Organisation for Small and Medium Enterprises Sector Development

RD&I – Research, Development & Innovation

3.5.2 Overview

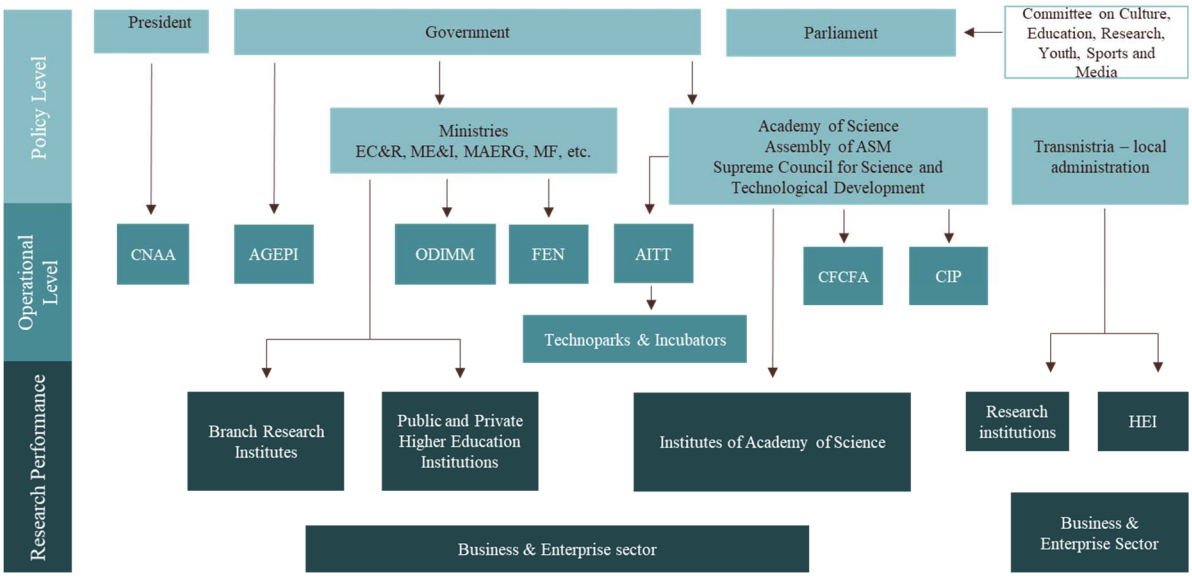
Moldova is a small, landlocked country in Eastern Europe. Coming with a post-soviet legacy of highly centralised public system of R&I, it is currently on its path to adopt a number of strategies and policies that would position the country in a competitive state and support digitalisation and innovations. Although very rich in terms of numbers of scientific publications and number of PhD degree holders per capita, the country struggles with transfer of knowledge to market. The start-up ecosystem relies on external funding and support programs with international mentorship which help boost SME innovation, particularly in the ICT technology realm. Public innovation has also demonstrated relative growth over the past years, having institutions such as the e-Government Centre and Moldova Social Innovation Lab established as key stakeholders that facilitate implementation of digital tools in the public sector.

3.5.3 Stakeholders

The Moldovan R&D system stakeholders are rather polarised between the public realm and private organisations, which operate under relatively different perspectives and priorities. While the public R&D sector is highly concentrated around the Moldovan Academy of Science and its connected institutes, with public agencies only funding public institutes, private support organisations mainly work with early stage start-ups on the ideation stage and connecting them to networks of local and international mentors from the respective industries. Moldova lacks intermediary structures which would align all stakeholders as to policy discussions, drafting and implementation, financing of RD&I activities both in private and public organisations responding to commonly adopted directions, etc. The fragmentation is observed not only institution-wise, but also there is a geographical divide in the area of influence of RD&I stakeholders and innovators. Out of 60 institutions accredited by CNAA in 2005-2013 to carry out R&D activities, 57 were located in the capital – Chișinău, and the other 3 were in the regions.

In the figure below the key R&I stakeholders are mapped. However, in 2017, the deep Public Administration Reform is being implemented and some roles and institutions that were previously involved in the RD&I system (as policy-makers, implementing agencies, or other stakeholders) are in process change.

Figure 3.5.1. Moldovan innovation system



3.5.3.1 Government bodies and agencies

The government of the Republic of Moldova prepares national R&I development plans, submits them to the Parliament, approves national R&D Programs and ensures the cooperation between the ministries and enacts legislation. Other government bodies and agencies that are responsible for policy development and implementation and their functions are the following:

- Policy development and design are carried out by Ministry of Education, Culture and Science, which is in charge of the Moldovan Academy of Science and other Research institutions and Higher Education Institutions.
- There are 3 advisory governmental institutions: National Council for Accreditation which is under Presidency control, Centre of International Projects and Agency for Innovation and Technology Transfer (both under Academy of Science control).
- All policy documents, prior to being submitted to the Government for approval, have to pass all 3 mentioned institutions, and also Academy of Science, Ministry of Economy and Infrastructure, Ministry of Finance (as responsible for financing of the research) and AGEPI.
- State Branch Research Institutes, Institutes of Academy of Science and Higher Education Institutions are the only Research Institutions which could get financing through National (budgetary) R&D Programs under the Ministry of Economy and Infrastructure.

3.5.3.2 Universities

In 2015-2016, in Moldova operated 31 Higher Education Institutions (19 state and 12 private), hosting almost 82 thousand students. Universities in Moldova are rather educational centres than R&I hubs, while the research activity financed from budgetary sources is carried out and managed by the Academy of Science of Moldova (ASM) and related institutes. Stemming from a legacy of centralised system of R&D, the ASM benefits from the authority to implement the public economic, financial and scientific policies related to the Research and Development sector.

In 2016, the R&D activity in Moldova was carried out in 63 organisations, out of which 40 are institutes and research centres, 16 Higher education institutions and 7 – other types of units. The state expenditures on R&D amounted to EUR 21.6 million (3.3% of GDP), and 88% thereof was made in public institutions.[73]

Certain universities define their own R&D strategy and structures. For instance, the Technical University of Moldova has a Scientific Investigations Department, a division which manages the R&I activity within the University, technology transfer projects, support in application development for national and international R&I funding, including the organisation of thematic conferences and other events. The Moldova State University (MSU) has elaborated a R&I strategy, aiming to develop the scientific research within the institution to support increased educational services performance. The strategy mission lies in promoting the state policy as to fundamental applied sciences, interconnect science and education, train students of all levels in the area of research, promote innovations and technology transfer, through a series of activities: organizing the participation in various national and international research programs/contests, the accreditation of MSU and its staff for the R&I activity, coordination of students' scientific activity, state registration of research projects and reports, and more.

The profiles of research for which universities were accredited include: Building the rule of law and capitalizing on the cultural and historical heritage of Moldova in the context of European integration; Valorisation of human, natural and informational resources for sustainable development; Biomedicine, pharmaceuticals, maintenance and strengthening of health; Agricultural biotechnologies, soil fertility and food security; Nanotechnologies, industrial engineering, products and materials; Efficiency of the energy complex and ensuring energy security, including through the use of renewable resources.

Still, there is an observed skills gap in many areas that have the potential to drive the economy, particularly in R&D, which stems from high levels of immigration and brain drain. The educational

[73] http://independent.md/sstudiu-cat-s-cheltuit-anul-trecut-activitatile-de-cercetare-si-dezvoltare-din-republica-moldova/#.WhwGBUqWbIV

system currently in place does not help bridge the mismatch of produced competencies with the private sector needs, and there is a lack of critical mass in key skill sets.[74]

3.5.3.3 Companies

SMEs amount to over 95% of the number of businesses operating in Moldova. As a component of the private sector, ICT is a fast-growing industry, with over 1100 companies, highly attractive jobs, and launching products in value of over EUR 21 million (0.32% of GDP) on the local market, and of EUR 67 million for export in 2016.[75]

Still, the private sector in Moldova is not an active beneficiary of R&D funding considering that most policies and existing schemes do not target research in private companies. The main innovation support action is implemented by the AITT, which encourages companies to transfer innovations to market through grants, subsidies and facilitating the relationships between researchers, universities and industry representatives, yet is highly focused on public research organisations as opposed to existing businesses.

Some innovations were brought to life by private businesses supported by UNDP's Moldova Innovation Challenge Scheme. Since its start in 2015, the grant contest for innovative SMEs aided over 300 local companies, out of which 80 companies received direct financial support.[76]

There is practically no support for start-ups in Moldova offered by public schemes. Innovative start-ups, mostly focused on ICT products, have the opportunity to benefit from entrepreneurship support programs which appeared over the last two years in technoparks and incubators, such those hosted by Dreamups Innovation Campus (start-up School, Founder Institute), TEKWILL (Rockstart Launchtrack) which offer mentorship and partial funding (FI).

Regarding patents registered and/or renewed in Moldova, only a small proportion (4%) is filed by business enterprises and organisations. The reasons thereof stem from a weak cooperation between the private sector and R&D and a still developing innovation culture.[77]

According to the 2nd Stakeholders workshop on Moldova ICT Centric Innovation Ecosystem, held in June 2017 in Moldova, most of the talented Moldovan companies are focusing their efforts internationally, considering the small local markets, limited ICT usage and relatively low incomes.

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[74] Moldova ICT Centric Innovation Ecosystem Country Review (2nd Stakeholders workshop)

[75] http://infomarket.md/ro/marketpuls/Habitat_pentru_genii_capricioi__

[77] https://rio.jrc.ec.europa.eu/sites/default/files/report/Moldova-PSF_PR-KIAX16004ENNOP.pdf

3.5.3.4 Clusters

The development of clusters in Moldova is at an early stage and appeared from the needs of the industrial sector. According to the *Review of the state of development of clusters in EaP countries*, the still early-stage development of clusters stems from the limited participation of private companies and lack of a leading entity in the lobby process, weak collaboration between companies, public authorities and R&D stakeholders, insufficient information and support from outside partners as well as access to financing.

AITT is the agency facilitating the collaborative research activities between organisations and educational institutions, by offering grants and innovation vouchers in priority research areas.

An array of clusters activating in Moldova are focusing on cross-innovative areas, such as nanotechnology and new materials, food processing and applications of renewable energy technology in agriculture. These include the following:

1. Scientific and technological cluster “Academica”, bringing together 19 partners. Under its umbrella two separate structures were created: STP “Academica” and Innovation Incubator “Inovatorul”. It was the first innovation infrastructure created in Moldova and operates under general areas of research.
2. Educational and Scientific Cluster “Universcience”, created in 2011 under an agreement between 20 partners. It offers training to the scientific staff in their target fields of activities.
3. Moldova - Lithuanian Innovative Technologies Cluster, with the participation of 1 foreign and 5 national partners, created the premises for establishing the Moldovan-Lithuanian Innovation Incubator “Media-Garage” in 2014.
4. Science and Technology Park “Inagro” (established in 2008), is specialised in ecology and intensive agriculture, and brings together 4 partners.
5. “IT4BA” (IT Incubator for Business Application), is a cluster of science and technology in the IT field created in 2015 by 5 partners at the Academy of Economic Studies of Moldova.
6. Scientific and technological cluster in the IT industry, created in 2012, under which 2 innovation incubators were established: Innovation Incubator “Itech” of the Academy of Economic Studies of Moldova and Innovation Incubator “Inventica- USM” of the State University of Moldova.
7. Science and Technology Park “Micronanoteh”, established in 2009 through the association of two partners, is specialised in the field of microelectronics and nanotechnologies.

8. "Innovative Entrepreneur" cluster is related to the innovation incubator "North", established in 2012 by the association of five partners in the North of the country with the support of the Moldova State University “A. Russo” from Balti.
9. Science and Technology Park “Elchim-Moldova” is an organisation demonstrating growth in the partner companies’ performance. The cluster’s aim is to bring together research, intellectual and other resources to create innovative technologies in the electrophysical and electrochemical industry.
10. The Innovation and Educational “InnoCluster” was formed in 2012 by the merger of 6 partners operating in ATU Gagauzia: Association of Entrepreneurs, Chamber of commerce, Educational institutions, technical NGOs, “InnoCentre” incubator. Its purpose lies in the transfer of from research to business, whereby companies - residents of Innovation incubator – would convert research findings into products and services to market.

International experience shows that cluster formation and efficient implementation can address certain directions that are crucial for Moldova (improvement in quality of goods and services, enhanced readiness for export, capacity building for human resources and skill upgrade). In Moldova there are pre-conditions for cluster development considering the existence of relevant policies and support from international donors, financing sector-specific initiatives. Still, clusters are at a very early stage of development, existing clusters outlined above are relatively small and focus on collaborative R&D activities while there are still no strong clusters formed in strategic industries for the country, such as wine, automotive, IT, light industry.[78]

3.5.4 Services of the stakeholders

The basic services provided by the main stakeholders of the R&I system are summarised below. Moldova has multiple levels of support for innovative start-ups and SMEs, most of the being concentrated around the infrastructure and consulting services, as well as access to networks. Access to financial instruments is mainly granted by publicly-funded organisations (e.g. ODIMM’s grant scheme and Pare 1+1 program focusing on attracting remittances to the country) or international donors (USAID, UNDP) and consist of financial support in setting up a business and/or procurement of consulting services for business development.

[78] https://www.get-moldau.de/wordpress/wp-content/uploads/2016/07/PP_03_2016_en.pdf

Table 3.5.1. Basic services provided by the main stakeholders in Moldova

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks / Collabo-ration
R&I stakeholders					
e-Government Centre Moldova	+	+			+
Moldova Social Innovation Lab (MiLab)	+	+			+
Business Innovation Lab (Inobiz)	+	+		+	+
ODIMM (Organisation for Development of SMEs)		+		+	
Agency for Technology Transfer		+		+	
USAID Moldova Competitiveness project (start-up Moldova initiative)				+	+
Atelier99	+	+			+
Academy of Science of Moldova – Research and Development Agency	+	+	+		
National Institute for Economic Research	+	+			
Academy of Sciences of Moldova – Centre for International Projects		+		+	

Innovation Incubator “Inovatorul” (as part of STP “Academica”, Chisinau)	+	+			
Network of Business/Innovation Incubators in the country (many of them managed by ODIMM)	+	+			
Moldovan-Lithuanian Innovation Incubator "Media Garaj"	+	+			
Innovation Incubator "IT4BA	+	+		+	+
R&I stakeholders with a strategic focus on ICT					
TEKWILL ICT Centre of Excellence	+	+			+
ATIC (Moldovan Association of Private ICT Companies)	+	+			+
iHUB	+	+			+
Dreamups Innovation Campus	+	+		+	+
Research and Education Association Moldova (RENAM)		+			+
GirlsGoIT		+			+
Generator Hub	+	+			+
404 Not found	+	+			+

Information and Communication Technologies Centre in Education CTICE	+	+			+
Computer Training Centres	+	+			

3.5.5 Strategies

Strategies and policies are a state's mechanism to enable innovation ecosystems and creating the premises of a medium that fosters the efforts of RD&I stakeholders.[79] The main strategies targeting R&I in Moldova are presented in Table 2. The strategies addressing ICT Innovation are either developed on a national, all-encompassing level, either are incorporated in sectorial strategies.

Table 3.5.2: Relevant research, innovation and ICT strategies in Moldova

Strategies	
INNOVATION STRATEGY of the Republic of Moldova for the period 2013-2020 "Innovation for Competitiveness" (Government Decision no. 952 of 27.11. 2013)	The strategy is targeted on enhancement of innovation infrastructure, strengthening the potential for innovation, and internationalisation. The goal is to provide consistent framework of horizontal policies that will contribute to increasing the international competitiveness of the Republic of Moldova and building a knowledge-based economy, developing the human capital, building the skills of Moldovan companies to absorb, generate and disseminate information through their closer connection with universities and research centres. The Strategy adopts five general objectives: Adoption of an open governance model for research and innovation; Empowering people with innovative skills; Company orientation towards innovation; Applying knowledge to solve societal and global problems; Stimulating the demand for innovative products and promoting innovation.
Strategic Program on Governance Technological Modernisation (e-	The document sets the objectives of the e-Transformation process and offers an integrated vision of the public services modernisation process and making governance more efficient through the use of information technologies (IT). At the same time, the Strategic Program for the Technological Modernisation of the

[79] Bridging the digital innovation divide: A toolkit for strengthening ICT centric ecosystems (ITU)

Transformation) (Government Decision no 710 of 20.09.2011)	Governance sets the basis for a coordinated approach for intelligent investments in IT and increases IT capacities in the public sector. e-Transformation Program will serve as a basis for intelligent investments in IT.
National Strategy for Information Society Development "Digital Moldova 2020" (Approved by Government Decision no 857 of 31.10.2013)	General objective of the Strategy is to Create favourable conditions for development and wide use of ICT's potential by the public institutions, businesses and individuals in order to help them achieve economic, social and cultural goals, for the benefit of everyone. The Strategy is aimed to create conditions through minimum state intervention with maximum effect for information society development, focusing efforts on three pillars: Pillar I: Access and infrastructure – improvement of connectivity and network access; Pillar II: Digital content and electronic services- promoting digital content and generating services; Pillar III: - Capacities and utilisation- strengthening literacy and digital skills to enable innovation and stimulate usage.
STRATEGY to increase the competitiveness of the Information technology industry for the years 2015-2021 **(Government Decision no 254 of 14.05.2015)**	This document provides for the setting up information technology parks as well as their operation. The purpose of this strategy is to create the necessary premises to stimulate the development of the information technology industry by creating high added value jobs and attracting domestic and foreign investments. To stimulate the development of the internal market and innovation, development of new, commercially viable IT products and services will be stimulated, increased public spending on ICT and prioritizing local IT companies, raising awareness on the use of ICT in various sectors of the economy, introduce policies to facilitate e-commerce and reduce software piracy rates. The strategy also aims to support the creation of new digital content, delivery of digital media and marketing training and allow more Internet service providers to expand their capabilities.
The Research and Development Strategy of the Republic of Moldova until 2020 (Government Decision no 920 of 14.11.2014)	The paradigm of economic development will involve attracting investment, developing export industries, promoting the knowledge-based society, including strengthening research and development, innovation and technology transfer, geared towards efficiency and competitiveness. 5 general objectives of the reforms: 1) Governance of R&D on the basis of a consensual management model, oriented towards performance and excellence. 2) Developing human, institutional and infrastructure capacities. 3) Defining and managing research priorities. 4) Continuous dialogue between science and society, dissemination of knowledge and practical implementation of research results.

	5) Internationalisation of research, integration into the European research space and increasing international visibility.
Roadmap on Enhancing the Competitiveness of the Republic of Moldova (Government Decision no 4 of 14.01.2014)	The priorities and actions of the Roadmap are organised into separate Components. In addition, sector-level Components are included. The Components address Human Resources, Access to Finance; Transport Infrastructure; Energy Infrastructure; Quality Infrastructure; The Information Society; Trade Facilitation; Tax Policy and Administration; 9. Science, Technology and Innovation; Competition. The Roadmap addresses issues of central importance to improving Moldova's competitiveness, particularly in view of the opportunities and challenges opened by the DCFTA. The selection of these issues also draws upon the experience of governmental agencies and their sense of what are the key short to medium-term challenges facing the country in the process of achieving the objectives set, or implied, by the Association Agreement and the DCFTA.
Code on Science and Innovation of the Republic of Moldova no. 259/2004 and the Education Code of the Republic of Moldova no.152 / 2014	The declared objective of the amendments to the Code on Science and Innovation of the Republic of Moldova no. 259/2004 and the Education Code of the Republic of Moldova no.152 / 2014 is to achieve the objectives stipulated in the Government Program of Activity for the years 2016-2018, adopting a more open, inclusive and transparent model "and" strengthening capacities and functionality of quality assurance institutions in education ". Similar objectives are reflected in other important policy documents, such as the National Action Plan for the implementation of the Moldova-EU Association Agreement between 2017-2019, approved by the Government Decision no. 1472 of 30.12.2016, Moldova's Innovation Strategy for the period 2013-2020 "Innovations for Competitiveness", (Government Decision no. 952 of 27.11.2013) and the R & D Strategy of the Republic of Moldova until 2020, (Government Decision no. 920 of 07.11.2014)
National Strategy on Intellectual property until 2020 (Government Decision no.880 of 22.11.2012	Strategic vision: Intellectual property must become a fundamental tool in creating an environment conducive to innovation, creativity and free competition, for the economic, social and cultural development of the Republic of Moldova. Strategic Mission: Develop and strengthen an adequate legal, institutional and social framework for the creation, protection, management and plenary valorisation of intellectual property potential, meeting international standards and contributing to the development of a competitive national economy based on knowledge and innovation.
IT Sector Strategic Roadmap for Moldova *(Proposal*	The Roadmap Objectives: • Increase size and share of high value Technology Services exports originating from Moldova

of the new policy document)	• Create a sustainable talent pool to match evolving market requirements • Provide a favourable climate to attract investments in IT, R&D and technology start-ups • Promote and position Moldova as a viable investment destination for R&D and disruptive technologies. The interventions are classified across 4 pillars of the IT Industry: Capacity development, Business Ecosystem, Infrastructure Development, Investment promotion.
The STRATEGY for Development of the Small and Medium Enterprises Sector for the Years 2012-2020 (Government Decision no.685 of 13.09.2012)	The Strategy for the Development of the Small and Medium Enterprises Sector for 2012-2020 provides the long and medium-term policy framework for the development of micro, small and medium enterprises (SMEs) in the context of moving from the consumer-driven economic development model to a new export-oriented, investment and innovation paradigm, the political desirability of European integration and world economic trends. Strategic Mission: Creating a favourable business environment, promoting
Concept of Industrial Cluster Development (Government Decision No. 614 of 20.08.2013)	The Concept of Industrial Cluster Development examined the premises for cluster development in the country's industrial sector and concluded that the Moldovan economy had sufficient economic prerequisites for the creation and development of local and international clusters. Manufacturing industries in Moldova where clusters would most likely result in innovation and increased competitiveness were the food and beverage industries. The main objective of the state policy supporting the development of clusters is to enhance the development of industrial sectors and increase their share in the national economy by strengthening the managerial and organisational efforts, supporting the innovation process, and increasing the competitiveness of the large industrial enterprises and the SME sector.

Certain sector-specific strategies were adopted, which also take into account the digitalisation direction, for example the support in development and implementation of various innovative IT solutions in culture, tourism, health and agriculture.

3.5.6 Policies

In addition to different strategies, a set of policies were adopted or have been recently drafted, to support ICT innovation in Moldova, implement benefits for digitalisation of businesses and facilitate the research and development process.

Table 3.5.3.: Relevant research, innovation and ICT policies in Moldova

Policies	
Law no.77 of 04/21/2016 concerning the information technology parks	The law aims at creating the necessary conditions for boosting the development of the information technology industry and creating a competitive business environment on a regional level in the Republic of Moldova according to the Strategy for increasing the competitiveness of IT industry for the years 2015 -2021. The key element of the project is to implement the innovative tax model for IT parks' residents by applying a single tax in the amount of 7%, with simple and clear management mechanisms. The law expressly provides for 8 types of main activities that may be carried out within the IT parks. It is worth mentioning that the parks shall be 'virtual', and the residents shall work from their own offices situated on the territory of the Republic of Moldova, after their registration as resident and assumption of all the obligations stipulated in the law.
Code No. 259 of 15.07.2004 On Science and Innovation of the Republic of Moldova	This Code regulates the legal relations relating to the development and promotion of state policy in the field of science and innovation, scientific research, innovation and technological transfer, scientific and technological information, accreditation of organisations in the field of science and innovation, certification of scientific staff and highly qualified scientific-didactic, intellectual property protection, legal status of science and innovation topics.
Law No. 138 of 21.07.2007 on scientific-technological parks and innovation incubators	The regulatory scope of this law is the legal regime for the organisation and operation of science-technology parks and innovation incubators. The purpose of this law is to stimulate innovation and technology transfer activities aimed at transforming the results of scientific research and innovation into products, services, new or improved processes.

Although there were considerable improvements in the quality and goals of the newly adopted strategies and policy documents related to ICT innovation and R&D in general, there is an array of weaknesses that characterises the current system, such as its centralised and rather closed nature of the funding process, low competition for funding since the private sector does not have access to public research funding measures.

Also, organisations working with potentially innovative companies/ start-ups are not actively involved in the policy elaboration process, although they play a consistent role in supporting these

innovations. The policy-makers still lack the coherence, human resources capacity and vision to develop quality policies, according to the Peer review of the Moldovan Research and Innovation system.[80]

3.5.6.1 Public-private partnerships (PPP)

Public-Private Partnerships in the area of R&I in Moldova are a challenging area. Given the poor technology and innovations transfer to market, together with the lack of clear and supportive innovation policy, companies are not investing heavily in innovations nor perform internal R&I activities.

3.5.6.2 Public procurement on innovation (PPI) and pre-commercial procurement (PCP)

Public procurement is regulated in Moldova by the Public Procurement Law, by the Public Procurement Agency - an administrative authority subordinated to the Ministry of Finance, set up for the purpose of overseeing, ex-post controlling and coordinating inter-departmentally the field of public procurement. Moldovan Public Procurement is often influenced and limited by weak capacities of procurement teams to properly plan, document the development and specify requirements, unclear responsibilities in the procurement process, insufficient internal control and M&E thereof. [81]

Probably one of the most notable examples of innovations public procurement is related to the activity of the e-Government Centre Moldova. The goal of the E-Government Centre is to promote and support the development of technological modernisation of the public sector, in the context of the e-Transformation agenda's implementation. The long-term goal of this institution is to support the e-transformation of the public sector, through the use of advanced ICT that would lead to a more efficient, transparent and connected government. With the EGC support, the Public Procurement Agency implemented the e-Procurement system, which digitalises most of the procurement steps, from registering and publishing RfPs, submitting the invitations to tenders, modifying/approving bid documents, to application submission, communication with bidders, online access to auction documents, tracking of bidding processes, and more.

On the ICT for Government side, a number of e-solutions have been implemented by the Governmental institutions and contracted from private companies. One example is the MPay system - the service by which citizens can pay for public services with any payment instrument of their choice, such as bank card, internet banking or cash. It was developed by the private

[80] https://rio.jrc.ec.europa.eu/sites/default/files/report/Moldova-PSF_PR-KIAX16004ENNOP.pdf

[81] http://www.expert-grup.org/ro/biblioteca/item/download/1178_4a7fd2d319a93ecd88d49edbd4de1514

company Q-Systems with the support of the e-Government Centre in Moldova and CTS – Centre for Special Telecommunications. From its launch in 2013 to date, MPay registered over 6 million transactions.

Another notable solution, developed by the same company (Q-Systems), the company Rossoft, the E-Governance Centre, in partnership with the Ministry of Internal Affairs, is the mobile e-Trafic application. It enables users to receive notifications of traffic violations and informs users about the internal police document number of the action, the number of the violated article from the Contravention Code, the place and description of the violation, number of penalty points, the minimum and maximum amount of the fine.

3.5.6.3 Public funding

According to UNESCO data, in Moldova, spending on R&D has decreased significantly from 0.44% of GDP in 2010 to 0.37% of GDP in 2015.

GERD (Gross Domestic Expenditure on R&D), by sector of performance, was split between Government (67.14%), Business enterprise (20.75%), and Higher education (12.11%). By field of science, most funds were spent on Natural sciences (35%), followed by Engineering & Technology (24%), Agricultural sciences (14%) and Medical sciences (10%). The other less funded areas include social sciences and humanities.[82]

As mentioned earlier, the funding for R&D is highly centralised and concentrated in the public sector, particularly in institutions related to the ASM. Public funding to the private sector is represented mainly by grants and co-financing in business development, and very seldom addresses R&I activities initiated by companies.

3.5.6.4 Private funding

In Moldova, there is no fixed Business Expenditure for R&D (BERD) target set, while data on BERD is not available. Extrapolating based on the WEF score from the Global Competitiveness Report for 2015-2016, Moldova ranks 135nd out of 140 countries on R&D spending by private companies. Based on the Peer Review of the Moldovan Research and Innovation system, the industries investing in innovations is focused on trade and low-tech, consumer products, and is highly dependent on foreign technology as opposed to in-house development. Big, multinational companies (especially Telcos) are the private companies that have the capacity to invest relatively more in innovations as opposed to SMEs.

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[82] http://uis.unesco.org/en/country/md?theme=science-technology-and-innovation

Currently, banks in the Republic of Moldova do not have credit lines for R&D in the commercial offer. Thus, private companies can access bank capital only on the basis of general lending conditions. Because of this, private companies are not motivated to contract bank credits for R & D.

In the fall of 2017, two funds announced their entering on the Moldovan market to support innovative tech start-ups. One of them is *Seed Fund*, bringing together financing from USAID and the Swedish Government, and having a private fund as co-partner. The Fund was inaugurated at the start-up Week 2017, will amount to Eur 200,000 and will support approximately 10 innovative start-ups from Moldova.

The second fund is *u.ventures*, established by the Western NIS Enterprise Fund (WNISEF). WNISEF is a EUR 125 million (USD 150 million) regional fund with a focus on Ukraine and Moldova, funded by the U.S government via USAID. *U.ventures* aims to invest in early stage technology start-ups from Ukraine and Moldova with world-class teams and a global potential for growth. Initial investments range from EUR 85,000 (USD 100,000) to EUR 420,000 (USD 500,000).

3.5.7 Performance

According to the Global Innovation Index 2017, Moldova ranks 57/127 with a score of 36.84, being positioned between Costa Rica and Saudi Arabia. [83]

In terms of education, the average performance in science in Moldova for 15-year-olds was scored with 428 points, compared to an average of 493 points in OECD countries. In mathematics, students scored 420 points versus 490 points in OECD, while the score in reading is 416, compared to an average of 493 points in OECD countries.

Relative strengths of the innovation system are related to the following: accessibility and time compatible both with East and West (UTC+02:00), multilingual population (Ro, Ru, En, Fr, It, etc.); diversified industry footprint and cross-sector expertise[84]; number of citable researches and qualified PhD scientists; high patent registration rates; strong ICT skills and exports of ICT services (approx. 8000 core software professionals); existence of digitalisation and ICT strategies and policies; certain tax reliefs for ICT businesses, adoption of tech parks law; existence of support organisations including public innovators such as the eGovernment Centre and MiLab; European Neighbourhood Policy; access to microfinance loans, loan guarantees, grants (national

[83] http://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2017.pdf

[84] IT Sector Strategic Roadmap Development. Blueprint for Moldovan IT sector (Avasant with the support of USAID, Swedish Government)

and H2020 eligibility), a few venture and private equity funds; strong diaspora as resource for potential internationalisation of local products and services developed.

Relative weaknesses are in: poor linkages between research institutions and businesses; lack of coordination between governmental and private bodies, and low participation of the latter in the shaping of the R&I and ICT policy formulation; corruption, bureaucracy, ambiguity in and complicated company set-up process including fiscal management; issues with taxes, incentives, inspections; no public funding for privately-owned R&I initiatives; large focus on outsourcing ICT skills rather than building local products and services; lack of knowledge and business intermediaries; very early stage venture funding only being setting up in the late 2017.

3.5.8 Challenges

As for any country with an economy in transition, there is a number of challenges that affect the current innovation and R&D system in Moldova.

Centralised public system of R&I: the R&D activity is highly concentrated around the Academy of Science of Moldova, which formulates the R&D policy, priority actions, and manages most of the budgets allocated to research. Other public, and particularly private, actors play a limited role in the process nor have open access to public R&D funds. This is challenge since due to the concentration of the public R&D system, policies not always reflect the needs of the most innovative industries or those sectors with highest potential to innovate.

High level of fragmentation: the policy adoption system is highly dispersed and uncoordinated among institutions – fiscal and monetary, FDI, IP, trade, agricultural and industrial development priorities, health, etc. policies are not interconnected to respond to an overarching RD&I national strategy and insufficiently coordinated among decision makers. Oftentimes this determines inefficiencies and doubling of activities and roles leading to poor practical results. Moreover, not all relevant stakeholders (governmental agencies, consumers, associations, educational institutions and support organisations, civil society) are involved or consulted for the formulation and implementation of R&D policies. Also, there is a low capability of innovation management both within public and private institutions at all stages of innovation development, which is crucial for proper commercialisation of R&D results.

Low level of innovations applicability: a large part of the research and development carried out has a low transfer-to-market rate. Many studies are published yet the weak business skills and deficient collaboration between scientist and business people prevents innovations to be implemented into scalable products or services. Also, the capacity of human resources involved in research and poor innovation process management determines the low level of innovation transfer or development within private entities.

Education system focused on teaching: the quality of innovations and human capital capacity for developing and scaling innovations can also be derived from the education system currently in place, which is highly focused on teaching and delivering traditional theoretical programs, rather than on research and science. The lack of practical skills and innovative thought process, as well as little exposure to international experience, spills over to the consequent professional activity. The number of specialists graduating from education system in Moldova is decreasing on a constant basis, while many young people choose to study abroad, few of them bringing the experience back to the country. In order to efficiently implement innovations there is a need for human resources that are well prepared to assimilate the technological advancements and with basic understanding of technological advancements.

Overreliance on external funding: financing of R&D is mainly focused on the public sector/institutes, while practical applications and scale-ups are seldom supported financially. Public grants are available for traditional business establishment but not as much for R&I activities. Current public funding of RD&I is also flawed from the projects' selection and evaluation perspective. Externally-supported venture funds are in process of being established, while EU funding is available for Moldovan researchers and innovators, e.g. through H2020 programs. Local VC funds are insufficiently supported by comprehensive yet simple regulations which would protect and nurture the private funding of R&D activities.[85]

3.5.9 Gap analysis

Expenditures on R&D in Moldova are relatively lower compared to other countries in the region (e.g. the Baltics), with R&D spending 4 times lower than its neighbour, Romania, and over 80 times lower than the EU average.[86] The effectiveness and outcomes of these investments are also poorer, stemming from the challenges exposed above.

ICT innovation and digitisation are at an early stage of development and the process of setting up a coherent strategy and responsibilities is very fragmented. The few organisations aiming to support innovative start-ups, for example, have only recently begun to collaborate partially, still a competitive nature of the relationships is noticed. The tech start-ups ecosystem is supported by international development partners (USAID, UNDP, Swedish Government) however, as opposed to Estonia, for example, there is no unique umbrella organisation (a " start-up Moldova") which would represent all stakeholders and lobby for policies that would respond to the needs of

[85] Study on the improvement of the national regulatory and legislative framework in the field of intellectual property in order to encourage the innovative activity

[86] https://rio.jrc.ec.europa.eu/sites/default/files/report/Moldova-PSF_PR-KIAX16004ENNOP.pdf

the community. With recently launched VCs the financing of innovative start-ups will be accelerated, yet the lack thereof up to now confirms the still deficient regulatory framework and lack of trust in the system, which determines local start-ups to choose other countries to incorporate.

Although ICT is a top industry with attractive salaries and skilled human resources, Moldova still lacks ICT clusters, as opposed to Estonia, for instance, where ICT clusters are central to the development of the sector and boosting exports of ICT products and e-services. The new policy on IT technology parks which would facilitate cluster formation and more competitive services is a strong first step, and Estonian Tehnopol is a success story to be followed and learned from. Another relevant example is the Irish Digital Hub which is managed by a dedicated Agency. Although in Moldova there is an ICT Centre of Excellence set up and running, the country lacks a structure that would support the joint work of digital companies in their diversity, bringing together not just developers but creatives, marketers, etc. as well as a governmental agency invested in boosting the sector.

As to education, Moldova lacks a framework that would encourage and promote breakthrough, innovative ideas developed within HEIs and technology transfer from universities to markets. A good practice that can be matched is the German "Innovative Higher Education Institutions" program that sets the blueprint for private and education sector collaboration.

Also, Moldova lacks a strong PPI and PPP framework and examples of success stories. With fragmented funding for R&D that is focused on public research institutions rather than private initiatives, as well as low degree of readiness of the public sector to establish meaningful partnerships for implementing innovations in the public realm, Moldova has a large space for improvement in terms of legislation, human capacity and political will.

Table 3.5.4. Stakeholder analysis

Services	Estonia	France	Germany	Ireland	Sweden	UK	Moldova
Access to infrastructure							
Tech parks	+	+	+	+	+	+	
University clusters	+	+	+	+	+	+	
Access to supercomputers	+	+	+	+	+	+	
ICT labs	+	+	+	+	+	+	+

Advice and consulting							
Consulting on grants	+	+	+	+	+	+	+
Business consulting	+	+	+	+	+	+	+
Training	+	+	+	+	+	+	+
Research funding							
Financing universities	+	+	+	+	+	+	+[87]
Financing PROs	+	+	+	+	+	+	+
Grants for researchers	+	+	+	+	+	+	+
ICT Innovation public procurement	+	+	+	+	+	+	+
Business funding							
Tax incentives		+				+	+
Grants	+	+	+	+	+	+	+
Loans	+	+	+	+	+	+	+
Guarantees	+	+	+	+	+	+	+
Equity	+	+	+	+	+	+	+

[87] AITT.md – Agency for Innovation and Technology Transfer, established by the Academy of Science of Moldova.

Funding venture capital funds	+	+	+	+	+	+	+
Networks							
Enterprise network	+	+	+	+	+	+	+
start-up network	+	+	+	+	+	+	+
Investor networks	+	+	+	+	+	+	
University network		+	+	+	+	+	+
ICT research network		+		+	+		

3.5.10 Roadmaps and Recommendations

The proposed national roadmaps should include following:

- Consolidate the RD&I ecosystem by studying best practices of economies with similar backgrounds or leaders from the region (e.g. Estonia), adapting it to the local socio-economic state and clearly define the roles of key actors and correlation between them for a more efficient co-operation. It is crucial to coordinate all efforts and involve all main stakeholders in the policy drafting and implementing policy. It can be achieved by creating of an overarching Innovation agency which would envision a unique RD&I roadmap for the country, coordinate strategies and other policy documents among governmental bodies, focus policies on domestic needs and priority industries, facilitate effective PPP implementation.
- Accelerate launched policy initiatives (tech parks, tax incentives) and recognise ICT and RD&I as strategic areas for the country development and further policy development. Research international good practices in terms of relevant policies, and reform R&D as well as start-up launch process, inspection, funding and taxation regulations accordingly.

- Boosting the efficiency and effectiveness of R&I funding and funding bodies, including a stronger collaboration across sectors (public-private-government links), transparent funds management with simple administrative procedures and stipulations for both public and private research conditions. Also regarding financing, clear and supportive measures for seed funding should be put in place.
- Improve human resources capacities, mobility and collaboration between researchers, and reform the education system (in particular the tertiary and professional levels) so as to produce competent human capital, skilled in carrying out research. Education should have an inter-disciplinary approach to stimulate innovative thinking and develop innovation implementation as well as management skills. Internships and close work with the private sector during curricula elaboration, especially in IT, should be promoted, and the curricula aligned with the evolving industry needs. The intense brain-drain can be reduced or leveraged by encouraging collaborations with the diaspora, support skills sharing, have returnees deliver trainings and transfer best practices from abroad. In the medium run, efforts can be made to repatriate start-ups set up by Moldovan entrepreneurs abroad by offering attractive investment and other facilities.[88]
- Elaborate a supportive framework for specific industry clusters formation, in order to promote knowledge transfer, pooling of resources and collaborative, scalable projects. This can be achieved through creation of consulting and technology transfer centres with private sector involvement, for coaching and transfer of best practices to start-ups and emerging SMEs. These centres could be created in the regions / rural areas as well[89], to increase the pool of potential talent and trained human resources. Also, existing support organisations (hubs, incubators, accelerators, centres of excellence) should have their capacities consolidates as to not provide more complex services at all stages of innovation. New structures that are industry- (or sector-) focused can also be created to address and nurture more targeted R&D initiatives from ideation to market.[90]
- Creation of an overarching organisation such as Enterprise Moldova / start-up Moldova, which would represent the innovative start-ups interests. There is a perceived lack of trust in the current ecosystem players and a need for community building activities. A unifying organisation would promote role models and success stories, bind and solidify the

88 Moldova ICT Centric Innovation Ecosystem Country Review (2nd Stakeholders workshop)

89 IT Sector Strategic Roadmap Development. Blueprint for Moldovan IT sector (Avasant with the support of USAID, Swedish Government)

90 Study on the improvement of the national regulatory and legislative framework in the field of intellectual property in order to encourage the innovative activity

community, make connections with external ecosystems for good practices transfer and coordinate twinning projects with international players in cross-cutting industries.

3.6 Ukraine

3.6.1 Abbreviations

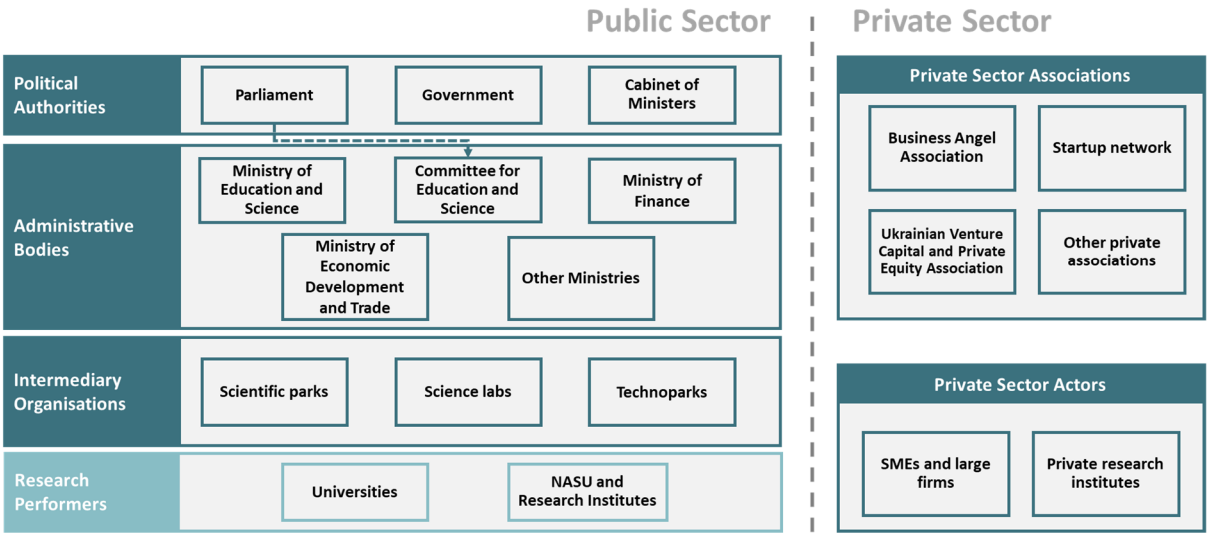
EaP	Eastern Partnership countries
GERD	Gross domestic expenditure on research and development
MEDTU	Ministry of Economic Development and Trade of Ukraine
MESU	Ministry of Education and Science of Ukraine
NASU	National Academy of Sciences of Ukraine

3.6.2 Overview

Over last years, Ukraine has made some progress in the sphere of innovations in general and ICT in particular. ICT becomes more and more popular for doing business. This results in appearance of new elements of innovation ecosystem all over Ukraine. At the same time the number of incubators and accelerators is increasing, which should help Ukraine to develop promising technologies. Simultaneously, Ukrainian government created ample of strategies and policies targeted at ICT development. Moreover, GERD in 2016 was on a level of 0.48, which is quite good results compared to other EaP countries, but quite bad compared to EU countries.

3.6.3 Stakeholders

Figure 3.6.1. Ukrainian innovation system



3.6.3.1 Government bodies and agencies

On the strategic level the main Ukrainian governmental authorities that oversee innovation system are the President of Ukraine, who sets strategic goals in research and innovation, and the Parliament of Ukraine (Verchovna Rada). The Cabinet of Ministers is responsible to propose instruments in accordance to set goals that aims at improving innovation environment on a governmental level. The Committee for Education and Science in its turn consider and discuss relevant legal acts. Additionally, in October 2017 was established Innovation Council, which is responsible for provision of recommendations for the development and use of the state's innovative potential, the development of innovation infrastructure, science support and the implementation of priority projects in the real economy. The National Council of Ukraine on the Development of Science and Technology is an advisory and consultative body attached to the Cabinet of Ministers of Ukraine, as provided for by the Law of Ukraine on Science and Technology.

MESU is the main governmental operation player responsible for Higher Education and implementation of R&D and innovation policy initiatives that are already proposed by other institutions. Besides, MESU oversees Horizon 2020 implementation. In addition, all other ministries are involved in and have their budgets for this process of implementation within the limits of their authority. For example, MEDTU is in charge of industrial R&D, the Ministry of Finance is responsible for budgeting, while the Ministry for Foreign Affairs is in charge of international issues.

NASU is the main scientific player on the map of Ukrainian innovation system, which consists of ample research institutes. It receives around a half of state funds spent in this field and is relatively autonomous from the ministries in its activities.

3.6.3.2 Universities

As of 2017, there are 657 higher education institutions active in Ukraine, among which 287 are universities. During the years of Ukrainian independence, the number of university students was gradually growing from 0.9m in 1991 to 2.8m in 2008. Then declined to 1.7m in 2013 mostly because of demographic situation in Ukraine. After reform of educational sector in 2014 along with annexation of Crimea and beginning of the conflict in the eastern Ukraine, number of universities declined even more to 1.4m in 2017. Simultaneously, number of students dropped first from 2.3 million in 2008 to 1.7 million in 2014, and then to less than 1.4 million in 2017 year[91].

According to MESU, as of 2014 universities contributed to only 15.8% of any kind of R&D activities in Ukraine. Among all scientific publications in Ukraine 79% are done by higher education institutions, only 11% of which are listed in the international databases. According to MESU as of 2016 only 15% of governmental higher education funding goes to R&D. Therefore, MESU is going to increase financing of R&D from 6.2 million EUR in 2018 to 30-46 million EUR in 2020.

In Ukraine there is a gap between the real sector of the economy and the educational and scientific sphere. The competences of personnel often do not match the labour market needs. Moreover, there is a lack of innovation research component in universities. As Ukrainian universities are primarily focused on teaching, business rarely look for R&D services in Universities.

Yet, the new Law “On Higher Education” in 2014 gave Ukrainian Universities more freedom in teaching programs’ formulation. Still cooperation between innovation infrastructure organisations and HEI in development of educational programs is rather an exception than a rule. Yet, there are already several good examples such as cooperation between Lviv IT cluster and Lviv Polytechnic Institute who jointly developed and implemented new teaching program “Internet of things” in 2016 (specialists from IT businesses were involved in teaching this course). In 2017 Lviv National University also jointed the initiative and jointly with Lviv IT cluster developed new teaching program “Data Science & Intelligent Systems”.

The situation with entrepreneurial education however is not very optimistic. Even after implementation of new law on education, there is a gap between teaching programs and skills needed in practice. Although most Ukrainian universities (even technical) have Economic and

[91] Source: State statistics Service of Ukraine

Business Departments, they provide mostly theoretical knowledge that could be hardly implemented in business processes. Yet, there are several good examples of modern business education in Ukraine (MBA).

3.6.3.3 Companies

According to State statistics service of Ukraine the role of private sector in R&D keeps increasing. Enterprise sector performed 55.4% of all R&D in 2010, while in 2016 it was already 61.8%. Moreover, in 2010 15.2% of all R&D were financed by private sector, while in 2016 this number grew to 29.2%.

Only 16.6% of enterprises were introducing innovations in 2016 compared with average 49% rate in the EU. In 2014-2016 the highest rate of innovation activity was observed in the field of information and telecommunications (22.1%), food processing and pharmaceutical sectors (22.0%), financial and insurance activities (21,7%), engineering, marketing and science related services (20.1%). In Ukraine the role of private sector in R&D is undermined by dominance of traditional economy sectors (agriculture, metals and heavy manufacturing) that have low demand for R&D and lack of motivation and ability of financial institutions to support R&D compared to other business activities. SMEs faces scarce financial resources and low supply of high quality equipment and personnel as well as low demand for innovations from big state-owned enterprises. Still, Ukraine was ranked 50th out of 127 countries in Global Innovation Index 2017, which is much better compared to previous years (i.e. in 2014 Ukraine was ranked 63^{d}).

3.6.3.4 Clusters

Innovation support infrastructure has emerged in the form of science parks, start-up incubators and accelerators as the existing clusters are focused only on industrial development, such as construction, oil and gas, metal manufacturing, etc.92

More than 30 tech-funds are operating in Ukraine, including 17 Venture Capital funds, 8 Private Equity funds, 6 incubators, 7 accelerators, 3 corporate VCs. Moreover, there are more than 20 co-working spaces where entrepreneurs can develop their innovative ideas and seek for advice and support.

92 Konstantynova, S. “Ukrainian Cluster Policy: What’s Wrong”, 2015.

3.6.4 Services of the stakeholders

The basic services provided by the main stakeholders of the R&I system are summarised below. Ukraine supports innovative start-ups and SMEs in various ways, however some services seems to be underprovided.

Table 3.6.2. Basic services provided by the main public innovation service providers in Ukraine

Type of service*	Access to research and infrastructure	Advice and consulting	Financial instruments for research	Financial instruments for business development	Networks / Collaboration
R&I stakeholders					
The Ukrainian State Fund for Fundamental Research (SFFR)			+		
CRDF Global Ukraine			+		
R&I stakeholders with a strategic focus on ICT					
Ministry of Education and Science of Ukraine			+		
National Academy of Sciences of Ukraine	+		+		+
Foundation for Scientific and Technological Development of Ukraine n.a. academician V.S. Mihalevich			+	+	+
Special joint calls, e.g. joint call of the NASU and Taras Shevchenko National University of Kyiv			+		

Science & Technology centre in Ukraine		+	+	+	+
Science Parks	+	+			+

***For a more detailed description of each service, see Appendix 1**

3.6.5 Strategies

There has been developed several strategies that could influence on ICT development of Ukraine. The most relevant ones are listed in a table below.

Table 3.6.3. Relevant research, innovation and ICT strategies in Ukraine

Strategies	
Strategy of SME development till 2020 year	The goal of this strategy is to improve environment for SMEs via facilitation of access to finance, simplification of tax administration, promotion of entrepreneurial culture, development of business skills training and export promotion, and consolidation of potential to innovate. Within this strategy, state policies for SMEs would be systematically introduced up to 2020, which expected to result in higher level of SME competitiveness.
Concept of Scientific, Technological and Innovative Development	The concept consolidates the main idea of the need to ensure a combined approach that would anticipate the balance of regulatory and market leverage in the relevant field. To approach more effective combination of market with the scientific and technological potential, it was proposed to make a clear structural separation of the scientific potential of commercial and non-profit parts: non-profitable covers the science associated with a non-profit growth of scientific knowledge, commercial - innovation, applied research, development of new technologies and products.
Strategy of innovation development of Ukraine for 2010-2020 in the context of globalisation challenges	The main objective of the document is to create a national innovation system that will consolidate the efforts of the legislative and executive authorities, the scientific and business communities of the society to optimally solve the complex of methodological, strategic and tactical problems of forming an innovative model of the country's development, which has to ensure high level of country's competitiveness.
State strategy of regional	The strategic goal of the implementation of the state regional policy was to create conditions for the dynamic and balanced development of the regions of Ukraine

Strategies	
development for the period till 2020	in order to ensure the social and economic unity of the state, raising the level of competitiveness of regions, activating economic activity, raising the standard of living of the population, observance of social and other standards guaranteed by the state for every citizen irrespective of place of his or her residence. In pursuance of the strategy, an Action Plan was adopted for its implementation by 2017, approved by the CMU Decree No. 821 of 07.10.2015. It provided: I. Improvement of the mechanism for planning of regional development; II. Ensuring stable and predictable financing of regional development; III. Improvement of the process of monitoring and evaluation of regional development.
Vision: "Knowledge- and innovation-based exports for sustainable development and success in global markets"	This vision has a strong focus on innovation development. It suggests development of environment that stimulates trade and innovation for diversified exports, Development of business and trade support services that improve the competitiveness of SMEs and strengthen the skills and competencies that SMEs require to engage in international trade.
Enactment of the President of Ukraine "On measures for the development of the national component of the global Internet information network and ensuring wide access to this network in Ukraine"	The purpose of the document is to establish that the development of the national component of the global Internet information network, ensuring wide access to this network of citizens and legal entities. National information resources are one of the priority directions of the state policy in the field of informatisation. Additionally, this document foresees improvements in the sphere of constitutional rights of citizens to information, building an open democratic society, development of entrepreneurship.
Enactment of the President of Ukraine "On the priority tasks for	The document states that the development of information society in Ukraine and the introduction of the latest information technologies in all spheres of public life is one of the priorities of state policy.

Strategies	
the implementation of the latest information technologies"	
Enactment of the President of Ukraine "Strategy for the development of the information society in Ukraine"	The purpose of the strategy is to create favourable conditions for the development of the information society, socio-economic, political and cultural development of the state with a market economy, guided by European political and economic values, improving the quality of life of citizens, creating broad opportunities for meeting the needs and free development of the individual, raising competitiveness of Ukraine, improvement of the system of public administration with the help of information and communication technologies. The main stages of implementation are planned for 2020.
Decree of the Cabinet of Ministers of Ukraine "The concept of e-government development in Ukraine"	The introduction of e-government involves the creation of qualitatively new forms of organisation of the activities of state authorities and local self-government bodies, their interaction with citizens and business entities by providing access to state information resources, opportunities to receive electronic ones. Expected results of the Concept implementation are: - Improving the efficiency of public administration as a result of simplification of administrative procedures, reduction of administrative costs; - Application of modern methods of public administration; - Improving the quality of administrative services and their accessibility; - Ensuring control over the effectiveness of public authorities and local self-government bodies; - Ensuring a high level of accessibility of information about the activities of state authorities and local self-government bodies, providing citizens and NGOs with a direct opportunity to participate in the process of drafting decisions made at all levels of government; - Reducing the level of shadowing the economy; - Achievement of a qualitatively new level of management of the state and society as a whole, as well as to strengthen the trust in the institutes of the state.
Initiative "Digital Agenda of Ukraine - 2020"	The main objectives of this Strategy are: - Stimulating the economy and attracting investment; - To lay the foundation for transforming the sectors of the economy into a competitive and efficient;

Strategies	
	- Make "digital" technology available; - Create new opportunities for the implementation of human capital, the development of innovative, creative and "digital" industries and businesses; - To develop and seize global leadership in the export of "digital" products and services.
Decree of the Cabinet of the Ministers of Ukraine "Strategy for the development of small and medium enterprises in Ukraine up to 2020"	The main goal of the Strategy is to develop small and medium-sized businesses, create favourable conditions for doing business, which will reveal the potential of the SME sector in ensuring sustainable economic and social development of Ukraine. Implementation of the Strategy should contribute to the following objectives: - Creating the best conditions for doing business; - Building the institutional capacity to effectively formulate and implement the policy of entrepreneurship development; - SME sector development.
Regional program of development of small and medium entrepreneurship.	These programs have a typical structure and, as a rule, contain the following 4 sections: - Optimisation of business regulation; - Financial, credit and investment support for SMEs; - Resource and information support for SMEs; - Development of infrastructure for entrepreneurship support.

3.6.6 Policies

Along with national strategies, set policies targeted at development of ICT in Ukraine have been developed.

Table 3.6.4. Relevant research, innovation and ICT policies in Ukraine

Policies	
State target scientific and technical program for the development and	This Program is aimed at the development and creation of sensory science-intensive products, such as nanostructured materials, intelligently saturated sensory systems, devices and technologies, the level of development of which will contribute to technological upgrading of various sectors of the economy.

Policies	
creation of sensory science-intensive products for 2008-2017	
Law on priority directions of innovation activity development	Some issues of definition of medium-term priority directions of innovation activity of the national level for 2017-2021 years.
Law on the special regime of innovation activity of technological parks	This law defines the legal and economic principles for the introduction and operation of a special regimen of technological activity parks innovation.
Law "On Priority Areas of Innovation in Ukraine"	The purpose of the law is to provide an innovative model of economic development by concentrating state resources on the priority directions of scientific and technical renewal of production, increasing the competitiveness of domestic products in the domestic and foreign markets.
Law "On the Concept of the National Program of Informatisation"	Priorities are provided for the creation of a regulatory and legal framework for informatisation, including a system of protection of copyright and personal information: - The development of national Standards in the field of informatisation; - Formation of telecommunication infrastructure, optimisation of the existing network of data transmission lines, construction of new modern channels, including fibre-optic and satellite communication systems; - The formation of a computer network of education, science and culture as part of it Global network INTERNET; - Implementation of measures for information security.
Law "On the National Program of Informatisation"	The program is aimed at solving the following main tasks: - Formation of legal, organisational, scientific and technical, economic, financial, methodological and humanitarian prerequisites for the development of informatisation;

Policies	
	- Application and development of modern information technologies in the respective spheres of social life of Ukraine; - Formation of a system of national information resources; - Creation of the state-wide network of information provision of science, education, culture, health care, etc.; - Creation of general state systems of informational and analytical support of the activities of state bodies and local authorities; - Increasing the efficiency of domestic production on the basis of widespread use of information technology; - Formation and support of the market for information products and Services; - Integration of Ukraine into the world of information space.
Law "On the Basic Principles of Information Society Development in Ukraine for 2007-2015"	The main strategic goals of the development of the information society in Ukraine are defined as following: - Accelerating the development and implementation of the newest competitive ICTs in all spheres of public life, in particular in the Ukrainian economy and in the activities of state authorities and local self-government bodies; - Providing computer and informational literacy of the population, first of all, through the creation of a system of education focused on the use of modern ICTs in the formation of a fully developed personality; - Development of the national information infrastructure and its integration with the global infrastructure; - State support for new "electronic" sectors of the economy (trade, provision of financial and banking services, etc.); - Creation of national information systems, especially in the spheres of health care, education, science, culture, environmental protection; - Preservation of cultural heritage of Ukraine through its electronic documentation; - State support for the use of the latest ICT by the mass media; - Use of ICT to improve public administration, relations between the state and citizens, the emergence of electronic forms of interaction between public authorities and local self-government bodies and individuals and legal entities; - Achievement of effective participation of all regions in the process of formation

Policies	
	of the information society by decentralisation and support of regional and local initiatives; - Protection of information rights of citizens, especially regarding access to information, protection of personal information, support of democratic institutions and minimisation of the risk of "information inequality"; - Improvement of legislation on the regulation of information relations; Improving the state of information security in the use of the latest ICT.

3.6.6.1 Public-private partnerships (PPP)

The formation of PPP in Ukraine become possible after 2010 year when the Law on public-private partnership in Ukraine was adopted. This Law defines the organisational and legal framework for the interaction of public partners with private partners and the main principles of public-private partnership on a contractual basis. Even though the Law was adopted, in fact is not applicable. Still PPP contracts are not concluded due to complicated and non-transparent procedures. Only several PPP contracts so far were concluded, one of which, for example, is PPP contract for the modernisation of the heat sink (within the framework of the USAID project). In addition, the law is not adapted for application in the field of science, ICT and innovation. It can only be used for infrastructure objects located in the field of state monopolies.

Moreover, the PPP in Ukraine lacks not only transparency, but also consistency in terms of regulation. The main drawback of these terms is that the law on PPP contradicts the law on the transfer of objects of state and communal property rights, according to which rights on state and municipal owned objects cannot be transferred to private company. Ergo, currently PPP attracts extra attention from the law enforcement authorities and is associated with high level of risk.

3.6.6.2 Public funding

Following the negative trend started at 1990th, Ukrainian GERD as a percentage of GDP has groped significantly from 1.03 in 2005 to 0.48 in 2016 compared to average 2.03 rate in the EU. This tendency leads to a fall in number of researchers and brain drain. According to state statistics service of Ukraine 34.5% of expenditures on R&D in Ukraine were accounted by state. In 2016 85% of this budget was primary spent on basic needs of institutions, not on R&D. Big funding granted on competitive basis was inaccessible.

3.6.6.3 Private funding

According to State statistics service in Ukraine in 2016 private funding in R&D consisted of commercial enterprises funds (29.2% of all R&D expenditures), foreign funding (22.1%), and private funds (9.9%). The biggest share of financing was allocated to technical sciences (86% of all R&D expenditures), 82.4% of which was funded by private sector. Private sector funded 35.6% of expenditures of natural sciences, 7.4% of agricultural science and 1.8% of social sciences.

Due to economic instability and military conflict, the share of foreign funding in R&D has dropped to 22.1% in 2016 compared to 25.8% in 2010. Despite the negative trend, it keeps being relatively high compared to the other EaP countries.

According to State Statistics Service of Ukraine private funds of firms plays the key role in financing their innovations (97.2% of expenditures). Financing of innovations is not usually done by banking sector because of high interest rates and credit risks.

Ukrainian ICT firms (start-ups) are main beneficiaries of venture financing in Ukraine. At the same time analysis of the scope and scale of venture financing is limited because of the lack of statistical data and nonsufficient methodological base for venture financing assessment. There are number of venture and investments funds as well as incubators/accelerators providing access to private financing: for seed stage 17-42 thousand EUR, Early stage - 250 -420 thousand EUR, round A up to 840 thousand EUR.

3.6.7 Performance

Ukraine received a score of 37.6 in GII 2017 [93]and was ranked 50th out of 127 countries, while the scores of EU countries range from 41 to 63.7. This implies that Ukraine needs to improve its performance to be able to compete on the global market. However, in 2016 UN e-government survey Ukraine expanded its e-consultancy index activities from 27% to 84% over the last period and entered the list of the world's top 50 performers in e-participation being on the 32nd place (77th in 2014).

Ukraine is relatively strong in human capital having high levels of education (79% of population have higher education), strong math, science and design education as well as high level of growth of the IT outsourcing industry. Besides, recent increase in the number of multinational technology companies, which have R&D or technology centres in Ukraine, also proves significant level of human capital development. Growing number of start-ups and entrepreneurs succeeding on international market is an emerging strength of Ukraine. Relatively low labour cost, recent

[93] https://www.globalinnovationindex.org/analysis-indicator

currency depreciation, strategic geopolitical position and potential to market growth are attractive for investment.

3.6.8 Challenges

The key challenges for innovations in Ukraine from the government side are the weak rule of law and coordination, inefficient regulations, political and economic instability, poor conditions for doing business. Ukrainian innovation system requires additional reform of universities and academies inherited from the Soviet economy. Poor conditions for the researchers have caused significant brain-drain over the last 20 years. Universities' role needs to shift from only teaching students to conducting research and innovations.

Over the years of independence in the economy prevailed traditional sectors (agriculture, metals and heavy manufacturing), which generally have low demand for R&D. Lack of motivation and ability of financial institutions to support R&D compared to other business activities also added up to the poor situation. In its turn, SMEs face scarce financial resources and low supply of high quality equipment and personnel as well as low demand for innovations from big enterprises. Besides, lack of the dialog between innovation ecosystem players and coordination in innovation developments are important barriers for R&D and innovation.

3.6.9 Gap analysis

Table 3.6.5 Stakeholder analysis

Services	Estonia	France	Germany	Ireland	Sweden	UK	Ukraine
Access to infrastructure							
Tech parks	+	+	+	+	+	+	+
University clusters	+	+	+	+	+	+	
Access to supercomputers	+	+	+	+	+	+	+/-
ICT labs	+	+	+	+	+	+	+
Advice and consulting							

Services	Estonia	France	Germany	Ireland	Sweden	UK	Ukraine
Consulting on grants	+	+	+	+	+	+	+
Business consulting	+	+	+	+	+	+	+
Training	+	+	+	+	+	+	+
Research funding							
Financing universities	+	+	+	+	+	+	+
Financing PROs	+	+	+	+	+	+	+
Grants for researchers	+	+	+	+	+	+	+
ICT Innovation public procurement	+	+	+	+	+	+	+
Business funding							
Tax incentives		+				+	
Grants	+	+	+	+	+	+	+
Loans	+	+	+	+	+	+	+
Guarantees	+	+	+	+	+	+	
Equity	+	+	+	+	+	+	
Funding venture capital funds	+	+	+	+	+	+	+

Services	Estonia	France	Germany	Ireland	Sweden	UK	Ukraine
Networks							
Enterprise network	+	+	+	+	+	+	+
start-up network	+	+	+	+	+	+	+
Investor networks	+	+	+	+	+	+	+
University network		+	+	+	+	+	+
ICT research network		+		+	+		+

Even though there are lots of ICT development strategies and policies in Ukraine, still there is no proper comprehensive ICT development strategy and there is no single responsible for ICT development agent, which makes this area quite disorganised.

There is a functions' overlapping between MEDTU and MESU, in particular with regard to Horizon 2020 (MESU is responsible for general coordination, MEDTU for SMEs), events and activities are poorly coordinated. Horizon 2020 web page[94] is not good navigated. As of 2017, there are 41 NCPs and 5 Regional CPs, and a lot of them have their own web pages[95].

In Ukraine, there is still no single common innovation marketplace. Yet, there are separate business initiatives and large government structures. For example, in 2017 appeared the Reactor platform, which offers online mechanisms of searching for technology groups to address the business challenges and propose an option of presenting innovative projects to potential investors.

In spite of the large amount of innovation infrastructure organisations in Ukraine, there is still a gap in providing services for start-ups and innovation companies in general. Some services (e.g. office premises, IT courses such as Tech start-up School of Lviv Polytechnic University) are well represented, while some other services (e.g. search of R&D partners) are not.

94 http://h2020.com.ua/en/

95 e.g. http://lp.edu.ua/en/ncpmka

Ukraine has an insufficient level of consulting services provision in this area. Some organisations carry out an overview of technological innovations, but most often it is a duplication of information published in other developed countries.

Information about financial opportunities is really puzzled. There is no one source where all information is gathered together. Yet, there are several initiatives aiming at making this gap smaller. For example, in 2017, Ukrainian venture capital and private equity association issued Investors book[96]. Moreover, recently some companies and experts have started to provide support for applying projects to EU funds.

There are a lot of different trainings and workshops for SMEs that aim on upgrading business skills. Such donors as USAID, UNDP, EU Commission and many others provide such trainings, however usually these trainings provide initial level of knowledge. High skilled trainings are still lacking in Ukraine. Moreover, there is a lack of coordination between donors' initiatives in terms of training provision. EU4Business initiative tries to cover this gap in Ukraine.

Weak links between science and industry is the serious problem in Ukraine. Links existed in the Soviet time were destroyed, and new links were not created. There is a gap between developments provided by Ukrainian science and Ukrainian industry needs. On the one hand, industry is not aware of such developments, on the other - scientists lack knowledge how to commercialise their R&D. Creation of technology transfer offices in universities and research institutes could help to fill this gap.

Outdated equipment is really serious problem for the most Ukrainian R&D institutions. Purchase of equipment is not possible in the framework of majority of national grants and programs (it's not allowed due to budget restrictions, and it's not possible because of the high price that could not be covered by small amounts of grants). Nevertheless, supercomputer is operating in the Institute of Cybernetics and it can be used by business if needed.

Protection of Intellectual property rights in Ukraine is another weak side. As for now services on intellectual property rights protection are provided mainly by private firms. Yet, Ukrainian state service on intellectual rights is under reforming.

There are no tax credits for R&D in Ukraine, which could help to boost this market. Yet, there are some preferences for importing equipment for innovative projects, which are approved by the Government, could be used.

Moreover, there are some other gaps in ICT area in Ukraine. For example, there is no separate law on PPI and PCP, which makes this sphere almost completely unregulated. Public support on

96 http://ukraineinvest.com/wp-content/uploads/2017/05/UVCA-Investors-Book-2017-1-edition.pdf

venture capital funds is weakly developed. International cooperation in ICT and international experience sharing could be either improved. There is still lack of cluster development. The last but not the least, legislature concerning ICT (in particular PPP) is yet incoherent in Ukraine, which creates disturbances for innovation companies' development.

One of good examples from ICT ecosystem in Ukraine is Association of Industrial Automation of Ukraine, which cofounded in 2016 the national "Industry 4.0 in Ukraine" movement. The goal of this movement is to accelerate development of Ukrainian industries with high added value via the platform that unites business associations, groups and players on the ICT, APCS, engineering and machine building markets, scientists and educators. All principles of this movement were described in Charter 4.0, which by mid of 2017 were signed by 70 organisations.

3.6.10 Roadmaps and Recommendations

Based on the information on current state of art, the gap analysis had revealed the harmful factors for ICT developments in Ukraine. To make these factors omissible the following improvements need to be implemented.

- Ukraine heavily lacks start-ups and innovation culture, development of which would stimulate developments in ICT a lot. That is why formation of innovative brand of Ukraine should be among top priorities in this sphere.
- Realistic and effective innovation policy instruments should be identified so that to overcome problem of fragmentation in this area and lack of coordination between different actors. While setting priorities for innovation development, make an emphasis on appropriate implementation tools, which would allow to make innovation policies easier to implement and control the process.
- Ukrainian government should elaborate a cross-governmental Innovation Strategy and Action plan for science- and technology-based innovation, and simultaneously align international collaboration efforts in ICT with national priorities and strategies. Moreover, with the help of newly established Innovation council and Innovation Office, which should be established in 2018 year, the policy learning and experience sharing situation via the association to Horizon 2020 and COSME programs should be improved.
- So that to stimulate development of market of innovations and make it more attractive for investors and businesses, legislature on ICT should be appropriately adapted and the system of protection of intellectual property rights should be improved. Additionally, the coherence of laws should be improved aiming at elimination of inconsistencies that demotivate actors to enter the market.
- Interconnections between business and innovations in Ukraine are still underdeveloped. This issue could be overcome by establishment of science-industry mobility schemes and by supporting cooperative projects between the public research sector and industry.
- System of support of start-ups in universities should be also better developed in Ukraine. That is why improvement of access to national and international scientific infrastructures should be

stimulated. Furthermore, teaching programs based on entrepreneurs' needs should be established. This will allow to narrow the gap between the skills of specialists graduated from HEI and skills required by SMEs, start-ups and economy as a whole.

- And last but not the least, access to funding for start-ups should be improved. Even though in Ukraine there was established Innovation fund, which will financially support start-ups using the funds from the budget, yet there are no clear regulations concerning this funds' activity.

These are the main steps that need to be taken by Ukraine so that to improve its position on ICT compared to other countries.

3.6.11 References for Ukrainian Country Chapter

Links to mentioned strategies and policies

http://zakon2.rada.gov.ua/laws/show/916-14

http://zakon5.rada.gov.ua/laws/show/2632-17http://kno.rada.gov.ua/komosviti/doccatalog/document?id=48722

http://zakon2.rada.gov.ua/laws/show/385-2014-%D0%BF

http://zakon4.rada.gov.ua/laws/show/821-2015-%D0%BF/paghttp://zakon5.rada.gov.ua/laws/show/3715-17

http://zakon3.rada.gov.ua/laws/show/1056-2016-%D0%BF

http://zakon3.rada.gov.ua/laws/show/75/98-%D0%B2%D1%80

http://zakon3.rada.gov.ua/laws/show/74/98-%D0%B2%D1%80

http://zakon3.rada.gov.ua/laws/show/928/2000

http://zakon2.rada.gov.ua/laws/show/1497/2005

http://zakon2.rada.gov.ua/laws/show/537-16

http://zakon3.rada.gov.ua/laws/show/ru/386-2013-%D1%80

http://zakon3.rada.gov.ua/laws/show/2250-2010-%D1%80

https://ucci.org.ua/uploads/files/58e78ee3c3922.pdf

http://www.me.gov.ua/Documents/Download?id=153cbc70-9f02-48bd-b1f8-3e39c25d965e

4 STATE OF PLAY AND GAP ANALYSIS

4.1 Methodology of EaP stocktaking on services, tools and infrastructures for ICT innovation

Based on the available expertise of senior experts, consultations with the EC officials, and baseline study, the questionnaires have been developed in order to analyse the ecosystems and enabling environments in the EaP countries, from the viewpoint of available services, tools and infrastructures in place, including web-based platforms.

As a master line for choosing indicators and setting criteria, we have used the need to identify the gaps in the functional structure of the ICT innovation ecosystem (whether or not the required functions are performed) and the stakeholders' competence gaps.

The questionnaires were equipped with remarks explaining the indicators and included criteria to assess the compliance of national experience with these indicators. The questionnaires were accompanied by a glossary of major terms to provide the common understanding.

To fill out the questionnaires, national experts were asked to find a relevant organisation(s) delivering such services in their country.

An important notice is that the objective of this study was to find out **whether the new business founders and the existing businesses can already find the information about potential suppliers of these services in the Internet**. That is why, only the information available in the Internet was primarily used to fill out this part of questionnaire. If currently a particular service is not delivered but the national experts were aware about the future plans of delivering these services or of establishing new organisations to deliver these services, they have mentioned the name of the document where these plans are fixed. The idea-level plans that are not documented have not been accepted as an evidence.

The goal of the Study was not to rank the quality of the existing innovation infrastructure services or organisations, and the stocktaking work of national experts was not oriented towards this.

However, the provided indicators can be used to measure the comprehensiveness, the maturity and the innovativeness of the ecosystem.

The ecosystems can be considered as *comprehensive*, if they offer businesses the services covering the complete value chain and complete lifecycle of innovative businesses: offering companies the resources to generate first sales of their products and services at new markets, to expand the sales within the respective countries and regions, and finally to prepare for further expansion of the business activities.

The ecosystems can be considered as *mature*, if they offer basic services on a competitive basis, that is, there are several organisations offering basic services on a continuous basis. Measuring the degree of ecosystem maturity is possible by means of measuring the number of organisations delivering such services (in absolute and relative terms).

The ecosystems can be considered as *innovative* (on the world, regional, country level), if some services offered by them have not existed before (on the world, regional, country level); per definition, there will be only one or few organisations delivering such services.

4.2 Goals, approach and methodology

In this part of the Study, the results of survey and analysis of successful enabling environments and ecosystems at regional (EU, EU-27, 3rd countries) and partner country level is compared, and the initial maturity level of each partner country is assessed.

During the field work, the data about the existing ICT innovation ecosystem in EaP countries was collected, including the following types of organisations, including:

a. *those listed on the start-upEurope Map:*

- Universities;
- Public Organisations;
- Incubators;
- Accelerators;
- Co-working spaces;
- Influencers;

b. *those actors listed on the start-upEurope Map as Corporates and investors, disaggregated for the purposes of our Study to reflect the availability of funding for various stages of the business lifecycle:*

- Business Angel;
- Network of Business Angels;
- Venture Capitalist;
- Corporate Venture Capitalist;
- Crowdfunding Platform
- Corporates;

c. *the other relevant ICT Innovation ecosystem actors:*

- Policy-making authorities;
- Scientific and research institutes;
- ICT training centres;
- High-tech parks;
- Technology transfer offices;
- Fablabs;
- Business associations;
- Professional associations;
- Competence centres;
- Digital innovation hubs.

4.3 EaP ICT innovation organisations

During field research, the data about over 800 organisations (a total of 840 actors) in EaP countries was gathered, which were assessed as most relevant in terms of enabling ITC innovations (figure 4.3.1).

Additionally, the data about 165 start-ups was collected for the purpose of mapping them on the start-up Europe Map. These figures should not be treated as exhaustive data about the total number of available start-ups in the EaP countries and should not be treated as a representation of champion start-ups. The procedure of selecting the start-ups used in this Study was subject to availability on the Internet of specific data requested for registration of start-ups at the start-up Europe Map. The purpose of registering them was to illustrate the advertising possibilities of start-up Europe Map to all potential ICT Innovation stakeholders.

The scope of the collected data is comparable with the number of innovation support organisations registered at the start-up Europe Map for EU (figure 4.3.2).

Important to note, these numbers should not be interpreted for the purpose of championing the countries, because the differing size and the specialisation of the economic systems of the countries, and the institutional structure of the national innovation systems cause the differing needs in the structure of the institutional framework for innovations. Similarly, the numbers of organisations cannot be directly comparable because of very different size of the same types of organisations in different countries and regions. Finally, in many cases it was difficult to delineate the particular types of organisations in EaP countries because the *level of specialisation of the existing ICT innovation ecosystem is yet low*, and many functions that in EU countries are already

distributed among specialised actors, in EaP countries are performed by the same organisations (i.e., a state agency hosting a business incubator, a technology transfer office and providing access to funds). In some countries, the definitions of recently emerging forms of innovation infrastructure organisations are even *not fixed in the legislation or differ from EU definitions*. This leads to a conclusion that the data about the number of existing organisations should not be directly compared with the number of similar organisations existing in the EU; rather, the functions actually performed by the existing organisations need to be studied in-depth.

Figure 4.3.1. The sample of ICT-related innovation infrastructure organisations in EaP countries

Country	start-ups	Universities	Public Organizations	Incubators	Accelerators	Co-working spaces	Business Angel	Network of Business Angels	Venture Capitalist	Corporate Venture Capitalist	Crowdfunding Platform	Corporates	Influencers	Policy-making authorities	Scientific and research institutes	ICT training centres	High-tech parks	Technology transfer offices	Fablabs	Business associations	Professional associations	Competence centres	Digital innovation hubs	TOTAL INFRASTRUCTURE
Armenia	**33**	3	5	2	1	5	2	2	2	0	1	3	9	3	2	4	3	0	1	1	0	0	0	**49**
Azerbaijan	**17**	6	10	5	4	1	2	0	2	1	0	0	4	2	4	3	3	1	1	4	0	0	0	**53**
Belarus	**12**	9	3	4	2	7	14	2	6	1	3	1	11	7	6	4	11	5	1	6	4	4	2	**113**
Georgia	**63**	17	11	0	0	5	0	1	1	1	1	9	18	5	13	11	2	1	22	3	1	0	0	**122**
Moldova	**26**	28	6	20	1	4	2	0	1	0	1	23	4	4	19	4	4	1	1	9	3	1	1	**137**
Ukraine	**14**	45	3	11	11	35	23	3	16	3	2	65	12	6	13	49	4	10	7	24	16	0	8	**366**
TOTAL EaP	**165**	**108**	**38**	**42**	**19**	**57**	**43**	**8**	**28**	**6**	**8**	**101**	**58**	**27**	**57**	**75**	**27**	**18**	**33**	**47**	**24**	**5**	**11**	**840**
TOTAL EU*	**700**	**59**	**36**	**87**	**151**	**105**	**66**	-	-	**106**	**54**	-	-	-	-	-	-	-	-	-	-			**664**

*registered at start-up Europe Map, by 15.12.2017.

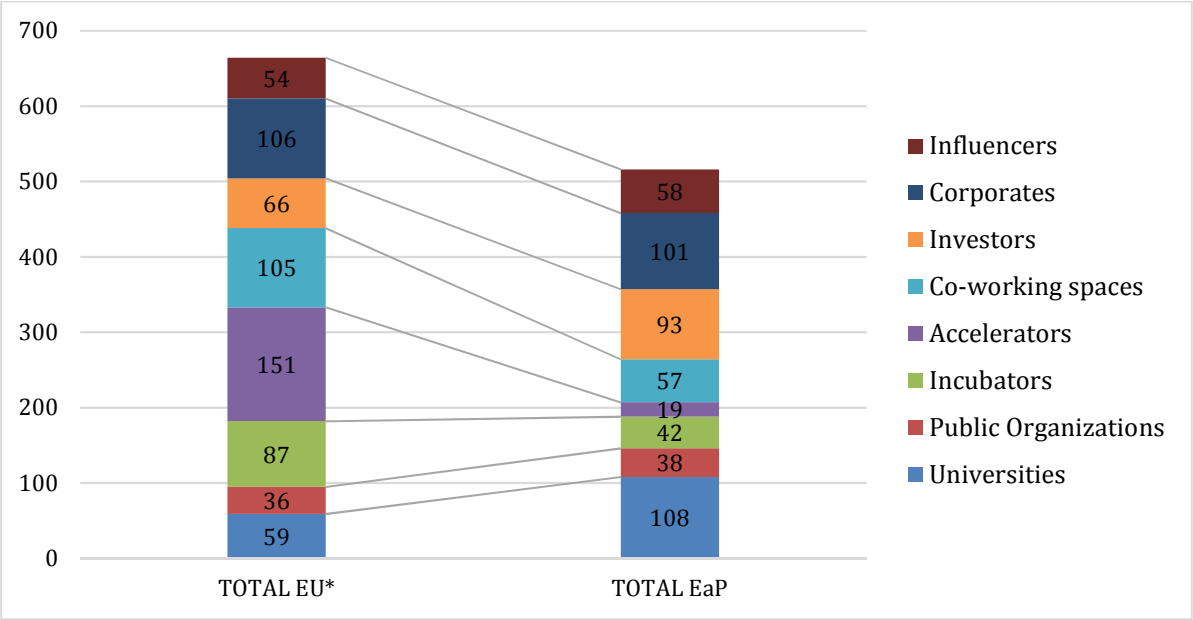
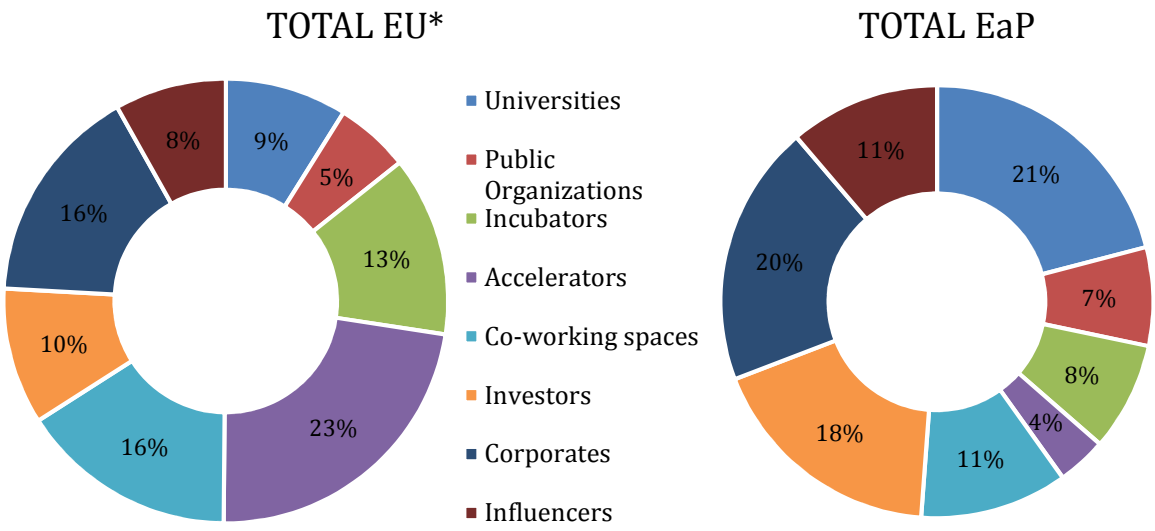


Figure 4.3.2 The sample of ICT-related innovation infrastructure organisations in EaP countries

Yet, comparison of structure of samples of EaP and EU innovation infrastructure organisations (figure 4.3.3.) reflects the basic difference in the ecosystems. In EU, the largest share of the ecosystem (23%) is taken by accelerators servicing the growth of the existing companies that have already started market operations. In EaP countries, the largest share (21%) is taken by the universities that service the resource needs of businesses.

Figure 4.3.3. Comparison of structure of samples of EaP and EU innovation infrastructure organisations



4.4 Mapping Stakeholders on the start-up Europe Map

4.4.1 Goal

The goal of this part of the Study was to identify, classify, register and map the Partners' ecosystem stakeholders, in line with the practices followed in relevant start-up Europe web-based platforms. The "Stakeholders Map" was to be incorporated into start-up Europe web-based platforms, notably the start-up Europe Map and the start-up Europe One Stop Shop.

4.4.2 start-up Europe One Stop Shop

The functionalities of start-up Europe One Stop Shop embrace the wide information and links to the existing networks for various types of stakeholders (corporates, accelerators, web investors, tech journalists/bloggers, universities; student organisations; female web entrepreneurs; tech transfer offices and national contact points), each of which has its own set of tools for collaboration and the own requirements for networking and registration, and mostly is envisaged for targeted usage by the registered members.

For start-ups, two mapping tools are available: start-up Europe Map and start-up Finder Dealroom.co. The last platform is constructed for matchmaking between start-ups and investors, and that is why it requires very specific financial and business model data to be submitted by start-ups. Thus, incorporating the start-ups into start-up Finder Dealroom.co has proved not possible within the time and resource available in the current project.

Incorporating the ecosystem stakeholders into the start-up Europe One Stop Shop was performed in the current project through the tool start-up Europe Map.

4.4.3 start-up Europe Map functionalities

The start-upEurope Map offers the following functionalities.

After signing up, the user has an opportunity to see a geographical map with the flags of the following types of stakeholders: start-ups; corporates; incubators; accelerators; investors; influencers; universities; public organisations; coworking space. It is possible to:

a. increase the scale and see all the entities registered in the particular region or city;

b. filter the entities by type and see the total number of these entities registered on the Map.

c. add the entities and see the personally added entities on the Dashboard.

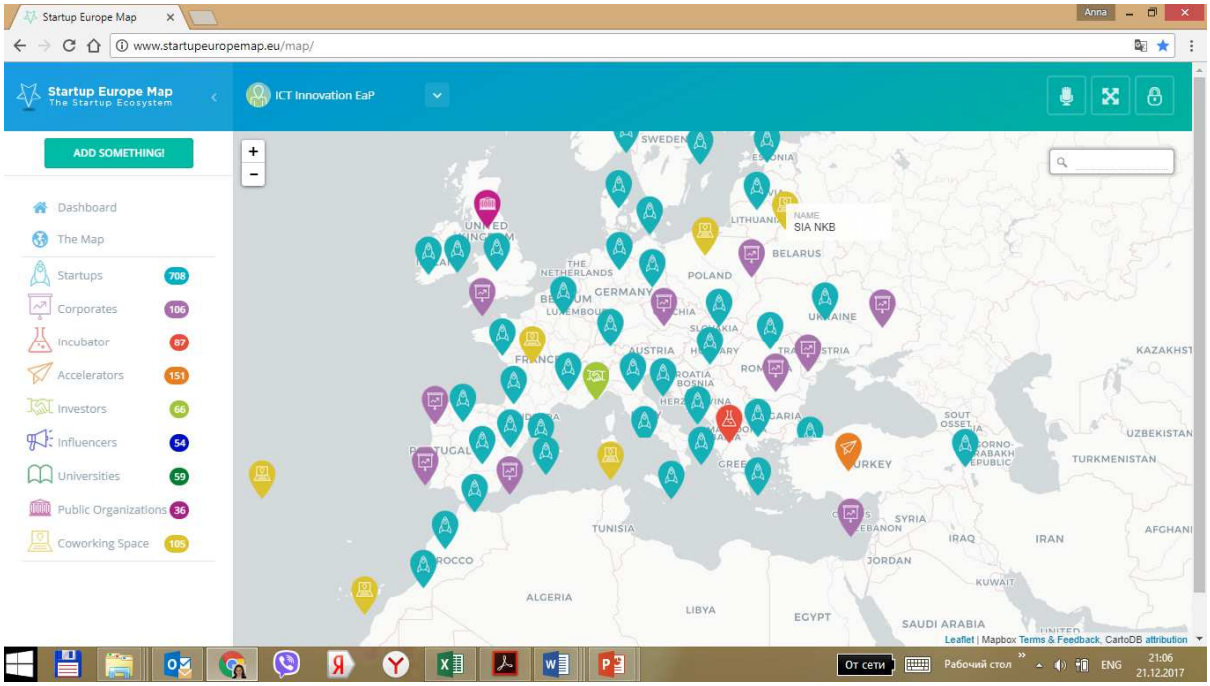
Downloading the datasets in XML or another format is not possible.

Also, though during the registration it is required to answer many questions including the description of the registered entity, the partners searched, and the services provided, this detailed information is not accessible by the Map users. Only the name, the city and the website URL are visible to users. Moreover, the spectrum of services about which the data is collected during registration, only covers networking; events; office-space; competition; education; mentoring and financing. But even across these services, for start-ups it is not possible to make a search in order to find an appropriate infrastructure organisation.

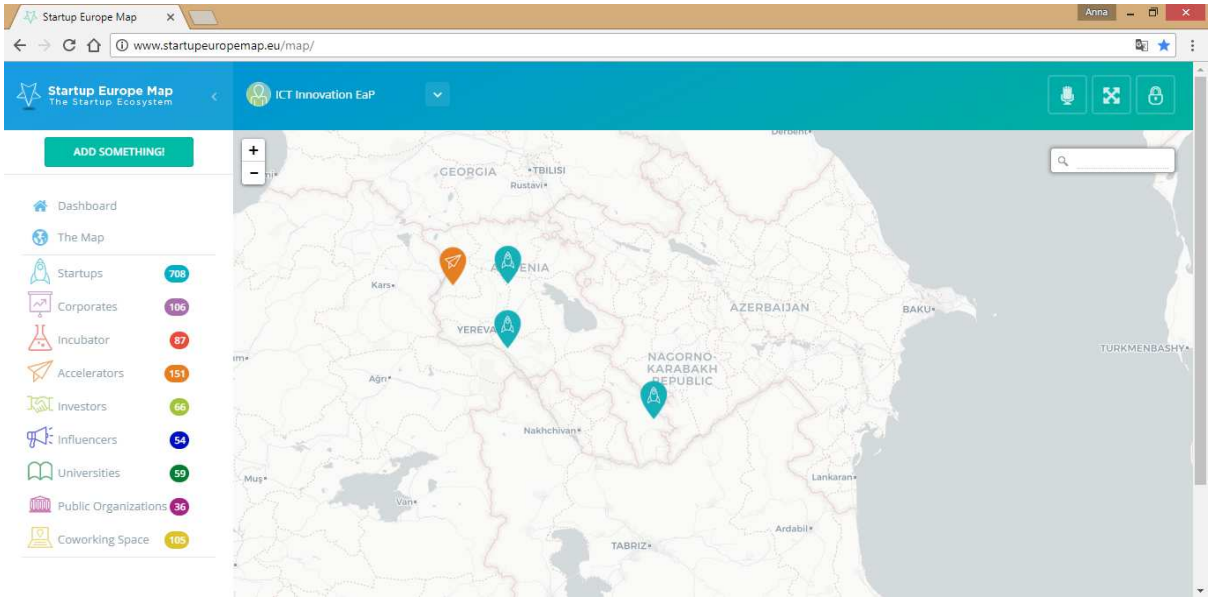
4.4.4 Initial situation

Before the EaP mapping activity of this project, the start-upEurope Map looked like follows.

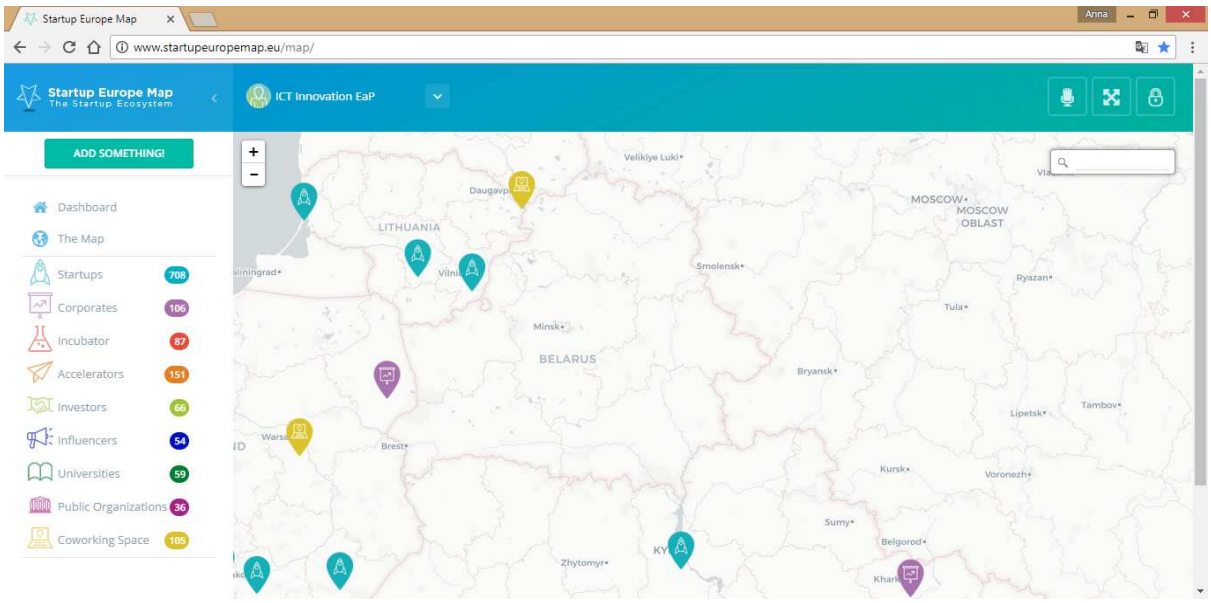
Armenia has had three start-ups in Yerevan, Vanadzor and Goris and one accelerator (Gyumri Technology Centre).



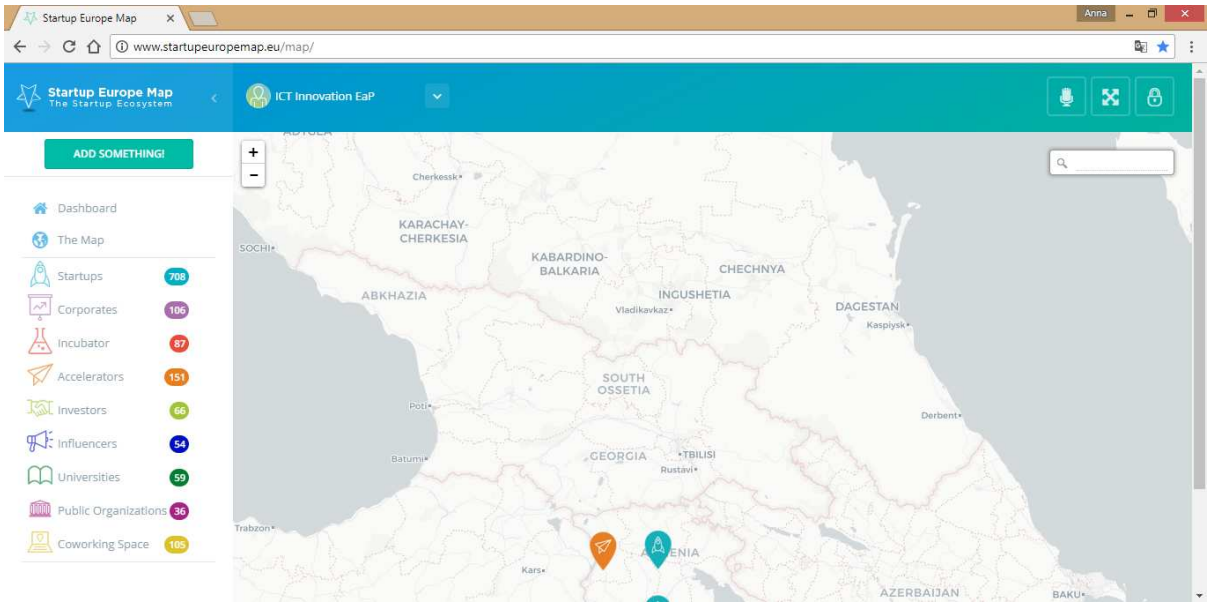
Azerbaijan has had no stakeholders registered.



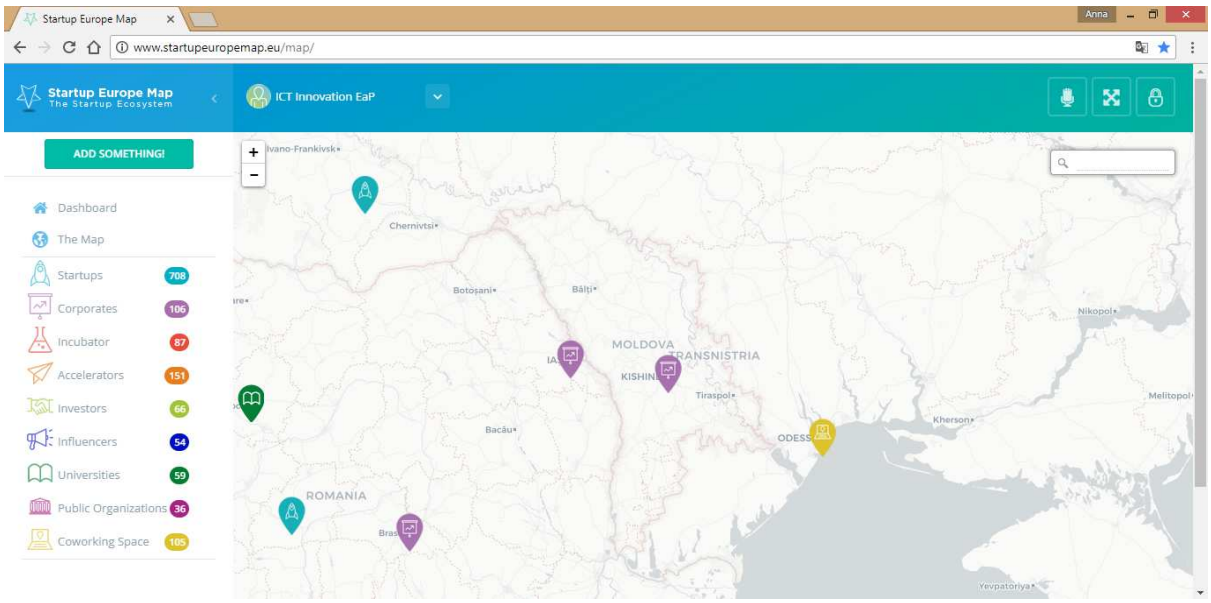
Belarus has had no stakeholders registered.



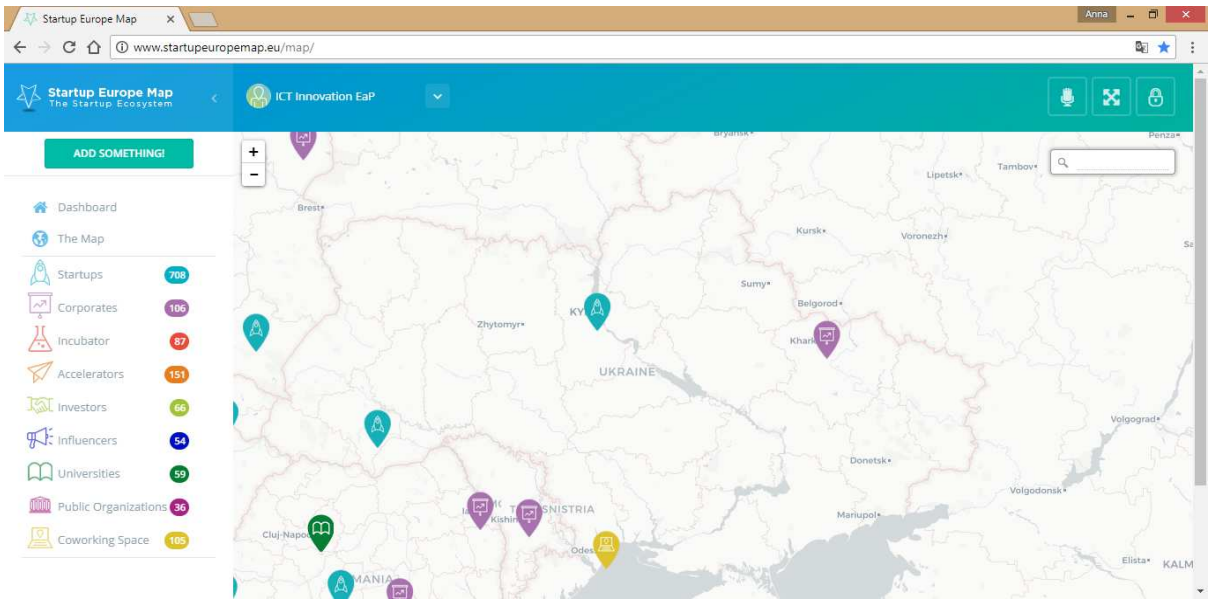
Georgia has had no stakeholders registered.



Moldova has registered one corporate in Chişinău.



Ukraine has had registered two start-ups (Kiev and Ivano-Frankivsk), one impact hub in Odessa and one corporate in Kharkiv.



4.4.5 Results achieved

With the goal of positioning the information on the start-upEurope Map, the data about relevant ICT innovation ecosystem stakeholders as well as innovative digital start-ups was collected, with a total list of 516 organisations (a selection from a total number of 840 organisations identified) and 165 start-ups.

This sample was collected on the criteria of relevance to the ICT innovation and availability of public data according to the criteria required for registration of such entities on the start-upEurope Map. Thus, this number should not be treated as a direct indication of the quality of infrastructure organisations or start-ups; rather as an indicator of their publicity. When looking for particular organisations, the common glossary was used (Appendix 10).

To provide the possibility of updating the data by the registered organisations, the national ownership of the country-specific data was enabled. This was done by creating 6 EaP profiles (like ICTinnovation.Armenia; ICTinnovation.Azerbaijan etc.) linked to 6 dedicated email addresses and registering the stakeholders of each EaP country under the appropriate EaP

profile. Logging in at start-upEurope Map under the specific country profile allows this country to update and delete the profiles of entities registered under its profile and add the new entities.

As a result of mapping, the capacity of start-upEurope map is practically doubled (516 EaP organisations additionally to 664 EU ICT innovation ecosystem stakeholders registered before (by 15.12.2017). This opens vast opportunities for EU start-ups to enter the EaP markets and get support there.

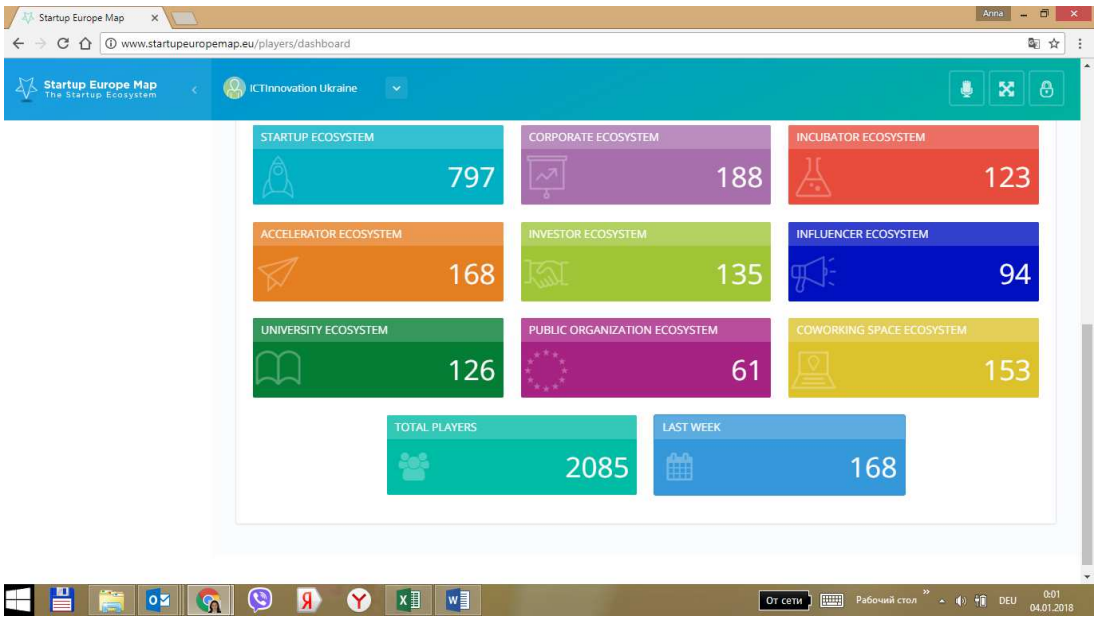
Figure 4.4.1. The sample of ICT-related innovation infrastructure organisations in EaP countries mapped at start-upEurope Map

Type of stakeholder	**start-ups**	Universities	Public Organizations	Incubators	Accelerators	Co-working spaces	Investors	Corporates	Influencers	**Total infrastructure**
Armenia	**33**	3	5	2	1	5	7	3	9	**35**
Azerbaijan*	**17**	6	10	5	4	1	5	0	4	**35**
Belarus	**12**	9	3	4	2	7	26	1	11	**63**
Georgia*	**63**	17	11	0	0	5	4	9	18	**64**
Moldova	**26**	28	6	20	1	4	4	23	4	**90**
Ukraine	**14**	45	3	11	11	35	47	65	12	**229**
TOTAL EaP	**165**	**108**	**38**	**42**	**19**	**57**	**93**	**101**	**58**	**516**
TOTAL EU**	**700**	**59**	**36**	**87**	**151**	**105**	**66**	**106**	**54**	**664**
TOTAL ***	**785**	**144**	**53**	**124**	**166**	**156**	**150**	**198**	**90**	**1081**
Surplus	**12%**	144%	47%	43%	10%	49%	127%	87%	67%	63%

*to be registered after the negotiated technical modernisation of the start-upEuropeMap.

**registered at start-up EuropeMap, by 15.12.2017.

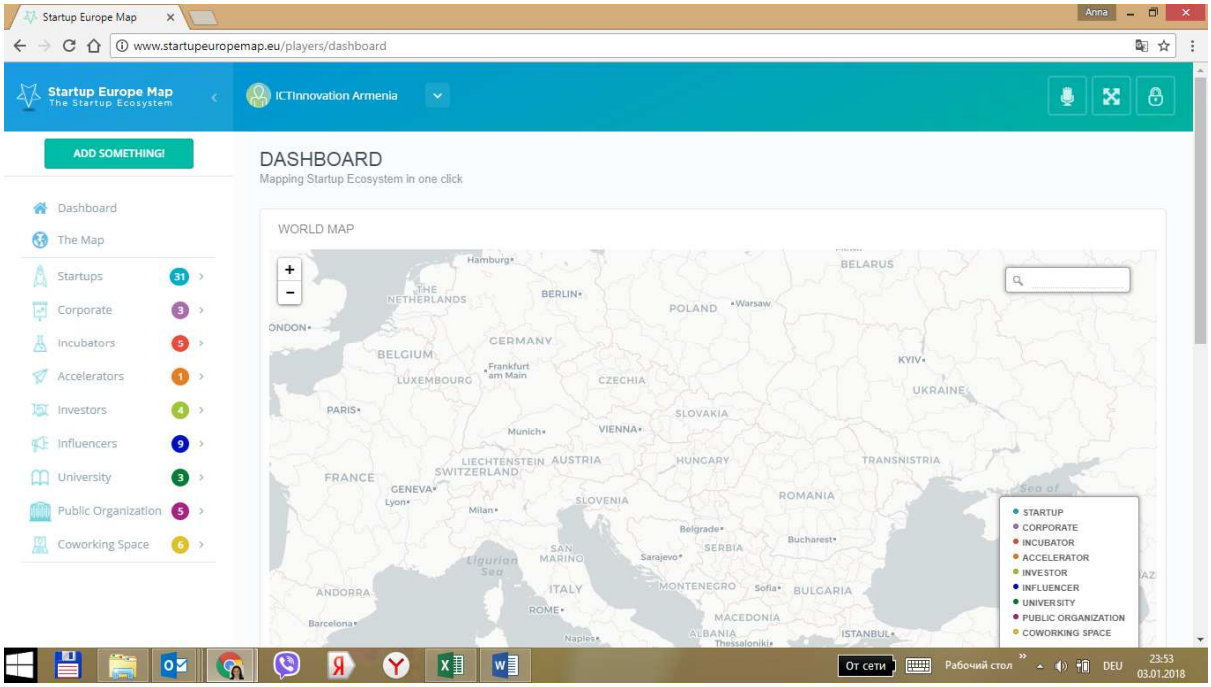
***registered at start-up EuropeMap, by 04.01.2018, including data from Armenia, Belarus, Moldova and Ukraine.



The mapping exercise has tackled several technical problems. First, Azerbaijan and Georgia have not been included into the long list of registerable countries; thus, it was not possible to register the collected data about the ICT innovation stakeholders on the start-up Europe Map within the timeframes of the current projects. Second, the data about the other EaP countries was successfully uploaded to the start-up Europe Map registration forms and the registered stakeholders are listed at the Dashboard visible after logging in under country' profile; however, they are not depicted on the geographical map.

Thus, as a result of the project, the country profiles look as follows now.

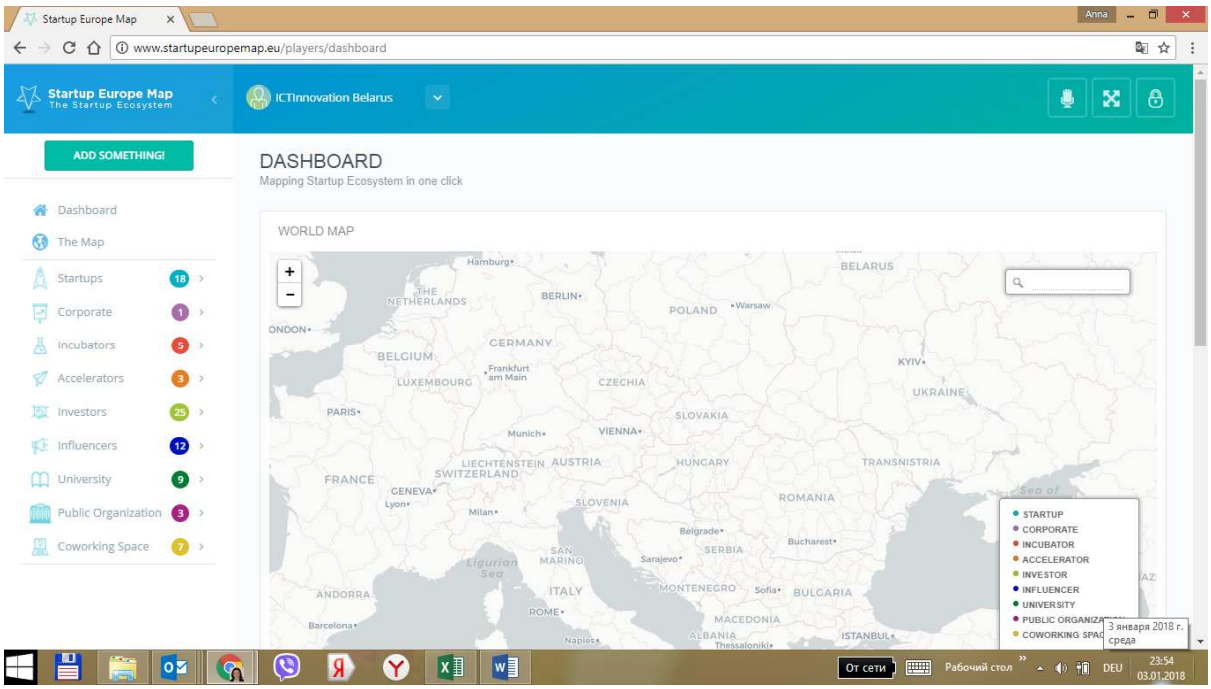
Armenia



Azerbaijan

To be added to the start-upEurope list of registerable countries.

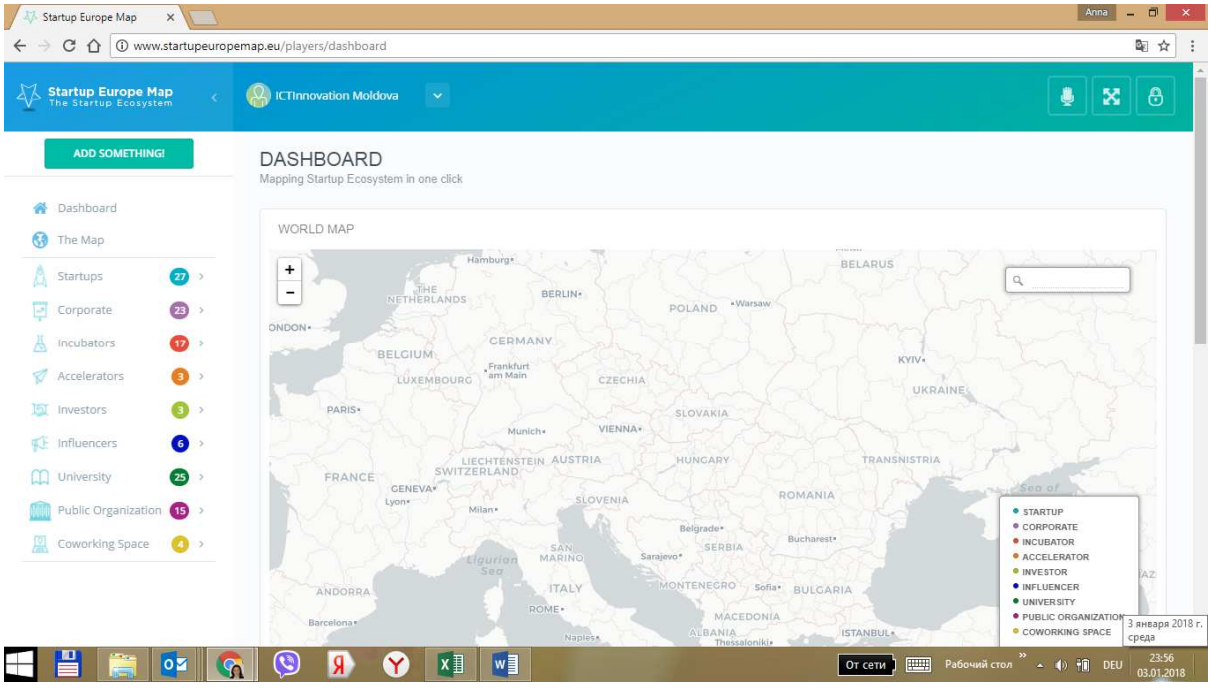
Belarus



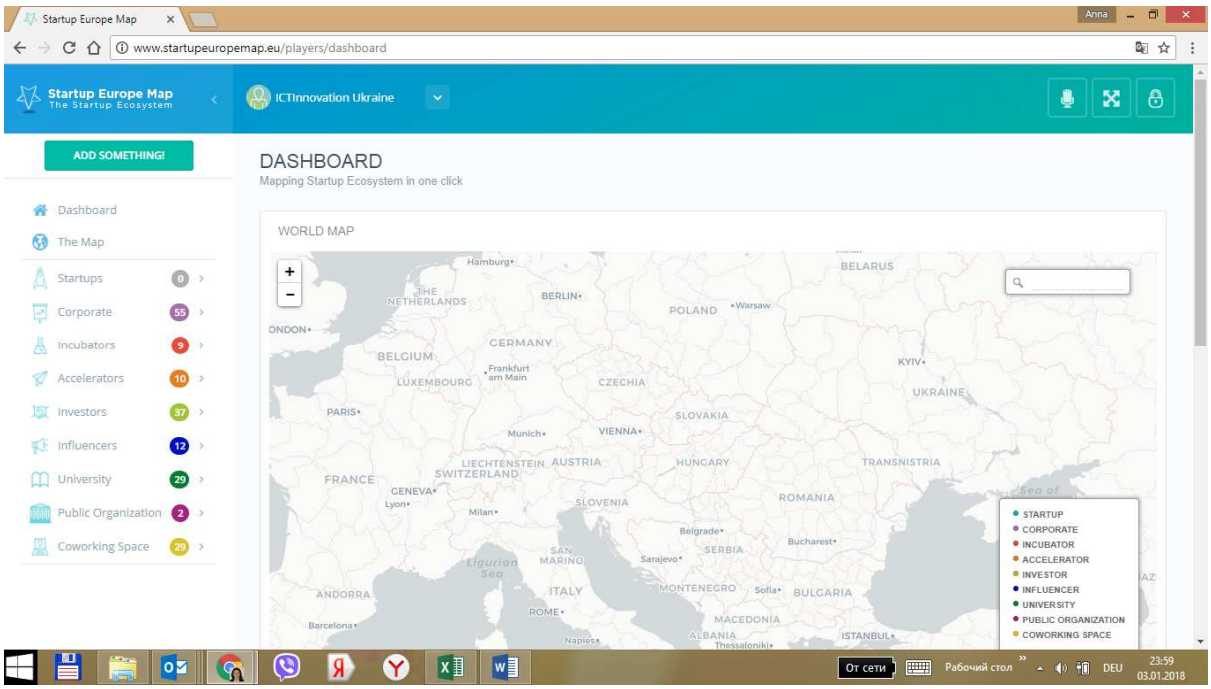
Georgia

To be added to the start-upEurope list of registerable countries.

Moldova



Ukraine



4.4.6 Data collected as an asset for the future improvement of ICT innovation ecosystems

The data collected during the project is highly recommended to be further used in practice to **improve the accessibility of the existing infrastructure organisations by start-ups and innovative businesses in EaP countries and to improve the quality of their services**.

First of all, the data on EaP ecosystem stakeholder is available in the format of Excel files, and might be further used by the EaP countries to create their national maps, publicly available databases and equip them with the various tools.

Yet, because of the small size of EaP domestic markets, it is highly recommended to create a general EaP ICT Innovation Map, so that the businesses and the organisations would be able to look for partners on the whole EaP region.

Second, in the project, the data in EaP countries was collected not only for those types of ICT innovation stakeholders listed on the start-upEurope Map, but also for the other ICT innovation ecosystem actors: relevant policy-making authorities; scientific and research institutes; ICT training centres; high-tech parks; technology transfer offices; fablabs; business associations; professional associations; competence centres and digital innovation hubs (a total of 324 organisations additionally to those 516 incorporated to the start-upEurope Map). The data was specified per types of investors (Figure 4.4.2.). These organisations should also be added to the EaP ICT Innovation Map.

Third, and most important, for the goals of the Study, the whole sample of the identified ICT Innovation ecosystem stakeholders was estimated from the viewpoint of specific services delivered by them to start-ups and innovative businesses. The list of services is more specific than those services listed on the available EU resources. Thus, it is highly recommended to create an ICT Innovation Map based on the stakeholders data collected and *ICT innovation service logframe* developed during the ICT Innovation Study 2017 (**EaP Digital Innovation Service Map**), as a one stop shop website for start-ups to find a specific service through business lifecycle stages with functionalities for infrastructure organisations to register and independently update

their information and for businesses to vote for existing and lacking services. It is recommended to connect (interlink) it with the start-up Europe Networks, including the Accelerators Assembly, start-up Europe University Network, start-up Europe India Network etc.

Figure 4.4.2. Overview of identified number of stakeholders per EaP country

Type of stakeholders	start-ups	Universities	Public Organizations	Incubators	Accelerators	Co-working spaces	Investors					Corporates	Influencers	**Policy-making	**Scientific and	**ICT training centres	**High-tech parks	**Technology transfer	**Fablabs	**Business	**Professional	**Competence centres	**Digital innovation	TOTAL INFRASTRUCTURE
							*Business Angel	*Network of	*Venture Capitalist	*Corporate	*Crowdfunding Platform													
Armenia	33	3	5	2	1	5	2	2	2	0	1	3	9	3	2	4	3	0	1	1	0	0	0	49
Azerbaijan	17	6	10	5	4	1	2	0	2	1	0	0	4	2	4	3	3	1	1	4	0	0	0	53
Belarus	12	9	3	4	2	7	14	2	6	1	3	1	11	7	6	4	11	5	1	6	4	4	2	113
Georgia	63	17	11	0	0	5	0	1	1	1	1	9	18	5	13	11	2	1	22	3	1	0	0	122
Moldova	26	28	6	20	1	4	2	0	1	0	1	23	4	4	19	4	4	1	1	9	3	1	1	137
Ukraine	14	45	3	11	11	35	23	3	16	3	2	65	12	6	13	49	4	10	7	24	16	0	8	366
TOTAL EaP	**165**	**108**	**38**	**42**	**19**	**57**	**43**	**8**	**28**	**6**	**8**	**101**	**58**	**27**	**57**	**75**	**27**	**18**	**33**	**47**	**24**	**5**	**11**	**840**
TOTAL EU	**700**	**59**	**36**	**87**	**151**	**105**	**66**					**106**	**54**	-	- -	-	-	-	-	-	-	-	-	**664**

*Data specified per groups by the Study

**Additional types of stakeholders identified by the Study

Figure 4.4.3. Stakeholders' data collected structure

Availability of information	Infrastructure organisations	start-ups
Obligatory information	Logo Name Contact Email Country City Street Street Number Postal Code Url Link	Logo start-up Name Contact Email Slogan Country City Street Street Number Postal Code Url Link
Additional information (if possible)	Description (140 characters) Positions in social networks: • Facebook • Twitter • LinkedIn • Sector(s): • Advertising • Agriculture • Automotive • Consulting • Data Analytics	Description (140 characters) Value proposition (140 characters) • Video Link • Iframe Video • Positions in social networks • Facebook • Twitter • LinkedIn • Sector(s):

	• E-Commerce • Education • Energy&Cleantech • Entertainment • Fashion • Finance • Food&Beverages • Gaming • Government • Health/Medical • Jobs&Recruiting • Legal • Lifestyle • Logistics and Transport • Manufacturing • Marketing • Media • Music • Photography & Video • Productivity • SaaS • Smart Cities • Social Networking • Software Tools • Sports • Travel & Tourism • Security • AI (Artificial Intelligence) • Machine-learning • Financing • Number of employees • Foundation year • Number of start-ups impacted • What are you looking for? • start-ups • Corporates • What do you offer to the start-up community? • networking • events • office-space • competition • education • mentoring • financing • Programme link (Url)	• Advertising • Agriculture • Automotive • Consulting • Data Analytics • E-Commerce • Education • Energy&Cleantech • Entertainment • Fashion • Finance • Food&Beverages • Gaming • Government • Health/Medical • Jobs&Recruiting • Legal • Lifestyle • Logistics and Transport • Manufacturing • Marketing • Media • Music • Photography & Video • Productivity • SaaS • Smart Cities • Social Networking • Software Tools • Sports • Travel & Tourism • Security • AI (Artificial Intelligence) • Machine-learning • Financing • Number of employees • Foundation year • Current stage of your start-up • Ideating • Concepting • Committing • Validating • Scaling • Establishing • Revenues of last year What are you looking for? • start-ups • Corporates

4.5 EaP ICT innovation service landscapes

The sample of ICT innovation infrastructure organisations was used to collect the field data about the scope of services that are actually suggested by the existing organisations to businesses

seeking digital innovations. The **ICT innovation service logframe** elaborated by the project team on the basis of the identified benchmarking EU practices was used as a framework.

The work on mapping particular organisations on the ICT innovation service map was performed with account of the very differing terminology and aggregation level for differentiating the services used by the organisations both within and across the countries.

The data on services was collected based on the available public data. This approach was selected in order to reconstruct the practical situation and conditions of individuals looking for specific services for their business development. Following this approach, primarily the data published on the websites of the selected sample of 840 ecosystem organisations was used. It was complemented with the existing published reports and information from other publicly available documented sources. The information about the services that are only planned to be delivered was included in those cases when these plans were supported by relevant published documents. The intentions of delivering some services not supported by documents were not considered for mapping.

As a result, the following ICT innovation service landscapes have been identified in the EaP countries.

Figure 4.4.1. ICT innovation service landscape in Armenia

	Universities	Public Organizations	Incubators	Accelerators	Co-working spaces	Business Angel	Network of Business Angels	Venture Capitalist	Corporate Venture	Crowdfunding Platform	Corporates	Influencers	Policy-making authorities	Scientific and research	ICT training centers	High-tech parks	Technology transfer offices	Fablabs	Business associations	Professional associations	Competence centers	Digital innovation hubs	Total number of Entitities involved
Resource Base																							
Human resources	3	2	3		2						1	3	1		3	1		1	1				**21**
Technologies		1										1	1	1					2				**6**
Office premises			2	1	4											2							**9**
Production & R&D facilities	3																	1					**4**
Finance																							
Access to public support		2	3	1	1							6	1	2	3	2			2				**23**
Access to private funding		1	2	1	1	1	2	2				6			2	1			2				**21**
Reputation and trust																							
Visibility		1	3	1	1			1		1					3	2		1	1				**15**
SEED STAGE (IDEA)																							
Trend-scouting and technologies foresight		1		1				1				3							2				**8**
Identify customers and develop value proposition			4	1				1				4							2				**12**
Building a balanced team and finding partners with complementary competencies	3	1	3	1	1			1				5			1	1			1				**18**
START-UP STAGE (PRODUCT)																							
Product development		1	4	1								2			1	1			2				**12**
Research and development		1																	1				**2**
Value proposition and business concept testing and validation	1	1	4	1															1				**8**
Intellectual property management		1		1																1			**3**
Product and Corporate Design		1	3	1												1			1				**7**
ENTERING THE MARKET																							
Marketing products and services		3	3	1	1														1				**9**
Distribution channels and sales		3	3	1	1														1				**9**
Innovation Management / Support of innovation processes (internal, external)		3	3	1	1														1				**9**
Accompaniment after entering the market		3	3	1	1														1				**9**
SCALE-UP, SCOPE-UP, SPEED-UP																							
Business services for growing and accelerating companies		3	3	1	1														1				**9**
Business scoping up		3	3	1	1														1				**9**
Business scaling up		3	3	1	1														1				**9**
BUSINESS TRANSFORMATION AND STRATEGY																							
Support to existing SMEs in managing the structural transformation and in developing business models		3	3	1									2										**9**
Thematic expertise		1																	2				**3**
NETWORKING AND COLLABORATION (for innovation infrastructure organisations)																							
NETWORKING AND COLLABORATION		1	2	1	1			1				4				1			1				**12**

Figure 4.4.2. ICT innovation service landscape in Azerbaijan

	Universities	Public Organizations	Incubators	Accelerators	Co-working spaces	Business Angel Network of Business Angels	Venture Capitalist	Corporate Venture	Crowdfunding Platform	Corporates	Influencers	Policy-making authorities	Scientific and research	ICT training centers	High-tech parks	Technology transfer offices	Fablabs	Business associations	Professional associations	Competence centers	Digital innovation hubs	Total number of Entitities
Resource Base																						
Human resources	12	1		1								1		1								16
Technologies	3		1									1						2				7
Office premises	1		2		1																	4
Production & R&D facilities	3												1		1							5
Finance																						
Access to public support		2																				2
Access to private funding				1			2	1														4
Reputation and trust																						
Visibility											1											1
SEED STAGE (IDEA)																						
Trend-scouting and technologies foresight	6	1		1							1	1										10
Identify customers and develop value proposition	6	1	1	2																		10
Building a balanced team and finding partners with complementary competencies			1	2			1															4
START-UP STAGE (PRODUCT)																						
Product development				2			1															3
Research and development	1																					1
Value proposition and business concept testing and validation				2			1															3
Intellectual property management		1		2																		3
Product and Corporate Design		1		2			1															4
ENTERING THE MARKET																						
Marketing products and services		2										1			1			2				6
Distribution channels and sales		2																				2
Innovation Management / Support of innovation processes (internal, external)																		2				2
Accompaniment after entering the market																						0
SCALE-UP, SCOPE-UP, SPEED-UP																						
Business services for growing and accelerating companies	1	1																2				4
Business scoping up																						0
Business scaling up		1																2				3
BUSINESS TRANSFORMATION AND STRATEGY																						
Support to existing SMEs in managing the structural transformation and in developing business models		1		2										1								4
Thematic expertise																						0
NETWORKING AND COLLABORATION (for innovation infrastructure organisations)																						
NETWORKING AND COLLABORATION																		3				3

Figure 4.4.3. ICT innovation service landscape in Belarus

	Universities	Public Organizations	Incubators	Accelerators	Co-working spaces	Business Angel	Network of Business Angels	Venture Capitalist	Corporate Venture	Crowdfunding Platform	Corporates	Influencers	Policy-making authorities	Scientific and research	ICT training centers	High-tech parks	Technology transfer offices	Fablabs	Business associations	Professional associations	Competence centers	Digital innovation hubs	Total number of Entitities
Resource Base																							
Human resources	3	1							1			3			4	2		1	1	1	2	2	**21**
Technologies	4											1		3			5						**13**
Office premises			2		7						1					11							**21**
Production & R&D facilities			2											6		8							**16**
Finance																							
Access to public support	3		1	1				6				1		6		11	1		1			3	**34**
Access to private funding			4	1			2		2	3						1	2						**15**
Reputation and trust																							
Visibility	3	1															1		3				**8**
SEED STAGE (IDEA)																							
Trend-scouting and technologies foresight	2					14						1		6			1						**24**
Identify customers and develop value proposition																							**0**
Building a balanced team and finding partners with complementary competencies		1																					**1**
START-UP STAGE (PRODUCT)																							
Product development																							**0**
Research and development																1							**1**
Value proposition and business concept testing and validation		1																					**1**
Intellectual property management			1									1				1			1				**4**
Product and Corporate Design																							**0**
ENTERING THE MARKET																							
Marketing products and services		1	1									2							1				**5**
Distribution channels and sales									1							1							**2**
Innovation Management / Support of innovation processes (internal, external)																							**0**
Accompaniment after entering the market												1							1				**2**
SCALE-UP, SCOPE-UP, SPEED-UP																							
Business services for growing and accelerating companies	1										1								1				**3**
Business scoping up																1							**1**
Business scaling up																1	3		2	3			**9**
BUSINESS TRANSFORMATION AND STRATEGY																							
Support to existing SMEs in managing the structural transformation and in developing business models		1										8		5		1			2	1			**18**
Thematic expertise		1										4		4					1	1			**11**
NETWORKING AND COLLABORATION (for innovation infrastructure organisations)																							
NETWORKING AND COLLABORATION	4	2	1	1	3		2	2				3		6		3	1		6	1			**35**

Figure 4.4.4. ICT innovation service landscape in Georgia

	Universities	Public Organizations	Incubators	Accelerators	Co-working spaces	Business Angel	Network of Business Angels	Venture Capitalist	Corporate Venture	Crowdfunding Platform	Corporates	Influencers	Policy-making authorities	Scientific and research	ICT training centers	High-tech parks	Technology transfer offices	Fablabs	Business associations	Professional associations	Competence centers	Digital innovation hubs	Total number of Entitities
Resource Base																							
Human resources	15	4			2							16	2		6	2		22					69
Technologies		3									2		1	1			1						8
Office premises	1	1			4						1	11			1	2		22					43
Production & R&D facilities		1									1	2				2		22					28
Finance																							
Access to public support		5			1						2	1	2		1								12
Access to private funding		3					1	1	1	1	5	1	1						1				15
Reputation and trust																							
Visibility		2			1						3	1	1		1								9
SEED STAGE (IDEA)																							
Trend-scouting and technologies foresight (ideas for innovative projects)		1									1	1	1										4
Identify customers and develop value proposition	1	2			1						3	1			2								10
Building a balanced team and finding partners with complementary competencies		1			1						4	2			1								9
START-UP STAGE (PRODUCT)																							
Product development		3			1						3												7
Research and development		2									1												3
Value proposition and business concept testing and validation											2												2
Intellectual property management		2									2						1						5
Product and Corporate Design					1																		1
ENTERING THE MARKET																							
Marketing products and services		2									2												4
Distribution channels and sales		1									3												4
Innovation Management / Support of innovation processes (internal, external)					1							1											2
Accompaniment after entering the market		1			1						4												6
SCALE-UP, SCOPE-UP, SPEED-UP																							
Business services for growing and accelerating companies		3			1						3		1						1				9
Business scoping up		1									2												3
Business scaling up		3			1								1										5
BUSINESS TRANSFORMATION AND STRATEGY																							
Support to existing small and medium-sized companies in managing the structural transformation and in developing business models		1											2										3
Thematic expertise												1											1
NETWORKING AND COLLABORATION (for innovation infrastructure organisations)																							
NETWORKING AND COLLABORATION		1			1						2	1	1							1			7

Figure 4.4.5. ICT innovation service landscape in Moldova

	Universities	Public Organizations	Incubators	Accelerators	Co-working spaces	Business Angel Network of Business Angels	Venture Capitalist	Corporate Venture	Crowdfunding Platform	Corporates	Influencers	Policy-making authorities	Scientific and research	ICT training centers	High-tech parks	Technology transfer offices	Fablabs	Business associations	Professional associations	Competence centers	Digital innovation hubs	Total number of Entitities
Resource Base																						
Human resources	12	6	2	2	3					10	1	2	1	3				2	1	1	2	48
Technologies	4	4	3	2	1					5		2	1		1	1		2		1		27
Office premises	13	1	19	1	4								1	1	2					1	2	45
Production & R&D facilities	2	3	3		1					4	1	2		2	2		1			1	1	23
Finance																						
Access to public support		3	20	1	2						1	4		2	1					1	3	38
Access to private funding		2		1	2							2		1		1		2		1	2	14
Reputation and trust																						
Visibility	3	4	2	2	1					3		1						1		1	3	21
SEED STAGE (IDEA)																						
Trend-scouting and technologies foresight	1	4	7	2	2							1								1	3	21
Identify customers and develop value proposition	1	2	9	2								2						2		1	1	20
Building a balanced team and finding partners with complementary competencies	1	3	6	2	1					3		1								1	3	21
START-UP STAGE (PRODUCT)																						
Product development	1	3	14	2	2					2										1	3	28
Research and development		1	2	1														1				5
Value proposition and business concept testing and validation	2	2	2	2																		8
Intellectual property management	1	2	3	1															1			8
Product and Corporate Design		2	1	2	1									1						1		8
ENTERING THE MARKET																						
Marketing products and services		3	1											1					1		1	7
Distribution channels and sales		1												1	1							3
Innovation Management / Support of innovation processes (internal, external)		1	14	1	2										1			2		1	3	25
Accompaniment after entering the market		2	17		1													1				21
SCALE-UP, SCOPE-UP, SPEED-UP																						
Business services for growing and accelerating companies	1	1	8	1	2					4		2								1	3	23
Business scoping up		1			1									1	1			1			1	6
Business scaling up		2		1	1						1							1				6
BUSINESS TRANSFORMATION AND STRATEGY																						
Support to existing small and medium-sized companies in managing the structural transformation and in developing business models		2		1	2							3								1	1	10
Thematic expertise		1																				1
NETWORKING AND COLLABORATION (for innovation infrastructure organisations)																						
NETWORKING AND COLLABORATION	4	2	21	2	4					5		1		1	1			2	1	1	3	48

Figure 4.4.6. ICT innovation service landscape in Ukraine

	Universities	Public Organizations	Incubators	Accelerators	Co-working spaces	Business Angel Network of Business Angels	Venture Capitalist	Corporate Venture	Crowdfunding Platform	Corporates	Influencers	Policy-making authorities	Scientific and research	ICT training centers	High-tech parks	Technology transfer offices	Fablabs	Business associations	Professional associations	Competence centers	Digital innovation hubs	Total number of Entitities
Resource Base																						
Human resources	22		3	2							1			35	2		4	1			3	**73**
Technologies	8			1											2	8	3					**22**
Office premises	8		4	1	22										1		6				1	**43**
Production & R&D facilities	17			1							1		10		2		7				1	**39**
Finance																						
Access to public support	19	1	1	1			17					6									2	**47**
Access to private funding	7		7	5	22	22	3	3	2		9				3						5	**88**
Reputation and trust																						
Visibility	21										3							23			2	**49**
SEED STAGE (IDEA)																						
Trend-scouting and technologies foresight	3			2											1		1	1				**8**
Identify customers and develop value proposition	3		6	1			3	1										1			1	**16**
Building a balanced team and finding partners with complementary competencies	0			3					1		3				1							**8**
START-UP STAGE (PRODUCT)																						
Product development	2		2	4			3	1			3						2				2	**19**
Research and development	8						1		1												1	**11**
Value proposition and business concept testing and validation			6	4			2	1														**13**
Intellectual property management	11		2	4				1								8						**26**
Product and Corporate Design				4													3					**7**
ENTERING THE MARKET																						
Marketing products and services			4	2				1			1										1	**9**
Distribution channels and sales				3			1															**4**
Innovation Management / Support of innovation processes (internal, external)				3			1	1														**5**
Accompaniment after entering the market				3	22	22	3				3											**53**
SCALE-UP, SCOPE-UP, SPEED-UP																						
Business services for growing and accelerating companies				1			4	1			1										1	**8**
Business scoping up							2	1														**3**
Business scaling up				2			3	1													1	**7**
BUSINESS TRANSFORMATION AND STRATEGY																						
Support to existing small and medium-sized companies in managing the structural transformation and in developing business models	11	2		1																	1	**15**
Thematic expertise		2									1							1			1	**5**
NETWORKING AND COLLABORATION (for innovation infrastructure organisations)																						
NETWORKING AND COLLABORATION	4		6	2	22	22		1		1	11				3						5	**77**

Figure 4.4.7. Quantitative profile of the identified ICT innovation ecosystem organisations by services provided

		Armenia	Azerbaijan	Belarus	Georgia	Moldova	Ukraine	Total EaP	Share of EaP ICT Innovation Ecosystem
RESOURCE BASE	Human resources	21	16	21	69	48	73	248	30%
	Technologies	6	7	13	8	27	22	83	10%
	Office premises	9	4	21	43	45	43	165	20%
	Production & R&D facilities	4	5	16	28	23	39	115	14%
	Access to public funding	23	2	34	12	38	47	156	19%
	Access to private funding	21	4	15	15	14	88	157	19%
	Visibility	15	1	8	9	21	49	103	12%
SEED STAGE (IDEA)	Trend-scouting and technologies foresight (ideas for innovative projects)	8	10	24	4	21	8	75	9%
	Identify customers and develop value proposition	12	10	0	10	20	16	68	8%
	Building a balanced team and finding partners with complementary competencies	18	4	1	9	21	8	61	7%
START-UP STAGE (PRODUCT)	Product development	12	3	0	7	28	19	69	8%
	Research and development	2	1	1	3	5	11	23	3%
	Value proposition and business concept testing and validation	8	3	1	2	8	13	35	4%
	Intellectual property management	3	3	4	5	8	26	49	6%
	Product and Corporate Design	7	4	0	1	8	7	27	3%
ENTERING THE MARKET	Marketing products and services	9	6	5	4	7	9	40	5%
	Distribution channels and sales	9	2	2	4	3	4	24	3%
	Innovation Management / Support of innovation processes (internal, external)	9	2	0	2	25	5	43	5%
	Accompaniment after entering the market	9	0	2	6	21	53	91	11%
SCALE-UP, SCOPE-UP, SPEED-UP	Business services for growing and accelerating companies	9	4	3	9	23	8	56	7%
	Business scoping up	9	0	1	3	6	3	22	3%
	Business scaling up	9	3	9	5	6	7	39	5%
BUSINESS TRANSFORMATION AND STRATEGY	Support to existing small and medium-sized companies in managing the structural transformation and in developing business models	9	4	18	3	10	15	59	7%
	Thematic expertise	3	0	11	1	1	5	21	3%
NETWORKING AND COLLABORATION		12	3	35	7	48	77	182	22%

The Figure 4.4.7. summarises the number of organisations identified as those delivering relevant services in EaP countries. Taking into account, that one organisation can be involved into delivery of several services, the total number of organisations across the service map is much higher than the number of the identified actors in the ecosystem.

The gaps in the ICT innovation ecosystem between the EaP countries and the EU countries are difficult to measure in the quantitative terms because for EU countries the statistics of the desired level of disaggregation of services is not available, and also in EU the services are also not delivered by 100% of relevant organisations. Thus, it is not recommended to compare directly the amounts of organisations of various types in EU and EaP countries.

In order to provide some comparability of the ICT innovation landscapes among EaP countries, not the absolute but the relative numbers have been used. For assessing the scope of the function of the country ecosystem to provide particular service, the share of organisations mapped as delivering such a service was estimated in among the total number of organisations collected as a sample in particular EaP country. This approach leans on the assumption that the balanced ecosystem is pursued. The best approximation that was achievable within the timeframe of this Study was to measure the balance in the ecosystem by the evenness of distribution of organisations providing the services.

This has allowed assessing the gaps in relative terms: not to compare the existing situation with an imaginary “ideal” level or with the differing EU level, but to identify the weakest links within the ecosystem of particular EaP country. On this basis, it was possible to identify the stages of the innovation process that are least developed in each EaP country and within the EaP region generally.

Assessing the scope of organisations delivering various services across the business lifecycle exhibits that In EaP countries generally, the relative strength of ecosystems is concentrated on providing the resource base to innovative entrepreneurship and the networking opportunities (over 10% of organisations are involved into these services). Herewith, the start-up stage and the later stages of the innovation process remain very weakly serviced. Thus, *except for accompaniment after entering the market, all service groups need to be developed in EaP countries tailored to the business lifecycle needs.*

The weakest areas of the ICT innovation ecosystems in EaP countries generally (5% and below as a share of the existing ecosystem) are the following ones:

Start-up stage:

- Research and development
- Value proposition and business concept testing and validation

- Product and Corporate Design

Entering the market:

- Marketing products and services
- Distribution channels and sales
- Innovation Management / Support of innovation processes

Scale-up, scope-up, speed-up; business transformation and strategy

- Business scoping up
- Business scaling up
- Thematic expertise.

Interpreting the structure of these data should be performed only in qualitative terms, keeping in mind that the certain balance between the *specialisation* and the *competition* of organisations on particular services is needed. This means, that the services should be delivered by more than one organisation in order to provide the competition among the organisations fostering them to improve their services. At the same time, it should not be expected that all the services (taken on the disaggregated level) are delivered by all or overwhelming part of organisations even of the same type (all business incubators or all technoparks), because specialisation of organisations is a natural consequence of competition.

More detailed analysis across the countries shows the relative strengths and weaknesses of some EaP countries in some service areas (figures 4.4.8, 4.4.9). These figures depict the current landscape of the EaP ICT innovation ecosystems and can be used for determining the EaP countries that are relatively better than others in particular services and could thus be leaders in the process of harmonizing ICT innovation infrastructures in EaP.

Figure 4.4.8. Relative weaknesses and strengths across EaP countries for each service line (share in total number of infrastructure orgs)

SHARE IN TOTAL NUMBER OF INFRASTRUCTURE ORGS		AM	AZ	BY	GE	MD	UA
RESOURCE BASE	Human resources	43%	30%	19%	57%	35%	20%
	Technologies	12%	13%	12%	7%	20%	6%
	Office premises	18%	8%	19%	35%	33%	12%
	Production & R&D facilities	8%	9%	14%	23%	17%	11%
	Access to public funding	47%	4%	30%	10%	28%	13%
	Access to private funding	43%	8%	13%	12%	10%	24%
	Visibility	31%	2%	7%	7%	15%	13%
SEED STAGE (IDEA)	Trend-scouting and technologies foresight (ideas for	16%	19%	21%	3%	15%	2%
	Identify customers and develop value proposition	24%	19%	0%	8%	15%	4%
	Building a balanced team and finding partners with co	37%	8%	1%	7%	15%	2%
START-UP STAGE (PRODUCT)	Product development	24%	6%	0%	6%	20%	5%
	Research and development	4%	2%	1%	2%	4%	3%
	Value proposition and business concept testing and v	16%	6%	1%	2%	6%	4%
	Intellectual property management	6%	6%	4%	4%	6%	7%
	Product and Corporate Design	14%	8%	0%	1%	6%	2%
ENTERING THE MARKET	Marketing products and services	18%	11%	4%	3%	5%	2%
	Distribution channels and sales	18%	4%	2%	3%	2%	1%
	Innovation Management / Support of innovation proc	18%	4%	0%	2%	18%	1%
	Accompaniment after entering the market	18%	0%	2%	5%	15%	14%
SCALE-UP, SCOPE-UP, SPEED-UP	Business services for growing and accelerating compa	18%	8%	3%	7%	17%	2%
	Business scoping up	18%	0%	1%	2%	4%	1%
	Business scaling up	18%	6%	8%	4%	4%	2%
BUSINESS TRANSFORMA	Support to existing small and medium-sized compani	18%	8%	16%	2%	7%	4%
	Thematic expertise	6%	0%	10%	1%	1%	1%
NETWORKING AND COLLABORATION		24%	6%	31%	6%	35%	21%
	Average	21%	8%	9%	9%	14%	7%

Figure 4.4.9. Relative weaknesses and strengths across the whole EaP sample (share in total number of infrastructure orgs)

SHARE IN TOTAL NUMBER OF INFRASTRUCTURE ORGS		AM	AZ	BY	GE	MD	UA	Average
RESOURCE BASE	Human resources	43%	30%	19%	57%	35%	20%	34%
	Technologies	12%	13%	12%	7%	20%	6%	12%
	Office premises	18%	8%	19%	35%	33%	12%	21%
	Production & R&D facilities	8%	9%	14%	23%	17%	11%	14%
	Access to public funding	47%	4%	30%	10%	28%	13%	22%
	Access to private funding	43%	8%	13%	12%	10%	24%	18%
	Visibility	31%	2%	7%	7%	15%	13%	13%
SEED STAGE (IDEA)	Trend-scouting and technologies foresight (ideas for	16%	19%	21%	3%	15%	2%	13%
	Identify customers and develop value proposition	24%	19%	0%	8%	15%	4%	12%
	Building a balanced team and finding partners with co	37%	8%	1%	7%	15%	2%	12%
START-UP STAGE (PRODUCT)	Product development	24%	6%	0%	6%	20%	5%	10%
	Research and development	4%	2%	1%	2%	4%	3%	3%
	Value proposition and business concept testing and v	16%	6%	1%	2%	6%	4%	6%
	Intellectual property management	6%	6%	4%	4%	6%	7%	5%
	Product and Corporate Design	14%	8%	0%	1%	6%	2%	5%
ENTERING THE MARKET	Marketing products and services	18%	11%	4%	3%	5%	2%	7%
	Distribution channels and sales	18%	4%	2%	3%	2%	1%	5%
	Innovation Management / Support of innovation proc	18%	4%	0%	2%	18%	1%	7%
	Accompaniment after entering the market	18%	0%	2%	5%	15%	14%	9%
SCALE-UP, SCOPE-UP, SPEED-UP	Business services for growing and accelerating compa	18%	8%	3%	7%	17%	2%	9%
	Business scoping up	18%	0%	1%	2%	4%	1%	4%
	Business scaling up	18%	6%	8%	4%	4%	2%	7%
BUSINESS TRANSFORMA	Support to existing small and medium-sized compani	18%	8%	16%	2%	7%	4%	9%
	Thematic expertise	6%	0%	10%	1%	1%	1%	3%
NETWORKING AND COLLABORATION		24%	6%	31%	6%	35%	21%	20%
	Average	21%	8%	9%	9%	14%	7%	11%

For example, **Armenia** is better in services for access to human resources and funding, identifying customers and developing value proposition; building a balanced team, finding partners with complementary competencies and product development. **Azerbaijan** is good in trend-scouting and technologies foresight as well as Identifying customers and developing value proposition. **Belarus** looks better in access to public funding, trend-scouting and technologies foresight, support to existing small and medium-sized companies in managing the structural transformation and in developing business models and in thematic expertise. **Georgia** is the best in providing access to human resources, office and production & R&D facilities for its digital businesses. **Moldova** outperforms the other countries in access to technologies and office premises as well as services available in the area of innovation management, support of innovation processes (internal, external); accompaniment after entering the market; business services for growing and accelerating companies. **Ukraine** is the best in providing access to private funding, intellectual property rights management.

A more detailed view inside the landscapes of particular countries allows revealing the relative weaknesses and strengths that can be used for national roadmaps on ICT innovation ecosystems (Tables 4.4.1.-4.4.6.).

Table 4.4.1. Relative weaknesses and strengths of ICT innovation ecosystem in Armenia (% of sample organisations delivering services)

RESOURCE BASE	Human resources	43%
	Technologies	12%
	Office premises	18%
	Production & R&D facilities	8%
	Access to public funding	47%
	Access to private funding	43%
	Visibility	31%
SEED STAGE (IDEA)	Trend-scouting and technologies foresight	16%
	Identify customers and develop value proposition	24%
	Building a balanced team and finding partners with complementary competencies	37%
START-UP STAGE (PRODUCT)	Product development	24%
	Research and development	4%
	Value proposition and business concept testing and validation	16%
	Intellectual property management	6%
	Product and Corporate Design	14%
ENTERING THE MARKET	Marketing products and services	18%
	Distribution channels and sales	18%
	Innovation Management / Support of innovation processes (internal, external)	18%
	Accompaniment after entering the market	18%
SCALE-UP, SCOPE-UP, SPEED-UP	Business services for growing and accelerating companies	18%
	Business scoping up	18%
	Business scaling up	18%
BUSINESS TRANSFORMATION &STRATEGY	Support to existing SMEs in managing the structural transformation and in developing business models	18%
	Thematic expertise	6%
NETWORKING AND COLLABORATION		24%

Table 4.4.2. Relative weaknesses and strengths of ICT innovation ecosystem in Azerbaijan (% of sample organisations delivering services)

RESOURCE BASE	Human resources	30%
	Technologies	13%
	Office premises	8%
	Production & R&D facilities	9%
	Access to public funding	4%
	Access to private funding	8%
	Visibility	2%
SEED STAGE (IDEA)	Trend-scouting and technologies foresight	19%
	Identify customers and develop value proposition	19%
	Building a balanced team and finding partners with complementary competencies	8%
START-UP STAGE (PRODUCT)	Product development	6%
	Research and development	2%
	Value proposition and business concept testing and validation	6%
	Intellectual property management	6%
	Product and Corporate Design	8%
ENTERING THE MARKET	Marketing products and services	11%
	Distribution channels and sales	4%
	Innovation Management / Support of innovation processes (internal, external)	4%
	Accompaniment after entering the market	0%
SCALE-UP, SCOPE-UP, SPEED-UP	Business services for growing and accelerating companies	8%
	Business scoping up	0%
	Business scaling up	6%
BUSINESS TRANSFORMATION&STRA	Support to existing small and medium-sized companies in managing the structural transformation and in developing business models	8%
	Thematic expertise	0%
NETWORKING AND COLLABORATION		6%

Table 4.4.3. Relative weaknesses and strengths of ICT innovation ecosystem in Belarus (% of sample organisations delivering services)

RESOURCE BASE	Human resources	19%
	Technologies	12%
	Office premises	19%
	Production & R&D facilities	14%
	Access to public funding	30%
	Access to private funding	13%
	Visibility	7%
SEED STAGE (IDEA)	Trend-scouting and technologies foresight (ideas for innovative projects)	21%
	Identify customers and develop value proposition	0%
	Building a balanced team and finding partners with complementary competencies	1%
START-UP STAGE (PRODUCT)	Product development	0%
	Research and development	1%
	Value proposition and business concept testing and validation	1%
	Intellectual property management	4%
	Product and Corporate Design	0%
ENTERING THE MARKET	Marketing products and services	4%
	Distribution channels and sales	2%
	Innovation Management / Support of innovation processes (internal, external)	0%
	Accompaniment after entering the market	2%
SCALE-UP, SCOPE-UP, SPEED-UP	Business services for growing and accelerating companies	3%
	Business scoping up	1%
	Business scaling up	8%
BUSINESS TRANSFORMATION & STRATEGY	Support to existing small and medium-sized companies in managing the structural transformation and in developing business models	16%
	Thematic expertise	10%
NETWORKING AND COLLABORATION		31%

Table 4.4.4. Relative weaknesses and strengths of ICT innovation ecosystem in Georgia (% of sample organisations delivering services

RESOURCE BASE	Human resources	57%
	Technologies	7%
	Office premises	35%
	Production & R&D facilities	23%
	Access to public funding	10%
	Access to private funding	12%
	Visibility	7%
SEED STAGE (IDEA)	Trend-scouting and technologies foresight (ideas for innovative projects)	3%
	Identify customers and develop value proposition	8%
	Building a balanced team and finding partners with complementary competencies	7%
START-UP STAGE (PRODUCT)	Product development	6%
	Research and development	2%
	Value proposition and business concept testing and validation	2%
	Intellectual property management	4%
	Product and Corporate Design	1%
ENTERING THE MARKET	Marketing products and services	3%
	Distribution channels and sales	3%
	Innovation Management / Support of innovation processes (internal, external)	2%
	Accompaniment after entering the market	5%
SCALE-UP, SCOPE-UP, SPEED-UP	Business services for growing and accelerating companies	7%
	Business scoping up	2%
	Business scaling up	4%
BUSINESS TRANSFORMATION AND STRATEGY	Support to existing small and medium-sized companies in managing the structural transformation and in developing business models	2%
	Thematic expertise	1%
NETWORKING & COLLABORATION	Networking and collaboration	6%

Table 4.4.5. Relative weaknesses and strengths of ICT innovation ecosystem in Moldova (% of sample organisations delivering services)

RESOURCE BASE	Human resources	35%
	Technologies	20%
	Office premises	33%
	Production & R&D facilities	17%
	Access to public funding	28%
	Access to private funding	10%
	Visibility	15%
SEED STAGE (IDEA)	Trend-scouting and technologies foresight	15%
	Identify customers and develop value proposition	15%
	Building a balanced team and finding partners with complementary competencies	15%
START-UP STAGE (PRODUCT)	Product development	20%
	Research and development	4%
	Value proposition and business concept testing and validation	6%
	Intellectual property management	6%
	Product and Corporate Design	6%
ENTERING THE MARKET	Marketing products and services	5%
	Distribution channels and sales	2%
	Innovation Management / Support of innovation processes (internal, external)	18%
	Accompaniment after entering the market	15%
SCALE-UP, SCOPE-UP, SPEED-UP	Business services for growing and accelerating companies	17%
	Business scoping up	4%
	Business scaling up	4%
BUSINESS TRANSFORMATION AND STRATEGY	Support to existing SMEs in managing the structural transformation and in developing business models	7%
	Thematic expertise	1%
NETWORKING AND COLLABORATION		35%

Table 4.4.6. Relative weaknesses and strengths of ICT innovation ecosystem in Ukraine (% of sample organisations delivering services)

RESOURCE BASE	Human resources	20%
	Technologies	6%
	Office premises	12%
	Production & R&D facilities	11%
	Access to public funding	13%
	Access to private funding	24%
	Visibility	13%
SEED STAGE (IDEA)	Trend-scouting and technologies foresight	2%
	Identify customers and develop value proposition	4%
	Building a balanced team and finding partners with complementary competencies	2%
START-UP STAGE (PRODUCT)	Product development	5%
	Research and development	3%
	Value proposition and business concept testing and validation	4%
	Intellectual property management	7%
	Product and Corporate Design	2%
ENTERING THE MARKET	Marketing products and services	2%
	Distribution channels and sales	1%
	Innovation Management / Support of innovation processes (internal, external)	1%
	Accompaniment after entering the market	14%
SCALE-UP, SCOPE-UP, SPEED-UP	Business services for growing and accelerating companies	2%
	Business scoping up	1%
	Business scaling up	2%
BUSINESS TRANSFORMATION AND STRATEGY	Support to existing SMEs in managing the structural transformation and in developing business models	4%
	Thematic expertise	1%
NETWORKING AND COLLABORATION		21%

The suggested approach can be used to assess the **maturity level of ICT innovation service landscape** in each partner country, and to trace its dynamics. By comparing (within one country) the changing data on the share of relevant organisations providing particular services in time, we can observe whether the ecosystem is providing the larger or the smaller choice of services enabling various stages of the ICT innovation process. It is also possible to make the cross-country comparison of shares of organisations providing particular services; yet in order to do so on a continuous basis, a very strict methodology should be developed and consistently to identify the general population of ICT innovation ecosystem stakeholders, the sample of relevant infrastructure organisations, and the criteria of reporting on particular services.

From practical viewpoint, such a thorough approach might be very cost-intensive, while the assessment of the quality of services delivered will still remain the major indicator of the ecosystem performance. Hence, *the main recommendations from here are that the business should be enabled the best access to the services via one stop shop, and that the web platform servicing as a gateway to ICT innovation services delivered by various organisation (also across borders) should have the functionality of assessment by businesses of the quality of the services received.*

Additionally, the **specialised web-based platforms** supporting ICT innovations were tried to be detected in EaP countries. They are studied as a separate group of tools, because they are usually co-owned, operated, or jointly updated by multiple organisations.

Screening has shown that only Belarus, Georgia and Ukraine have some types of web-platforms (table 4.4.8.).

Table 4.4.7. Specialised web-based platforms supporting ICT innovations in EaP countries

Number of web-based platforms	AM	AZ	BY	GE	MD	UA
1. A one stop shop website for start-ups to find a relevant technopark, incubator or accelerator with an option of search for specific services				1		
2. A web-based platform for start-ups to promote the information on themselves to find investors and partners			5	1		10
3. A web-based platform for investors (business angels, VCs, corporate investors) to find start-ups to invest			1	1		5
4. A web-based platform for non-ICT companies to find and compare for their digitalisation appropriate partners among (example: Compare):						1
● IT infrastructure providers						
● business process analysts, IT-architects, software developers						
● system integrators						
● informatisation and digitalisation consultants, including digital business models (please specify for which market segments these platforms are available – financial, trade, logistics, industry, healthcare, education, etc)						
5. A web-based platform for communication of innovation infrastructure organisations						1
6. A web-based database about current research projects in specific areas of digitalisation (IoT, Big Data etc) (open to public)			1			
7. Open innovation tools enabling the integration of software solutions developed by several companies (like open API platforms)						
8. Open innovation tools for joint software development by several companies						1
9. IoT accelerator enabling a unified approach to developing applications and services						3
10. A web-based infrastructure for correlating teaching, practice, and research related to ICT and digitalisation (example: HCAT+)			2			

The need for development of such platforms for each particular country is disputable.

Some platforms (like open API platforms) can be dependent on national information security legislation or linked to international standards, which is sector-specific. *The recommendations for roadmap should hence first of all include research activities to identify the situation for particular sectors of economy according to the specialisation of the EaP country.*

The other platforms (like those for start-ups to promote the information on themselves to find investors and partners and those for investors (business angels, VCs, *corporate investors) to find start-ups to invest, are more efficient at the international (global) scale. In this case, the roadmap should pursue informing the EaP stakeholders on the existing international platforms and probably envisage some activities to integrate the existing EaP databases into the existing platforms.*

A web platform for start-ups to find a relevant technopark, incubator or accelerator with an option of search for specific services according to their lifecycle; complemented with the functionality of communication of experts and innovation infrastructure organisations; collecting information about current research projects in specific areas of digitalisation (IoT, Big Data etc) (open to public) and correlating teaching, practice, and research related to ICT and digitalisation, - this a clear case for an *international scale platform.*

Taking into account the extensive field work executed within the Study, and the vast information on the existing organisations, it is recommended to continue with establishing a common EaP Service Map Platform, that can be also extended to a common EaP-EU platform.

4.6 EaP ICT innovation service landscapes qualitative problems and best practices

The landscapes of the ICT-related innovation infrastructure cannot be described by mere numbers of organisations and need a qualitative assessment.

This was provided by national experts based on their own expertise and the interviews with the relevant stakeholders and has allowed to reveal the following problems common for most EaP countries.

General problems:

- The existing national innovation systems in EaP countries are fragmentary and incomplete.
- Although a number of policy documents on innovative development have been adopted, there is no provision for co-operation and coordination of Implementation, there is no clear vision of the nature and the best ways to promote the innovative process. There is a huge need for a systemic and policy approach.

- Only a few mechanisms for encouraging the innovation activities are applied in EaP countries.
- In spite of the large amount of innovation infrastructure organisations, there is still a gap in providing services for start-ups and innovative companies in general.
- The existing services are not targeted on the needs of particular branches of economy, particular blocks of the value chain, value chain as a whole or circular economic processes.
- There is a significant lack of the comprehensive digital innovation framework. Lack of recognition of ICT as strategic sector.
- There is no single common innovation marketplace.
- Domestic markets are held back by a lack of demand, limited ICT usage and low incomes
-

Specific problems concerning **resource base** (human resources, technologies, office premises, production & R&D facilities, finance, reputation and trust, visibility):

- Human resource base suffers from brain drain, poaching, skill mismatch, & quality.
- The R&D ICT based infrastructure in academic institutions and universities is mainly outdated and hardly may be shared for showcase of the latest technologies. Purchase of equipment is not possible in the framework of majority of national grants and programs (it's not allowed due to budget restrictions from the one hand, and it's not possible because of the high price that could not be covered by small amounts of grants).
- Costs for both consumers and businesses limit the use of latest technologies.
- Access to research facilities is limited and focused on pure research rather commercialisation.
- Too few fablabs are operating and could be used privately to develop prototypes.
- Weak links between science and industry persist and a there is a serious gap between developments provided by science and industry needs. From the one hand, industry is not aware of the latest technological developments, from the other - scientists lack of knowledge to commercialise their R&D. Creation of technology transfer offices in universities and research institutes is a step forward in filling the gap, but there is a long way ahead.
- Cooperation between innovation infrastructure organisations and HEI in the development of educational programs is still rather an exception than the rule.

- In most EaP countries, there are no legal acts or regulations on the activity of venture capital funds. There are no regulations that would facilitate venture investment and would stimulate the funding of new IT initiatives, including innovative projects, start-ups and innovation or technology transfer.
- There is no one source on funding opportunities where all information is gathered together.
- There is a clear lack of appropriate finance at all stages of innovation, especially later stages. New forms of funding, like crowdfunding, microfinancing is in shortage.
- State procurement systems are not supporting innovation.
- There aren't enough hubs or co-working spaces to spread the innovative culture.
- Entrepreneurial culture & investment opportunities are inhibited by business culture, trust & bureaucratic barriers to doing business.

Good practices include attraction of corporate investments for establishing R&D-intensive laboratories in ICT (Moldova, Georgia).

Specific problems of businesses at the **seed stage (idea):**

- Insufficient level of competencies available in EaP countries for consulting on technology foresight; customers identification and value proposition development; building a balanced team and finding partners with complementary competencies.
- The low ability of companies to pay for the services of specialised consulting companies, especially international ones.

Specific problems of businesses at the **start-up stage (product):**

- Limited access to R&D and product development. Significant gap, there are no special services to find R&D partners.
- Huge lack of awareness on IPR strategies linked to business strategies.
- Huge lack of consulting on value proposition & business concept testing and validation.

Specific problems of businesses at the stage of **entering the market,** and **scale-up, scope-up, speed-up stage:**

- Some few commercial courses and consultancy on innovation management exist, but very few businesses appreciate their value and/or are able to pay for such services.
- Lack of consultancy services on specific marketing for ICT-based products. Especially start-ups don't have enough resources to pay for marketing of digital services that should be implemented at the very early stages of business deployment.

- The services for these stages are provided mainly by business angels and incubators, and venture capitalists; yet not for all businesses these tools are suitable.
- Specific reforms and incentives mainly cover the early stages of business development.
- Very few or absent acceleration programmes.
- Because domestic markets are weak, links to international markets need to be developed.

Specific problems of businesses at the stage of **business transformation and strategy:**

- Full absence or very limited services and lack of holistic approach in managing the structural transformation and in developing business models.
- It is very difficult to find good cases of service providers in this area.
- Thematic expertise is provided by professional associations, but there is no or low thematic and sectoral focus.
- The clusters aren't well implemented yet.

The existing **good practices of EaP countries** are described in more details in the Appendices

4.7 EaP ICT innovation legal framework

The Study has also investigated the specific legal framework relevant for ICT innovations. It was not possible to make an in-depth comparison of particular issues covered by the legal acts, analyse their consistency with the EU legislation etc. However, the table summarises the fact that some EaP countries have a complete lack of regulation on the issues important for businesses to start investing their time and resources into digital innovations.

Table 4.6.1. EaP ICT innovation legal framework

	ARMENIA	AZERBAIJAN	BELARUS	GEORGIA	Moldova	UKRAINE
Official format for Public-Private Partnerships (P3)			2015	2016	2008	2010
Specific regulations regarding Public Procurement of Innovative solutions (PPI) and Pre-Commercial Procurement (PPC)			2014			
Specific regulations prompting innovation	+		2009	+	2007	+
International agreements concerning ICT innovation and digitalisation	+		+	+	2010	+

Legal act(s) on commercialisation of R&D results created with state financing, spin-offs, spin-outs			2013		2004	+
Legal act(s) on intellectual property rights in ICT sphere	+	2012	+	1999	2010	+
Legal framework for crowdfunding, business angels and venture capital funding	+					+
Legal act(s) on electronic digital signature and electronic document (legal force of electronic documents is equal to paper documents)	+	+	2009	2017	2014	+
Equal validity of electronic and offline contracts		+	2009	2017	2004	+
Equal validity of paper and electronic invoices			2016	2010	2014	
Legal act(s) on electronic commerce (trade in Internet-shops, etc.)	+		2014		2004	+
Regulation on EDI-providers			2014			
Regulations of cloud providers					2014	
The national legislation establishes obligatory minimal requirements to providers of cloud services			2014		2014	+
The national legislation sets safe and fair contract terms and conditions for cloud computing contracts					2014	
Legal act(s) on personal data	+	+		2011	2011	+

The most well developed (available in all EaP countries) is the legislation on:

- intellectual property rights in ICT sphere
- electronic digital signature and electronic document (legal force of electronic documents is equal to paper documents).

On the contrary, the most widespread gaps are:

- Regulations of cloud providers and the national legislation sets safe and fair contract terms and conditions for cloud computing contracts (available only in Georgia)
- Regulation on EDI-providers (available only in Belarus).

A burning issue in 4 out of 6 EaP countries are:

- specific regulations regarding public procurement of innovative solutions (PPI) and pre-commercial procurement (PPC);
- legal framework for crowdfunding, business angels and venture capital funding.

Some areas, like legislation on personal data in Belarus, are still a problem for only one EaP country.

The general recommendation following from this screening is that the legal framework gaps can be filled taking into account the EU baseline.

Yet, the other recommendation is to look at the experience of implementation of the new regulation in the neighbouring EaP countries, where the institutional framework and the resource base might be more similar than those of the EU countries.

5 ROADMAPS AND RECOMMENDATIONS

5.1 Action Plan: harmonisation priorities and pillars

This Action plan is developed based on the identification of regional recommendations for joint actions by the partners. In Chapter 2 common challenges for EaP have been identified, however even though the challenges are common, the policy measures proposed are possible recommendations for individual countries and are therefore not included in this chapter Action Plan.

The Second Eastern Partnership Ministerial declaration has approved specific targets for 2020 as part of a roadmap for future digital cooperation in the EaP, ensuring concrete benefits for citizens and businesses. The targets for 2020 in the area of ICT innovation are set as:

- well-structured ICT research, innovation and start-ups ecosystems in place for all countries,
- established connections among partners' ecosystems and with similar EU ecosystems.

To achieve these targets, six harmonisation pillars (domains) are suggested, that represent the EU baseline in a strategic manner and are applicable to the entire region based on the gap analysis. The proposed pillars are:

1. ICT innovation training
2. ICT innovation networking
3. ICT innovation institutional framework
4. ICT innovation infrastructure
5. ICT innovation pilot projects for SMEs
6. ICT innovation services.

Each pillar contains specific project activities at each implementation level. The projects are formulated and assessed using the SMART objectives framework, as shown below:

S = Specific, i.e. whether there is sufficient detail to address the challenge

M = Measurable, i.e. whether it is possible to measure progress and accomplish results

A = Accepted, i.e. whether challenges are recognised, and objectives accepted by stakeholders

R = Realistic, i.e. whether objectives and challenges are attainable

T = Time-bound, i.e. whether the implementation period is clear

For each pillar, SMART objectives are defined, and respective harmonisation actions are proposed as described in Tables 5.1.1-5.1.6.

Table 5.1.1. Pillar 1. ICT innovation training

Objective	Description of harmonisation action
Specific	• To empower the EaP ICT innovation ecosystems with specific competencies for policy-making, digital business development and innovation services (*currently EaP countries have a big gap between the competencies needed and those available)* • To help establish educational and competence centres on digital innovations (*no or very few such centres are existing in EaP countries)*
Measurable	1.1. A common training package for the EaP partners is developed, targeting the needs of different kinds of ICT innovation ecosystem players, implementable in the online and offline format, allowing for flexible training modalities. The training package is customised for each EaP partner. 1.2. The certain number of trainers on digital innovation topics for different stakeholder groups is performed. The trained trainers and consultants are made visible to the users through registration at the EaP Digital Innovation Service Map. 1.3. Targeted training to the key ecosystem players in each EaP partner is performed, both online and offline, using the customised training package. 1.4. Study visits and short-term internships (up to 1 month) at benchmarking digital enterprises and relevant EU state bodies for different groups of stakeholders are organised. 1.5. Competencies in EaP countries are developed for consulting on technology foresight; value proposition and business model development; digital innovation management and marketing; Intellectual property rights strategy; digital transformation etc. through organizing internships to EU innovation ecosystem players. 1.6. A number of educational and competence centres on digital innovations are launched, with permanently available online modular training courses, with the sustainable organisational and financial models. These educational and competence centres are made visible to the users through registration at the EaP Digital Innovation Service Map.
Accepted	• All countries emphasis the strong need for training on digital innovation topics.
Realistic	• All countries have clear plans – whether in draft form or approved – to develop digital competencies in their strategies for informatisation or economic development

Objective	Description of harmonisation action
	• All countries have educational facilities able to absorb the competencies, adapt the training package and disseminate the knowledge.
Time-bound	• 2018-2020

Table 5.1.2. Pillar 2. ICT innovation networking

Objective	Description of harmonisation action
Specific	• To increase the efficiency of the *"EU4Digital: ICT innovation"* network activities by wide and targeted information dissemination, identification and involvement of relevant stakeholders servicing as the lead users and drivers of digital innovations, assistance in organisation of thematic expert groups within and across EaP countries through establishing its contact points (network offices/centres) in each EaP country (*Currently there are no systemic activities in EaP countries to identify the stakeholders among policy-making organisations, businesses, academy etc.)*. • To facilitate the clustering around digital innovation topics as a basis for flexible and sustainable cooperation among businesses, R&D and education centres and the interaction with EU clusters *(no specialised digital innovative clusters are visible at EU level at the EU Cluster Collaboration Platform now)* • To facilitate cooperation, information sharing and awareness raising between the diverse ICT innovation and start-up ecosystems actors in EaP countries and with the EU through network activities and the web-based platform *"EU4Digital: ICT innovation" (no such information exchange exists on a regular basis in EaP region and no platform for it)* • To help businesses and start-ups with digital innovation projects to find a specific service through business lifecycle stages, through creation of a one stop shop *EaP Digital Innovation Service Map* based on the stakeholders data collected and ICT innovation service logframe developed during the ICT Innovation Study 2017 *(no such platform exists in EaP countries now; while the existing start-up Europe Map does not provide the functionality of searching for specific services at the needed level of disaggregation)* • To enable a competitive flexible framework for stimulating the supply of services for ICT innovations in accordance with the actual demand on the basis of the *EaP*

Objective	Description of harmonisation action
	Digital Innovation Service Map's functionality of business voting for existing and lacking services. • To help businesses and start-ups with digital innovation projects to find specific partners through StartEaP Week *(no such event organised yet)* and services through their business lifecycle stages (*no such platform is available to EaP countries now) consequentially deploy the spectrum of services for different stages of the business lifecycle in accordance with the ICT innovation service logframe (the very limited services are available now in EaP countries).*
Measurable	2.1. "EU4Digital: ICT innovation" network has established its contact points (network offices/centres) in each EaP country, performing activities on wide and targeted information dissemination, identification and involvement of relevant stakeholders into the "EU4Digital: ICT innovation" activities, assistance in organisation of thematic expert groups within and across EaP countries. 2.2. The major actors of ICT innovation and start-up ecosystems (e.g. start-ups, investors, corporates, incubators, technoparks, accelerators, universities, media, relevant public bodies and organisations) are involved in networking among EaP partners and with their counterparts in EU Member States, via workshops, conferences etc. 2.3. The development of the certain number of specialised cluster organisations on digital innovations is facilitated, also using the opportunities of the EU Cluster Collaboration Platform. 2.4. A web-based platform *"EU4Digital: ICT innovation"* is developed for information sharing, awareness raising and facilitating the work of expert groups among EaP partners, comprising relevant material from EaP partners and EU Member States, including ICT innovation-related regulation, legislation, relevant programmes, strategies, initiatives, best practices and success stories, contacts to ecosystem players, events info etc. 2.5. The *EaP Digital Innovation Service Map* is created based on the stakeholders' data collected and *ICT innovation service logframe* developed during the ICT Innovation Study 2017, as a one stop shop website for start-ups to find a specific service through business lifecycle stages with functionalities for infrastructure organisations to register and independently update their information and for businesses to vote for existing and lacking services. Connect it with the start-up Europe Networks, including the Accelerators Assembly, start-up Europe University Network, start-up Europe India Network etc.

Objective	Description of harmonisation action
	2.6. StartEaP Week is organised annually, following the model of start-up Europe Week, to bring together all the relevant ICT innovation and start-up ecosystem players from EaP partner and EU Member States.
Accepted	• All countries acknowledge the need for a common marketplace for innovations and innovation services. All countries acknowledge the need for networking internationally.
Realistic	• All countries have start-ups and basic innovation infrastructure organisations. • All countries have collected the data on the major players in their ICT innovation ecosystems.
Time-bound	• 2018-2020

Table 5.1.3. Pillar 3. ICT innovation institutional framework

Objective	Description of harmonisation action
Specific	• To specify the gaps in the legislation for ICT innovation and start-up ecosystems, including the EU and EaP legislation on data storage and flows, risk and crowd funding, IPR in digital area, regulation on infrastructure organisations and start-ups etc. • To enable the harmonisation (matching, balancing, enabling non-contradiction) of legislation for ICT innovation and start-up ecosystems in EaP countries with the relevant legislation in EU countries. • To enable the harmonisation of statistics on ICT innovation in EaP countries with the relevant statistics in EU countries both methodologically and in its practical application level. • To create the more start-up friendly regulatory regime. • To provide access of EaP countries to EU expertise, tools and services of the EU Open Data Portal; cloud services for SMEs (cloud providers certification; Trusted Cloud; typical SLAs and contracts etc), Mittelstand 4.0 Initiative. • To trace the dynamics of the EaP ICT innovation ecosystem development through an updated ICT Innovation study.

Objective	Description of harmonisation action
Measurable	3.1. The detailed Study of legislation for ICT innovation and start-up ecosystems is performed, including the EU and EaP legislation on data storage and flows, risk and crowd funding, IPR in digital area, regulation on infrastructure organisations and start-ups etc. 3.2. The legislation for ICT innovation and start-up ecosystems in EaP countries is harmonised (matched, balanced, non-contradicting) with the relevant legislation in EU countries. The statistics on ICT innovation in EaP countries is harmonised with the relevant statistics in EU countries both methodologically and in its practical application level. 3.3. The innovative technology license / sandbox legislation is developed to allow start-ups to start operating with more start-up friendly regulatory regime. 3.4. The tools and service kit of the EU Open Data Portal for digital innovative businesses and researchers are selected, transferred and customised to the EaP countries. 3.5. The tools and service kits to support the mastering of cloud services for SMEs (cloud providers certification; Trusted Cloud; typical SLAs and contracts etc) are selected, transferred and customised to the EaP countries. 3.6. The tools (reference model, standards, SME support tools etc) of the Mittelstand 4.0 Initiative are selected, transferred and customised to the EaP countries. 3.7. An updated ICT Innovation study is performed to trace the dynamics of the EaP ICT innovation ecosystem development.
Accepted	• All countries acknowledge the need for improvement of legislation and statistics for ICT innovations • All countries acknowledge the need for special institutional tools fostering digital innovations
Realistic	• All countries have governmental agencies responsible for statistics and legislation on innovations, as well as the regular practices of their revision
Time-bound	• 2018-2020

Table 5.1.4. Pillar 4. ICT innovation infrastructure

Objective	Description of harmonisation action
Specific	• To enable the cost-efficient and customer-oriented investments into web-based platforms and tools for EU4Digital:ICT Innovation network through development of their proper terms of reference as well as strategies and roadmaps for deployment and implementation of these platforms and tools. • To enable the usage of permitted information resources (databases) by SMEs and start-ups to enhance their value propositions and digital business models. • To assist the adoption by SMEs of common standards and frameworks for real-time and cost-efficient integration of their separate information systems and information resources for enabling synergetic innovations in specific industries relevant to EaP country specialisation.
Measurable	4.1. ToR for web-based platforms and tools for EU4Digital:ICT Innovation network are formulated; strategies and roadmaps for deployment and implementation of these platforms and tools are developed. 4.2. Open data portals are deployed with access to the permitted information resources (databases) in a machine-readable form. 4.3. Open API marketplaces are deployed for specific industries relevant to EaP country specialisation.
Accepted	• All countries have clear plans – whether in draft form or approved – to increase the efficiency of their information resources.
Realistic	• The leading players in EaP countries are already using the international open data and open API marketplaces and are able to quickly demonstrate their efficiency to innovative start-ups.
Time-bound	• 2019-2020

Table 5.1.5. Pillar 5. ICT innovation pilot projects for SMEs

Objective	Description of harmonisation action
Specific	• To help SMEs with the selected innovative projects based on digital technologies (including the EaPConnect infrastructure; cloud services; Open Data Portals; Big Data; IoT, AI, VR&AR; eID; IoT; smart contracts etc) to get funding before their concepts are outdated *(no such funding is available in EaP countries now)*; • To enable the other SMEs the clear demonstrative effect at the practical application level of the innovation opportunities of digital technologies *(very few examples of innovative projects based on digital technologies are visible to traditional SMEs)*
Measurable	5.1. A certain number of pilot projects of SMEs and public organisations are serviced by the fast track fund. The information about results is well disseminated.
Accepted	• All countries acknowledge the big need for fast funding of the highly innovative projects
Realistic	• All countries have SMEs wishing to implement their innovative digital business projects • All countries have good media for dissemination of information.
Time-bound	• 2019-2020

Table 5.1.6. Pillar 6. ICT innovation services

Objective	Description of harmonisation action
Specific	• To deploy the key services for different stages of the ICT innovation business lifecycle that need the support of public funds because they cannot be supplied by the market (because of too early stages of the innovation process, externalities, or the need to deploy these services via clusters, associations and in a public-private partnership, which are best suited for gathering diverse competencies from different sectors, diversification of risks and creating sustainable organisational structures *(the very limited services are available now in EaP countries).*
Measurable	**Resource base:** • The laboratories/learning factories for SMEs on the prototype of the German Lernfabriks are equipped and launched in EaP countries in accordance with the specialisation of the country, for showcasing the latest technologies and serving as operational fablabs open for private SMEs and start-ups to develop prototypes. • The web platform(s) are created to enable alternative fundraising opportunities of innovative projects for start-ups and SMEs (crowd funding; P2P lending and microfinancing; mixed financing; secure ICO enhanced by expert support). • An EU VC Fund of Funds is established which would seed the creation of venture capital funds in each of the EAP countries **Seed and start-up stage:** • An additional module aggregating the information on the available resource base is developed for an EaP Digital Innovation Service Map. • An additional module enabling team-building for digital businesses and finding partners with complementary competencies is developed for an EaP Digital Innovation Service Map. • An additional module enabling the networking of the R&D and innovation laboratories and centres for digital innovations among the EaP partners and with the EU Member States is developed for an EaP Digital Innovation Service Map. **Entering the market; scale-up, scope-up, speed-up; business transformation**

Objective	Description of harmonisation action
	• The acceleration programmes specialised by sectors of economy most relevant to each EaP country are transferred from EU and customised (localised) to EaP countries. • The “fast track” channels of integrating the EaP and EU digital businesses to the distribution channels of each other are established. • Assistance is rendered in the business processes analysis & restructuring, and development of the digitalisation strategies (roadmaps) for the selected enterprises in EaP countries with strategic importance to the government (the funding for digital technologies purchase and deployment needs to be sought additionally).
Accepted	• All countries mark the urgent need for the services for ICT innovations that cannot be delivered by the market because of early stages of the innovation process, externalities and the needs for joint activities of multiple stakeholders.
Realistic	• Small-scale pilot projects of enthusiastic software developers, businesses, researchers, infrastructure organisations and policy-making bodies are introduced and the innovative institutional structures (like fablabs, foundations for innovative development etc) are established that can serve as a basis for deployment of key services for different stages of the ICT innovation business lifecycle that need the support of public funds.
Time-bound	• 2019-2020

The abovementioned structure of activities addresses the key challenges common for all EaP countries. The action 1.1. „…Customise the training package for each EaP partner by adding legislation specifics and taking into account the stakeholders’ needs” can be performed with account of the training gaps identified for each EaP country (Annex 6.1). The Pillar 6 “ICT innovation services” common for all EaP countries can be complemented by activities on the development of services in accordance to the gaps identified specifically for these countries.

The proposed harmonisation activities serve as an entry point for the next three years 2018-2020, especially during 2019-2020 when the support mechanism of the European Neighbourhood Policy (ENP) assistance instruments in relation to the Eastern Partnership becomes fully

operational following mandatory tender procedures (planned for 2018). The proposed actions in ICT Innovation aim at creating a critical mass for wider and deeper cooperation after 2020. Their scope can be expanded through the engagement of other types of EU assistance, especially via twinning projects. Twinning can be used to share experiences and good practices. The ENP East twinning page mentions Armenia, Azerbaijan, Georgia, Moldova and Ukraine explicitly as eligible for twinning projects with the EU Member States. Besides regional networking and cooperation, much can be gained through strengthened collaboration/interaction with the existing EU associations (e.g. DIGITALEUROPE, Digital SMEs, EuroCloud, Eco.), organisations and projects (e.g. Cluster Collaboration Platform, Mittelstand 4.0, start-upEurope Map and One Stop Shop, Accelerators Assembly etc) dealing with ICT innovation-related services.

It is also suggested to utilise fully the opportunities created by the EaPConnect project to improve ICT innovation infrastructure and services in the region thanks to the state-of-the art high-capacity broadband internet networks for research and education across the EaP Partner Countries. Pilot projects for SMEs demonstrating how the ICT innovation can be enabled by the infrastructure deployed in the EaP Connect project will demonstrate the opportunities for both the start-ups and the existing businesses in the traditional industries striving to digital transformation.

Utilisation of the multiple funding opportunities, including those provided by the international financial organisations, will allow to consequentially deploy the broad spectrum of services for different stages of the business lifecycle identified in the *ICT innovation service logframe* to enable building the well-structured ICT research, innovation and start-ups ecosystems in EaP countries, including through connections among partners' ecosystems and with similar EU ecosystems.

Herewith, it needs to be noted that the efficiency of these ecosystems will be impacted by the external environment (broadly taken national innovation systems, FDI policy, economic stability, educational system, the policy of the Eurasian economic union of which Belarus and Armenia are the members) that cannot all be addressed by the tools and institutions of the ICT innovation infrastructure.

5.2 ICT Innovation actions/projects within pillars

In the following section, the key activities and projects are listed, addressing the key common problems of EaP countries in their ICT innovation ecosystems. The timeframe for their launch/implementation is indicated and the scope of the projects is marked.

Following the gap mapping, it is proposed that the future HDM harmonisation initiatives in ICT Innovation are formulated and implemented at three main scope levels:

- Level 1: Projects common for the entire region i.e. all 6 Partner Countries;

- Level 2: Projects common for certain groups of Partner Countries;
- Level 3: Country-specific projects for individual countries (national).

A summary of actions/projects implementation plan is summarised in the table 5.2.1. and the detailed structure is presented in the tables 5.2.2-5.2.6.

Table 5.2.1. ICT Innovation actions implementation plan

	REALISATION TIMEFRAME			IMPLEMENTATION SCOPE			RECOMMENDED ASSISTANCE	
	2018	2019	2020	National	EaP	EaP+EU	Technical	Logistics
PILLAR 1. ICT INNOVATION TRAINING								
1.1.								
1.2.								
1.3.								
1.4.								
1.5.								
1.6.								
PILLAR 2. ICT INNOVATION NETWORKING								
2.1.								
2.2.								
2.3.								
2.4.								
2.5.								
2.6.								
PILLAR 3. ICT INNOVATION INSTITUTIONAL FRAMEWORK								

	REALISATION TIMEFRAME			IMPLEMENTATION SCOPE			RECOMMENDED ASSISTANCE	
	2018	2019	2020	National	EaP	EaP+EU	Technical	Logistics
3.1.								
3.2.								
3.3.								
3.4.								
3.5.								
3.6.								
3.7.								
PILLAR 4. ICT INNOVATION INFRASTRUCTURE								
4.1.								
4.2.								
4.3.								
PILLAR 5. ICT INNOVATION PILOT PROJECTS FOR SMES								
5.1.								
PILLAR 6. ICT INNOVATION SERVICES								
6.1.								
6.2.								
6.3.								
6.4.								
6.5.								
6.6.								

	REALISATION TIMEFRAME			IMPLEMENTATION SCOPE			RECOMMENDED ASSISTANCE	
	2018	2019	2020	National	EaP	EaP+EU	Technical	Logistics
6.7.								
6.8.								

Table 5.2.2. Pillar 1. ICT innovation training

Key projects:		Realisation timeframe			Implementation scope			Recommended assistance	
		2018	2019	2020	National	EaP	EaP+EU	Technical	Logistics
1.1.	Develop a common modular training package (both online and offline) for the EaP partners, targeting the needs of different kinds of audiences/ ecosystem players, and topics of relevance/priority. Customise the training package for each EaP partner by adding legislation specifics and taking into account the stakeholders' needs (Annex 4.1).								
1.2.	Train the trainers on digital innovation topics for different stakeholder groups relevant for EaP countries. Register them at the EaP Digital Innovation Service Map.								
1.3.	Perform targeted training to the key ecosystem players in each EaP partner, both online and offline, using the customised training package.								
1.4.	Organise study visits and short-term internships (up to 1 month) at benchmarking digital enterprises and relevant EU state bodies for different groups of stakeholders.								

1.5.	Develop competencies in EaP countries for consulting on technology foresight; value proposition and business model development; digital innovation management and marketing; Intellectual property rights strategy; digital transformation etc. by medium- (1-6 months) and long-term (6-12 months) internships to EU innovation ecosystem players. Register the consultants at the EaP Digital Innovation Service Map.								
1.6.	Launch educational and competence centres on digital innovations with permanently available online modular training courses, with the sustainable organisational and financial models. Register the centres at the EaP Digital Innovation Service Map. Register them at the EaP Digital Innovation Service Map.								

Table 5.2.3. Pillar 2. ICT innovation networking

	Key projects:	Realisation timeframe			Implementation scope			Recommended assistance	
		2018	2019	2020	National	EaP	EaP+ EU	Technical	Logistics
2.1.	**"EU4Digital: ICT innovation" network** establishes its **contact points (network offices/centres)** in each EaP country, performing activities on wide and targeted information dissemination, identification and involvement of relevant stakeholders into the "EU4Digital: ICT innovation" activities, assistance in organisation of thematic expert groups within and across EaP countries.								
2.2.	**Network the major actors** of ICT innovation and start-up ecosystems (e.g. start-ups, investors, corporates, incubators, technoparks, accelerators, universities, media, relevant public bodies and organisations) among EaP partners and with their counterparts in EU Member States, via workshops, conferences etc.								
2.3.	Facilitate the development of the **specialised cluster organisations on digital innovations**, also using the opportunities of the EU Cluster Collaboration Platform.								

2.4.	**Develop a web-based platform "EU4Digital: ICT innovation"** for information sharing, awareness raising and facilitating the work of expert groups among EaP partners, comprising relevant material from EaP partners and EU Member States, including ICT innovation-related regulation, legislation, relevant programmes, strategies, initiatives, best practices and success stories, contacts to ecosystem players, events info etc.									
2.5.	Create the **EaP Digital Innovation Service Map** based on the stakeholders' data collected and *ICT innovation service logframe* developed during the ICT Innovation Study 2017, as a one stop shop website for start-ups to find a specific service through business lifecycle stages with functionalities for infrastructure organisations to register and independently update their information and for businesses to vote for existing and lacking services. Connect (interlink) it with the start-up Europe Networks, including the Accelerators Assembly, start-up Europe University Network, start-up Europe India Network etc.									
2.6.	Organise a **StartEaP Week annually**, following the model of start-up Europe Week, to bring together all the relevant ICT innovation and start-up ecosystem players from EaP partner and EU Member States.									

Table 5.2.4. Pillar 3. ICT innovation institutional framework

	Key projects:	Realisation timeframe			Implementation scope			Recommended assistance	
		2018	2019	2020	National	EaP	EaP+ EU	Technical	Logistics
3.1.	Perform a detailed Study on legislation for ICT innovation and start-up ecosystems, including the EU and EaP legislation on data storage and flows, risk and crowd funding, IPR in digital area, regulation on infrastructure organisations and start-ups.								
3.2.	Perform activities on harmonizing the legislation and statistics for ICT innovation and start-up ecosystems.								
3.3.	Develop an innovative technology license / sandbox legislation to allow start-ups to start operating with more start-up friendly regulatory regime								
3.4.	Select, transfer and customise to the EaP countries the tools and service kit of the EU Open Data Portal for digital innovative businesses and researchers.								
3.5.	Select, transfer and customise to the EaP countries of tools and service kits to support the mastering of cloud services for SMEs (cloud providers certification; Trusted Cloud; typical SLAs and contracts etc).								

3.6.	Select, transfer and customise to the EaP countries the tools (reference model, standards, SME support tools etc) of the Mittelstand 4.0 Initiative.								
3.7.	Perform an updated ICT Innovation study to trace the dynamics of the EaP ICT innovation ecosystem development.								

Table 5.2.5. Pillar 4. ICT innovation infrastructure

Key projects:		Realisation timeframe			Implementation scope			Recommended assistance	
		2018	2019	2020	National	EaP	EaP+ EU	Technical	Logistics
4.1.	Multitask project on development of ToR for web-based platforms and tools for EU4Digital:ICT Innovation network; strategies and roadmaps for deployment and implementation of these platforms and tools								
4.2.	Develop open data portals with access to the permitted information resources (databases) in a machine-readable form.								
4.3.	Develop open API marketplaces for specific industries relevant to EaP country specialisation.								

Table 5.2.6. Pillar 5. ICT innovation pilot projects for SMEs

		Realisation timeframe			Implementation scope			Recommended assistance	
	Key projects:	2018	2019	2020	National	EaP	EaP+ EU	Technical	Logistics
5.1.	Launch a fast track fund for pilot projects of SMEs and public organisations providing at the practical application level the clear demonstrative effect to the other SMEs and public organisations of the innovation opportunities of digital technologies, by opening and complementing the instruments of the COSME programme (including the EaPConnect infrastructure; cloud services; Open Data Portals; Big Data; IoT, AI, VR&AR; eID; IoT; smart contracts etc). Disseminate the information on results.								

Table 5.2.7. Pillar 6. ICT innovation services

	Key projects:	Realisation timeframe			Implementation scope			Recommended assistance	
		2018	2019	2020	National	EaP	EaP+ EU	Technical	Logistics
	Resource base:								
6.1.	Equip and launch in EaP countries the laboratories/learning factories for SMEs on the prototype of the German Lernfabriks in accordance with the specialisation of the country, for showcasing the latest technologies and serving as operational fablabs open for private SMEs and start-ups to develop prototypes.								
6.2.	Create the web platform(s) to enable alternative fundraising opportunities of innovative projects for start-ups and SMEs (crowd funding; P2P lending and microfinancing; mixed financing; secure ICO enhanced by expert support).								
6.3.	Establish an EU VC Fund of Funds which would seed the creation of venture capital funds in each of the EAP countries								
	Seed and start-up stage:								

6.4.	Develop for an EaP Digital Innovation Service Map an additional module aggregating the information on the available resource base.								
6.5.	Develop for an EaP Digital Innovation Service Map an additional module enabling team-building for digital businesses and finding partners with complementary competencies.								
6.6.	Develop for an EaP Digital Innovation Service Map an additional module enabling the networking of the R&D and innovation laboratories and centres for digital innovations among the EaP partners and with the EU Member States.								
	Entering the market; scale-up, scope-up, speed-up; business transformation								
6.7.	Transfer from EU the acceleration programmes specialised by sectors of economy most relevant to each EaP country and customise (localise) them to EaP countries.								
6.8.	Establish the “fast track” channels of integrating the EaP and EU digital businesses to the distribution channels of each other.								
6.9.	Assist in the business processes analysis & restructuring, and development of the digitalisation strategies (roadmaps) for the selected enterprises in EaP countries with strategic importance to the government (the funding for digital technologies purchase and deployment needs to be sought additionally).								

5.3 Common challenges in EaP region

Our study has highlighted and identified some challenges that are common for many or most of the EaP countries. Although the list of challenges introduced and described in this section is far from exhaustive, it is a short first list of main challenges and some suggested possible solutions that have been implemented by one or more EU Member States and can be used as a good practice that could be used as inspiration for the development of tailored national policy measures.

Although the challenges identified are common to all EaP countries, this study does not recommend the development of generic joint solutions that could address these challenges in a single joint action. Each challenge does require tailored national measures, while at international/regional level the added value of joining exiting transnational initiatives might be preferred over new regional collaboration at EaP level.

5.3.1 Problem: Brain drain

5.3.1.1 Description of the problem

Many EaP countries face the similar challenge of young highly educated young professional people that emigrate to other countries for better quality of life, career opportunities. These people will find jobs in high profile academia or international companies and will contribute to the increasing diaspora.

5.3.1.2 Possible Policy Measures:

- Offer temporary employment (not an internship, but separate high-talent program) for foreign graduated young talents in public institutions in your own country for soft landing and kick-starting their career in their home-country, offer possibilities for creating new valuable ideas for vitalisation of public sector, developing, pilot testing of new policy ideas and provide opportunities for young foreign graduated young talents to contribute to the their own country and get acquainted with public organisations.
- Empower diaspora to mentor young researchers / entrepreneurs in own country. Diaspora can provide access to knowledge, networks, investments in other countries that could benefit the home-country. However, active networking is important to keep relationship with home country active. Through these networks, it could be made easier for members of the diaspora to return their working life in their home country. Additionally, they can provide support and mentorship for young researchers and entrepreneurs to assist and guide them in their working career as researchers or entrepreneur.

5.3.2 Problem: Different, and narrow understanding of innovation

5.3.2.1 Description of the problem

Innovation is a difficult to define concept that holds the promise of modernisation, economic growth a development. However, many policy makers have a narrow understanding of innovation as limited to research commercialisation and developing (financial) support for new and existing high-tech industry with the hope that spill-over effects will automatically happen to other parts of the economy and society. However, a broad-based understanding of innovation, including new markets, new business models, new organisations models besides new products/services and processes also automatically mean that they can be applied by all actors in a society, including public actors, hospitals, education, etc. Additionally, in order for the spill-over effects from support to high-tech companies to take place, there should be a capacity and demand for uptake of innovations developed by innovators. A local market and demand for innovation developed by innovators in the home country is crucial for both the innovators for finding first launching customers as well as for the buyers of innovative solutions for the modernisation of their organisations.

5.3.2.2 Possible Policy Measures

Promote a ”broad based definition of innovation” that addresses the “supply” (R&D, high-tech) as well as the uptake of innovations (absorptive capacity) by all industries and sectors. Broad involvement of policy makers from different fields (education, health, finance, agriculture, defence, etc) is important to understand the broad implications and impact of innovation on society.

Development and implementation of specific policy measures targeted at increasing the absorptive capacity and demand for innovation within society. These policy measures could cover trainings, education, awareness trainings, (technology) audits, financial support for investments into modernisation, etc.

5.3.3 Problem: Lack of collaboration between industry & academia

5.3.3.1 Description of the problem

A collaboration between industry and academia (universities and research institutions) is important for the exchange of knowledge, people and ideas. In the EaP region, however there is limited collaboration between both worlds, partly due to a relative high focus in academia on ‘fundamental research’, shown by the fact that the research results are mainly monitored in number of publications. The number of contact research, demonstrations, prototypes, patents seems less prioritised. On the other hand, there are few technology-based companies that collaborate with academia to further their R&D efforts for the development of new innovative

solutions. Additionally, there seems to be a lack of people and organisations (both public and private) that are specialised in connecting and fostering industry-academia collaboration.

5.3.3.2 Possible Policy Measures:

- Innovation Vouchers for (co)-finance of introduction small scale collaborative R&D project between SME and university/research institution

Many European countries have introduced the policy scheme: “Innovation Vouchers” which reimburses the costs for (public) R&D institutions for doing collaborative research with SMEs. These small-scale funding (around 6 – 50 k EUR) schemes aim to establish first introduction, trust and collaboration between SME and R&D performing institution which would facilitate further collaboration.

- Collaboration support services, such as Enterprise Europe Network for enabling and organising collaboration / matchmaking events

The introduction of collaboration support services for matchmaking and connecting people from academia and industry to foster collaboration and spill-over effects that would benefit the company and the society in general.

- Create mobility schemes between industry and research sector

There are different mobility schemes possible that financially support the temporary employment of researchers into industry. The overall idea is that companies (especially SMEs) do not easily hire researchers (temporary or permanently). On the other hand, gaining working experience in a company might benefit the researcher in getting more hands-on experiences, increased skills-set and better understanding of company needs and business language.

5.3.4 Problem: Lack of applied R&D in industry

5.3.4.1 Description of the problem

Based on limited available statistics, it seems that private investments in R&D in EaP countries is much lower than in EU average. For companies, investments into R&D are risky, with costs in the short term and possible benefits from successful commercialisation of research results in the long term. Since companies in uncertain economic macro-conditions tend to have a stronger focus on the short run, there is a public role for stimulating the involvement of companies in R&D activities, as there is a societal benefit and possible spill-over effect to society.

5.3.4.2 Possible Policy Measures:

- Public co-funded applied R&D

Open competitions where the best applied research & development projects from industry will be selected for receiving co-finance can increase the private investment in R&D while also promote collaboration with research (if favoured in evaluation criteria). It is important that research projects are funded that comply with strategic goals & priorities of the country.

- Provide tax deduction incentives for companies that conduct applied research and development

Instead of providing direct financial support to companies performing R&D, also tax benefits could be provided. These tax benefits can range from deduction of profit tax as well as deduction of the employers share of employment tax for researchers employed. This last option will also benefit start-up companies that are pre-profit. To implement tax incentives good collaboration with Ministry of Finance, Ministry of Economy and Tax Inspection Agency is important. Additionally, companies should be informed about the possibility to deduct their taxes and it should be clear to all players what are the conditions and rules. It is important that companies are not afraid to use the scheme because of fear of being penalised with fines for incorrect tax declarations.

5.3.5 Problem: Fragmentation of public agencies involved in ICT innovation and start-up eco-system

5.3.5.1 Description of the problem

One of the challenges of dealing with the topic of ICT innovation and start-ups is that the authority for policy making is typically dispersed among different ministries and different public agencies. ICT might be under responsibility of a ministry of Telecommunication, while a Ministry of Science and Education is focusing on research policy and the Ministry of Economy on the innovation policy and possibly also the start-up policies. Therefore, it might be difficult to develop and implement a coherent overarching national strategy, policies and implementation of policies targeted at ICT innovation and start-ups.

5.3.5.2 Possible Policy Measures:

- Create a strong single policy advisory body for Research & Innovation

A single strong policy advisory body can develop knowledge, competences and provide a single coherent (evidence based) policy advice to government. Such an advisory board can be non-political, employ researchers for developing research on the topic of innovation policy, collect data, track evidence of impact and provide long term capacity on policy advice with organisational memory.

- Create a single Innovation Agency

A single Innovation Agency with mandate that includes ICT, digitalisation of society/industry and with the necessary financial and human resources should in EaP countries help implementing the national strategies and policy instruments. Such an Innovation Agency will intervene in the research and innovation landscape, gain knowledge and experience in the interface between policy and the field in which innovation actors operate. By combining the implementation of generic innovation policy measures and ICT specific policy measures by a single innovation agency, more synergy between the generic and specific policy measures can be obtained and a single actor for interaction from the innovation actors in the in the innovation system with public agencies in the field of innovation. The Innovation Agency can be made responsible for the implementation of all innovation related policy measures for provision of innovation grants, advisory services etc.

- Create Interdepartmental working groups responsible for policy areas that relates to more than one minister (digitalisation, innovation)

In order to create more harmonisation, dialogue and alignment between different ministries responsible for different policy domains (ICT, innovation, research, science and technology, start-ups), interdepartmental working groups consisting of representatives from different ministries can be set up for developing of policy recommendations in areas that cover areas that are affecting the responsibilities of different ministries. These interdepartmental working groups create communication, dialogue and better understanding between civil servants working for different ministries.

5.3.6 Problem: Fragmented policies, lack of implementation of policies

5.3.6.1 Description of the problem

An analysis of the alignment of different national policies and implementation of policy measurements in EaP countries reveals a great fragmentation between different national policies and a lack of dedicated policy measures designed for and aligned to the implementation of these national strategies. Many of the EaP countries have different innovation strategies, digitalisation strategies, science and technology strategies, and strategies for economic development of the country. However, very limited harmonisation or integration of these national strategies exist. Additionally, often dedicated implementation policy measures exist that are designed for the specific implementation of the national strategies.

5.3.6.2 Possible Policy Measures:

- Alignment of different national strategies to each other and to overall national strategic priorities

It is important that different national policies are coherent and aligned to an overall national strategy and priority. A clear overall vision for the country would provide guidance for the development of different national thematic strategies.

- Clear approval, support and provision of means by government for implementation of policy measures

An important disconnect exists between the different national strategies and the portfolio of policy instruments ('policy mix') for implementation. A lack of coherent, dedicated policy instruments with clear mandate, resources and means for supporting the implementation is limiting the impact of national strategies. These policy measure should have clear mandate from government and sufficient resources in terms of finance, quality of human skills and digital resources in terms of a well-functioning online platform for facilitating interaction, application, communication, reporting, etc)

- Create measures to measure progress and impact of implementation of policy measures and create policy learning

Evidence based policy is important to learn from which policies work, which don't and what is the interaction between different policies (so called policy mix). It is a common practice in most European Countries (and in EU) to allocate a certain percentage (typically around 5%) of the budget for policy implementation for the monitoring, reporting, evaluation, impact assessment (ex-ante, and ex-post). Dedicated capacity, skills should be developed for policy learning and providing the evidence for the impact obtained by the policy measure(s). This will also require the monitoring of the implementation of policy measures by both policy implementation agencies as well as beneficiaries. Digital solutions for data collection and storage and online reporting would facilitate this process, create more transparency and lower the administrative burden.

5.3.7 Problem: Outdated research infrastructure

5.3.7.1 Description of the problem

A well-functioning innovation eco-system is relying on a State of the Art research infrastructure. In the field of ICT, relevant research infrastructure such as high-performance computing, clean-labs, additive manufacturing equipment etc. can be crucial for researchers to perform world-class research and for companies to have access to state-of-the-art research knowledge and equipment necessary for the R&D for the development of new products and services. Investments into research equipment alone is often insufficient if the quality of research, the skill level of researchers and the clear utilisation plan for equipment by both researchers and entrepreneurs is not well developed.

5.3.7.2 Possible Policy Measures:

- Invest and raise private co-funding to invest in equipment, skills and competences in and around research infrastructure aligned to strategic priorities of the country

Investments into new research equipment is necessary. However, investments should be done carefully, not only in equipment, but also in the necessary required skills, knowledge and scientific excellence as well. By requiring co-funding from industry or private funds, an alignment with the needs of business can accomplished, while also securing the utilisation of the equipment by industry. Identification of specific needs for equipment in research relevant for the field of ICT innovation is necessary and should be based on the strategic priorities, strengths and opportunities of the country, both in terms of research capacity as well as industrial capacity.

- Encourage 'open access' of shared research infrastructure and use by private companies

Besides investing in new research equipment, it is important to improve utilisation of existing research infrastructure by providing access to companies. This will increase utilisation rate, it will foster industry research collaboration and brings into research certain types of research and development activities that would not have been possible for the company to do without access to the research infrastructure.

5.3.8 Problem: Lack of Multinationals with strong R&D capacity

5.3.8.1 Description of the problem

Foreign Direct Investment attraction is sometimes focusing on attracting any investment, irrespectively of the nature of these investments. In order to strengthen the ICT innovation capacity of the country, FDI in the field of R&D can have strong impact, due to inflow of knowledge, capacity, and funding into the country. These investments are often better integrated into the country's eco-system which makes them long term and they also provide good career development opportunities for people in the field of research and development in business environment.

5.3.8.2 Possible Policy Measures:

- Strengthen capacity of national agency responsible for attracting FDI in the field of attracting MNS for investment in R&D centres.

  Existing FDI attraction agencies that currently are responsible for attracting FDI could be mandated to prioritise or specifically target multinationals that are looking to invest into offshore research centres. This would mean targeting a specific type of FDI and developing specific tailored value proposition that would be beneficial for FDI invested into R&D centres.

- Align FDI attraction to national strategic priorities

The alignment with FDI attraction to national strategic priorities might help creating more dedicated focus and better value proposition for FDI. In case the country's priorities include specific target fields with ICT innovation (e.g. IIoT, additive manufacturing), multinationals operating in that specific area might be easier targeted and incentivised to invest into such an eco-system in case they believe that the prioritisation will lead to a stronger potential in the country for research, recruitment, collaboration and networking around their core area.

- Create favourable conditions for foreign investment in R&D (tax benefits, free economic zones, access to infrastructure, co-finance for investments

Countries often have created specific "Free economic zones" where (foreign) companies receive favourable conditions when investing to locate in these zones. Favourable conditions could be lower tax rates, favourable price of land, good quality available infrastructure etc. In order to attract multinationals with strong R&D capacity, these specific zones could be designed to provide more attractive conditions for locating R&D centres. This could be by creating these specific free economic zones around knowledge centres where talented and educated people are located and/or abundant relevant research and innovation actors or infrastructure. An additional added value is that better networked and integrated multinational R&D centres into a local eco-system will create dependencies and will make it harder for the multinational to relocate the R&D centre outside the country.

5.3.9 Problem: Lacking uptake of ICT innovations in society

5.3.9.1 Description of the problem

An overall focus on developing the supply side of ICT innovation system in a society will lead to narrow support for a relatively small number of stakeholders, including universities, research institutes and innovative companies (both start-ups and established companies). This creates two related problems. First of all, companies developing these state-of-the-art ICT innovations will have challenges in selling their innovations in the local market. Having a small local market is important for these companies to pilot their innovations with first customers nearby with whom they can do further development and adaptations of their innovations to their customer needs. A lack of local customers will make it harder for these innovative ICT solution developers to test their solutions, get market validation and scale their solutions to international level. Second, the impact of supporting the development, market introduction and sales at international level of new ICT innovations by supporting a few "champions" will have limited impact on the overall economy of the country. High-tech companies tend to provide limited number (but highly skilled and highly paid) jobs. For a country to develop and grow its economy, it is important that all sectors of the country will modernise. In the field of ICT innovation, this means that uptake of digital solutions and integrating them into society is very important. This should be done at all relevant sectors of

a society, not limited to its economy. The uptake of digital solutions in health, education, social care, public sector is just as important as the digitalisation of industry or service sector.

5.3.9.2 Possible Policy Measures:

- Development and implementation of a bottom-up inclusive national digitalisation strategy and implementation plan.

One of the lessons learned from the Baseline scenario is that leading European countries in ICT innovation have developed and adapted a national digitalisation strategy. Such a strategy does not focus on the development and support of new ICT innovations but mainly focusses on how an economy, industry, society can benefit from introduction of digital solutions and the development of new business models and organisational models around these digital solutions. It is important that the strategy is developed bottom-up and includes representatives from different sectors and stakeholders from society in order to align the digitalisation strategy to the actual needs of the different stakeholders and create stronger support for the implementation of this strategy.

- Development of policies to increase the absorptive capacity of society: trainings, incentives, co-finance of modernisation investments etc.

Demand focused innovation policy measures are important to enable the better uptake of ICT innovations in society. To do this, more awareness needs to be created about the needs and added value of ICT innovations can provide. Besides increasing the awareness there is a need to increase the ability and capability for this uptake. The so called 'absorptive capacity' of society needs to be increased that would enable a better and faster uptake of digital solutions. This can be done through specific trainings, seminars, financial and non-financial incentives for investments into uptake of ICT innovations by companies. Specific financial support for co-funding into investment into the modernisation of companies and specifically manufacturing industry would facilitate the integration of new ICT innovations. In short, local manufacturing industry needs to invest in "Industry 2.0 and 3.0" before moving towards "Industry 4.0".

- Creation of Digital Innovation Hub that provide business support, advice, access to research and ICT developers to different fields/industries

One of the new practices identified and actively spread in the European Union is "Digital Innovation Hubs". These are regionally embedded orchestrators of eco-systems that bring together the facilities and stakeholders arounds ICT and support the joint collaborative

research and development as well as support the business development around new ICT innovation solutions.

5.3.10 Problem: Lack of reliable and comparable statistics

5.3.10.1 Description of the problem

Reliable and relevant statistics can provide more insights that enable more focusses policy efforts to where it is needed and provide feedback on the impact of these policy measures over time. Although not everything of importance and value can be easily measured, statistics are a crucial support as input into decision and policy making.

5.3.10.2 Possible Policy Measure:

- Investment in skills, methodology, capacity and measures for collecting of R&D and innovation related statistics

Developing a strong statistics office will take long investments into skills, procedures, practices and know-how on how to build capacity, and practice in collecting, analysing, storing and disclosing public statistics. Close collaboration with European Statistic Offices is advised since harmonisation of indicators and practice of statistics collection is needed to allow comparison between different countries.

5.3.11 Problem: Lack of Start-up culture and eco-system

5.3.11.1 Description of the problem

Start-ups are in developed economies partly responsible for developing and testing in the market of new innovative solutions and new business models. Although most start-ups fail, the successful start-ups that scale can be responsible for disruptive existing industries and players and create new value for customers. A healthy start-up culture and eco-system is important to create sufficient good quality start-ups, from which few will grow to scale and create the economic leading companies of tomorrow. A healthy start-up culture and ecosystem is important for start-ups to start growing and surviving. A culture that promotes and supports entrepreneurs to start their business, an administrative culture that supports the easy of doing business. A healthy start-up ecosystem ensures that there is a critical mass of people and organisations that can provide high quality start-up support services. These services range from mentoring, growth services, advise, networking, partnering, legal, accounting, administrative, business development, marketing, etc.

5.3.11.2 Possible Policy Measures:

- Joint collaboration with foreign (diaspora) ‘smart’ investors

The challenges of building a thriving start-up ecosystem is challenging if there are no skills or experienced people. Utilising the skills, knowledge, experience, network and financial capacity of diaspora working and living in strong star-up eco-systems could share their experiences, networks. Specific opportunities could be developed for setting up of specific Venture Capital funds managed by diaspora for investments into start-ups in EaP country/countries as is already happening in some of the EaP countries.

- Linking of emerging start-up eco-systems at national level with international start-up ecosystems

In order for a national start-up eco-system to further mature and grow, it is important to create durable links with other existing start-up ecosystems. Good practice from Europe are the development of Start-up Europe Map which makes start-ups stakeholders visible and approachable. Additionally, active collaboration between innovation stakeholders in different eco-systems in different countries allows for exchange of best practices in start-up support services, in providing access to start-up support services from other international start-up ecosystems that are not available in the country and collaboration on provision of soft-landing services: the support services for start-ups that want to scale or expand to new international market.

- Support for bottom-up clustering, co-location of start-up companies and start-up service suppliers for creating interlinkages and synergies

One of the best way to facilitate the development of a start-up support eco-system is to support start-up companies themselves to cluster and develop start-up support services. Start-ups know themselves best what support services they need and in many developed countries have developed themselves new organisations, clusters, hubs, co-working spaces, associations, networks, incubators, accelerators that provide the most required start-up support services. Public sector could help facilitate the initial bottom-up networking through organisations of first events, location for meeting, offering available public spaces for creation of co-working spaces.

- Support the creation of public/private start-up funds for investment in different company development stages

Active support in creating favourable legal and financial (co-funding) conditions for new venture funds to be established for investing into start-up companies. These venture funds can provide besides finance also scale-up services for helping companies to scale their business. Fund managers with experience from abroad can bring additional skills and knowledge for helping local start-ups and scale-ups grow.

5.3.12 Problem: Lack of funding for research and innovation

5.3.12.1 Description of the problem

According to the limited available statistics in EaP countries, there is limited investments into research, development both from public and from private sector. Our research from baseline reveals that strong performing countries have both a high share of public and private investments into R&D.

5.3.12.2 Possible Policy Measures:

- Provide specific “centres of competence” for Horizon 2020 and other international funding possibilities

Specific competence centres can provide advice, awareness raising, consultation, trainings and feedback for organisations that would like to attract funding from international sources. Specific competences are required for international funding attraction, including proposal writing, project administration, financial project administration and reporting, project management, etc. Different funding programs have different program logic of interventions and therefore different expectations and rules for applicants. Specific centres of competence can help applicants from both industry and academia to identify suitable funding opportunities and provide support during the project proposal preparation.

5.3.13 Problem: Fragmented disconnected donor programs

5.3.13.1 Description of the problem

Most EaP countries have donor programs that through competitions provide small grants for start-ups and/or researchers and/or mobility schemes. One of the challenges for EaP countries is that they have limited to no control over these programs and they are not always aligned to the national strategies and existing policy measures. Different donor programs might overlap or duplicate and/or might not be aligned to the national strategy or the specific needs of the country.

5.3.13.2 Possible Policy Measure:

- Develop strong national strategy and priorities and request alignment of donor programs with these strategies

Coordination between different donor programs might be challenging but worth pursuing. However first the country has to have a clear national strategy regarding ICT innovation and

start-ups to communicate to donor countries the strategic directions to which the donor programs should contribute to.

5.3.14 Problem: Low awareness, knowledge and capacity to protect IP

5.3.14.1 Description of the problem

For companies that develop ICT innovation it is important to have the right Intellectual Property protection not limited to the home country. Protection of IP through patents, design registrations, copyright, trademarks, utility models or other ways is important for companies targeting international markets.

5.3.14.2 Possible Policy Measures:

- Make use of and to some extend replicate the European Helpdesk for IPR

Companies that have developed innovative (ICT) solutions that want to go to international European markets, could benefit from the European Helpdesk for IPR. Similar, each EaP country could provide similar services by providing free advice on IPR, especially in key target markets (e.g. USA, Europe, Russia, China).

- Provide co-funding for preparation, application, expansion and protection of IP

Different European countries provide financial co-funding for companies in the preparation and/or submission of new patents. Even though patents at national level provide very limited protection, they are a first step in the expansion of the geographical coverage and can be an important first step to take.

5.3.15 Problem: Procurement practices limit the role of public as launching customer for newly developed innovation within the country

5.3.15.1 Description of the problem

In most countries, the public sector is an important procurer of goods and services. For companies that develop new ICT goods and/or services, the public sector could be an important customer. However, in many cases laws regarding public procurement can provide strong requirements for companies or the reliability of the products/services they would like to sell to the public sector. Innovative products and services have no track record and start-up companies also lack history. Therefore, public procurement rules can strongly limit the uptake of innovative ICT solutions by the public sector. On the other hand, different European countries have demonstrated that the public sector could function as a launching customer for new ICT solutions.

5.3.15.2 Possible Policy Measures:

- Develop and strengthen the regulations, capacity, awareness, skills and best practices regarding public procurement of innovation

Creation of national “competence centre” regarding public procurement of innovation that can assist other public bodies in their preparation and implementation of public procurement of innovation. Public procurement of innovation is an important tool for public sector to express their needs for solutions that are not available on the market yet and support the development of these solutions, tailored to the need of the public body. In several European countries, digital e-government services were developed by local IT industry through public procurement of innovation. Since many different public bodies (government, ministries, agencies, regional authorities, municipalities, etc. could be using public procurement of innovation, it is helpful to have a single national competence centre that can advise on how to use public procurement of innovation as a tool and implement it, while complying to national legislation regarding public procurement.

6 RECOMMENDATIONS FOR A COMMON EAP TRAINING PACKAGE

6.1 Goals, approach and methodology

The goal of this part of Study was to specify in detail the content and structure of a common training package for the EaP countries, to address the needs of the main groups of EaP ICT innovation ecosystem stakeholders in knowledge, skills and competencies related to ICT innovation and digital transformation

For the purpose of this Study, digital transformation is understood as application of modern information technologies for radical increase of productivity and value. Thus, the knowledge, skills and competencies related to ICT innovation and digital transformation go but beyond the software development skills and even beyond the running of a software development company. The spectrum of knowledge, skills and competencies studied embraces the spectrum of challenges faced by non-ICT businesses during their digital transformation, by founders of innovative start-ups that are based on a digital business model, by innovation infrastructure organisations supporting these businesses, by policymakers when developing the national policies and tools for fostering digital innovations on a country level.

The material of this part of Study is structured as follows.

First, the training needs of different types of stakeholders are identified separately for each EaP country and in general for the EaP region.

Next, the roadmap related to ICT innovation training needs is drafted.

Finally, the specification of training packages separately for different groups of stakeholders is developed, that can be used as a ToR framework for development of particular courses.

The target groups of the training courses include:

- business managers and business consultants;
- consultants on digital business at innovation infrastructure organisations;
- policy-makers responsible for digital development of society and state organisations responsible for realisation of digital policies and implementation of its instruments.

A special requirement to the courses is that the courses should combine the dialogue-structured lectures with practical exercises. The practical part should take at least 50% of the courses. The courses should be equipped with access to the modern software packages and tools. The practical part should include field visits to digitalised enterprises of various branches of economy. The courses should take its insights from professional expertise of top managers of leading

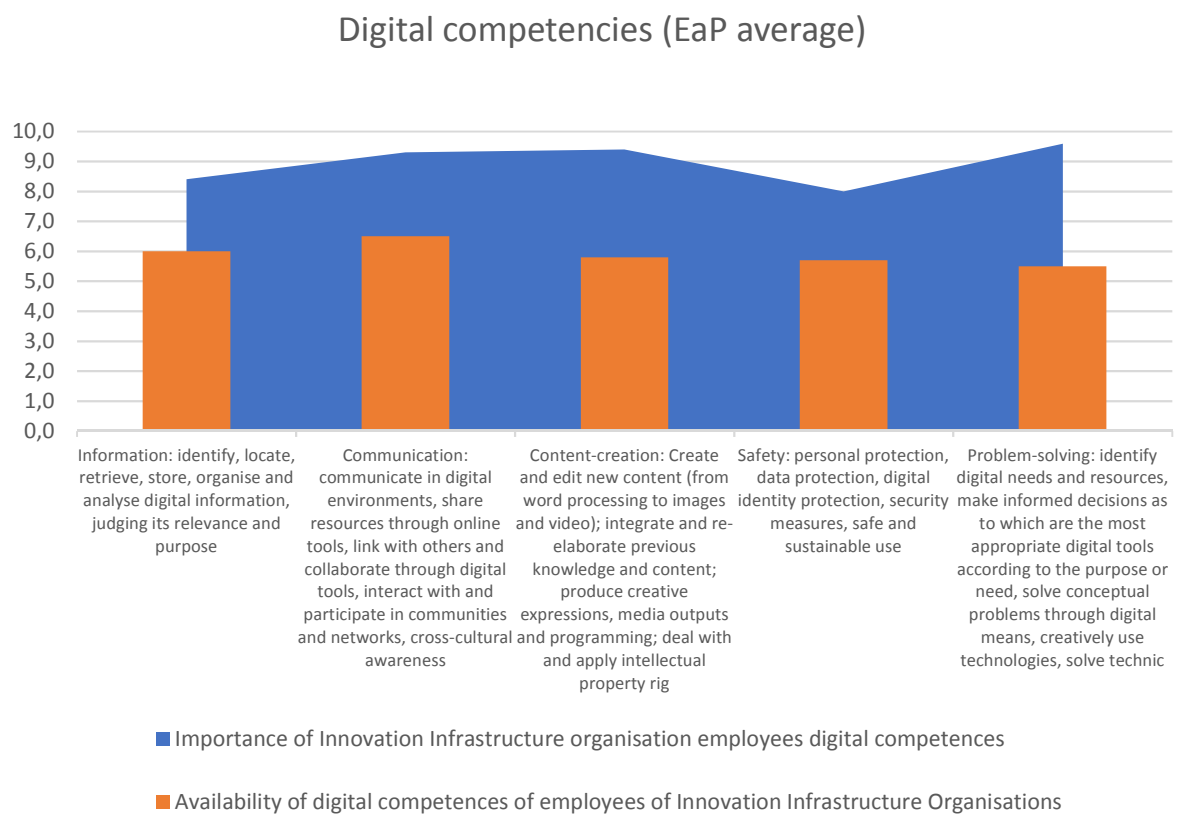
software companies, state regulating authorities, business associations and the extended literature and update legal documents.

The training courses should intend to develop the following skills:

- Increase the understanding of policy-makers of the opportunities, limitations of digital transformation as well as advanced tools for fostering the technology- and innovation-driven economic growth; enhance their skills on practical development of digital innovation policies.
- Increase the understanding of ICT innovation infrastructure organisations on how to develop their specialisation when addressing the needs of businesses in ICT innovations; enhance their skills on practical implementation of relevant tools and services.
- Increase the understanding of businesses on digital markets and managing digital businesses; enhance their practical skills on finding the IT-enabled solutions to business problems and to the burning social problems, identifying and resolving the problems of digital transformation of the existing businesses.

6.2 Training needs: gap analysis

Experts estimations the digital competences defined in accordance with methodology of The Digital Competence Framework 2.0 (EC, 2017) show that the gap for citizens is not that big.



However, when it goes for creation conditions for development of digital economy, much more specific competencies need to be estimated.

The framework for estimation of these competencies was elaborated by the authors on the basis of the baseline analysis of best practices existing in the selected countries of EU and the world.

The level of available knowledge about new opportunities in the sphere of information and (broader) digital technologies, limitations and conditions of efficient usage as well as the level of relevant skills and competencies have been studied separately for different groups:

- policy-makers and state bodies;
- innovation infrastructure organisations;
- non-ICT businesses;
- lecturers and professors at high educational establishments.

6.2.1 Training needs of policy makers

The gap between the available level of specific digital competences (estimated through the prism of Digital Competence Framework 2.0) of policy makers in the country and the estimated importance of specific digital competences of policy makers in the EaP countries is generally not very big and requires only slight improvement.

6.2.1.1 Developing digital policies and regulations

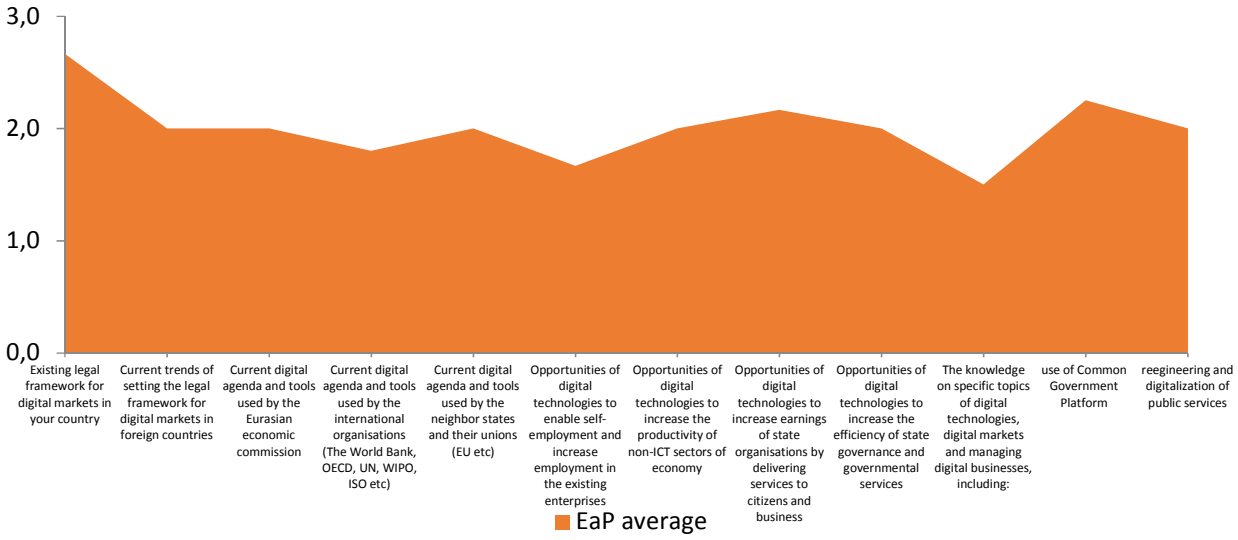
The experts mark that the knowledge of regulators and state bodies existing legal framework for digital markets in EaP countries is rather high and sufficient for developing strategic regulations and operative decision-making.

However, in the other areas, some training is needed to better equip the regulators and state bodies for developing strategic regulations and operative decision-making:

- Current trends of setting the legal framework for digital markets in foreign countries
- Current digital agenda and tools used by the Eurasian economic commission
- Current digital agenda and tools used by the international organisations (The World Bank, OECD, UN, WIPO, ISO etc)
- Current digital agenda and tools used by the neighbour states and their unions (EU etc)
- Opportunities of digital technologies to enable self-employment and increase employment in the existing enterprises
- Opportunities of digital technologies to increase the productivity of non-ICT sectors of economy

- Opportunities of digital technologies to increase earnings of state organisations by delivering services to citizens and business
- Opportunities of digital technologies to increase the efficiency of state governance and governmental services

The worst is the estimated level of knowledge of regulators and state bodies on specific topics of digital technologies, digital markets and managing digital businesses - it is even not sufficient for initiating public discussions.



Herewith, some EaP countries perform better in some areas, which can be used for up taking them the leadership roles in driving the training of policy-makers across EaP countries.

Thus, **Armenia** performs better than other EaP countries on *current digital agenda and tools used by the international organisations (The World Bank, OECD, UN, WIPO, ISO etc).*

Azerbaijan, **Georgia** and **Ukraine** might lead on trainings of policy-makers in opportunities of digital technologies to *increase the efficiency of state governance and governmental services*.

Belarus might lead on training as for *current digital agenda and tools used by the Eurasian economic commission*.

Moldova is better than other EaP countries in current digital agenda and tools used by the neighbour states and their unions (EU etc) and in the knowledge of policy-makers about the opportunities of digital technologies to enable self-employment, increase employment in the existing enterprises and increase the productivity of non-ICT sectors of economy.

Georgia and **Ukraine** might lead on trainings of policy-makers in opportunities of digital technologies *to increase earnings of state organisations by delivering services to citizens and business*.

6.2.1.2 Technological trends

The importance of mastering the skills/ knowledge concerning particular technological trends by policy-makers and state organisations on average for all topics was estimated by policy-makers as 8 out of 10.

The level quantity and quality of training provided by the country's eco-system for ICT and innovation (innovation infrastructure, universities etc) for policy-makers and state organisations on the mentioned skills / knowledge is on average estimated as 4 out of 10.

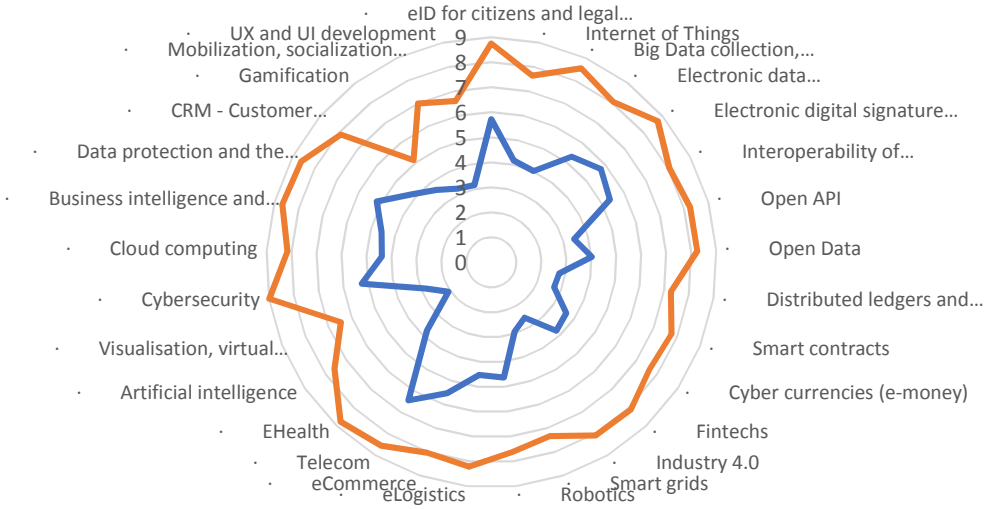
The training gap for policy-makers is the highest for the following topics:

- Artificial intelligence
- Big Data collection, aggregation, analysis, visualisation services
- Cyber currencies (e-money)
- Distributed ledgers and blockchain
- eHealth
- Fintechs
- Industry 4.0
- Open API
- Open Data
- Smart contracts.

EaP countries

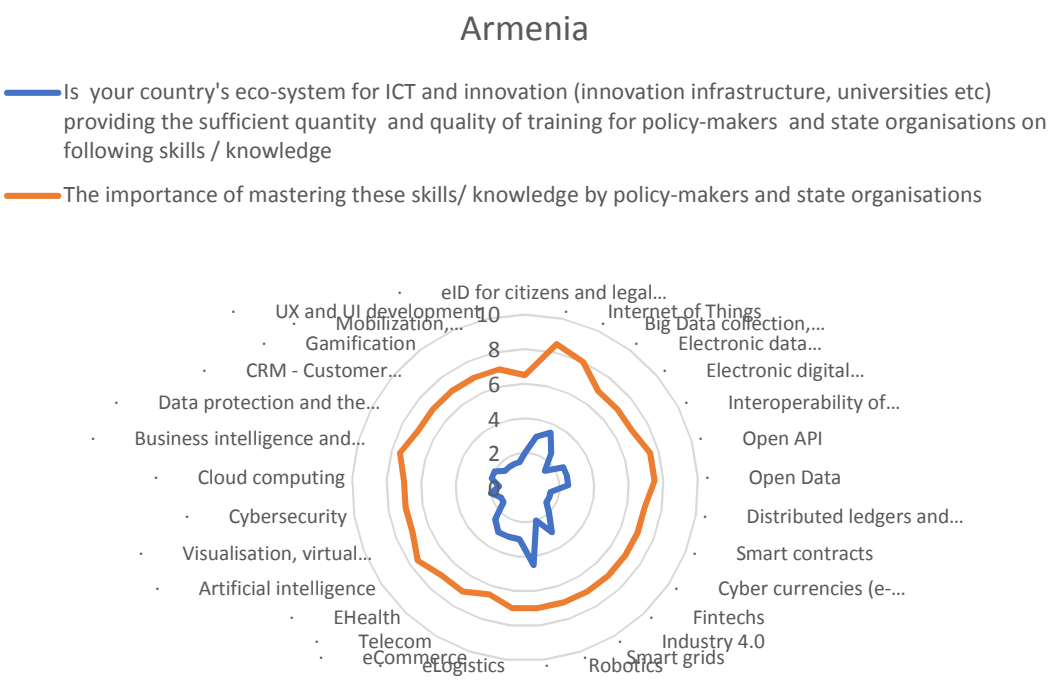
Is your country's eco-system for ICT and innovation (innovation infrastructure, universities etc) providing the sufficient quantity and quality of training for policy-makers and state organisations on following skills / knowledge

The importance of mastering these skills/ knowledge by policy-makers and state organisations



In **Armenia**, the largest training gap is observed in:

- Artificial intelligence
- Business intelligence and analytics
- Cloud computing
- CRM - Customer relationship management
- Cyber currencies (e-money)
- Distributed ledgers and blockchain
- Electronic digital signature (EDS)
- Gamification
- Internet of Things
- Mobilisation, socialisation and omni-channelled service as trends of digital markets
- Smart contracts
- UX and UI development
- Visualisation, virtual reality and augmented reality.

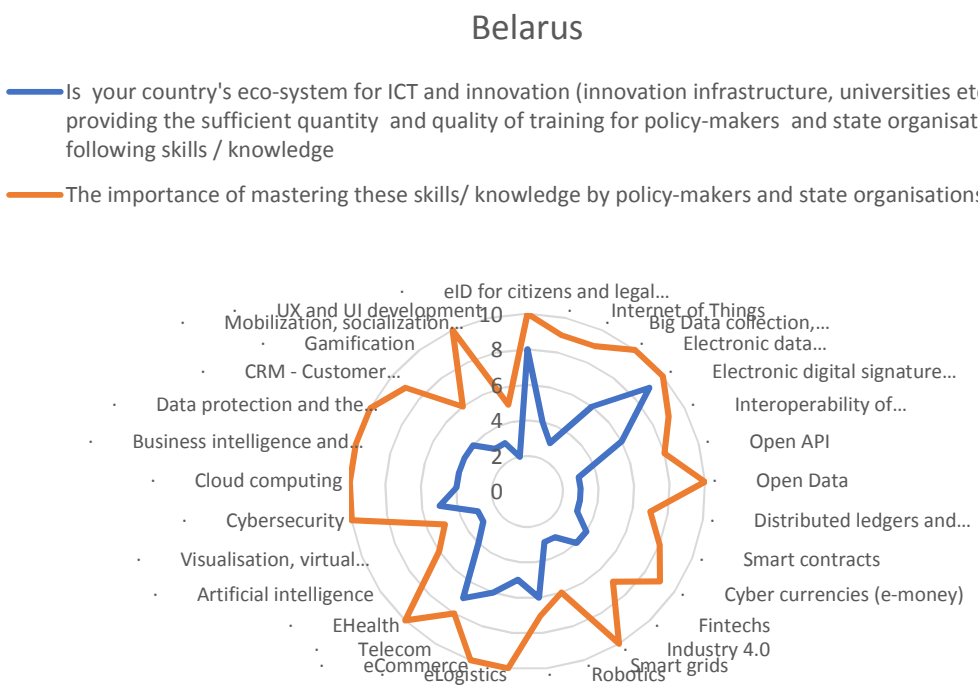


In **Azerbaijan**, the largest training gap is observed in:

- Artificial intelligence
- Cloud computing
- Distributed ledgers and blockchain
- eHealth
- Fintechs
- Industry 4.0
- Open API
- Open Data
- Smart contracts
- UX and UI development.

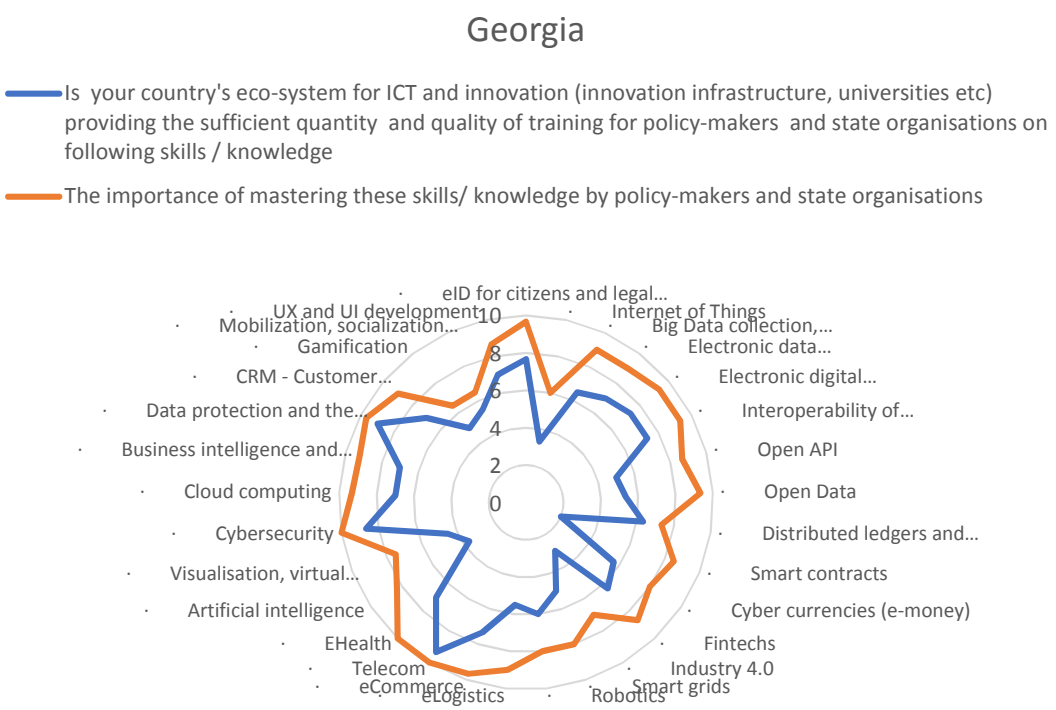
In **Belarus**, the largest training gap is observed in:

- Big Data collection, aggregation, analysis, visualisation services
- Business intelligence and analytics
- Cloud computing
- Data protection and the legal implications
- eHealth
- Industry 4.0
- Mobilisation, socialisation and omni-channelled service as trends of digital markets
- Open Data.



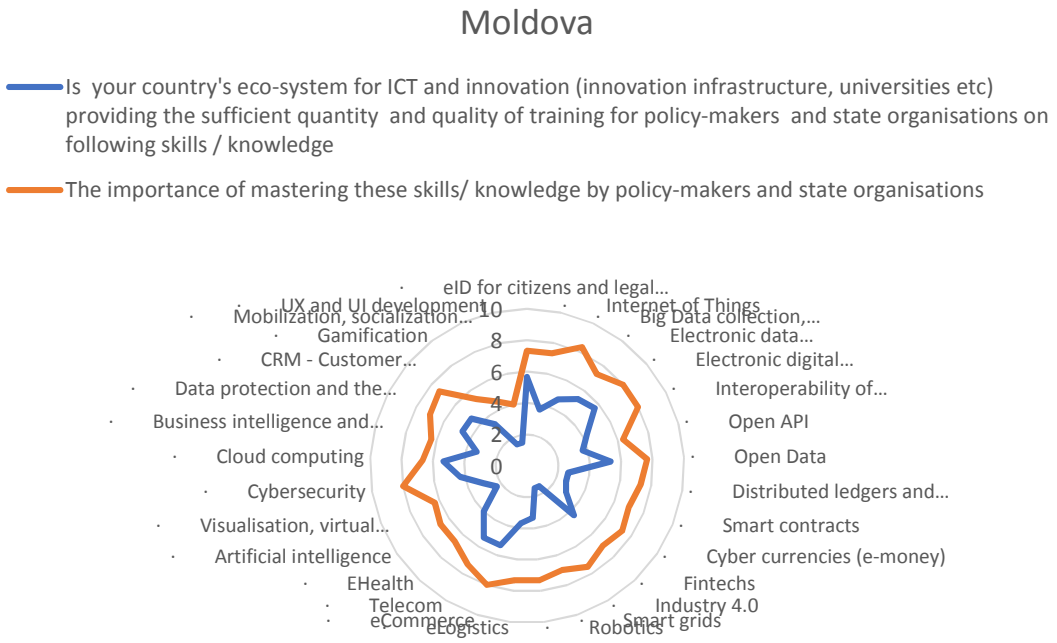
In **Georgia**, the largest training gap is observed in:

- Artificial intelligence
- eLogistics
- Industry 4.0
- Open API
- Open Data
- Smart contracts.



In **Moldova**, the largest training gap is observed in:

- Big Data collection, aggregation, analysis, visualisation services
- Cyber currencies (e-money)
- Distributed ledgers and blockchain
- eLogistics
- Industry 4.0
- Internet of Things
- Interoperability of information systems
- Robotics
- Smart contracts
- Smart grids.



In **Ukraine**, the largest training gap is observed in:

- Artificial intelligence
- Big Data collection, aggregation, analysis, visualisation services
- Distributed ledgers and blockchain
- eHealth
- eID for citizens and legal entities
- Electronic data interchange (EDI)
- Electronic digital signature (EDS)
- Fintechs
- Open API
- Robotics
- Smart grids.

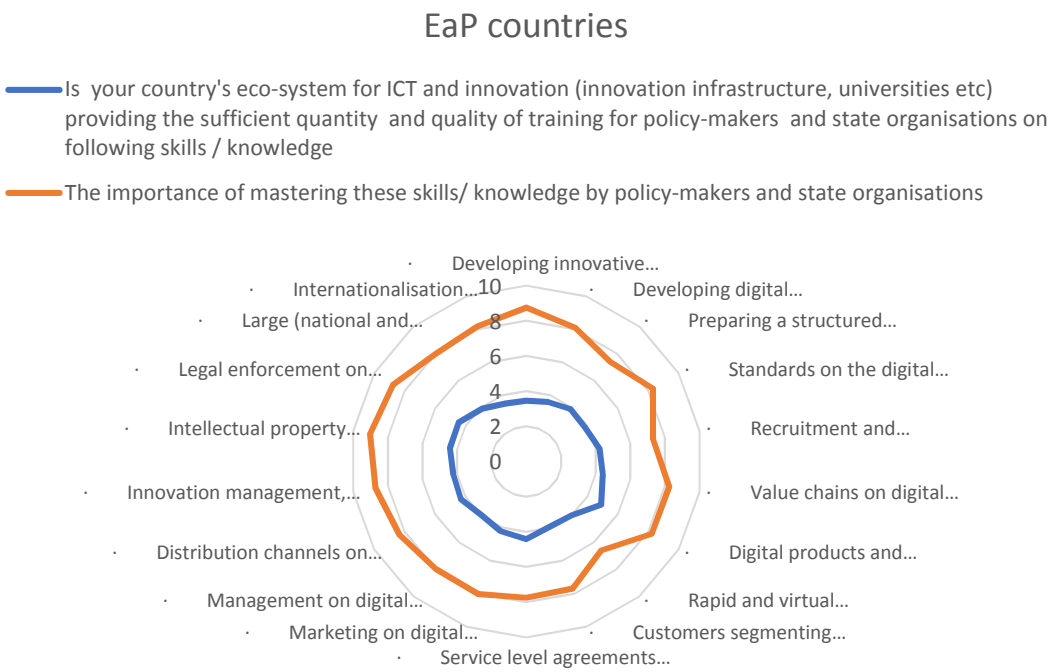
6.2.1.3 Digital business management

On average the EaP policy-makers have estimated very high the importance of knowledge on digital business management for their policy-making activities (8 points out of 10).

The level of quantity and quality of training provided by the country's eco-system for ICT and innovation (innovation infrastructure, universities etc) for policy-makers and state organisations on the mentioned skills / knowledge is on average estimated as 4 out of 10.

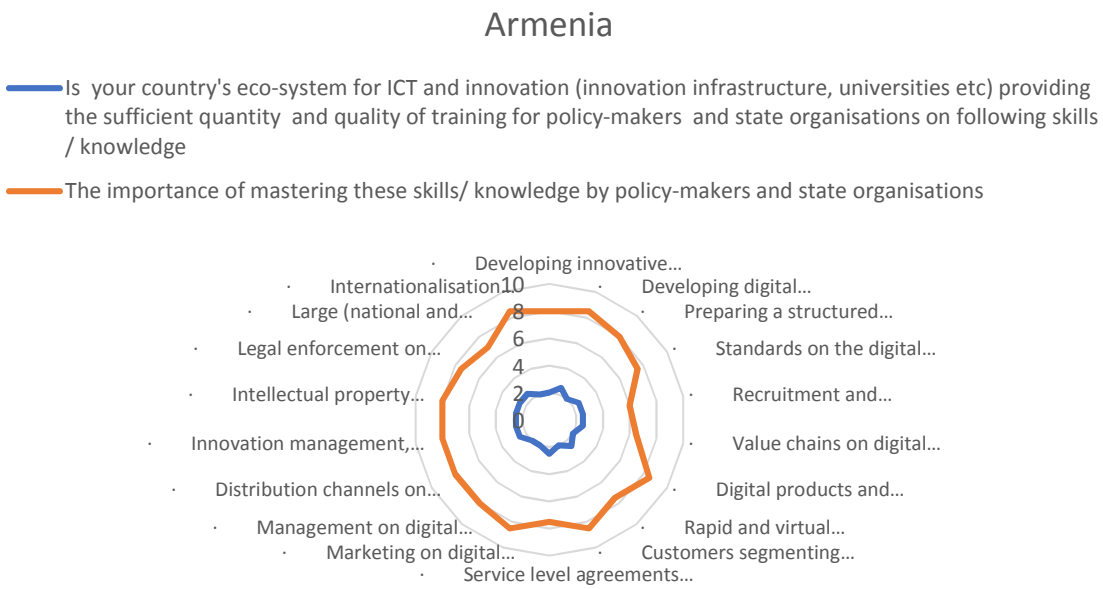
The gap is the highest for:

- Developing digital business strategies and roadmaps
- Developing innovative business models based on digital technologies
- Innovation management, change management, risk management on digital markets
- Intellectual property management on digital markets
- Internationalisation specifics on digital markets.



In **Armenia**, the largest training gap is observed in:

- Customers segmenting and lead management on digital markets
- Developing digital business strategies and roadmaps
- Developing innovative business models based on digital technologies
- Digital products and services development and design
- Internationalisation specifics on digital markets
- Marketing on digital markets
- Preparing a structured digital business plan applicable for fundraising.

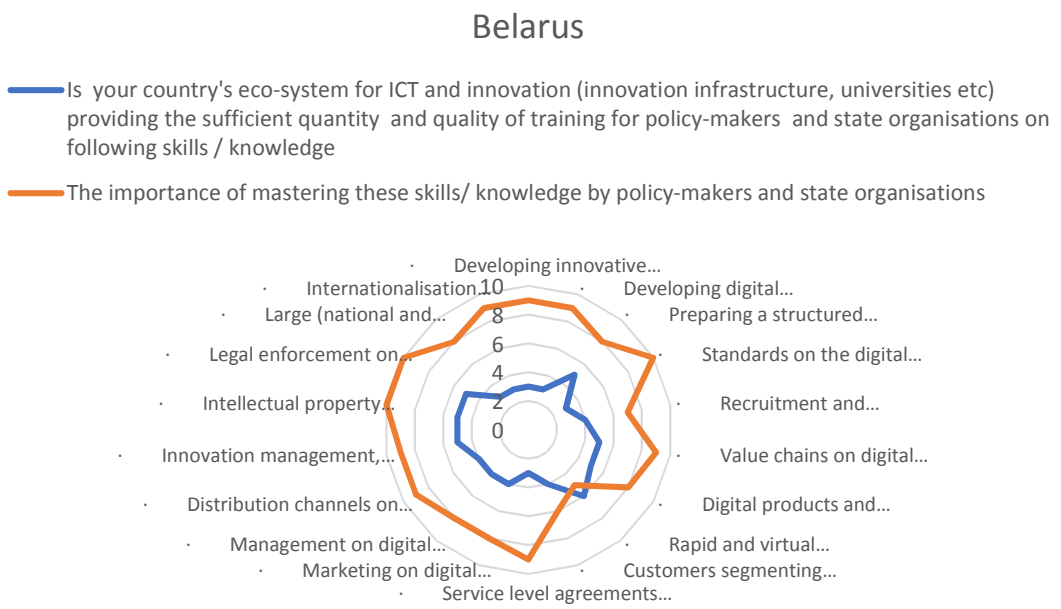


In **Azerbaijan**, the largest training gap is observed in:

- Developing innovative business models based on digital technologies
- Internationalisation specifics on digital markets
- Legal enforcement on digital markets
- Management on digital markets
- Recruitment and personnel management on digital markets
- Standards on the digital market
- Value chains on digital markets.

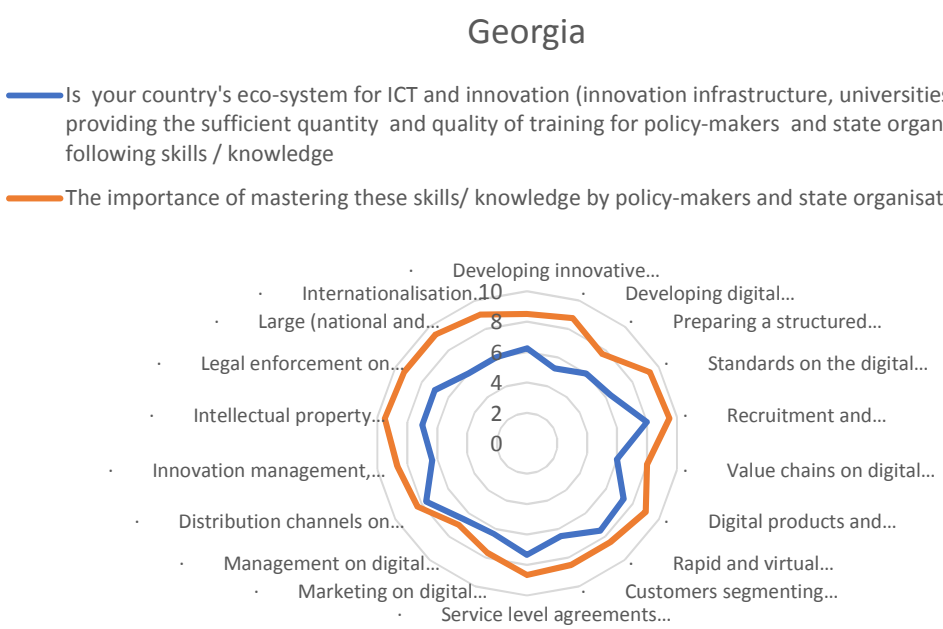
In **Belarus**, the largest training gap is observed in:

- Developing digital business strategies and roadmaps
- Developing innovative business models based on digital technologies
- Internationalisation specifics on digital markets
- Service level agreements (SLAs) and contracts on digital markets
- Standards on the digital market.



In **Georgia**, the largest training gap is observed in:

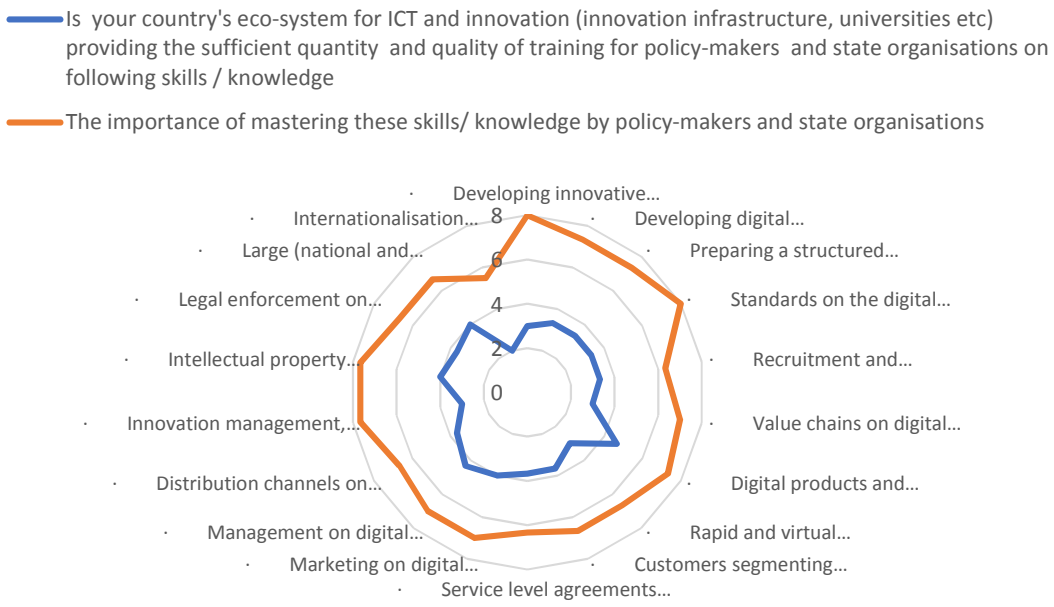
- Developing digital business strategies and roadmaps
- Internationalisation specifics on digital markets
- Large (national and international-scale) information systems and relevant market niches
- Standards on the digital market.



In **Moldova**, the largest training gap is observed in:

- Developing digital business strategies and roadmaps
- Developing innovative business models based on digital technologies
- Innovation management, change management, risk management on digital markets
- Preparing a structured digital business plan applicable for fundraising
- Standards on the digital market
- Value chains on digital markets.

Moldova


Is your country's eco-system for ICT and innovation (innovation infrastructure, universities etc) providing the sufficient quantity and quality of training for policy-makers and state organisations on following skills / knowledge
The importance of mastering these skills/ knowledge by policy-makers and state organisations
Developing innovative...
Developing digital...
Preparing a structured...
Standards on the digital...
Recruitment and...
Value chains on digital...
Digital products and...
Rapid and virtual...
Customers segmenting...
Service level agreements...
Marketing on digital...
Management on digital...
Distribution channels on...
Innovation management,...
Intellectual property...
Legal enforcement on...
Large (national and...
Internationalisation...
8
6
4
2
0

In **Ukraine**, the largest training gap is observed in:

- Customers segmenting and lead management on digital markets
- Developing innovative business models based on digital technologies
- Distribution channels on digital markets
- Innovation management, change management, risk management on digital markets
- Intellectual property management on digital markets
- Legal enforcement on digital markets
- Management on digital markets.

6.2.2 Training needs of innovation infrastructure organisations for enabling ICT innovations

Generally, it was estimated that there is a considerable gap among the need of businesses to be serviced across the stages of the full innovation process, and the quality of services (consultations) of innovation infrastructure organisations currently delivered to companies, with account for the *peculiar needs of innovative businesses at different stages* (seed, start-up, scale-up, consolidation, renewal). Armenia and Ukraine observe the largest gap of this kind.

The same gap is observed as for spectrum of services delivered to innovative businesses in the country with account of digital market specifics and the contact persons.

In order to determine the particular knowledge domains where the innovation infrastructure organisations need most of training, the expert opinions have been collected by the national experts in two dimensions: to estimate the quality of services (consultations) of innovation infrastructure organisations currently delivered to companies, and the need from businesses for such services in each EaP country.

6.2.2.1 Technological trends

Most knowledge domains on technological trends have been estimated as highly important in all EaP countries due to high need of businesses in respective services, with an average score 9 out of 10.

The knowledge domains with the highest business need of relevant consultancy from innovation infrastructure organisations in EaP countries include:

- Artificial intelligence
- Big Data collection, aggregation, analysis, visualisation services
- Business intelligence and analytics
- Cloud computing
- CRM - Customer relationship management
- Cybersecurity
- Data protection and the legal implications
- eCommerce
- eHealth
- Electronic data interchange (EDI)

- Fintechs
- Industry 4.0
- Internet of Things
- Interoperability of information systems
- Mobilisation, socialisation and omni-channelled service as trends of digital markets
- Open API
- Open Data
- Smart grids
- Telecom
- UX and UI development
- Visualisation, virtual reality and augmented reality.

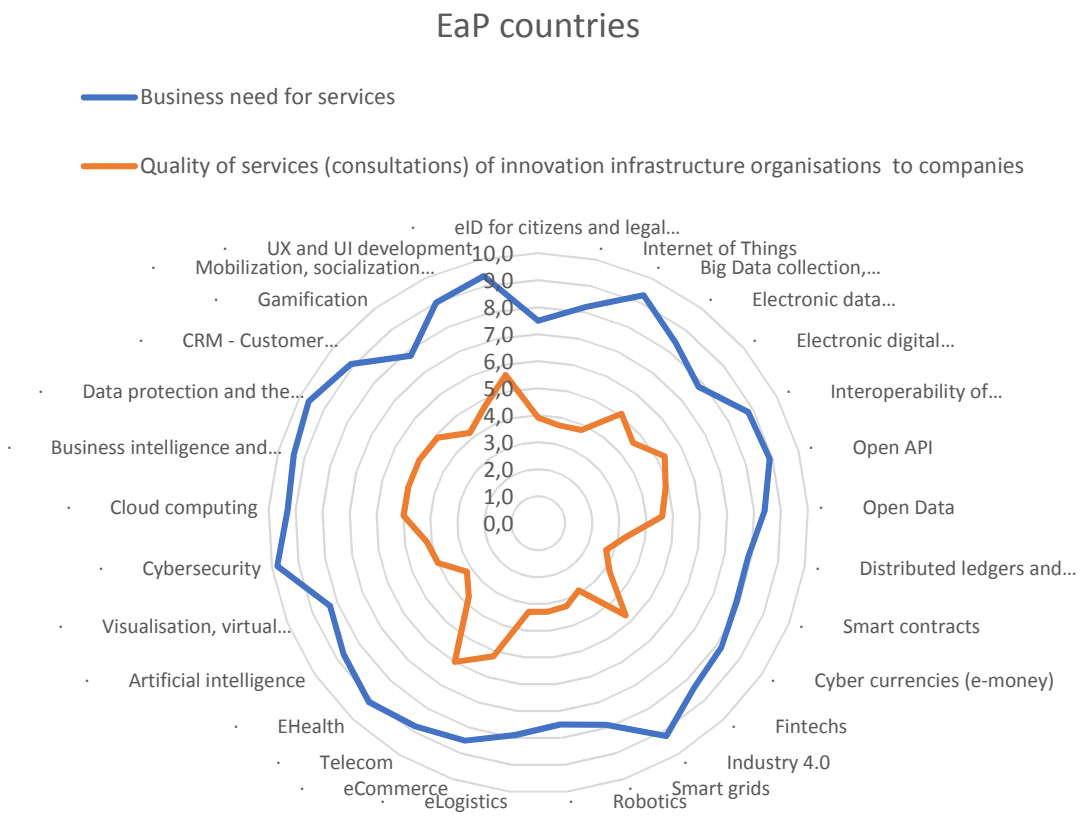
Herewith, the average quality of services offered by the innovation infrastructure organisations was estimated with a score 4 out of 10.

The lowest score (below 4) was assigned to services concerning the following areas:

- Artificial intelligence
- Cyber currencies (e-money)
- eLogistics
- Industry 4.0
- Robotics
- Smart contracts.

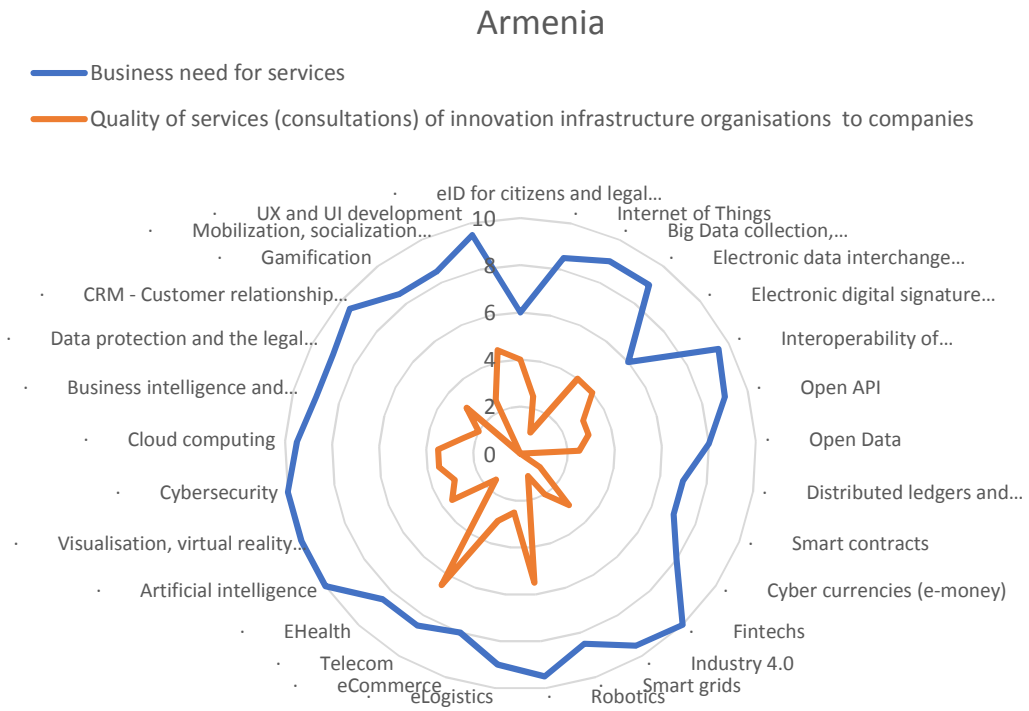
The knowledge domains on technological trends where the largest gap is observed include:

- Artificial intelligence
- Big Data collection, aggregation, analysis, visualisation services.
- Cybersecurity
- eHealth
- Industry 4.0.


EaP countries
Business need for services
Quality of services (consultations) of innovation infrastructure organisations to companies
eID for citizens and legal...
Internet of Things
Big Data collection,...
Electronic data...
Electronic digital...
Interoperability of...
Open API
Open Data
Distributed ledgers and...
Smart contracts
Cyber currencies (e-money)
Fintechs
Industry 4.0
Smart grids
Robotics
eLogistics
eCommerce
Telecom
EHealth
Artificial intelligence
Visualisation, virtual...
Cybersecurity
Cloud computing
Business intelligence and...
Data protection and the...
CRM - Customer...
Gamification
Mobilization, socialization...
UX and UI development
10,0
9,0
8,0
7,0
6,0
5,0
4,0
3,0
2,0
1,0
0,0

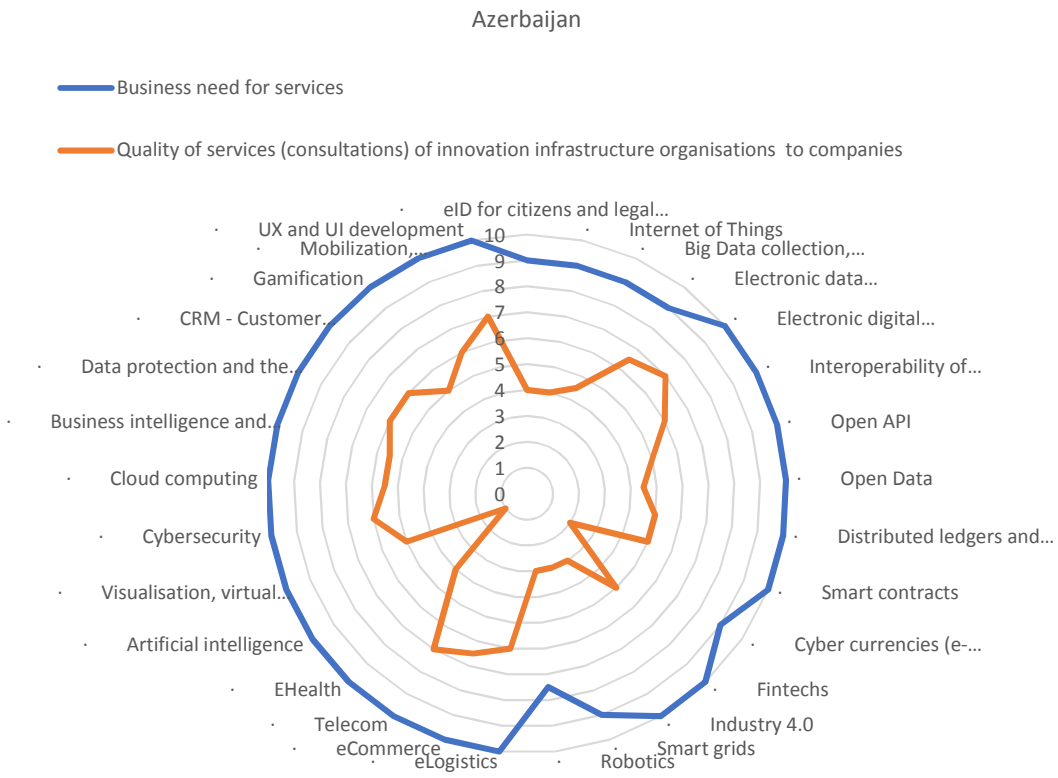
In **Armenia**, the largest training gap is observed in:

- Big Data collection, aggregation, analysis, visualisation services
- Gamification
- Industry 4.0
- Smart grids
- Distributed ledgers and blockchain
- Smart contracts
- Cyber currencies (e-money)
- Fintechs
- eHealth
- Data protection and the legal implications
- Visualisation, virtual reality and augmented reality.



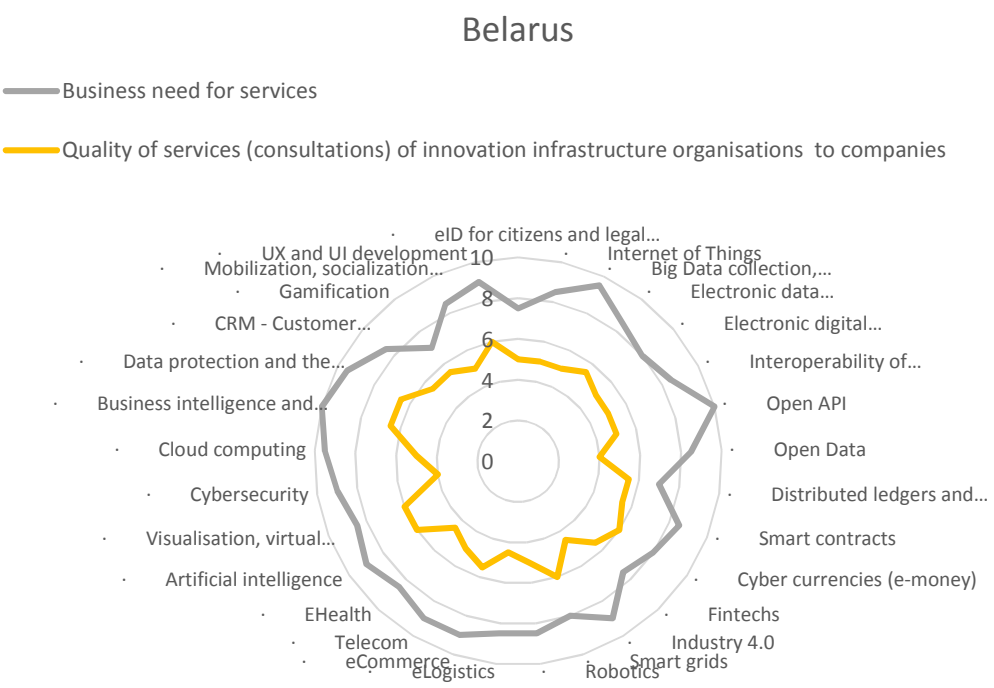
In **Azerbaijan**, the largest training gap is observed in:

- Artificial intelligence
- Cyber currencies (e-money)
- Industry 4.0
- Smart grids.



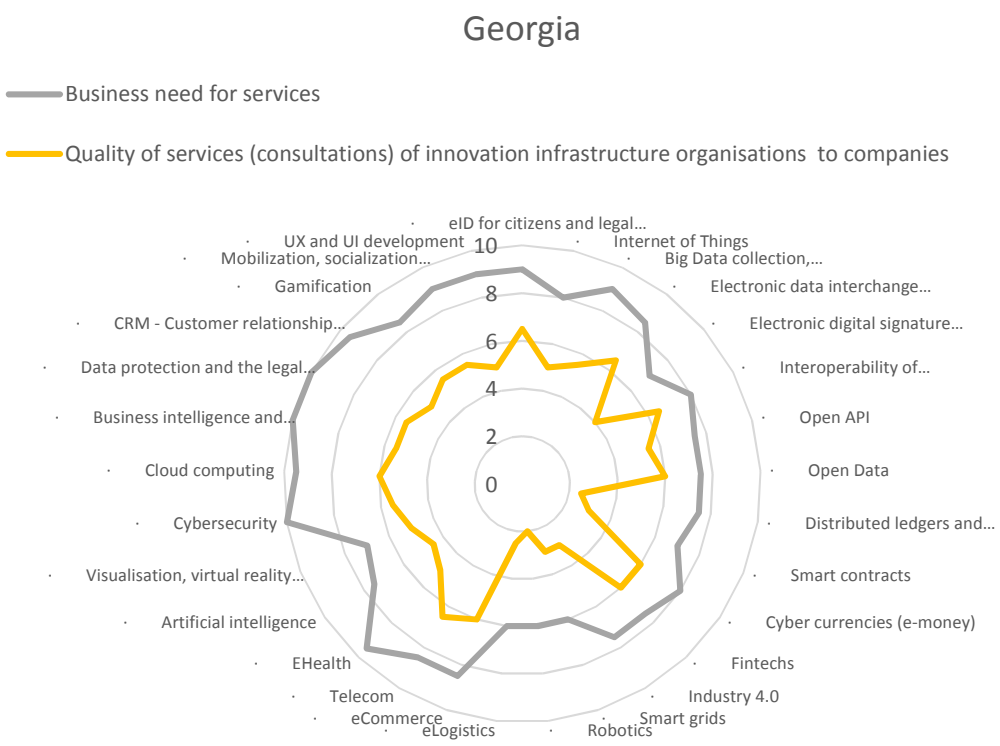
In **Belarus**, the largest training gap is observed in:

- Big Data collection, aggregation, analysis, visualisation services
- Cloud computing
- Cybersecurity
- Industry 4.0
- Open API
- Open Data.



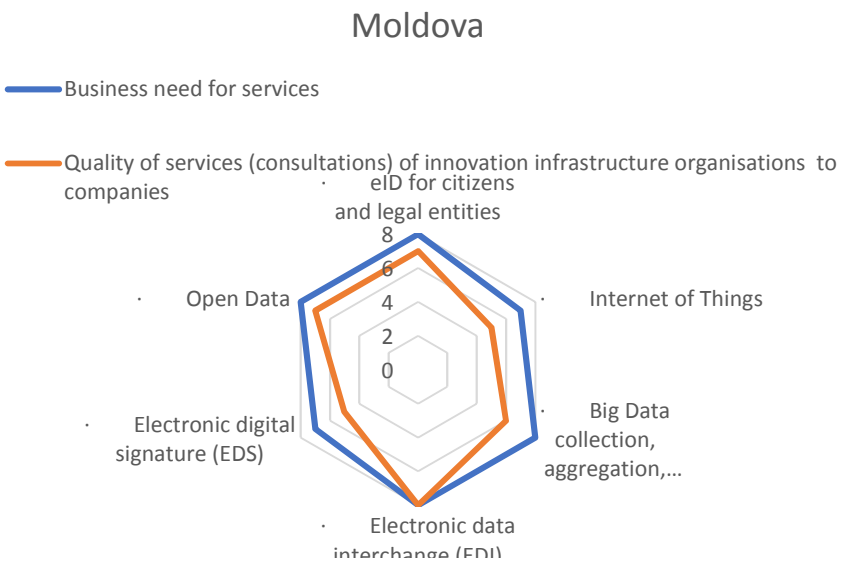
In **Georgia**, the largest training gap is observed in:

- Business intelligence and analytics
- CRM - Customer relationship management
- Cybersecurity
- Data protection and the legal implications
- Distributed ledgers and blockchain
- eHealth
- Industry 4.0.



In **Moldova**, the largest training gaps are observed in the areas for which no response was given by the innovation infrastructure agencies:

- Interoperability of information systems
- Open API
- Distributed ledgers and blockchain
- Smart contracts
- Cyber currencies (e-money)
- Fintechs
- Industry 4.0
- Smart grids
- Robotics
- eLogistics
- eCommerce
- Telecom
- eHealth
- Artificial intelligence
- Visualisation, virtual reality and augmented reality
- Cybersecurity
- Cloud computing
- Business intelligence and analytics
- Data protection and the legal implications
- CRM - Customer relationship management
- Gamification
- Mobilisation, socialisation and omni-channelled service as trends of digital markets
- UX and UI development



In **Ukraine**, the largest training gap is observed in:

- eID for citizens and legal entities
- Big Data collection, aggregation, analysis, visualisation services
- Smart contracts
- Cyber currencies (e-money)
- Industry 4.0
- Cybersecurity.

6.2.2.2 Digital business management

Additionally, the knowledge domains on digital business management have been studied, using the same methodology: by estimating the quality of services (consultations) of innovation infrastructure organisations currently delivered to companies on these topics, and the need from businesses for such services in each EaP country.

The business needs for services (consultancy) of innovation infrastructure organisations on digital business management have also been estimated as highly important in all EaP countries, with an average score 9,1 out of 10.

The knowledge domains with the highest business need of relevant consultancy from innovation infrastructure organisations in EaP countries include:

- Developing digital business strategies and roadmaps
- Developing innovative business models based on digital technologies
- Digital products and services development and design
- Innovation management, change management, risk management on digital markets
- Intellectual property management on digital markets
- Management on digital markets
- Preparing a structured digital business plan applicable for fundraising
- Rapid and virtual prototyping techniques
- Recruitment and personnel management on digital markets.

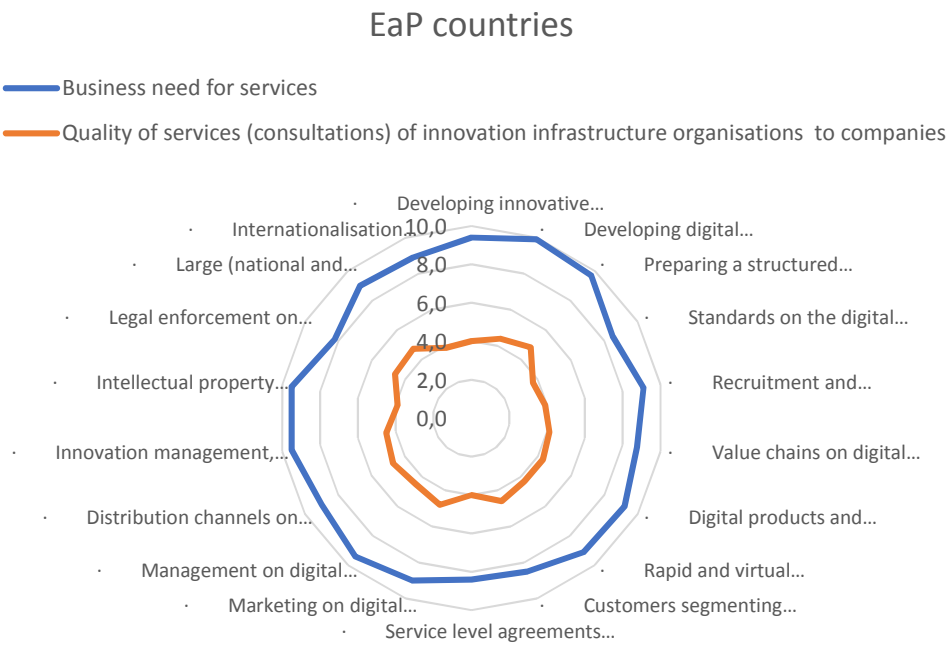
The quality of relevant services actually delivered by innovation infrastructure organisations have been scored as 4,3 out of 10.

The lowest score (below 4) was assigned to services concerning the following areas:

- Developing innovative business models based on digital technologies
- Intellectual property management on digital markets
- Internationalisation specifics on digital markets
- Recruitment and personnel management on digital markets
- Service level agreements (SLAs) and contracts on digital markets
- Standards on the digital market.

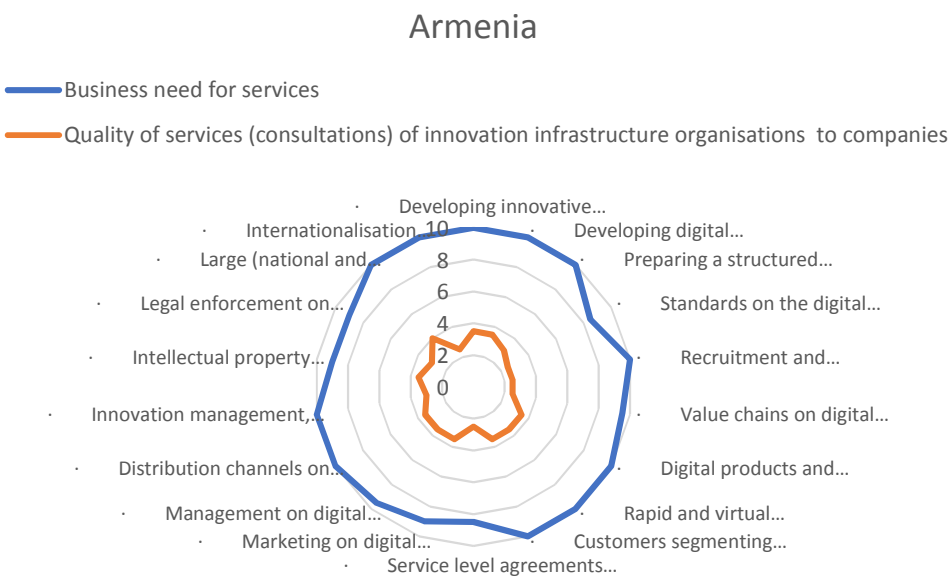
The knowledge domains on digital business management where the largest gap is observed include:

- Internationalisation specifics on digital markets
- Innovation management, change management, risk management on digital markets
- Recruitment and personnel management on digital markets
- Developing innovative business models based on digital technologies
- Developing digital business strategies and roadmaps
- Intellectual property management on digital markets.



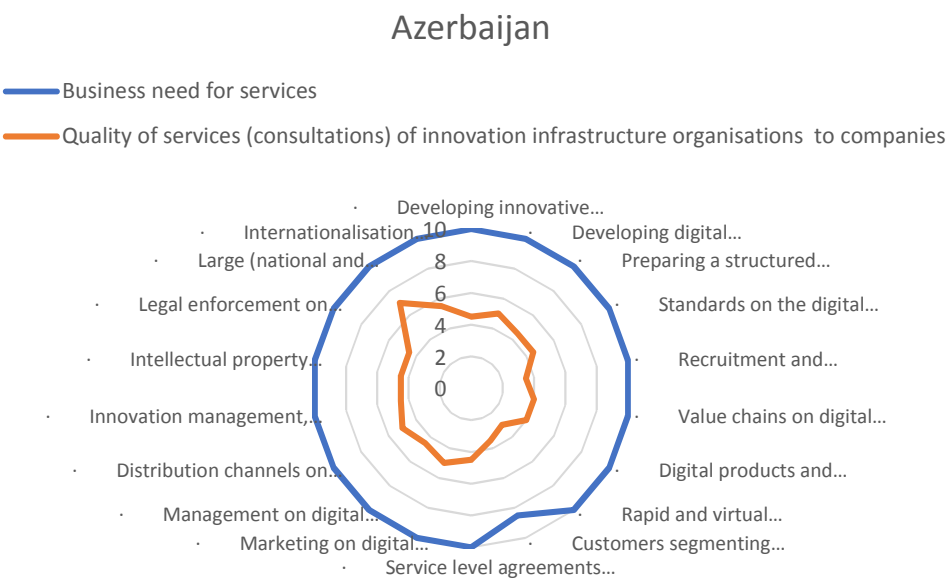
In **Armenia**, the largest training gap is observed in:

- Innovation management, change management, risk management on digital markets
- Internationalisation specifics on digital markets
- Preparing a structured digital business plan applicable for fundraising
- Recruitment and personnel management on digital markets
- Value chains on digital markets.



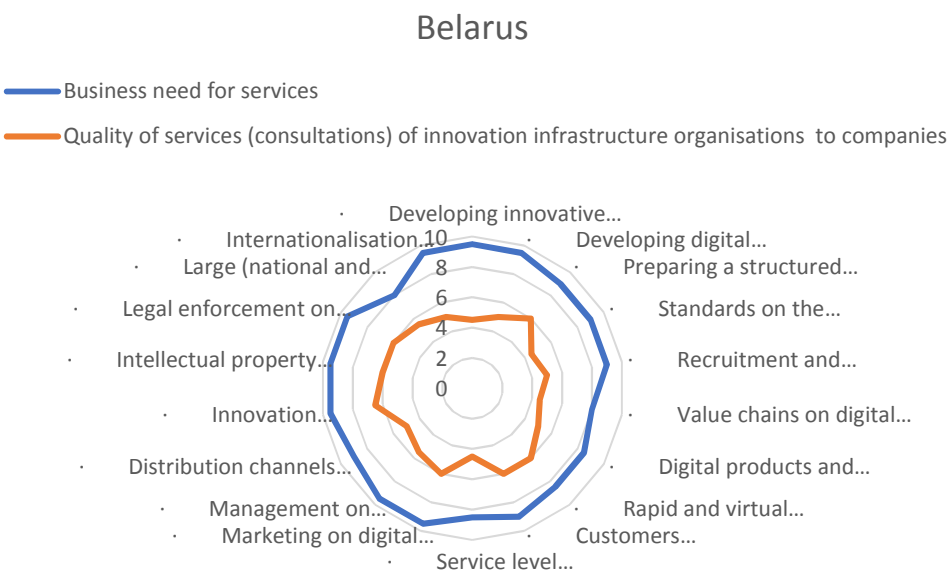
In **Azerbaijan**, the largest training gap is observed in:

- Digital products and services development and design
- Rapid and virtual prototyping techniques
- Recruitment and personnel management on digital markets
- Value chains on digital markets.



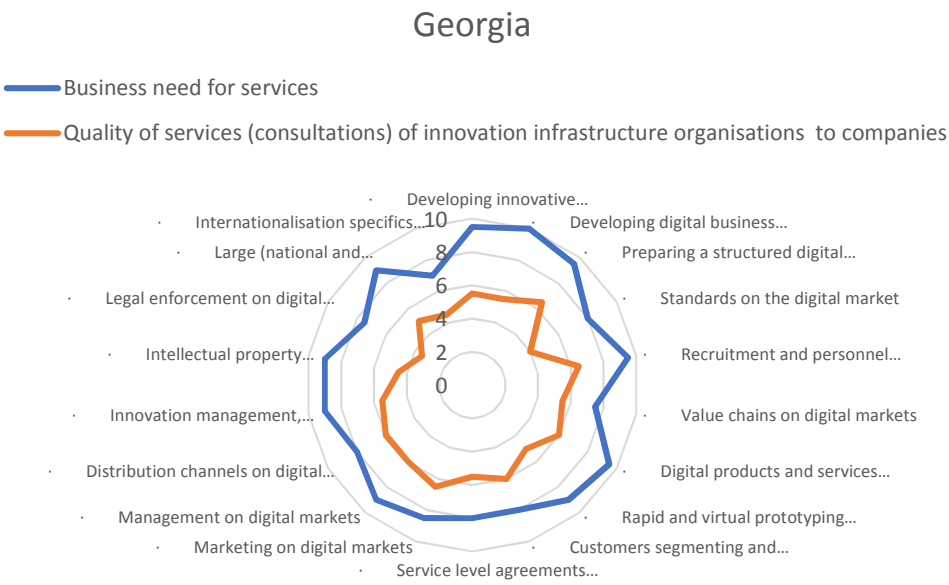
In **Belarus**, the largest training gap is observed in:

- Developing digital business strategies and roadmaps
- Developing innovative business models based on digital technologies
- Internationalisation specifics on digital markets
- Standards on the digital market.



In **Georgia**, the largest training gap is observed in:

- Developing digital business strategies and roadmaps
- Developing innovative business models based on digital technologies
- Intellectual property management on digital markets
- Large (national and international-scale) information systems and relevant market niches
- Legal enforcement on digital markets
- Rapid and virtual prototyping techniques
- Standards on the digital market.

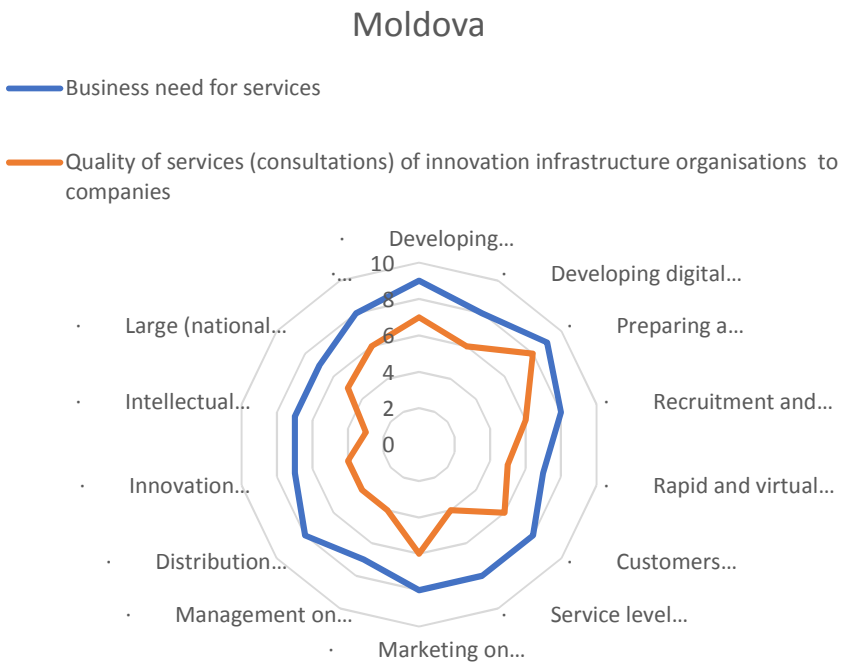


In **Moldova**, the largest training gap is observed in the areas where no estimates have been given by innovation infrastructure organisations:

- Standards on the digital market
- Value chains on digital markets
- Legal enforcement on digital markets
- Digital products and services development and design,

As well as in:

- Service level agreements (SLAs) and contracts on digital markets;
- Distribution channels on digital markets
- Intellectual property management on digital markets

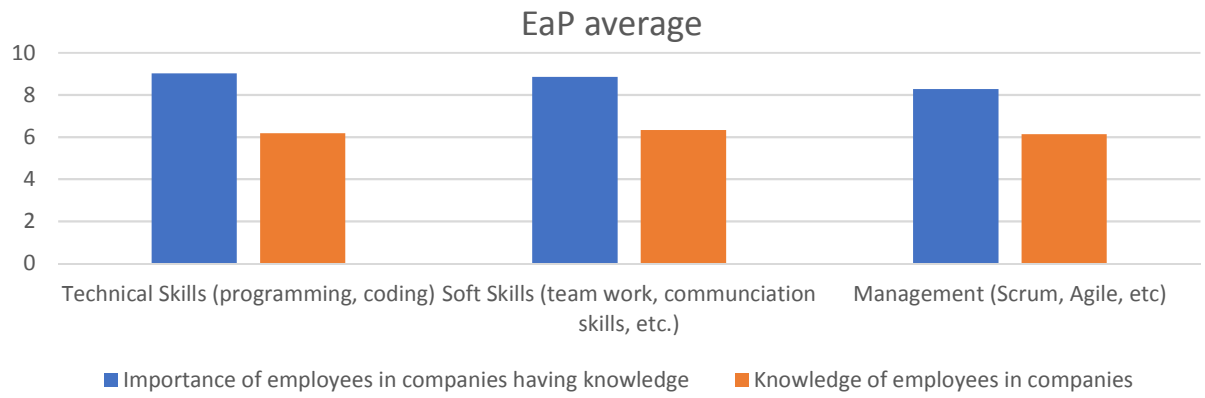


In **Ukraine**, the largest training gap is observed in:

- Developing digital business strategies and roadmaps
- Developing innovative business models based on digital technologies
- Innovation management, change management, risk management on digital markets
- Intellectual property management on digital markets
- Internationalisation specifics on digital markets
- Large (national and international-scale) information systems and relevant market niches
- Management on digital markets.

6.2.3 Training needs of ICT and non-ICT businesses for performing ICT innovations

Generally, the businesses interrogated in the EaP countries have estimated that the level of knowledge on technical skills, soft skills and management skills of employees at the companies in their countries are rather high.



In order to determine the particular knowledge domains where businesses in EaP countries need most of training, the national experts have collected the opinions from ICT and non-ICT businesses.

Due to resource and time limits, it was not possible to collect a data reflecting the needs of businesses in particular technologies and related knowledge: evidentially, there would be big differences observed not only across the branches of economy but also across the size of businesses and their areas of specialisation.

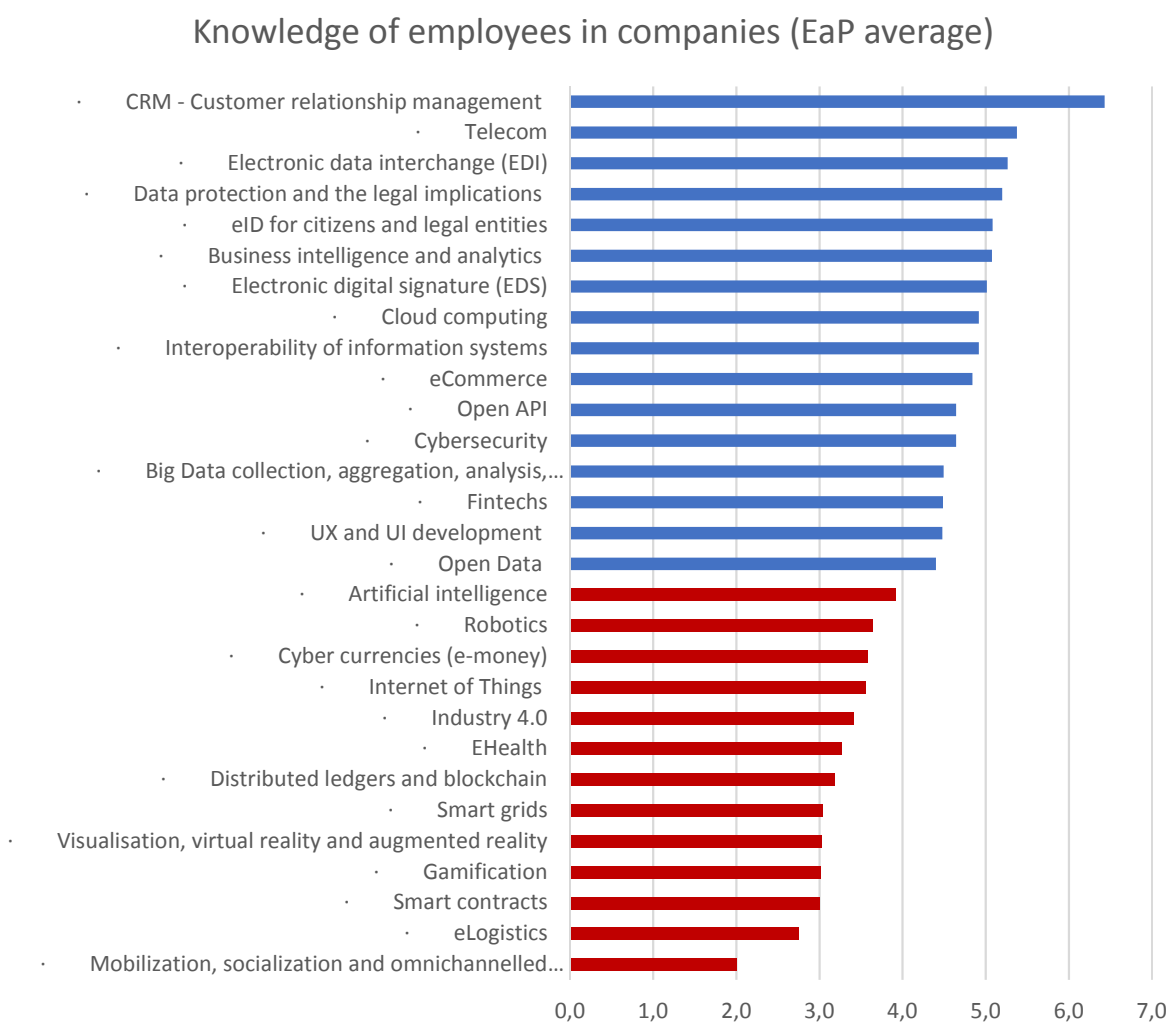
Thus, the situation was only roughly assessed as for the general availability of knowledge on particular technological trends across the businesses.

6.2.3.1 Technological trends

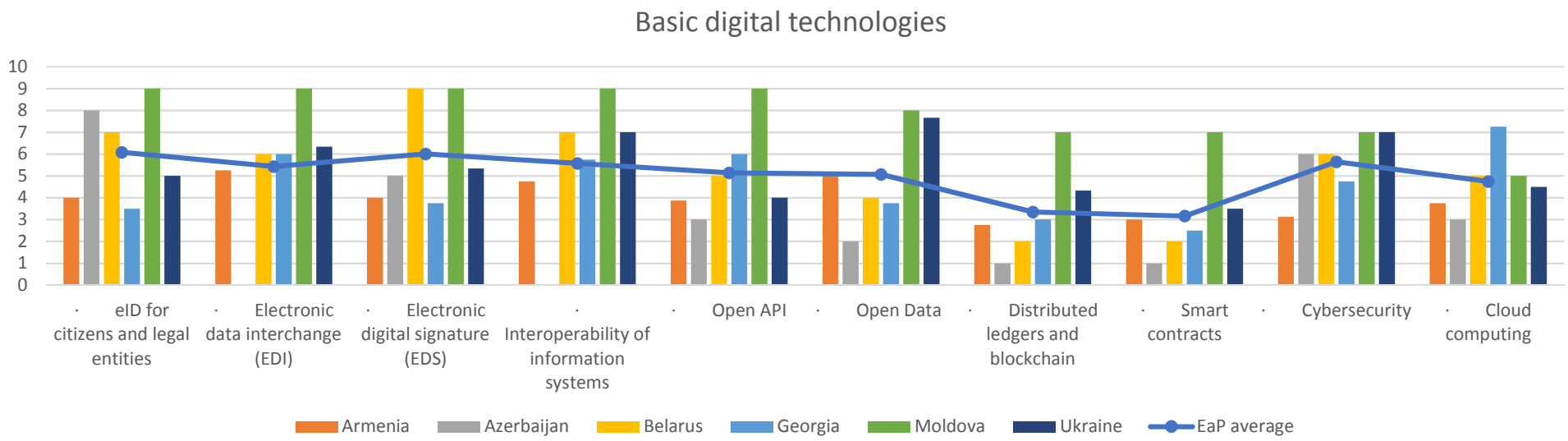
According to rough expert estimations, the lowest level of knowledge of EaP businesses in technological trends (below 4 points out of 10) is observed for the following areas of knowledge:

- Artificial intelligence
- Cyber currencies (e-money)
- Distributed ledgers and blockchain
- eHealth
- eLogistics
- Gamification

- Industry 4.0
- Internet of Things
- Mobilisation, socialisation and omni-channelled service as trends of digital markets
- Robotics
- Smart contracts
- Smart grids
- Visualisation, virtual reality and augmented reality.



Closer look at the position of individual countries as for knowledge of businesses on particular digital trends shows the following.


Basic digital technologies
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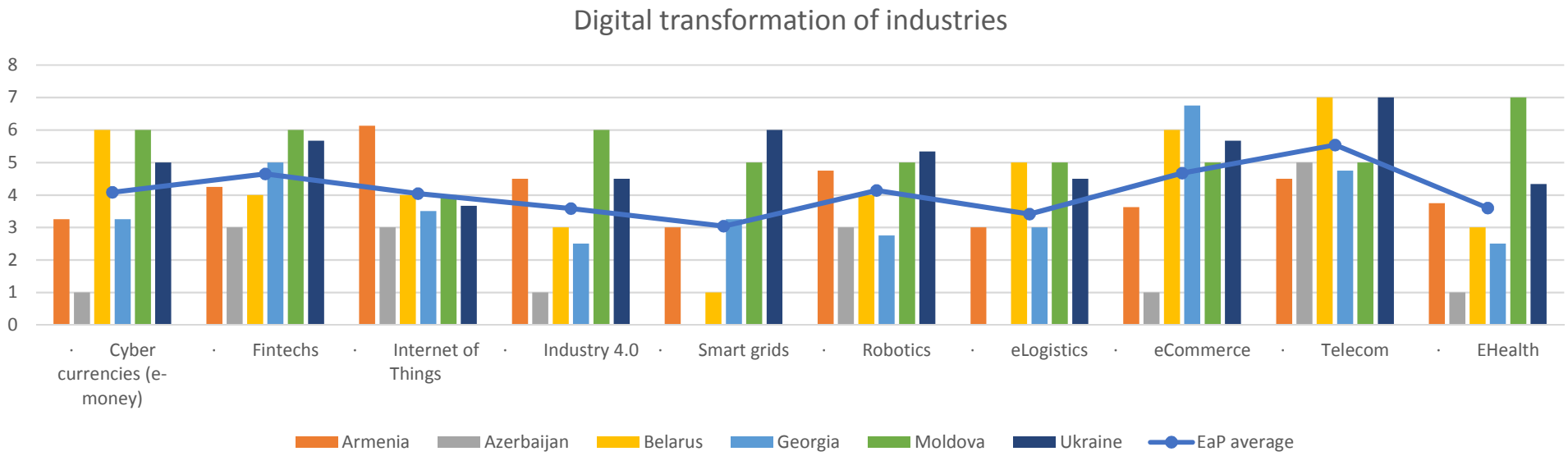
eID for citizens and legal entities
Electronic data interchange (EDI)
Electronic digital signature (EDS)
Interoperability of information systems
Open API
Open Data
Distributed ledgers and blockchain
Smart contracts
Cybersecurity
Cloud computing
Armenia
Azerbaijan
Belarus
Georgia
Moldova
Ukraine
EaP average


Digital transformation of industries
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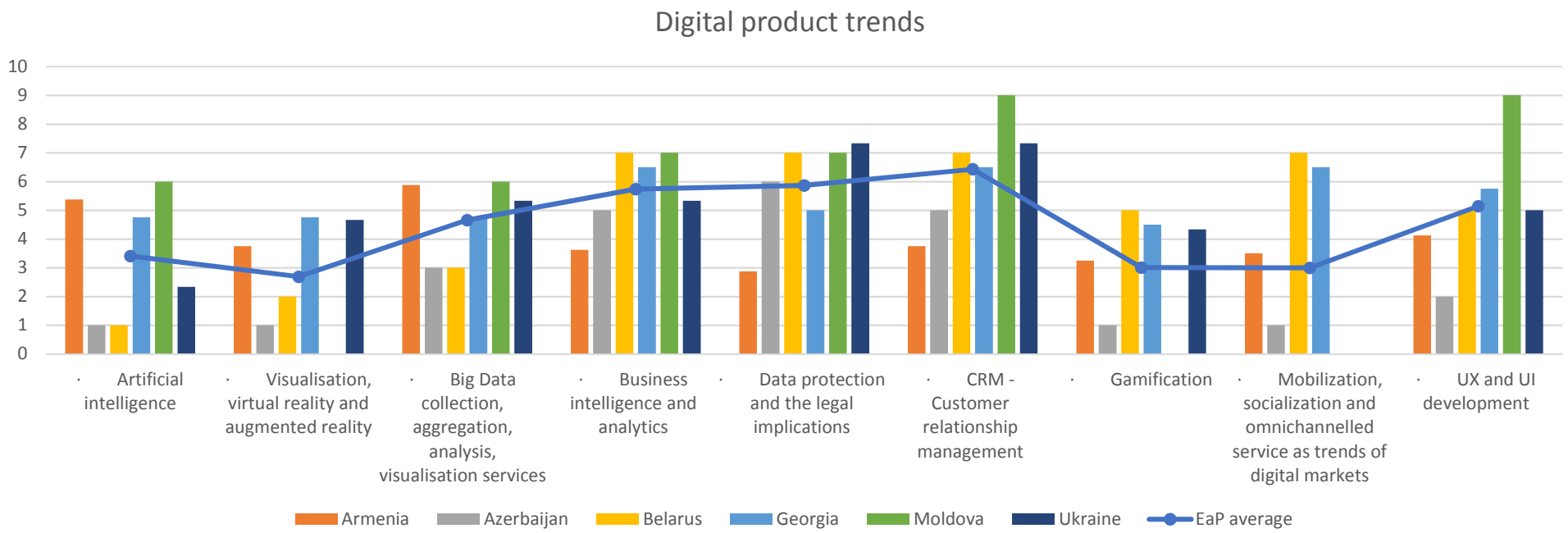
Cyber currencies (e-money)
Fintechs
Internet of Things
Industry 4.0
Smart grids
Robotics
eLogistics
eCommerce
Telecom
EHealth
Armenia
Azerbaijan
Belarus
Georgia
Moldova
Ukraine
EaP average


Digital product trends
10
9
8
7
6
5
4
3
2
1
0
Artificial intelligence
Visualisation, virtual reality and augmented reality
Big Data collection, aggregation, analysis, visualisation services
Business intelligence and analytics
Data protection and the legal implications
CRM - Customer relationship management
Gamification
Mobilization, socialization and omnichannelled service as trends of digital markets
UX and UI development
Armenia
Azerbaijan
Belarus
Georgia
Moldova
Ukraine
EaP average

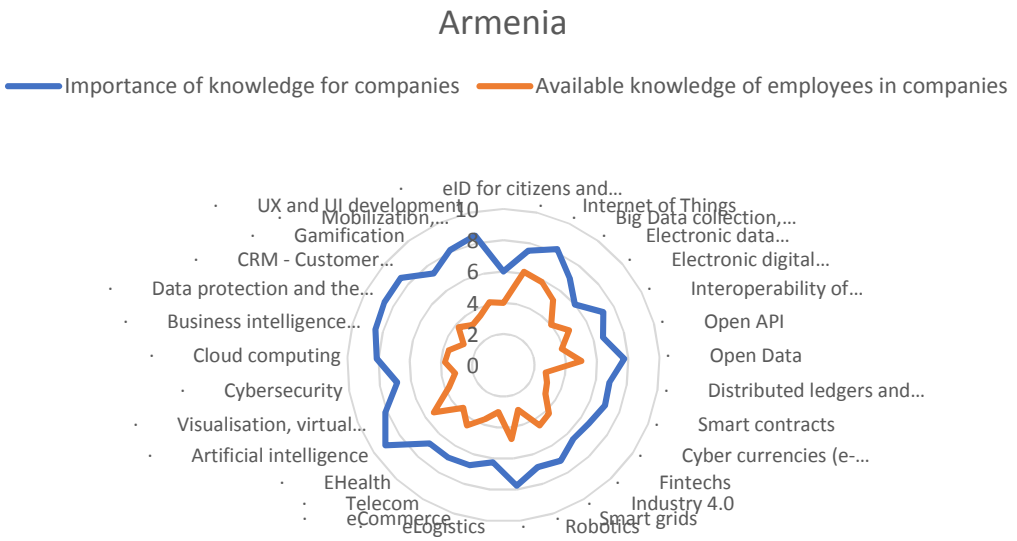
Businesses in Moldova occur to be in front of other EaP countries as for mastering the knowledge about *basic digital technologies*; while businesses in Azerbaijan are lagging behind at most in this group of technological trends. Georgian businesses outperform the other EaP businesses in knowledge on cloud computing. An average level of knowledge in this group for EaP businesses makes 5 out of 10.

Businesses in Moldova and Ukraine occur to be in front of other EaP countries as for mastering the knowledge about *digital transformation of industries*; while businesses in Azerbaijan are again lagging behind at most in this group of technological trends. An average level of knowledge in this group for EaP businesses makes 4 out of 10.

The picture on *digital product trends* is not that straightforward. Businesses in Armenia are better than other EaP countries as for artificial intelligence; visualisation, virtual reality and augmented reality; Big Data collection, aggregation, analysis, visualisation services. Belarus is outperforming in Business intelligence and analytics; data protection and the legal implications; customer relationship management; gamification; mobilisation, socialisation and omni-channelled service as trends of digital markets. Georgia and Moldova are good in most of these areas with some exceptions. An average level of knowledge in this group for EaP businesses makes 4 out of 10.

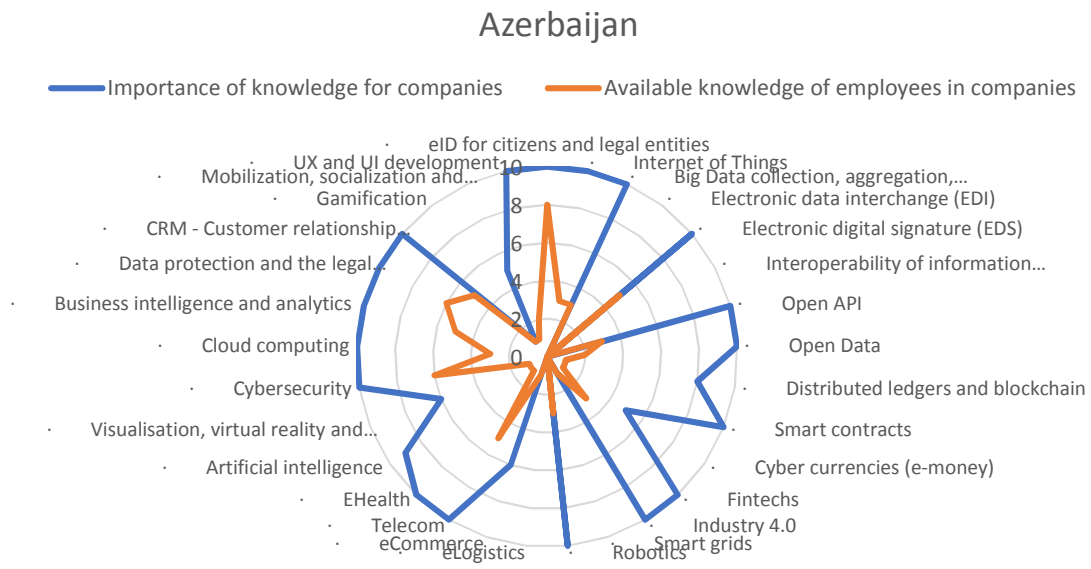
In **Armenia**, the largest gap is observed for the following areas:

- Business intelligence and analytics
- CRM - Customer relationship management
- Data protection and the legal implications
- Mobilisation, socialisation and omni-channelled service as trends of digital markets.



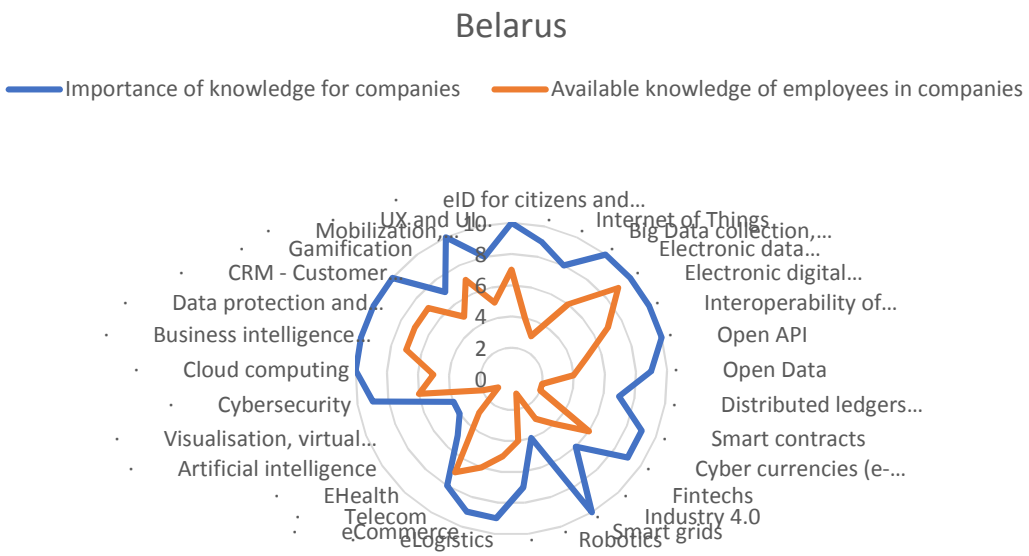
In **Azerbaijan**, the largest gap is observed for the following areas:

- UX and UI development
- eHealth
- Artificial intelligence
- Open Data
- Smart contracts
- Industry 4.0.



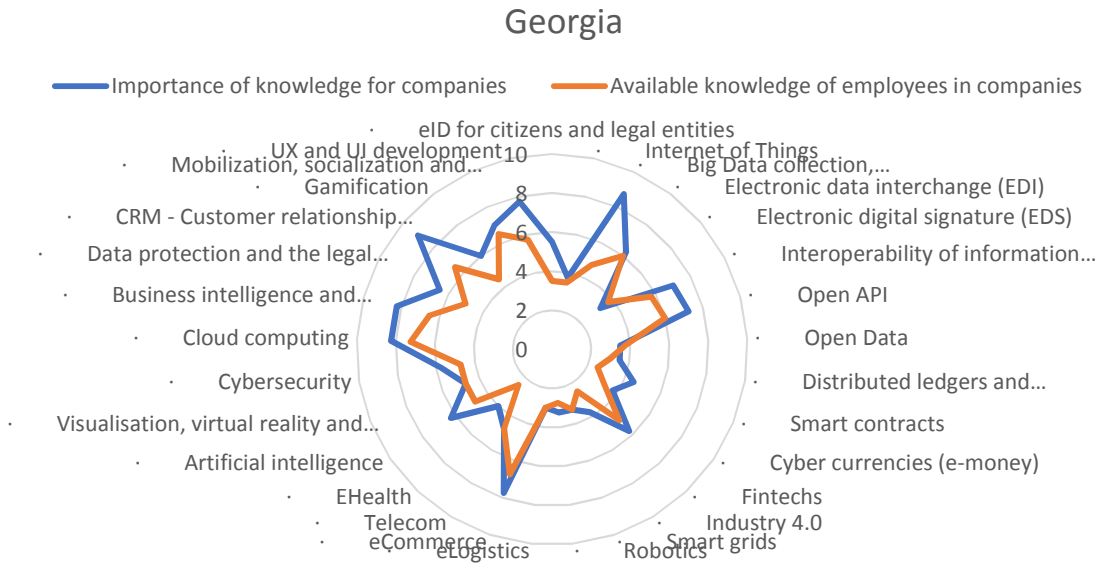
In **Belarus**, the largest gap is observed for the following areas:

- Smart contracts
- Cloud computing
- Open API
- Open Data
- Distributed ledgers and blockchain
- Internet of Things
- Big Data collection, aggregation, analysis, visualisation services
- Industry 4.0.



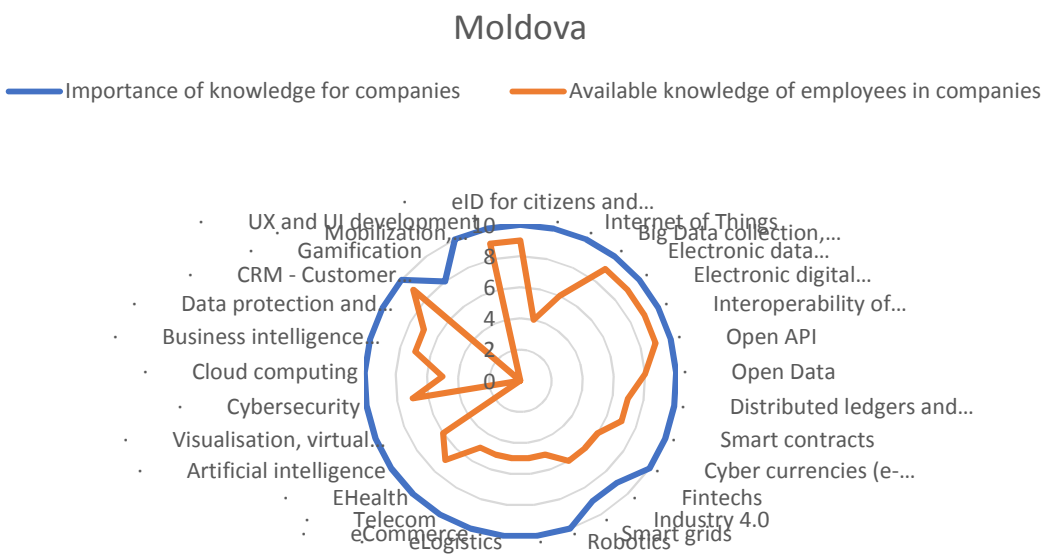
In **Georgia**, the largest gap is observed for the following areas:

- Big Data collection, aggregation, analysis, visualisation services
- CRM - Customer relationship management
- eID for citizens and legal entities
- Smart contracts
- UX and UI development.



In **Moldova**, the largest gap is observed for the following areas:

- Gamification
- Internet of Things
- Mobilisation, socialisation and omni-channelled service as trends of digital markets
- Visualisation, virtual reality and augmented reality.



In **Ukraine**, the available knowledge was assessed in comparison with the importance of employees in the company.

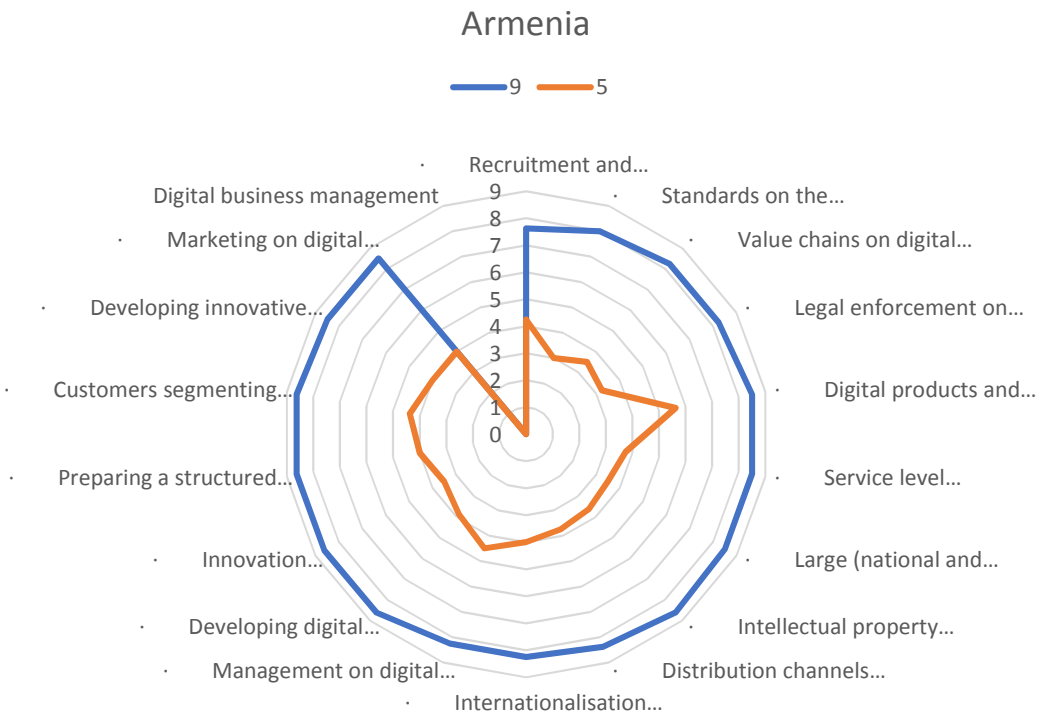
6.2.3.2 Digital business management

The knowledge on different aspects of digital business management is generally marked by EaP businesses of higher importance than the knowledge of particular technological trends, with an average score of importance equal to 8 out of 10. Herewith, the level of available knowledge was generally estimated at the level of 5 out of 10.

Moldova is outperforming the other EaP countries as for estimated level of knowledge on digital business management available for companies. Generally, businesses possess the slightly better knowledge relevant for the initial stages of the innovation process comparing to business growth and internationalisation aspects; yet for all areas there is a clear need for direct business training and development of specialised consultancy services.

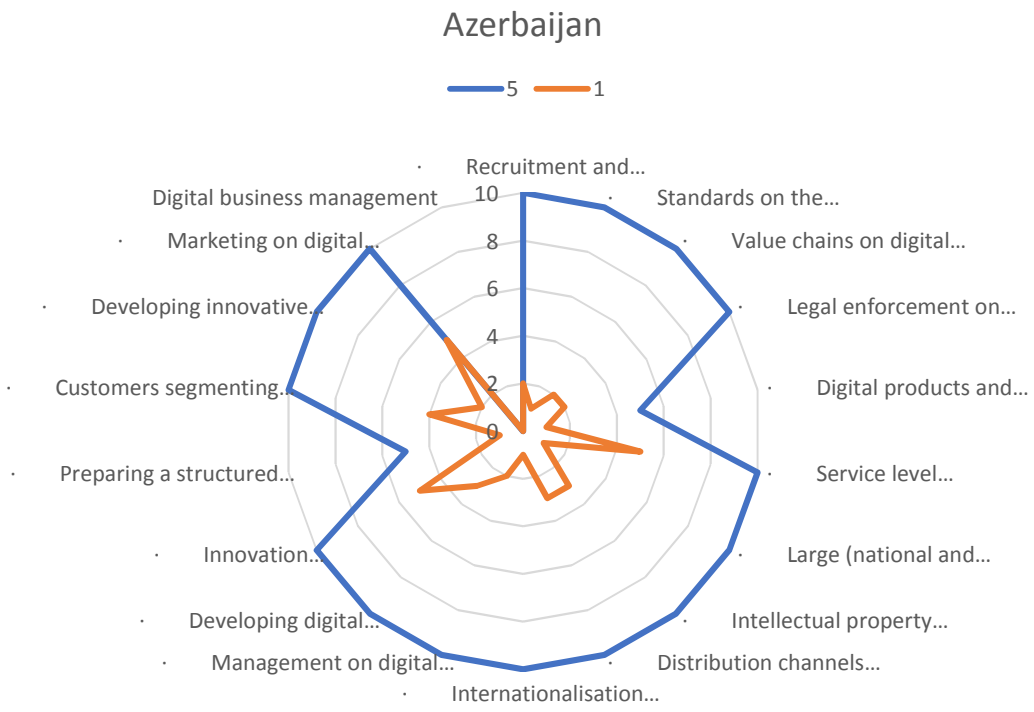
In **Armenia**, the largest gap is observed for business knowledge in the following areas:

- Innovation management, change management, risk management on digital markets
- Intellectual property management on digital markets
- Large (national and international-scale) information systems and relevant market niches
- Legal enforcement on digital markets
- Standards on the digital market.



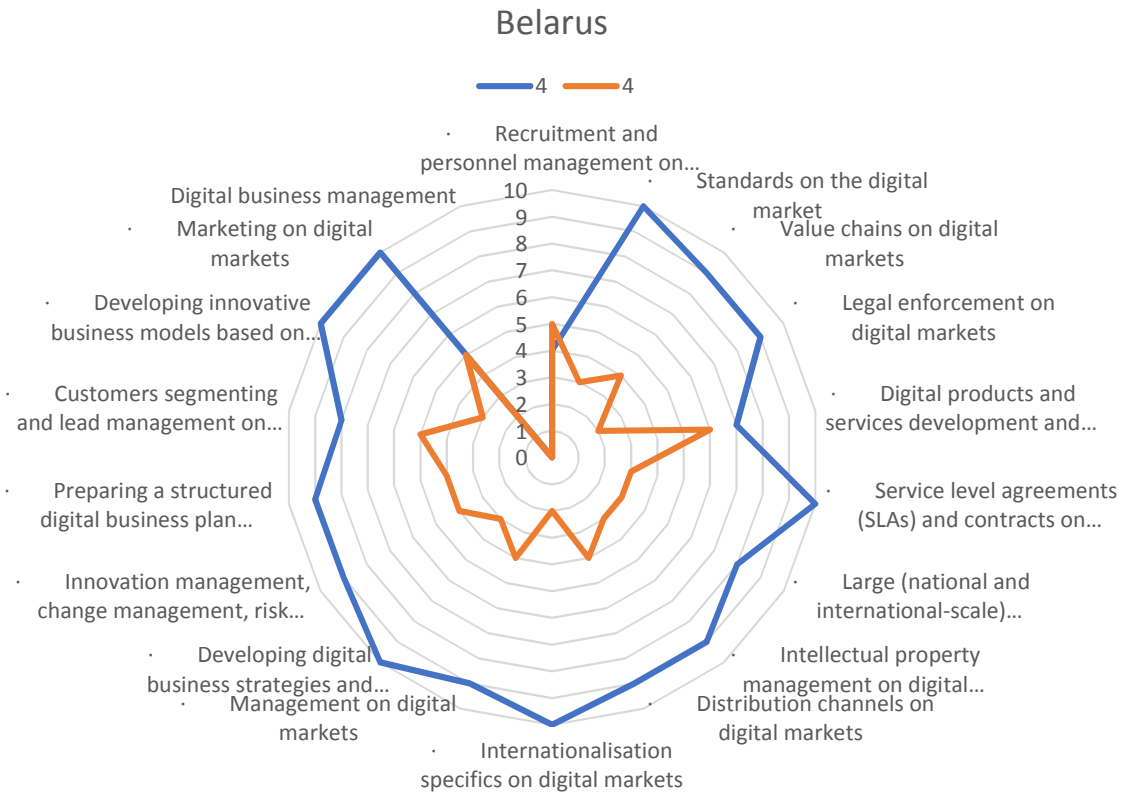
In **Azerbaijan**, the largest gap is observed for business knowledge in the following areas:

- Developing innovative business models based on digital technologies
- Internationalisation specifics on digital markets
- Large (national and international-scale) information systems and relevant market niches
- Legal enforcement on digital markets
- Management on digital markets
- Recruitment and personnel management on digital markets
- Standards on the digital market
- Value chains on digital markets.



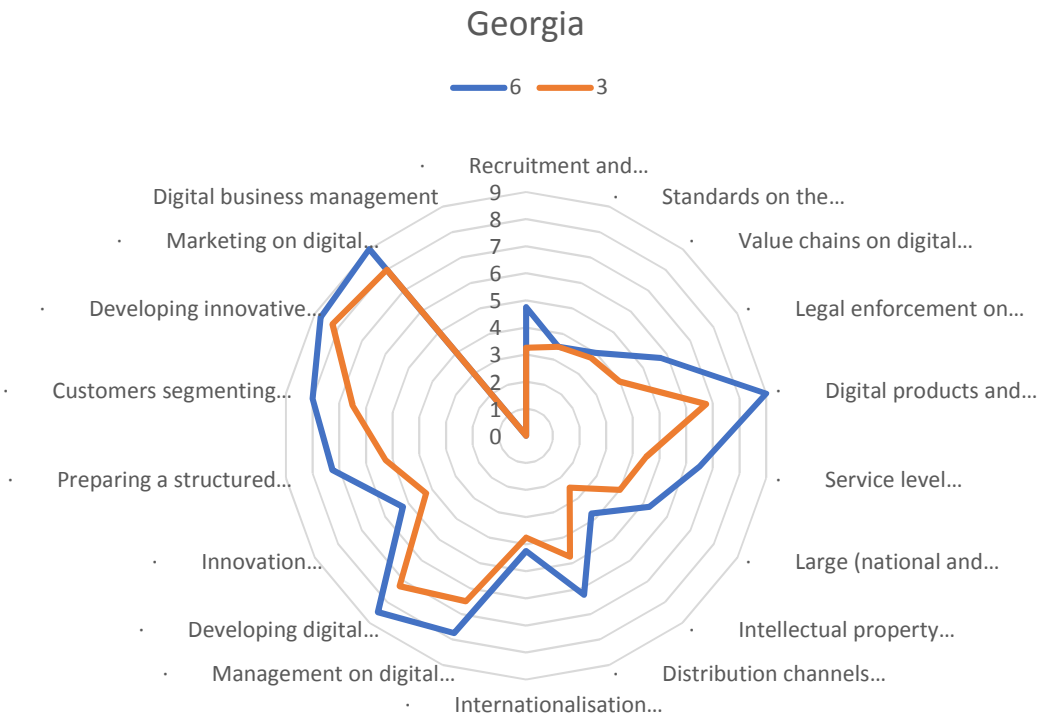
In **Belarus**, the largest gap is observed for business knowledge in the following areas:

- Developing innovative business models based on digital technologies
- Developing digital business strategies and roadmaps
- Internationalisation specifics on digital markets
- Legal enforcement on digital markets
- Service level agreements (SLAs) and contracts on digital markets.



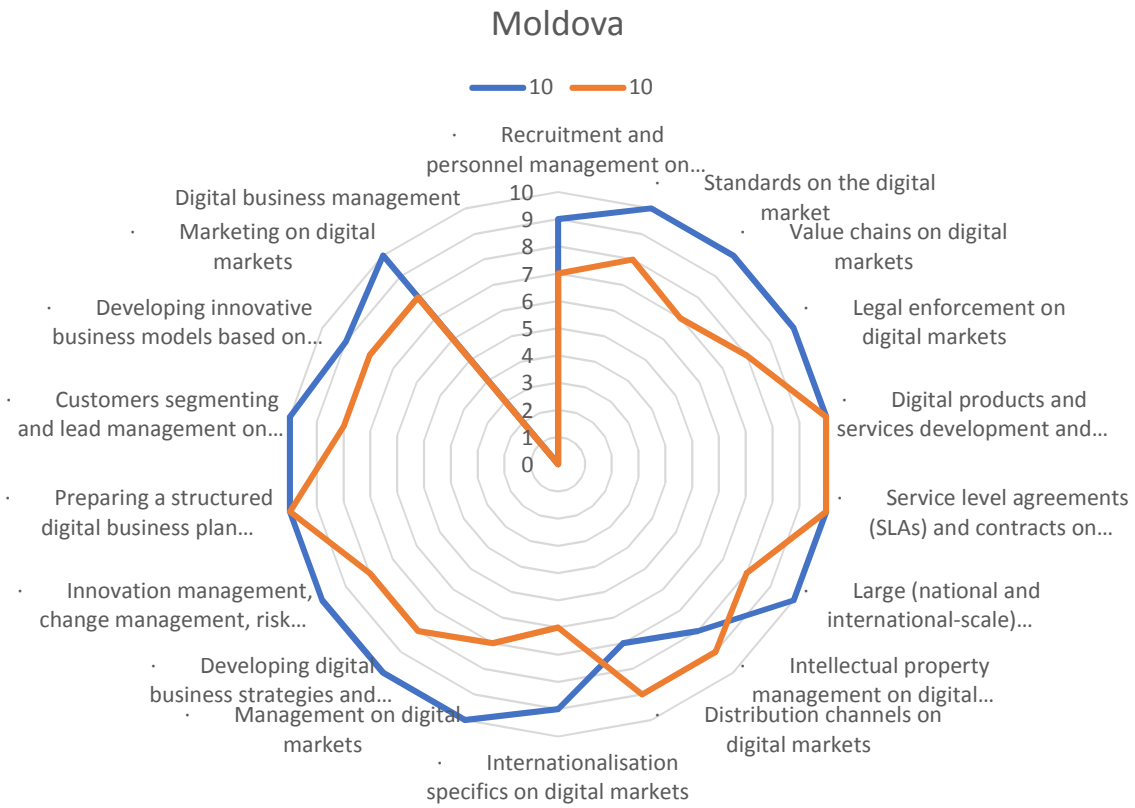
In **Georgia**, the largest gap is observed for business knowledge in the following areas:

- Digital products and services development and design
- Rapid and virtual prototyping techniques
- Service level agreements (SLAs) and contracts on digital markets.



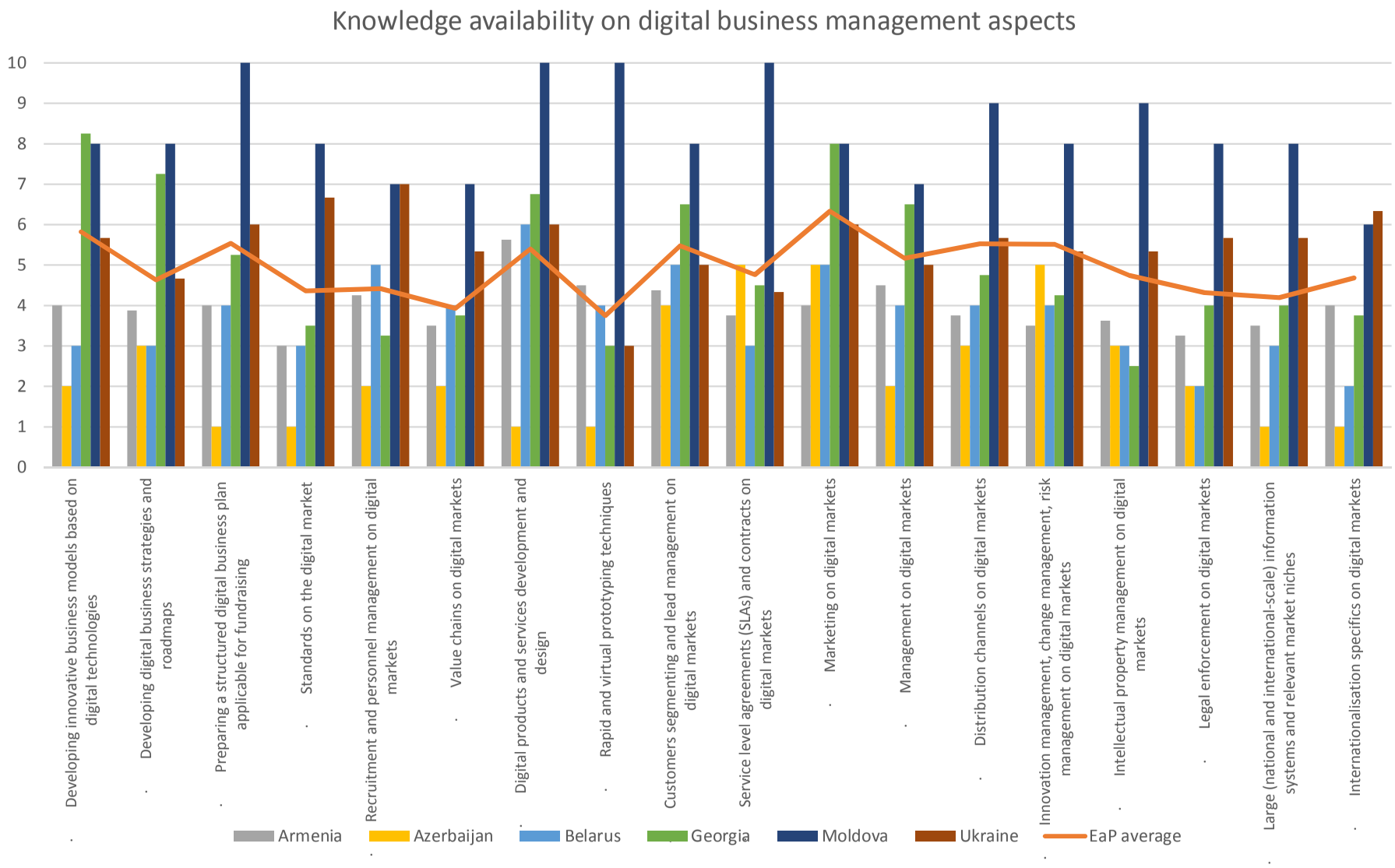
In **Moldova**, the largest gap is observed for business knowledge in the following areas:

- Internationalisation specifics on digital markets
- Management on digital markets
- Value chains on digital markets.



In **Ukraine**, the largest gap is observed for business knowledge in the following areas:

- Innovation management, change management, risk management on digital markets
- Intellectual property management on digital markets.


Knowledge availability on digital business management aspects
10
9
8
7
6
5
4
3
2
1
0
Developing innovative business models based on digital technologies
Developing digital business strategies and roadmaps
Preparing a structured digital business plan applicable for fundraising
Standards on the digital market
Recruitment and personnel management on digital markets
Value chains on digital markets
Digital products and services development and design
Rapid and virtual prototyping techniques
Customers segmenting and lead management on digital markets
Service level agreements (SLAs) and contracts on digital markets
Marketing on digital markets
Management on digital markets
Distribution channels on digital markets
Innovation management, change management, risk management on digital markets
Intellectual property management on digital markets
Legal enforcement on digital markets
Large (national and international-scale) information systems and relevant market niches
Internationalisation specifics on digital markets
Armenia
Azerbaijan
Belarus
Georgia
Moldova
Ukraine
EaP average

6.3 National and EaP recommendations of ICT innovation training

6.3.1 Topics recommendations on ICT Innovation-related training for EaP roadmaps

Based on the results of the Study, the following training modules can be considered a priority for *EaP-wide activities on ICT Innovation trainings*:

	Policy-makers	**Innovation infrastructure organisations**	**Businesses**
Technological trends	• Artificial intelligence • Big Data collection, aggregation, analysis, visualisation services • Cyber currencies (e-money) • Distributed ledgers and blockchain • eHealth • Fintechs • Industry 4.0 • Open API • Open Data • Smart contracts	• Artificial intelligence • Big Data collection, aggregation, analysis, visualisation services • Business intelligence and analytics • Cloud computing • CRM - Customer relationship management • Cybersecurity • Data protection and the legal implications • eCommerce • eHealth • Electronic data interchange (EDI) • Fintechs • Industry 4.0 • Internet of Things • Interoperability of information systems • Mobilisation, socialisation and omni-	• Artificial intelligence • Cyber currencies (e-money) • Distributed ledgers and blockchain • eHealth • eLogistics • Gamification • Industry 4.0 • Internet of Things • Mobilisation, socialisation and omni-channelled service as trends of digital markets • Robotics • Smart contracts • Smart grids • Visualisation, virtual reality and augmented reality.

		channelled service as trends of digital markets • Open API • Open Data	
Digital business management	• Developing digital business strategies and roadmaps • Developing innovative business models based on digital technologies • Innovation management, change management, risk management on digital markets • Intellectual property management on digital markets • Internationalisation specifics on digital markets.	• Developing digital business strategies and roadmaps • Developing innovative business models based on digital technologies • Innovation management, change management, risk management on digital markets • Intellectual property management on digital markets • Internationalisation specifics on digital markets • Recruitment and personnel management on digital markets • Service level agreements (SLAs) and contracts on digital markets • Standards on the digital market	• Customers segmenting and lead management on digital markets • Developing digital business strategies and roadmaps • Developing innovative business models based on digital technologies • Distribution channels on digital markets • Innovation management, change management, risk management on digital markets • Internationalisation specifics on digital markets • Management on digital markets • Marketing on digital markets • Preparing a structured digital business plan applicable for fundraising

Besides, it is important to provide training for policy-makers on:

- Current trends of setting the legal framework for digital markets in foreign countries
- Current digital agenda and tools used by the Eurasian economic commission
- Current digital agenda and tools used by the international organisations (The World Bank, OECD, UN, WIPO, ISO etc)

- Current digital agenda and tools used by the neighbour states and their unions (EU etc)
- Opportunities of digital technologies to enable self-employment and increase employment in the existing enterprises
- Opportunities of digital technologies to increase the productivity of non-ICT sectors of economy
- Opportunities of digital technologies to increase earnings of state organisations by delivering services to citizens and business
- Opportunities of digital technologies to increase the efficiency of state governance and governmental services.

The identified gaps in knowledge of policy-makers, innovation infrastructure organisations and businesses of particular countries can also be considered as a priority for *training on a bilateral level (EaP country-EU)* and included into the topic recommendations to *EaP national roadmaps* on ICT Innovation-related training.

6.3.2 Recommendations for the roadmap of ICT Innovation-related training activities

The roadmap of ICT Innovation-related training activities might be implemented in cooperation with *EU4Digital:Digital Skills* expert working group and should include the following activities:

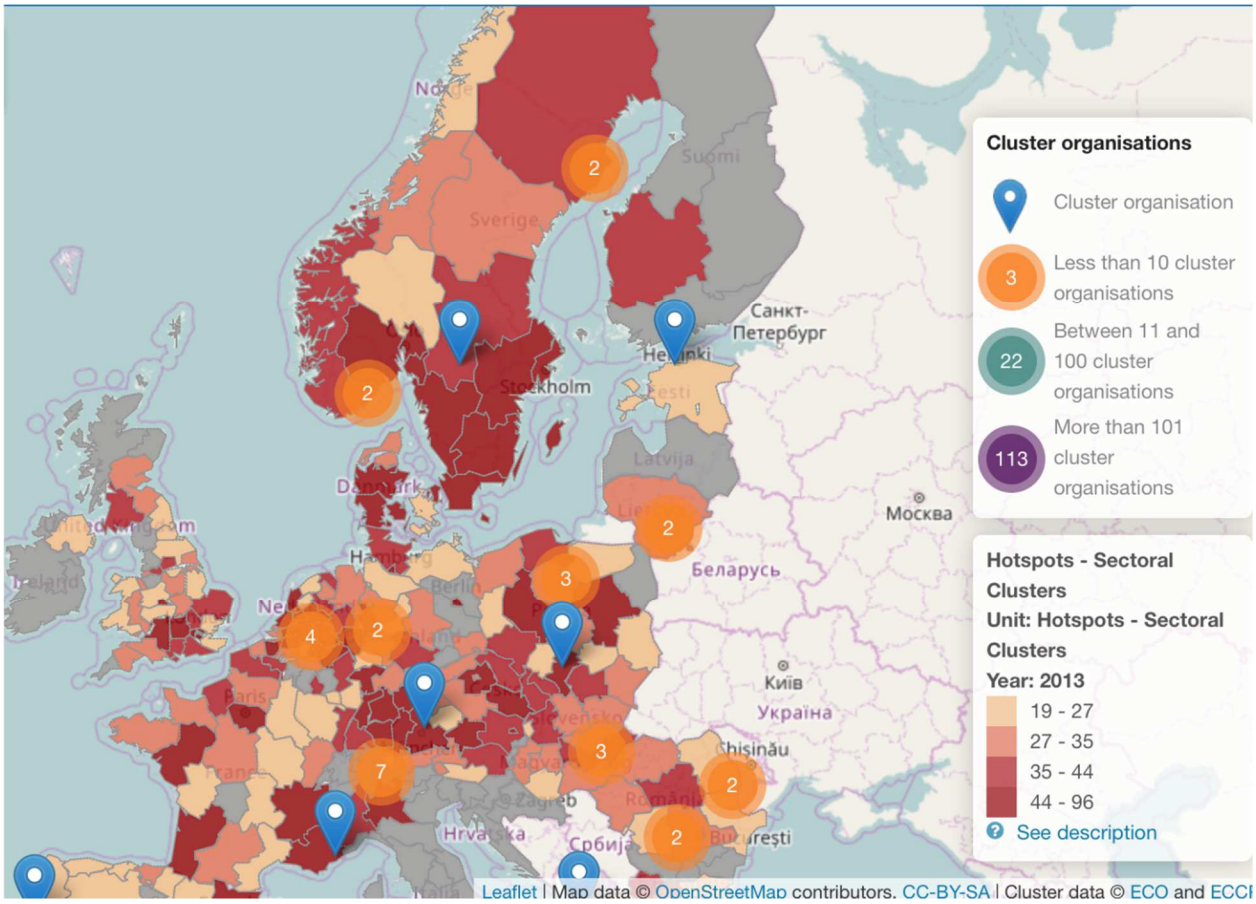
1. Identifying the advanced educational and training centres in EU delivering the relevant ICT Innovation skills.
2. Developing on the basis of the Digital Skills and Jobs Coalition Platform of the **map of such centres**, searchable by topic, country and training conditions (required level of education for enrolment to the course; conditions of payment; opportunity to apply for a scholarship; open to citizens of EU/EaP/world etc).
3. Identifying and **joining the existing associations/networks/clusters** on digital innovation training.
4. Developing an **online database of video materials** to showcase the latest technologies to existing enterprises and start-ups.
5. Targeted activities on **training the trainers for specific ICT Innovation topics** (on-site, remote training, practical internships at digitalised enterprises and public organisations etc).
6. Targeted activities on **launching pilot competence centres focused on specific digital transformation topics in EaP countries**, in correlation with the digital agenda of each EaP country.

7. **Networking of EaP competence centres** to make use of the knowledge complementarity (staff exchange, mobility schemes for the nurtured businesses, etc).
8. Targeted activities on **creating a general platform-aggregator of services of specialised ICT innovation infrastructure organisations for both EU and EaP countries**, to further foster the harmonisation of digital markets.

Appendices

Appendix 1: European Cluster Collaboration Platform. Retrieved

Figure A1.1. European Cluster Collaboration Platform



Source: https://www.clustercollaboration.eu/cluster-mapping

APPENDIX 2: DESCRIPTION OF SERVICES PROVIDED BY THE MAIN STAKEHOLDERS

Table A.2.1. Overview of classification of innovation services

Service	*Description*
Access to research and infrastructure	*Providing access to open access centres, shared facilities, research knowledge, scientists, etc.*
Advice and consulting	*Providing advisory, mentoring, coaching, consulting services, as well as incubation, acceleration services for businesses from start-ups to large companies.*
Financial instruments for research	*Providing funding and/or financial aid for research, development and innovation.*
Financial instruments for business development	Providing finance (debt or equity) through all phases of the establishment of a business – from ideas with potential growth in the early stages to existing companies that are investing in growth and expansion.
Networks/Collaboration	*Granting access to networks and establishing partnerships between different stakeholders (universities, researchers, public sector actors, businesses, investors, etc.) at a regional, national, and international level.*

APPENDIX 3 SYSTEMATISATION OF BASELINE SERVICES, TOOLS AND INFRASTRUCTURES FOR ICT INNOVATION (ICT INNOVATION SERVICE MAP)

For the purposes of this Study, the range of services identified during the Baseline analysis were systematised according to the **stages of the innovation process with account of specific needs of businesses**.

The basic assumption of our approach was that on different stages of development, businesses tackle various needs, and for enabling the development of businesses, the ecosystem should be tailored to address these needs. Herewith, market can take up the delivery of some services – mostly these are the services of burning necessity bringing clear revenue or cost-saving results to businesses to persuade businesses to pay. The other services need to be developed with support of public funds, because of too early stages of the innovation process or externalities making it unprofitable for market to deliver the services. Again, the yet other services can be developed via cluster, associations and in a public-private partnership, which are best suited for gathering diverse competencies from different sectors, diversification of risks and creating sustainable organisational structures.

Both the businesses developing the innovative ICT-based solutions, and the businesses that seek to restructure their business and production model leaning on ICT innovation opportunities, are the target audience for these services.

The services enabling the resource base and the networking services are studied as separate blocks, since these services are important for businesses through the whole lifecycle.

As a result, the following **taxonomy of services, tools and infrastructures for ICT innovation** was developed.

Figure 1. Taxonomy of services, tools and infrastructures for ICT innovation (ICT Innovation Service Map)

RESOURCE BASE

1. Human resources
2. Technologies
3. Digital Infrastructure
4. Data as a resource
5. Office premises
6. Production & R&D facilities
7. Finance
    a. Access to public support (regional/national programmes, innovation vouchers, etc.)

b. Access to private funding (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.)

8. Reputation and trust
    a. Labelling as a quality mark
    b. Certification as a quality mark
9. Visibility

SEED STAGE (IDEA)

10. Trend-scouting and technologies foresight (ideas for innovative projects)
11. Identify customers and develop value proposition
12. Building a balanced team and finding partners with complementary competencies

START-UP STAGE (PRODUCT)

13. Product development
14. Research and development
15. Value proposition and business concept testing and validation
16. Intellectual property management
17. Product and Corporate Design

ENTERING THE MARKET

18. Marketing products and services
19. Distribution channels and sales
20. Innovation Management / Support of innovation processes (internal, external)
21. Accompaniment after entering the market

SCALE-UP, SCOPE-UP, SPEED-UP

22. Business services for growing and accelerating companies
23. Business scoping up
24. Business scaling up

BUSINESS TRANSFORMATION AND STRATEGY

25. Support to existing small and medium-sized companies in managing the structural transformation and in developing business models
26. Thematic expertise

NETWORKING AND COLLABORATION (for innovation infrastructure organisations)

27. B2B networking (business to business)
28. B2G networking (business to government)

29. B2A networking (business to academia)

30. I2I networking (infrastructure to infrastructure)

WEB-BASED PLATFORMS

RESOURCE BASE

1. Facilitating access to human resources

This group of services typically includes the following activities:

activities of innovation infrastructure organisations and public organisations for increasing young people's interest in ICT

activities of innovation infrastructure organisations and public organisations helping universities to develop and deliver new teaching programs for the needs of digital market and develop specialist personnel

activities of innovation infrastructure organisations and public organisations promoting students' internships and increasing graduate retention in the country or particular region of a country

activities of universities to cultivate an entrepreneurial mentality in students and promote the creation of start-up companies

organizing hackathons for teambuilding and business ideas development

2. Facilitating access to technologies

This group of services typically includes the following activities:

activities of innovation infrastructure organisations, universities, R&D centres to showcase the latest technologies to existing enterprises and start-ups

help to find appropriate technologies in the market or from research institutes/universities

consult businesses about strategic use of available international intellectual property

consult businesses about strategic usage of relevant international standards

3. Facilitating access to digital Infrastructure

Please estimate whether in your country, the basic digital infrastructure is available to enable the secure, robust, responsive and intelligent communications and computation facilities for digital business:

Indicator	**Number/Capacity**	**Weblinks**
mobile broadband infrastructure		
cloud computing infrastructure providers (data centres, IaaS)		

4. Facilitating access to data as a resource

Please estimate whether in your country, the basic data sources are available to serve the digital business models:

Indicator	**Number/Capacity/Specialisation**	**Weblinks**
open data portal with access to state and private information resources (databases)		
open API marketplaces (general or for specific industries, i.e. financial)		
system for unified digital IDs for citizens		
official comprehensive register of legal entities		
unified register of electronic passports of goods		

5. Facilitating access to office premises

This group of services typically includes the following activities:

access to office and co-working spaces at rental costs lower than market prices (number of organisations providing them)

access the infrastructure of partner networks in other cities or countries for a certain period of time, including meeting rooms (example: Business Roaming Agreement (www.clusterize.org)

6. Production & R&D facilities

This group of services typically includes the following activities:

access to R&D environment equipped with update digital technologies, tools and equipment (provided by universities, R&D institutions or technoparks specifically for digital businesses and start-ups)

access to facilities (laboratory etc) for developing virtual and physical prototypes of new products with significant digital component

access to facilities for pilot/beta testing of product and process prototypes (including both testing for complex technical characteristics and the testing community of educated experts and customers)

access to specialised production facilities for products and services with significant digital component (powerful water and electricity supply, broadband Internet connection, data centre and cloud computing facilities etc)

7. Facilitating access to finance

    a. Access to public support (regional/national programmes, innovation vouchers, etc.)

This group of services typically includes the following activities:

collecting and disseminating information about funding opportunities

facilitate access to funding for R&D, from regional sources

facilitate access to funding for R&D, from national sources

facilitate access to funding for R&D, from European sources ((Horizon 2020, COSME, ERDF …)

facilitate access to funding for R&D, from international sources

support in the preparation of projects for EU and international funding

specific advisory services on raising funds

information about R&D and innovation Tax Credits

    b. Access to private funding[97] (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.)

fundraising guidance to raise seed capital (angel investors and early stage venture capital firms)

fundraising guidance to raise Series-A stage investment (venture capitalists)

fundraising guidance to raise Series-B stage investment (venture capitalists, corporate funds)

fundraising guidance to raise Series-C stage investment (hedge funds, investment banks, private equity firms and big secondary market groups, mergers and acquisitions)

crowdfunding services

crowd investing services

B2B lending

consulting services: validate the business plan and financial model

consulting services: financing needs assessment and fundraising strategy

pre-screening and preselection of start-ups and support process to structure SMEs business plans organizing VC pitching

organizing one-to-one calls and meetings with investors

[97] http://www.investopedia.com/articles/personal-finance/102015/series-b-c-funding-what-it-all-means-and-how-it-works.asp?lgl=rira-baseline-vertical

access to exclusive match-making events with investors

access to international Business Angels network(s)

access to international network(s) of specialised digital technology venture capital providers and corporate venture investors

Please estimate the volume of funds available/allocated on different stages of investments:

	Available funds	Weblink	Allocated funds	Weblink
Seed capital (angel investors and early stage venture capital firms)				
Series-A stage investment (venture capitalists)				
Series-B stage investment (venture capitalists, corporate funds)				
Series-C stage investment (hedge funds, investment banks, private equity firms and big secondary market groups, mergers and acquisitions)				

8. Building reputation and trust as resources

This group of services typically includes the following activities:

a. Labelling as a quality mark

based on assessment of business models and financial plans, assigning start-ups with a label (of technopark, incubator, accelerator, network etc) recognised by investors

participation in the international initiatives of cluster benchmarking (EIP label, Cluster analysis etc).

b. Certification as a quality mark

attesting and certification of conformity of innovative ICT services providers (cloud providers, EDI providers, etc) (please specify for which ICT services the previous activity is accomplished)
participation in the EU initiatives on certification of innovative ICT services providers

9. Visibility

This group of services typically includes the following activities:

visibility via the available community, regular newsletters of cluster organisations to members for dissemination of information about business and cooperation opportunities etc, representation and promotion of start-ups in mass media

SEED STAGE (IDEA)

10. Trend-scouting and technologies foresight (ideas for innovative projects)

This group of services typically includes the following activities:

regularly updated analysis (scouting) to identify promising new technologies with great potential for the parties involved (performed by innovation infrastructure organisations, universities, public organisations, business associations)
regularly updated analysis to identify the digitalisation degree of specific sectors/industries (financial, transport and logistics, etc) (estimate the degree of technologies diffusion, identify the unused technological opportunities, identify the areas where the potential demand and the technological opportunity exist, but the supply is absent or limited etc)

11. Identify customers and develop value proposition

This group of services typically includes the following activities:

help the founders (with a product/service with significant digital component) who lack business skills (like farmers, architects, musicians etc) to segment the market and identify the target group of customers, to detect the customers' needs, develop value proposition for target groups of customers, and develop a business model (can be also performed by specialised consultancy companies)

12. Building a balanced team and finding partners with complementary competencies

This group of services typically includes the following activities:

help new businesses to identify the complementary competencies required to enable the value proposition and to build a balanced team (i.e. through organizing hackathons, matchmaking events or using the existing networks)
help new businesses to identify the external partners with complementary competencies and resources required to enable the value proposition (i.e. through organizing matchmaking events or using the existing networks)

START-UP STAGE (PRODUCT)

13. Product development

This group of services typically includes the following activities:

consulting about new product development tools, including developing creative concepts (conception, campaign, implementation, marketing mix)
assistance in expert analysis of product / service / technology during iterative product development
matching services to help establishing links with distribution channels

14. Research and development

This group of services typically includes the following activities:

help SMEs to find partners in joint research and development projects

15. Value proposition and business concept testing and validation

This group of services typically includes the following activities:

provide access to a group of pilot customers (early adopters) for testing new value propositions for various market segments (on a voluntary or paid basis) to get detailed feedback to reduce the risk of failure, scale quickly and generate qualified sales leads
assistance in selection of profit sources, developing marketing strategy and setting pricing policy

16. Intellectual property management

This group of services typically includes the following activities:

analysis of patent landscape and freedom to operate, assistance in applying for patents
assistance in concluding patent sales and licensing agreements
consultations about aligning the strategy of intellectual property management with the business strategy
consultations about managing the relations concerning intellectual property within the firm and with other firms
assistance in resolving conflicts apropos intellectual property

17. Product and Corporate Design

This group of services typically includes the following activities:

help businesses to develop the specific product industrial design, user-friendly interface, user-friendly design of products/services; brand/trademarks etc.
help businesses to develop the specific corporate design (corporate identity, manuals, business stationery, brand development, wording etc).

ENTERING THE MARKET

18. Marketing products and services

This group of services typically includes the following activities:

performing or subsidizing market studies for companies
subsidise participation at trade fairs, congresses, etc. (joint presentations)
assistance in event organisation, PR and marketing campaigns

19. Distribution channels and sales

This group of services typically includes the following activities:

assistance in extending distribution channels and organizing sales
help innovative businesses to organise lead management
help innovative businesses to develop model contracts and service level agreements (SLAs)

20. Innovation Management / Support of innovation processes (internal, external)

This group of services typically includes the following activities:

help innovative businesses to collect and manage customers feedback and increase customer engagement
advice on specific innovation process management tools/techniques
risk management advice

21. Accompaniment after entering the market

This group of services typically includes the following activities:

assistance in obtaining special insurance conditions following the audit and “certification” of the project with significant digital component (for example in cloud computing industry, data centres get special insurance against incidents with personal and corporate data of other companies they store, and being certified by state authorities or public organisations under this or that certification scheme improves their insurance conditions because certification minimises uncertainty)
mentoring throughout the growth stages

SCALE-UP, SCOPE-UP, SPEED-UP

22. Business services for growing and accelerating companies

This group of services typically includes the following activities:

collaboration with and consultancy from international business developers – serial entrepreneurs, business consultants, industry experts

consulting and assistance with new regime of taxation and reporting associated with business growth from small to medium and from medium to large-scale companies; connect growing companies to the most appropriate sources of funding and additional resources
assist growing companies with the development and proofing of their business models and strategies

23. Business scoping up

This group of services typically includes the following activities:

support the design and implementation of roadmaps to assist the scoping of companies (growing diversity of products and services; conquering new target groups of customers)
improve positioning of products or services with customers

24. Business scaling up

This group of services typically includes the following activities:

support the design and implementation of roadmaps to assist the scaling of companies (growth of output; conquering new geographical markets with the same products and target customer groups)
market studies to identify new business opportunities abroad
organizing thematic missions including B2B meetings in foreign countries; support to attend international trade shows and network events to increase business visibility
assistance to identify strategic and operational partners across borders
assistance to identify potential customers (leads) across borders and transform them into deals or collaborations
consulting local companies about and support with compliance to export/import regulations
access to international networks of partner clusters (accelerators, incubators etc), including using their office facilities
assistance of integration into supply chains and distribution channels in foreign markets
access to pools of qualified local employees on foreign markets, who pass on their local know-how and provide business contacts
international branding and marketing

BUSINESS TRANSFORMATION AND STRATEGY

25. Support to existing small and medium-sized companies in managing the structural transformation and in developing business models

This group of services typically includes the following activities:

educating about new opportunities in the sphere of information and (broader) digital technologies, limitations and conditions of efficient usage, for different groups:
non-IT businesses

state bodies and policy-makers

public organisations

teachers at educational establishments

preliminary simulations and visualisations for all manufacturing companies with complex digital products and digitalised business and production processes

digitalisation services: assisting any company in its digital transformation by assessing the digitalisation opportunities for both the organisational structure of the whole company, production processes, products & services: support with the design and implementation of innovative business models and development of their digital transformation roadmaps

help non-IT businesses to select the best technological options that meet the innovation goals

administrative creation of the outposts (office space, legal structure, employment contracts, recruitment of the best experts) of non-ICT corporations in the domestic innovation cluster

26. Providing thematic expertise

This group of services typically includes the following activities:

organise the specialised expert communities and working groups and sector-specific communities; thematic groups in the area of emerging or breakthrough digital technologies to encourage collaborative innovations; accumulate the network of experts with competencies in specific areas along the entire value chain of digitalisation, including technology and service providers, users, research institutions and multipliers (examples: Automobile & Transports; Digital Trust & Security; Free and Open Source Software; Health & ICT Initiative; Smart Energy Management; System Design and Development Tools; Telecoms)

organizing working groups for innovative digital solutions in non-IT industries including experts from both IT and these industries

NETWORKING AND COLLABORATION (for innovation infrastructure organisations)

27. B2B networking (business to business)

This group of services typically includes the following activities:

support SMEs to engage with SMEs (B2B meetings))

support SMEs to engage with external MNCs; access to the decision-makers of major industrial enterprises

28. B2G networking (business to government)

This group of services typically includes the following activities:

bridging SMEs and government for studying the legislation gaps

bridging SMEs and government for drafting new legislation

bridging SMEs and government for public-private-partnership projects

collaboration on servicing the supervised businesses with other infrastructure organisations in the country

29. B2A networking (business to academia)

This group of services typically includes the following activities:

organizing networking within the innovation infrastructure organisation or cluster (member to member introductions)
bridging SMEs to scientific research organisations and individual scientists
networking events in different formats, organisation of workshops and conferences

30. I2I networking (infrastructure to infrastructure)

This group of services typically includes the following activities:

collaboration on servicing the supervised businesses with other infrastructure organisations within the country
collaboration on servicing the supervised businesses with other infrastructure organisations internationally.

WEB-BASED PLATFORMS

1. A one stop shop website for start-ups to find a relevant technopark, incubator or accelerator with an option of search for specific services
2. A web-based platform for start-ups to promote the information on themselves to find investors and partners
3. A web-based platform for investors (business angels, VCs, corporate investors) to find start-ups to invest
4. A web-based platform for non-ICT companies to find and compare for their digitalisation appropriate partners among (example: Compare):

- IT infrastructure providers
- business process analysts, IT-architects, software developers
- system integrators
- informatisation and digitalisation consultants, including digital business models (please specify for which market segments these platforms are available – financial, trade, logistics, industry, healthcare, education, etc)

5. A web-based platform for communication of innovation infrastructure organisations
6. A web-based database about current research projects in specific areas of digitalisation (IoT, Big Data etc) (open to public)

7. Open innovation tools enabling the integration of software solutions developed by several companies (like open API platforms)
8. Open innovation tools for joint software development by several companies
9. IoT accelerator enabling a unified approach to developing applications and services
10. A web-based infrastructure for correlating teaching, practice, and research related to ICT and digitalisation (example: HCAT+)

APPENDIX 4 THE LIST OF BENCHMARKING ORGANISATIONS DELIVERING RELEVANT SERVICES, TOOLS AND INFRASTRUCTURES FOR ICT INNOVATION

Table A.4.1. List of used benchmarked organisations in different base-countries

Estonia

- *Estonian Connected Health Cluster*
- *Estonian ICT Cluster*
- *Tallinn Science Park Tehnopol*
- *start-up Incubator*
- *Prototyping Fund Prototron*
- *SPRINGBOARD- business acceleration programs and B2B matchmaking*

France

- *Aerospace Valley*
- *Cap Digital*
- *EMC2*
- *Minalogic*
- *MOV'EO*
- *Secured Communicating Solutions cluster*
- *Systematic Paris-Region*
- *ViaMéca*

Germany

- *CyberForum e.V.*
- *automotive-bw*
- *Hamburg Aviation e.V.*
- *Virtual Dimension Centre (VDC)*
- *Navispace*
- *Cloudzone –Messe Ltd*
- *EuroCloud Deutschland_eco e.V.*
- *CLOUDING SMEs*
- *Cloud for Europe*
- *Mittelstand 4.0*
- *RAMI 4.0*

Sweden

- *Future Positon X*
- *Compare - Competence area ICT*
- *Dataföreningen i Norr*
- *Fiber Optic Valley*
- *Hudiksvalls Hydraulikkluster*
- *Media Evolution Southern Sweden*
- *Mobile Heights*
- *ProcessIT Innovations*

Ireland

- *Irish Software Innovation Network (ISIN)*
- *Financial Services Innovation Centre*
- *Irish Data and Cloud Cluster*
- *Digital Hub*
- *WESTBIC Business and Innovation Centre*

UK

- *North East Automotive Alliance Limited*

European initiatives

- *33/17 European Cluster Collaboration Platform*
- *EIT ICT*
- *EIT Digital Academy*

USA

- *The U.S. Economic Development Administration: Regional Innovation Strategies (RIS) Program*
- *Silicon Valley Corporate Accelerator*

South Korea

- *Accelerators, funding, and government initiatives*
- *G3 LABS*
- *SVIK (Smart Venture Institute) in Daegu*

Japan

- *Japan's 5th Science and Technology Basic Plan (2016- 2020)*
- *The EU-Japan Centre for Industrial Cooperation*
- *JEUPISTE (Japan-EU Partnership in Innovation, Science and Technology)*
- *EU-Japan clusters helpdesk*

APPENDIX 5 GOOD PRACTICES OF SERVICES FOR ICT INNOVATION IN EAP COUNTRIES

RESOURCE BASE

Human resources

AZERBAIJAN
Barama Hackathon 2017 FinTech App was a 2-day event organised jointly by Barama and ADA University that challenges teams of 3 participants to create solutions regarding issues at financial, banking, commerce sectors. 36 hours of non-stop coding for new services and applications. 50 participants with a variety of backgrounds and skill sets will come together at ADA University on October 28-29, 2017. Last year, Barama Hackathon 2016 was held by Barama Innovation and Entrepreneurship Centre. The project is aimed to promote the IT industry in the country and provide the talented youth an opportunity to demonstrate their knowledge and skills in this sphere. http://hackathon.barama.az/ https://www.azernews.az/business/112000.html

BELARUS
1. The Belarusian State University of Informatics and Radioelectronics (BSUIR) signed three contracts with Chinese organizations to perform R&D work in the area of electromagnetic compatibility of radioelectronic devices, radiolocation, and ion-plasma equipment for thin-film technologies. The engineering and educational centre BSUIR - Huawei has been open at the University. This is a laboratory when introducing cloud computing which will be realized in educational process. Within his cooperation was lunched the international educational project for young specialists under the name "Future Seeds". Students of the Belarusian State University, BSUIR and the Belarusian state academy of communication have an opportunity to pass a training in China. The program of training includes acquaintance to achievements in the field of information and communication technologies on the basis of Huawei Technologies Co., Ltd. and visit of largest IT laboratories in China. Also, there are 37 laboratories at the BSUIR as EPAM Systems, Cisco or Itransition where students are trained at certain courses and receive certificates of these world companies. *2.* Microsoft company works in Belarus with government agencies and the education system. Microsoft supports young endeavours, which are just making the first steps in their own business. Under the aegis of Microsoft Corporation, the national final stage of the international technology contest Imagine Cup 2017 takes place in the business incubator of the Minsk-based Hi-Tech Park they will get valuable experience and a bunch of useful recommendations and advice.

ICT development in healthcare and education is a crucial component of the Belarusian national socio-economic development program and the program to develop digital economy and information society in 2016-2020

GEORGIA

Engagement young people in the innovation industry is one of the mostly well-developed area of the innovation environment in Georgia.

GITA (www.gita.gov.ge) remains the key facilitator of activities aimed at increasing young people's interest in ICT. GITA facilitates several events for students and young entrepreneurs, provides special trainings for start-ups and general audience, as well as facilitates partnership with HE institutions via Students Pre-accelerator Project. Additionally, GITA provides financial support for organization of different innovation competitions, including hackathons. GITA manages

- start-up Beats project, under which regular meetings of the interested audience with successful people who work in different fields, including successful starters are organized;
- Innovation and Entrepreneurial Skills Development Program by conducting numerous Training of Trainers (TOT) and workshops in various fields,
- 40,000 IT Specialists' program - aiming to increase level of technical skills available on labour market in programming (Java, iOS, Android, Web programming, IT project management and quality assurance, etc.);

GITA also actively collaborates with the Ministry of Education and Science (www.mes.gov.ge), and international organizations, to integrate innovation and entrepreneurship program in the curriculum.

The Ministry of Education and Science is the second important player, enabling engagement of young people in the innovative ecosystem. Ministry of Education and Science, in collaboration of municipalities and GITA, facilitates engagement of young people through the network of Fablabs, established based on vocational or higher education institutions. Currently, in addition to 2 fablabs, functioning under the patronage of GITA, 20 fablabs based on facilities of HEIs and VETs are providing several educational and youths engagement activities. In addition to above mentioned infrastructure, engagement and capacity development of young people is enabled through three regional innovation centres and the network of iLabs, establishment of which was facilitated and supported by GITA.

There are several training centres and non-profit/community organizations, which enable engagement, capacity development and creative networking of young generation. Among such players are: the STEP IT Academy (ge.itstep.org), Computer Literacy Enhancement Society (www.taoba.ge/site), Georgian Research and Educational Networking Association – GRENA (www.grena.ge), Geolab (www.geolab.edu.ge), Creative Education Studio (www.ces.ge), School of Innovative Entrepreneurship (www.facebook.com/innovativeentrepreneurshipschool/), Management Academy (www.macademy.ge), Youth Innovations' Centre (www.facebook.com/innovations.ge), Young Entrepreneurs' School (www.facebook.com/mfocrystalyes), Information Technology Centre "Mziuri" (www.mziuri.ge), Fabrika Tbilisi (ww.fabrikatbilisi.com), Impact Hub Tbilisi (tbilisi.impacthub.net), iHUB Tbilisi (ihub.world/en/tbilisi-en), Geocell Hub (foursquare.com/v/geocell-hub-vake/53958e31498eb409d69f8d98). Georgia's chapter of the Women Techmakers is represented by the Google Developer Group (GDG) Tbilisi (www.meetup.com/Google-Developer-Group-Tbilisi-GDG-Tbilisi). GDG Tbilisi is an informal

association of professionals, facilitating organization of different hackathons and large Devfests. Even the youngest members of society are engaged through activities of the Juniors Innovation Lab (www.inlab.ge).

In addition to above mentioned players, it is worth to mention several state agencies, which directly or indirectly are involved and can influence the environment:

- The National Centre for Teacher Professional Development (www.tpdc.gov.ge) under the Ministry of Education and Science ensures capacity development of secondary school's teachers in implementation of ICT curricula;
- EMIS IT Academy is a community college, managed by the EMIS (Education Management Information System) agency under the Ministry of Education and Science (www.emis.ge), working actively with young generation, as well as managing the Fablab (EMIS Fablab);
- Innovative Service Lab (sda.gov.ge/?page_id=7325&lang=en), managed by the Service Development Agency (SDA) under the Ministry of Justice, which enables engagement and education of ICT professionals in development/integration of innovative services, based on electronic state services platform.

The role of the higher education institutions should be specially mentioned here. Following the state initiatives and overall trends and demand, almost all leading state and private universities are involved in establishment of the innovation ecosystem. However, while the state universities are both pushed and financially supported by the state (the infrastructure is mainly financed by the state), the private universities are developing their infrastructures using own financial resources, but usually cooperate closely with GITA, international donor organizations, ICT industry, and non-governmental sector.

The following state HEIs are involved in the innovation promotion activities through the schools, academic programs and/or innovation infrastructure, like iLabs, Fablabs and etc.:

- Georgian Technical University, GTU (www.gtu.edu.ge);
- Iv. Javakhishvili Tbilisi State University, TSU (www.tsu.edu.ge);
- Ilia State University, ILIAUNI (www.iliauni.edu.ge);
- Tbilisi State Academy of Arts (www.art.edu.ge);
- Gori State Teaching University, GSTU (www.gu.edu.ge);
- Batumi Shota Rustaveli State University, BSU (www.bsu.edu.ge);
- Akaki Tsereteli State University, ATSU (www.atsu.edu.ge).

The following private universities could be considered as HEI leaders of the innovation ecosystem:

- University of Georgia, UG (www.ug.edu.ge), managing Innovation Centre – start-up Factory (www. start-upfactory.ge) and hosting the iHUB infrastructure (ihub.world/en/tbilisi-en/);
- Free University (www.freeuni.edu.ge), under the School of Mathematics and Computer Sciences (MACS) actively developing the robotics and engineering directions and supplying human resources for significant part of high-tech start-ups;
- International Black Sea University, IBSU (www.ibsu.edu.ge), managing Innovation Lab at the Faculty of Computer Technologies and Engineering, and Idea Lab at the Faculty of Business Management;
- Caucasus University, CU (www.cu.edu.ge), under the Caucasus School of Technologies hosting several events, like hackathons;

- Georgia Institute of Public Affairs, GIPA (www.gipa.ge), managing the innovation lab CG Multilab (www.facebook.com/CGMultilab);
- Recently established Business and Technology University, BTU (www.btu.ge), managing the high-tech park named "Silicon Valley", and where the entrepreneurship and technology curricula are integrated.

Despite the so wide involvement of HEIs in the innovation promotion activities, there are several disconnects, which are worth to be mentioned:

- The technology curricula of most of HEIs, especially of state universities, are disconnected with needs of the industry, are commonly oriented on development of technical skills rather than development of innovative thinking and are fitted to available teaching resources rather than best teaching practices;
- The technology curricula usually do not cover development of managerial, business and entrepreneurial knowledge and skills and there is lack of communication/linkage between business and technology programs;
- The academic staff is rarely represented by the acting industry professionals and the technology curricula are taught by the academicians, poorly following the technology trends and industry demands.

National Centre for Educational Quality Enhancement (www.eqe.ge) is an agency under the Ministry of Education and Science, responsible for development of the educational standards, including qualifications standards. Several activities, intended to establish minimal standards for ICT education has been organized by the agency during the last decade, but without any outstanding visible results.

The hackathons events are a rapidly growing form of popularisation of innovation in youths in Georgia. Hackathons and similar events are usually organized/supported and hosted by GITA, HEIs, as well as by private and non-governmental sector. Despite the fact, that the events have not regular form so far, there are several events which are worth to be mentioned here:

- Upcoming Space Hackathon 2018 (ge.usembassy.gov/space-hackathon-registration-open-now-october-18);
- Upcoming Fishackathon Tbilisi 2018 - A Global Sustainability Hackathon (www.meetup.com/HackerNestTBS/events/242387421/);
- GARAGE48 TBILISI 2017 (www.hackathon.com/event/garage48-tbilisi-2017-33012689844)
- Garage48 "Gamification & Entertainment" Tbilisi 2017 (www.hackathon.com/event/garage48-gamification-entertainment-tbilisi-2017-40186112745);
- Bio-Hackathon Tbilisi 2017 (www.facebook.com/events/1105033179633916/, biohackathon.ge/);
- GDG Devfest Tbilisi 2017 (www.meetup.com/Google-Developer-Group-Tbilisi-GDG-Tbilisi/events/243482919/);
- hackTBILISI 2015 (2015f.hacktbilisi.com/en/);
- Garage48 Hardware & Arts hackathon Tbilisi 2015 (www.hackathon.com/event/garage48-hardware-arts-hackathon-tbilisi-2015-19799069550).

MOLDOVA

Good practices:

Association of Private ICT Companies (ATIC) in partnership with the Ministry of Youth and Sport, with the support of USAID, SIDA and Austrian Development agency launched the project "*Aleg cariera IT- I Am Selecting the Carrier in IT*" http://cariera.ict.md/ aimed to increase young people interest in IT. The best young entrepreneurs from start-ups and from different companies are interviewed telling their success stories and how the success was achieved. Example: http://unimedia.info/stiri/aleg-cariera-it--care-sunt-avantajele-alegerii-unei-facultati-in-domeniul-tic-79220.html

http://unimedia.info/stiri/aleg-cariera-it--anastasia-Sersun--software-developer-cel-mai-mult-ma-inspira-in-domeniul-it-faptul-ca-ma-simt-creator-137232.html

http://unimedia.info/stiri/aleg-cariera-it--care-sunt-avantajele-alegerii-unei-facultati-in-domeniul-tic-79220.html

A range of contests are being organised for young people. Examples: The Republican Contest "Best Innovating Student" (translation)

http://aitt.md/ro/press-release/comunicate-de-presa/cea-de-a-x-a-edi%C8%9Bie-a-concursului-republican-%E2%80%9Dcel-mai-bun-elev-inovator%E2%80%9D-a-avut-loc.html

The 10th edition of the Republican Contest "Best Innovating Student" took place on May 20, 2017 and brought together over 100 participants from 36 educational institutions representing 14 districts and municipalities. The anniversary competition of the most ingenious and young innovators in the country was hosted by the High School of the Academy of Sciences of Moldova.

The Best Innovation Idea- AITT Contest (translation)

On Thursday, June 15th, 2017 at the Small Hall of the Academy of Sciences (Ştefan cel Mare and Sfânt 1 there were presented the most original ideas in the 1st edition "The best innovation idea". The purpose of this contest was to support and promote the ideas of young people wishing to open their own business, as well as to identify the most viable business idea in the field of innovation. 32 ideas from young people who want to start or develop their own business in the following areas: Innovative materials, technologies and products; Information technologies; Energy efficiency and capitalisation of renewable energy sources; Biomedicine and Health; Biotechnologies and Food Industry.

http://aitt.md/ro/press-release/comunicate-de-presa/i-a-edi%C8%9Bie-a-concursului-%E2%80%9Dcea-mai-bun%C4%83-idee-inova%C8%9Bional%C4%83%E2%80%9D--a-avut-loc.html

IT practitioners are invited to participate in a workshop to develop a public service assessment tool provided by the National Social Insurance House (CNAS). The event is organised by the Moldovan Social Innovation Laboratory (MiLab) - a joint project of UNDP Moldova and the State Chancellery - in partnership with the National Association of ICT Companies and CNAS and will take place between 12 and 26 September 2017 (translation).

http://itmoldova.com/it-news-md/pnud-va-acorda-10-000-usd-pentru-o-aplicatie/

The Project *"Introducing Problem Based Learning in Moldova: Toward Enhancing Students' Competitiveness and Employability"* (PBLMD) http://www.pblmd.aau.dk/about-pblmd/

- a national, capacity building project that aims to improve quality of teaching and learning methodologies and higher education programmes in Moldova while enhancing their relevance for the labour market and disadvantaged groups in the society. The project also has a special mobility strand under which bachelor students and academic staff from Moldova are travelling to EU project partners for studying and training. The total budget of the project is €1,544,760, of which €657,275 is student and academic staff mobility.

Team leaders from the six partner universities: Aalborg University, Denmark, Technical University of Moldova, Cahul State University, State Medical and Pharmaceutics University "N. Testemiţanu ", State University of Moldova, Bălţi State University, Academy of Economic Study of Moldova announced the launch of 6 study programs, to the most demanded specialties, offered by universities in the Republic of Moldova to be implemented from 1 September 2017.

The Methodological Guide for Teachers "The Basics of Entrepreneurship" *(Șuleanschi, Sofia. Suport de curs la disciplina Bazele antreprenoriatului : Ghid metodic pentru profesori / Sofia Şuleanschi, Valentina Olaru, Daniela Pădure. – Chişinău : Garomont-Studio, 2013 . – 104 p.)*

http://ceda.md/wp-content/uploads/2015/02/GHID-METODOLOGIC-PENTRU-PROFESORI.pdf was prepared.

Examples of initiatives: http://trb.ro/lookit-instruire-domeniul-zona-rurala/

http://www.akademos.asm.md/files/Reteaua Look@IT – un potential mecanism de formare si dezvoltare a e-competenţelor elevilor si tinerilor.pdf

The Technical University in partnership with ATIC supported by USAID, SIDA, IBM, Microsoft, Orange, Moldcell, Starnet OM, Velopoint established the TEKWILL Excellence Centre- the hub

where people, community, ideas, resources, science and industry meet to identify, facilitate and enhance excellence in information technology- www.tekwill.md

Examples of Hackatons:

BEST Hackathon 2017

https://www.facebook.com/pg/BEST.Chisinau/events/?ref=page_internal

https://dezvoltare.md/garage48-chisinau-2017/

The experience of educational incubators is not a very positive one. With the exception of Inno-centre Incubator in Comrat, none of the incubators created by the higher education institutions managed to attract resident companies. (AGEPI Study).

Moreover, several Scientific-Technological Parks (Inagro, Micronanoteh) and Innovation Incubators (e.g., Inovatorul, Politehnica, Nord, IT4BA, Media Garage) did not reflect any results in the Reports for 2016 (*Source: Report on the activity and main scientific achievements in the sphere of Science and innovation in 2016 Academy of Science, p.144* http://www.asm.md/administrator/fisiere/rapoarte/f175.pdf*)*

UKRAINE

Current situation:

The new 2014 Ukrainian Law "On Higher Education" gave Ukrainian Universities more freedom in teaching programs' formulation.

Most of the Ukrainian Universities provide IT education, now it's very popular. But cooperation between innovation infrastructure organisations and HEI in development educational programs is still rather an exception than the rule.

Good practices:

One of them is cooperation between Lviv IT cluster and Lviv Polytechnic Institute who jointly developed and implemented new teaching program "Internet of things" in 2016; specialists from IT businesses were involved in teaching this course. This year Lviv National University also jointed the initiative and jointly with Lviv IT cluster developed new teaching program "Data Science&Intelligent Systems". This course includes 4 parts: Machine Learning&Artificial Intelligence, Data Analysis, Internet of Things and Smart Solutions&Intelligent Systems.

http://itcluster.lviv.ua/new-educational-programs-launch-at-ivan-franko-national-university-of-lviv/

https://ain.ua/2017/07/14/stvoryuvati-novi-osvitni-it-programi

https://life.pravda.com.ua/columns/2017/04/19/223730/

There are a lot of hackathons and other match-making events not only in Kyiv but also in Kharkiv and Lviv as well.

Examples:

https://dou.ua/calendar/16799/?from=similar_events

http://blockchainua-hackathon.com/

https://dou.ua/calendar/16761/?from=similar_events

http://klitschkofoundation.org/en/projects/science/falling-walls-lab-kyiv/

https://www.facebook.com/events/316498488706703/

http://nure.ua/all_news/xnure-predlagaet-posorevnovatsya-v-formate-hackathon-it-eureka-2017/

http://it-kharkiv.com/ru/events/it-eureka-ukraine-hackathon/

Also, there are a lot of IT courses in all Ukrainian cities suited for different levels of users (different levels of knowledge).

The situation with entrepreneurial education is not very optimistic. There is a gap between teaching programs and skills needed in practice. Although most Ukrainian universities (even Technical) have Economic and Business Departments they provide mostly theoretical

knowledge that could be hardly implemented in business processes. But there are also good examples of modern business education in Ukraine (MBA)

Top Ukrainian MBA schools http://mbafield.com.ua/ua/mba-schools

http://forbes.net.ua/ua/business/1369858-mva-po-ukrayinski-zirkova-chetvirka-biznes-shkil

We also have number of start-up schools

Examples:

http:// start-upukraine.com/

http://kpi.ua/ start-up-school ; http:// start-up-kpi.blogspot.com/

http://lp.edu.ua/lviv-tech-school

http:// start-up.lviv.ua/contacts/

http://sumdu.edu.ua/int/en/news/1110-ssu-will-open- start-up-school-according-to-sikorsky-challenge-methodology.html

https://www. start-upschool.org/about

Recommendations:

- Teaching programs should be developed based on entrepreneurs needs identified through different surveys; it will allow to fill the gap between specialists graduated from HEI and specialists needed by SMEs, start-ups and economy as a whole
- Universities should involve successful businessmen for teaching; they can share their success stories and increase creativeness and entrepreneurial skills of students
- Teaching programs should be developed jointly with innovation infrastructure organisations, business associations etc.

An important issue is that the teachers are left behind current trends and IT innovations. One of the solutions to this issue is to invite leading technical IT professionals to teach special courses.

For start-ups development, it is necessary to develop the services of university mentors

Technologies

ARMENIA

Current situation:

Mobile penetration is quite impressive: mobile network coverage includes 100% of population which ranks Armenia among the first countries in the world, and mobile phone subscriptions stand at 112.4% of the population. PC and internet penetration is much lower. According to the 2016 Digital Yearbook, 70% of individuals use internet in Armenia, 40.1% of households have PCs and 35.6% have access to internet. The level of individual usage is significantly lower in rural areas due to underdeveloped infrastructure (fixed broadband is mostly available in cities) and lower incomes as compared to the urban population.

Source: “European Union joint analysis of the situation in Armenia” report, 2016.

The latest technologies of Armenian universities are very often outdated from global analogues, so such showcases are organised very rare.

There are few organisations in the field who try to find technologies which can be commercialised however the success rate is very low.

There are 2-3 times annually different conferences and seminars focusing on IP in ICT, which usually are being attend by 50-100 people.

Standardisation in ICT is weaker than IP consulting, if not considering multinationals.

AZERBAIJAN

After the oil sector, the telecommunications industry is the largest sector in Azerbaijan, and a major contributor to the country's economy. Government-owned Aztelekom has been the country's main telecom service provider, being directly controlled by the Ministry of Communications and High Technologies (MCHT). In 2017 AzTelekom revealed plans to introduce fibre-to-the-home (FTTH) broadband in an upgrade to its existing ADSL network.

Azerbaijan's fixed-line network provides good national coverage and subscriber numbers were expanding at a modest rate up to 2014. However, by during 2015, 2016 and 2017 growth had flattened. Just over 80% of fixed lines are in urban areas, despite 50% of the population living in rural areas.

The mobile market in Azerbaijan has seen moderate growth over the past few years. Market penetration has increased from 107% in 2013, to over 110% by 2017. Further moderate growth is predicted over the next five years to 2021.

There are four major mobile operators in the Azerbaijan market. Azercell dominates the market. Bakcell and Azerofon account for the majority of the remainder of the market.

Internet user penetration reached nearly 80% by 2016. Broadband now has a significant presence in the market with over 90% of fixed internet services being broadband by 2017.

The fixed broadband market has seen moderate growth over the past few years. Fixed broadband penetration has increased significantly from 2009 onwards. Moderate growth is predicted over the next five years to 2021.

https://finance.yahoo.com/news/azerbaijan-telecoms-mobile-broadband-statistics-143000398.html

BELARUS

1. **Decree No. 8 "On the development of the digital economy" was signed in Belarus on December 22, 2017.**

http://president.gov.by/ru/official_documents_ru/view/dekret-8-ot-21-dekabrja-2017-g-17716/

The Digital Economy Development Ordinance has enabled Favourable effect of Digital Economy Development :

- The removal of bureaucratic obstacles for the Hi-Tech Park resident companies, which hindered full-fledged development of product models in IT and opens up new opportunities for small companies and start-ups, which have now an opportunity to design and develop product models.
- There are five various types of specialists per one programmer in the product business model supported by the ordinance: business analysts, designers, marketing specialists, translators, and others. This means that IT generates additional non-IT jobs.
- The decree will allow creating more jobs and relocating back to Belarus the business operations, which have been placed in other jurisdictions up till now.
- The document is meant to enable the conditions to encourage international IT companies to tap into Belarus, open here branch offices, and make IT products which are highly sought after in the world. It makes Belarusian economy more attractive for large investments.
- The ordinance is aimed at investment in the future: IT specialists and education. Resident companies of the Hi-Tech Park can now aid educational institutions in any way, including with direct grants for students and professors.
- The procedure of hiring foreign highly-qualified specialists is also simplified. Job permits are no longer required. Temporary registration has been simplified. Foreign workers and founders of the HTP resident companies no longer need visas.
- The ordinance is designed to introduce cutting-edge financial instruments and technologies, including those to provide more favourable conditions for applying the blockchain technology.
  Actually, the ordinance does not recognize cryptocurrencies as a means of payment in Belarus, but mentions mining as an important part of the blockchain technology. Individuals and the Hi- The Ordinance also legalizes the creation, mining, storing, and acquisition of tokens. These activities are exempt from taxes till 2023.

2. In accordance with the report published by Broadband Commission for Sustainable Development “Broadband Status: Broadband for Sustainable Development, at 2017 year the Republic of Belarus was ranked 29th out of 148 countries according to the ranking of percentage of households connected to the Internet. As for the index "the number of wireless broadband access subscribers per 100 inhabitants" Belarus took the 58th position among 196 countries.

According to the latest data, as for the index "the number of fixed broadband access subscribers per 100 inhabitants", the Republic of Belarus is ranked the 21st out of 196 countries, in 2015 it was ranked 23rd.

3. In December 2017 at the II Congress of Scientists of Belarus the draft of the Strategy "Science and Technology: 2018-2040" was approved. Taking into account global trends, among priority directions of scientific and technological development of the IT industry and digital economy of the Republic of Belarus were identified:

- processing of large data (Big Data), including on the basis of cloud technologies;
- intellectual information systems;
- machine learning and human-machine interaction;
- quantum and optical technologies;
- creation of digital productions, including on the basis of additive technologies;

- mechatronic systems and robotic complexes;
- ensuring cybersecurity.

4. The Belarusian-Korean Centre of cooperation in information technologies has been open in Minsk. In 2017 within work of the Centre different projects on development of system of paperless trade, transfer to an electronic type of archival documents and accumulation of competences of the sphere of information security are complete. All these projects were realized at the cooperation with Korean IT companies: KINY&Partners, KTNET and Ahnlab.

5. A large-scale fundamental digital economy development ordinance was signed on 22 December 2017. The document is mainly designed to create the conditions for international IT companies to tap into Belarus, open branch offices and R&D centres in the country and make products which are highly sought after in the world. The ordinance is aimed at investment in the future: IT specialists and education. One of main goals is to introduce cutting-edge financial instruments and technologies. The document will produce a powerful positive effect not only on the IT sector but also on the whole Belarusian economy and will turn Belarus into one of the most comfortable places for IT business.

6. At 2017, the Telecommunication infrastructure company SOOO Belarusian Cloud Technologies (beCloud) presented its two key cloud computing projects — the Republican Data Processing Centre and the Republican Cloud Platform.

BeCloud data centre is the biggest data processing centre in Belarus and one of the most up-to-date in Eastern Europe. The centre's cloud platform is now available to the governmental and private institutions in test mode. The national cloud platform will help both the state and the private sector to cut down on IT expenses. The data centre has been designed and built in compliance with the international standards Tier III Design and Tier III Facility. This is Belarus' first and only data processing centre to pass this level of certification, which testifies to the centre's extreme reliability and safety as high as 99.982%.

The potential clients and partners include state-run enterprises and institutions as well as private companies. All the Belarusian government agencies will start using beCloud's cloud computing platform by late 2018.

7. Belarus came to the 39th place in the rating of the Global index of cyber security according to the published report of the International Telecommunication Union (ITU), having outstripped a number of the European states, and came to the 3rd place in the region of the CIS.

GEORGIA

The Ilia State University manages the Technology Commercialization Office (iliauni.edu.ge/en/iliauni/proeqtebi/teqnologiebis-komercializaciis-ofisi-tco), established in 2012 with support of Sakpatenti (www.sakpatenti.org.ge). Technology Commercialization Office (TCO) is positioned as a "management and commercialization centre of Intellectual Property created in the field of science and is one of the leading universities in Georgia. TCO's aim is to develop communication process between research institutes and commercial companies by linking scientific innovations to market demand and providing a source of additional income for further research and development". However, the services of TCO still are not fully adequate and the centre shows no particular results.

Sakpatenti is in charge of elaboration of intellectual property (IP) policy and legislations, as well as registration of IP rights. Sakpatenti contributes for implementation of the innovation strategy

by providing consultancy support to tech start-ups (jointly with GITA), as well as delivering of educational activities in the IP area.

According to Assessment Report "Research & Development Projects of Georgia" as of October 30, 2015, Prepared by Capital City Venture, the biotechnologies is evaluated as a technology, well developed in Georgia and having the highest potential for commercialization. G. Eliava Institute of Bacteriophages, Microbiology and Virology (www.eliava-institute.org) has a leading position here. Although the organization has not formally established technology transfer and commercialization structure, it informally coordinates activities in the area and assists both researchers and businesses to enable transfer and commercialization of technology.

However, it should be mentioned, that the research/academic community is quite closed in Georgia (the share of innovative technology is presented/shared in the format of scientific conference, workshops and etc.) and commonly disconnected with the business. There is not regular facilities, events or channels of communication between scientific and business communities. The matching is commonly organized through direct contacts.

GITA in close collaboration with the Georgian National Academy of Science, NAS (www.science.org.ge) plans of establishment of the National Technology Transfer Centre (TTC), which will aim to commercialize R&D projects from universities and research institutes. This centre will provide assistance to commercialize ready to market solutions/products either by licensing deals or by creating start-up (spin-off) companies. Before launching the program, it is necessary to do a pilot project to conduct a study of local universities' and institutes' projects with further global or local commercialization potential.

In addition, in area of ICT technologies, GITA, in collaboration with large technology vendors (Intek, MS, HP, CISCO, Samsung) organizes events to showcase the latest technologies to existing enterprises and start-ups.

On the private consultancy level, there are some presence of consulting and law companies, providing legal and organization support in area of IP rights, technology transfer and technology commercialization. However, the most of services are based on commercial interests.

MOLDOVA

Current situation:

The Research and Development ICT based infrastructure in academic institutions is mainly outdated and hardly may be shared for showcase of the latest technologies to existing enterprises and start-ups.

Good practices:

According to http://utm.md/blog/2017/07/26/20-de-proiecte-majore-la-utm/ the Technical University of Moldova launches 20 major projects to be completed between 1 September 2017 and 30 June 2018.

Siemens Automation Laboratory with state-of-the-art technology, equipped by Siemens, the world leader in industrial automation.

Equipment value: 250 000 lei

Tolerance and Dimensional Control Laboratory, equipped with state-of-the-art equipment, donated by the Mitutoyo Japanese corporation, world leader in measurement, metrology and quality assurance in the automotive and automotive industry.

Equipment value: 300,000 lei

Launch of a co-working space and manufacturing MAKER SPACE on 900 square meters, endowed with the TEKWILL Training and Innovation Centre, which will offer prototyping, modelling and manufacturing capabilities, equipped with state-of-the-art industrial equipment for processing materials (wood, metals, plastic) 3D printers and IoT solutions. Implemented through the Moldova Competitiveness Project, funded by USAID and the Swedish Government.

Equipment value: 3.9 million lei

The relocation of the Moldova Pavilion from WorldExpo Milan-2015 (the Milan cube) to Râşcani campus of UTM, with its use in didactic and exhibition activities.

The "Game development and computerised graphics" laboratory, equipped with Apple iMac performance graphics stations, will be complemented with virtual and augmented reality equipment.

Equipment value: 850 000 lei

Internet of Things (IoT) lab for designing and creating remote monitoring and remote monitoring systems for various processes. Implemented through Moldova's Competitiveness Project, funded by USAID and the Government of Sweden.

Equipment value: 147 000 lei

Laboratory of Measurements, Transducers and Drives, for the study of basic concepts on electrical measurements, transducers, execution elements and acquisition of data in automated, mechatronic and robotic systems. Funded by the Moldova Competitiveness Project, financed by USAID and the Government of Sweden.

Equipment value: RON 1.2 million

Robotic Industrial Laboratory, dedicated to the study of devices and components of robotic and mechatronic systems, development of applications of robotic systems, elaboration of artificial intelligence algorithms. Funded by the Moldova Competitiveness Project, financed by USAID and the Government of Sweden.

Equipment value: 230,000 lei

Consolidation and extension of joint projects by the Faculty of Textile and Polygraphy and the Centre of Excellence in Design "ZIPHOUSE" with Milan's fashion design schools.

Value: 420,000 lei

BitDefender Anti-Malware and Anti-Virus Lab, which joins NATO's information security laboratory at the CyberSecurity UTM Centre.

Value: 1 million lei

Network Security Laboratory provided by NEC Corp. and CISCO Systems, dedicated to the study of security of information and telecommunication systems.

Value: 630 000 lei

Strengthening the capabilities of the National Centre for Biomedical Engineering with modern devices, electronic measuring equipment and devices, technological laboratories, electronic microscopes, microprocessor systems, reconfigurable devices.

Purchase value: 2.7 million lei

Providing necessary equipment to the National Centre for Nuclear Safety of the Technical University of Moldova.

Value of purchases: 540,000 lei

Developing the teaching and scientific laboratories of the NIBM Centre "Microelectronics and Nanotechnologies" and "Microelectronic Systems Engineering".

Value of purchases: 1.5 million lei

Laboratories equipped with experimental stands and modern equipment produced by the German company G.U.N.T. For the Faculty of Power Engineering and Electrical Engineering.

Equipment value: 3.2 million lei

Completion of the endowment of the laboratories of the Faculty of Food Technology, financed by the European Investment Bank (totalling 3 years - 1.8 million euros)

Equipment value: 4.2 million lei

Courses CISCO

The integration of the CISCO Core Business Information Technology Core Curriculum at all faculties of TUM, the Teachers' Training Teachers Training Centre being taught at the ICT's Teacher Training Centre. Subsequently, the respective teachers will provide Cisco Systems licensed courses to students of the Technical University of Moldova.

Redesigning the Modelling and Computerized Laboratory of the Industrial and Product Design Department with Apple iMac, All-In-One Graphics Stations and WACOM Graphics Tablets.

Equipment value: 360 000 lei

Launch of an innovative space with 4 "Future classroom" technology studios, which will offer students and teachers the opportunity to experience new approaches

The most ingenious and original innovations, ready to be implemented in the most diverse fields, have been varnished by the students of the Technical University of Moldova at the traditional Exhibition "Creation opens the Universe".

Representing a maturity examination for students, master students and PhD students who have the opportunity to portray their creations and inventions to the general public, the exhibition included interior, industrial, clothing and print design works, architecture and energy, machine building and Mechanics, ICT and bioenergy, radio and telecommunication, civil engineering and transport, food technologies and environmental protection, etc.

http://diez.md/2017/05/07/foto-studentii-de-la-utm-au-prezentat-cele-mai-ingenioase-inovatii-cadrul-unei-expozitiei/

UKRAINE

Current situation:

Weak links between science and industry is the serious problem in Ukraine. Links existed in the Soviet time were destroyed, and new links were not created. There is a gap between developments provided by Ukrainian science and Ukrainian industry needs.

From the one hand industry is not aware of such developments, from the other - scientists lack of knowledge to commercialise their R&D. Creation of technology transfer offices in universities and research institutes is a step forward in filling the gap, but there is a long way ahead.

Good practices:

Rare examples of platforms (activities) to fill the gap can be found, e.g. AgTech Forum, where new high technologies for agribusiness are provided (https://agtech.com.ua/forum/) .

We have good examples of spin-offs, but not so much.

At the same time the number of incubators and accelerators is increasing, it should help “to grow up” promising technologies.

There are also a number of events in Ukraine (mostly in Kyiv, Kharkiv and Lviv) aimed to present (for HEI and research institutes) and to find (for business) appropriate technologies.

Examples:

http://innovationmarket.com.ua/en/

http://sbi-forum.org.ua/

http://dni-nauky.in.ua/#about

http://festival.nas.gov.ua/announce/open/39
http://new.nas.gov.ua/UA/Messages/Announcements/Pages/View.aspx?MessageID=3151

http://rada.gov.ua/news/Novyny/131734.html

HEI

http://kpi.ua/1103-4

https://nubip.edu.ua/node/15746

http://iii.ua/ru/news/krashchi-z-ukrayinskih-vinahodiv-ta-rozrobok-otrimali-viznannya-v-mizhnarodniy-den-iv

The typical situation is when universities simply offer a list of their development results, which are often prototypes (TRL 6), and very rarely universities offers technologies that business can use.

Office premises

ARMENIA

Current situation:

No spaces with rental cost lower than market prices. However, there are about 5-6 co-working places, but only 2-3 are popular ones.

GEORGIA

First of all, the public premises, managed by GITA (Technoparks in Tbilisi and Zugdidi), regional innovation centres, all Fablabs and iLabs, as well as premises of iHUB Tbilisi, (ihub.world/en/tbilisi-en/) and Impact Hub Tbilisi (tbilisi.impacthub.net), all enable the free of charge co-working space for start-ups. Additionally, the premises of infrastructure, owned by the universities, are available for students for free. For example, the newly established hi-tech park "Silicon Valley", managed by the Business and Technology University (btu.ge/en/about-us) offers students and tech start-ups free co-working facilities. The Innovation Centre – start-up Factory, hosted by the University of Georgia (start-upfactory.ge), offers similar facilities both for free and on commercial basis.

Additionally, there are several facilities, providing co-working and/or office space on commercial basis, and this infrastructure become more and more popular. Among such facilities, the most popular are:

- Fabrika Tbilisi (www.fabrikatbilisi.com);
- Vere Loft (www.vereloft.ge);
- Regus www.regus.com.ge;

The last (Regus) is a franchise of the international network of similar facilities (www.regus.com), with the membership, valid at any partner facility worldwide.

Additionally, the Mediatheka (www.mediatheka.ge), owned and managed by the Municipality of Tbilisi, provides co-working space at three locations. The Generator 9.8 (www.facebook.com/Generator9.8Geo/) is a social-café-style co-working space, located on the premises of one of the branches of the Mediateka, which positions itself as a space, where the ideas can be shared and put into practice.

However, it should be noted, that the mentioned infrastructure is mainly available in the capital city of Georgia, as well as in some large urban areas of Georgia. The availability of such spaces in regions is limited – only three Innovation Centres, established with support of GITA are

currently available. GITA plans to enhance the network of regional Innovation Centres across the country in order to enable availability of such infrastructure in regions.

Additionally, based on MoUs (Memorandums of Understanding) GITA enables access the infrastructure of partner networks, such as Mektory, Tallinn Institute of Technology, Estonia (www.ttu.ee/mektory-eng), Yazd Science and Technology Park, Iran (en.ystp.ac.ir), and Qatar Science and Technology Park (qstp.org.qa).

MOLDOVA

Good practices:

The main provider of office premises is recently established (2016) IT Excellence Centre Tekwill.

https://www.tekwill.md/about

Besides, several scientific-technological parks, Innovation Incubators, Universities, and other stakeholders are offering office premises.

https://hub.md/

http://www.ihub.com.ua/en/chisinau-en

https://www.404.md/

UKRAINE

Current situation:

The procedure for renting state-owned premises is long and bureaucratic. The agreement is concluded with the state property fund, and it is also necessary to obtain a permit from the Ministry. A university does not have the right to independently establish the rent for the premises, the cost of the lease is calculated according to a special procedure, which is determined by the Cabinet of Ministers.

Good practices:

The number of co-working spaces is increasing, they became really popular, some of them are just co-working spaces, some of them are the part of new innovation eco-system (e.g. http://unit.city/, https://www.creativequarter.net/main)

Production & R&D facilities

ARMENIA

Good practices:

Production and R&D facilities usually are connected to a good broadband internet connection and have other necessary equipment for a productive work.

AZERBAIJAN

Good practice:

UNEC TECHNOLOGY TRANSFER CENTRE

The main goal of establishment Technology Transfer Centre is the development of innovation activity of UNEC and other universities, establishment of mutual relations between university and business bodies and ensuring transfer of results achieved from scientific-research works conducted by the university employees. It is planned to create relations with global business atmosphere of TTC in order contribute to the innovation development of economy through attracting modern technology and knowledge to Azerbaijan.

The activity of Technology Transfer Centre of UNEC will be improved in two directions: Inside University and on the country's level.

TTC will implement the activation of intellectual creative activity by university staff, evaluation and legal protection of mental activity, including consulting, patent and support to patent research works; ensuring transfer of knowledge and technology among universities of the country and legal clearance (licensing agreements etc), staff training for scientific-technological entrepreneurship activity and requalification, also will carry out other duties.

BP, ADA UNIVERSITY CREATE BIG DATA RESEARCH CENTER

BP Azerbaijan reports that the Big Data Centre was established at the Azerbaijan Diplomatic Academy – the ADA University.

"BP and its partners have launched the first Big Data Research Centre in Azerbaijan. The project, which started last year, is part of BP's and its co-ventures' commitment to supporting the development of education and capacity-building in the country," the Company said.

The Centre is based in Baku's ADA University where a new Master's Degree programme in Big Data Analytics and Data Sciences will commence to help meet the country's needs for data scientists and big data analysts. The Centre will also have a wider impact - it will be open to public institutions and private sector representatives providing them access to its resources.

Addressing the event which marked the opening of the Centre, Prof. Hafiz Pashayev, Rector of the ADA University, said: "The establishment of the Centre is very important to the entire academic community in the country.

Gary Jones, BP's Regional President for Azerbaijan, Georgia and Turkey, said that the new centre will boost the development of qualified data scientists, data and information engineers and big data analytics professionals for the country.

Over the past year a library on data analytics has been established, all equipment and resources including hardware and software and 30 workstations have been installed, staff have been trained and the Centre is now ready to start functioning.

The one year USD 410,000 worth project started in October 2016 and is implemented by the ADA University.

http://abc.az/en/news/3493

http://www.euronews.com/2017/12/14/bakutel-azerbaijan-wants-to-become-an-ict-hub

Azerbaijan's International Telecommunications and IT fair: a regional ICT platform.

Virtual and Augmented Reality were the stars of 2017 year's edition of Bakutel, Azerbaijan's International Telecommunication and Information Technologies Exhibition.

Virtual reality #VR highlights the 23rd edition of # bakutel #azerbaijan.

One of the trends this year was the combination of the two technologies for applications in fields ranging from art to medicine.

One stand featured connected surgical glasses help surgeons better visualise the features of a patient's face during an operation.

"The general concept of this project is to combine the virtual anatomy of each patient with the real anatomy of the patient who will be operated. During surgery, if you are wearing these glasses, you can see the internal anatomy of the patient – it's like looking through the skin of the face, you can see the facial skeleton, the muscles, the nerves, the vessels and so on."
Ismayil Ferzeliyev, doctor, Azerbaijan Medical University

Virtual Reality is still a key element in the gaming world, but the field of application of this technology is growing fast.

"This platform that you see is not only for gaming. A lot of countries use it in medicine. Our company has started to develop some platforms especially for medicine, for trainings – for example fire trainings."
Aygun Hasanova, spokeswoman, Phobia VR

Bakutel is a unique platform for professionals in the ICT field to meet. This edition brought together more than 190 companies from 20 countries.

It's an opportunity for start-ups to present their projects to potential investors, like the 'Wand' smart pen.

"'Wand' is an electronic device that sends every scratch you made on the paper via Bluetooth to your smartphone's application. After you have written on the paper the ink evaporates after 30 minutes but during this time your data has been safely saved on our servers in our software application."
Elchin Aghazade, 'Wand' project manager.

http://www.ameaytp.az/content.aspx?id=2

BELARUS

The «Digital Economy Development Ordinance» allows residents of Belarus' Hi-Tech Park to perform more business activities. It allows sealing deals in a digital form and expands ways of monetizing applications.

GEORGIA

Public/Open Infrastructure:

Technoparks in Tbilisi and Zugdidi, as well as 22 Fablabs, start-up Factory (www. start-upfactory.ge), and "Silicon Valley" high-tech park (www.btu.ge) provide facilities, equipped with digital technologies, tools and equipment, enable for developing virtual and/or physical prototypes of new products, as well as for pilot/beta testing of product and process prototypes.

There is no openly available production infrastructure, specialized for products and services with significant digital component (powerful water and electricity supply, broadband Internet connection, data centre and special cloud computing facilities etc.)

Scientific Infrastructure:

The R&D infrastructure is available at scientific-research institutions, but those facilities are not publicly available. Information on actual capability of the R&D infrastructure in not available in open sources. However, the scientific infrastructure is important to be mentioned here.

In last decade around 100 research institutes (more than half of which belonged to the National Academy of Science, NAS (www. science.org.ge) became independent entities with a legal status of legal entities under the public law (LEPL). Today, more than 80% of institutions are under the auspices of public universities, some of them merged and established research centres, a few institutes have kept their independent status, and others were closed down. Nowadays, scientific research in Georgia is conducted by 31 public and private universities and several institutes acting independently as LEPLs (please, follow the link http://mes.gov.ge/content.php?id=599&lang=eng to find the list of scientific-research institutions). Besides, some private institutes are focused on applied/project-oriented activities. Since 2011 a major part of research institutes (around 50) have been integrated into the main seven public universities. In the context of the innovation R&D infrastructure and potential, the following organizations should be mentioned:

- Georgian Academy of Agricultural Sciences (www.gaas.dsl.ge)
- G. Eliava Institute of Bacteriophages, Microbiology and Virology (www.eliava-institute.org);
- Ivane Beritashvili Centre of Experimental Biomedicine (www.lifescience.org.ge)
- Andronikashvili Institute of Physics (www.aiphysics.tsu.ge)
- High Energy Physics Institute (www.hepi.edu.ge).

One more important player in the innovation ecosystem is the State Military Scientific-Technical Centre Delta (www.delta.gov.ge), controlled by the Ministry of Defence. STC Delta is engaged in Defence Industry and provides technical support for Georgian Armed Forces. One of the main tasks of the centre is design-implementation in production up-to-date and innovative military technology. The company owns extensive R&D and production infrastructure inside the enterprise. Additionally, Delta ensures the state control of six scientific-research institutes (www.delta.gov.ge/en/institute):

- F. Tavadze Metallurgy and Material Science Institute
- Micro and Nanoelectronics Institute
- Ilia Vekua Sukhumi Institute of Physics and Technology (SIPT)

- R. Dvali Institute of Machine Mechanics
- Scientific Research Institute Optica
- G.Tsulikidze Mining Institute

Private infrastructure:

It should be highlighted, that most of the R&D in Georgia is conducted by research institutes and universities. Unfortunately, private sector innovation is not well developed and is detached from academia. Companies lack needed know-hows and capacity to conduct the innovations. In the area of ICT, most of IT companies relay on existing innovation and provide products, based on the technologies, enabled by large vendors. Important exceptional case is AzRy LLC (www.azry.com) – one of the leaders of IT industry in Georgia, providing both customized software development and embedded systems engineering services. The last area includes extensive R&D effort in the field of microcircuits and chips.

MOLDOVA

Current situation:

The Academy of Science ICT based R&D research infrastructure mainly is outdated and is in the process of modernisation. Weak links between science and industry persists and a there is a serious gap between developments provided by science and industry needs.

Good practices:

In October 2016, the Science to Business Platform (S2B) was launched at the Academy of Sciences of Moldova, with the expectation to establish an efficient way of communication and cooperation between the scientific and business environment in order to intensify the partnership of the two environments and identifying clear mechanisms and ways of collaborating between the scientific and the entrepreneurial environment:

http://aitt.md/ro/press-release/comunicate-de-presa/evenimentul-de-deschidere-a-platofmei-science-to-business-a-avut-loc.html

The Tekwill Centre which is already functioning has powerful water and electricity supply, broadband Internet connection is now in the process of equipping with necessary ICT based tools to ensure facilities (laboratory etc) for developing virtual and physical prototypes of new products with significant digital component. The first IoT Laboratory was launched in July 2017: http://itmoldova.com/it-news-md/primul-laborator-internet-things-iot-lab-din-moldova-lansat-oficial/
The Technical University of Moldova developed and approved a set of projects on implementation of modern digital technologies:

http://utm.md/blog/2017/07/26/20-de-proiecte-majore-la-utm/

Lack of facilities for pilot/beta testing of product and process prototypes (including both testing for complex technical characteristics and the testing community of educated experts and customers)

UKRAINE

Current situation:

Outdated equipment is really serious problem for the most Ukrainian R&D institutions. Purchase of equipment is not possible in the framework of majority of national grants and programs (it's not allowed due to budget restrictions from the one hand, and it's not possible because of the high price that could not be covered by small amounts of grants).

Good practices:

Supercomputer is operating in the Institute of Cybernetics and it can be used by business if needed.

There is a possibility to work in foreign labs in the framework of international grants and programs (According to the new Law of Ukraine "On science and scientific and technological activities" Ukrainian scientists got the opportunity to spend several months abroad performing research and to save the working place during this time. Before it was really problematic).

Nevertheless, few fablabs are operating in Ukraine and could be used privately to develop prototypes.

Finance

Access to public support (regional/national programmes, innovation vouchers, etc.)

ARMENIA

Good practices:

Competitive Innovation Fund has been established within the framework of the WB Second Education Quality and Relevance Project (2010-2015). Grants have been provided to 10 HEIs, up to USD 600 thousand aimed at triggering innovations.

The first venture fund – Granatus Ventures – was set up on a public-private match funding basis in 2013 with initial funding budget of USD 6 million. It targets seed stage, start-up and spin-off investments in the range between USD 50 thousand and one million on a working prototype or beta version in knowledge-intensive and high-tech sectors.

The Science and Technology Entrepreneurship Programme (STEP), run by Enterprise Incubation Foundation (EIF), the RA Government and US Civilian Research and Development Foundation, provides grants through "From Idea to Market" competition. start-up Cup (official partner of US State Department's Global Entrepreneurship Programme) has been introduced in Armenia since 2012. Microsoft Innovation Centre in Armenia runs several competitions. Armrobotics competition aimed on Armenian Robotics Development is organised by the Union of Information Technology Enterprises. The Social Innovation Camp is organised by Eurasia Partnership Foundation and UNDP. On its basis, UNDP with EU financial support has launched a social venture incubator (Kolba Lab).

STEP and Innovation Matching grants (IMG) are currently provided to start-ups within EU SME Development in Armenia project implemented by GIZ in partnership with EIF.

The law on IT State Support provides tax benefits to information technologies innovation start-up companies for 5 years.

AZERBAIJAN

Good practice:

In 2016, Azerbaijan started to implement venture capital funds which are aimed at support of the IT- entrepreneurship development.

Addressing the conference held in ADA University Elmir Valisade, Deputy Minister of Communications and High Technologies said that all necessary conditions for the development of innovative entrepreneurship and start-ups had been created in the country. Problems such as bureaucracy, lack of access to funds occurring formerly were excluded, all these procedures had been simplified.

Particularly State Fund for the development of information technologies renders all necessary assistance for the development of start-ups. Resources of the Fund are directed to financing the projects and competition on the priority areas for the development of the information and communication technologies sector.

“All these are obvious examples of the creation of all necessary conditions for the development of IT entrepreneurship,” Valisade said.

Deputy Minister mentioned that for the past 10 years the country faced strong potential in human resources, laid down several industry-specific companies, which currently implement most of the projects realised in different spheres.

Valisade also mentioned that Azerbaijan is currently working on the preparation of legislative base for the formation of venture capital financing. The government has already created certain conditions and is currently developing new bills for further development in this sphere. “Initiatives taken by the ministry are currently under consideration in other governmental institutions,” the deputy minister said.

Previously, it was offered to use the resources of the Pension Fund and insurance market as the source of funding for start-up projects. The practice is widely used in Western countries, pension funds actively participate and bear responsibility for the investment process of innovative projects. International experience makes it obvious that venture capital financing is of great importance for the development of internet-business and start-ups. Experts say that the governmental support, strengthening of cooperation with international funds as well as aide of “business angels” (entrepreneurs who provide capital) are among the most important factors for the accomplishments in the sphere. The absence of risk insurance in the country is one of the main obstacles for the activities in this direction.

High Technologies Park which is the basic project of Azerbaijan’s high tech economic development also promotes creation of venture funds for the support of IT entrepreneurship.

“Formation of venture capital funds may become a connective link between local and foreign projects and trigger further development in this sphere,” Seymur Agayev, CEO of High Tech Park Azerbaijan told Trend.

The Azerbaijani government continuously works in order to foster the high-tech economy in the country by providing a business-friendly environment composed of brand-new facilities, economic incentives, and business services.

GEORGIA

There are four key state players, enabling financial sourcing of the innovative infrastructure:

- Shota Rustaveli National Science Foundation (www.rustaveli.org.ge) under the Ministry of Education and Science (www.mes.gov.ge);
- GITA (www.gita.gov.ge) under the Ministry of Economy and Sustainable Development (www.economy.ge);
- Entrepreneurship Development Agency (Enterprise Georgia, www.enterprisegeorgia.gov.ge), also under the Ministry of Economy and Sustainable Development; and
- Partnership Fund (www.fund.ge), in line with its subsidiary start-up Georgia LLC.

When the Ministry of Education and Science provides basic funding, while GITA, Shota Rustaveli foundation and Partnership fund provide competitive funding.

In 2016, Ministry of Education provided funding for around 10 million EUR to research and innovation system. Most of the funding of the Ministry of Education was directed to support universities, while the other 2 top recipients where impendent research institutes and National Academy of Sciences.

Shota Rustaveli National Science Foundation, provides competitive funding, via competitive grants. In 2016, the lion share (75%) of funding was allocated to science and research funding, which supported applied research, and fundamental research. Other top recipients of funding are infrastructure building, and support to young scientists.

On the other hand, **GITA** focuses not on the research institutes but on the researchers, and innovative companies. Its budget grew gradually from 1.7 million EUR in 2014, to 2.7 million EUR million 2016.

Another notable body is the JSC **Partnership Fund (PF)**, established in 2011. The fund is a 100% state-owned investment fund and is positioned as a private equity and venture capital arm of Georgian government, providing direct and fund of fund investments. Formally positioned as a management agency of state-owned enterprises, the fund additionally provides direct financing by buying equity (both from start-ups and later stage companies), and by providing mezzanine loans and guarantees. In 2016, the Partnership Fund established a subsidiary fund – the **start-up Georgia LLC**, which is positioned as a venture fund with mandated to invest in innovative Georgian start-ups by providing equity investment and grant financing to start-up companies at their early stage of development.

Enterprise Georgia is mainly oriented on supporting of traditional businesses (both start-ups and established), having high export potential. However, the Enterprise Georgia is an important source of co-financing for businesses, which are established under several states and privately financed hi-tech start-up support programs, and which are already successfully operating.

GITA and Partnership Fund jointly are managed the governmental start-up support program **start-up Georgia** (www. start-up.gov.ge). Under the umbrella of the program, the support is divided into two parts:

(1) Partnership Fund finances directly innovative start-ups for the local market;
(2) GITA finances high-tech globally scalable start-up projects.

The source of financing is the budget, allocated by the Supervisory Board of the Partnership Fund for investment in the program as well as other private or donors' funds, mobilized by the fund and/or GITA. Total amount of funds already allocated is GEL 11 million, however plans to increase investments up to GEL 35 million. In total, 90 companies were financed in both components in 2016-2017 and 20 projects received additional venture financing of up to GEL 100,000 with a 5% equity composition.

GITA additionally accumulates finds from difference sources, other than state budget. These sources are:

- World Bank's Georgia National Innovation Ecosystem (GENIE) Project;
- EEN (European Enterprise Network); and
- Horizon 2020.

Under the GENIE project (total budget USD 42 million), significant funds were allocated by GITA to build the Tbilisi tech park, biotech centre and research labs, while the research was distributed as competitive grants are allocated to financially support start-up companies.

The total funding of USD 7 million will be distributed through a matching grants program (start-up matching grants to companies in the early stage of innovative product development, up to USD 30,000 and 10% of co-financing from other sources, and innovation matching grants for SMEs that are aiming at developing or adopting innovations that have market potential - the maximum amount of USD 250,000 shall be complemented by 30-40% of co-funding).

Additionally, GITA issues micro and matching grants of up to GEL 5,000 for financing prototyping R&D and IP rights. In 2016, GITA financed up to 80 projects. In 2015, GITA implemented a grant project whereby 17 organizations received a grant of up to GEL 50,000 each.

The interesting player of the ecosystem, enabling access to the international resources through several grant programs, is non-profit Georgian Research and Development Foundation (www.grdf.ge). Among the grant programs, managed by GRDF (in collaboration with GITA and Rustaveli Foundation) are:

- Science &Technology Entrepreneurship Program (STEP) Georgia: "Virtual Incubation Program" (VIP), supported by the US Department of States;
- Science & Technology Entrepreneurship Program (STEP) Georgia: "Global Pivot to Success" (GPS) – start-up Competition, supported by the US Department of States;
- 2017 Georgia Biosciences Fellowship Program;
- Etc.

The Women in Business program (www.ebrdwomeninbusiness.com) enables access to international partner sources (both public and private) through the European Bank for Reconstruction and Development (EBRD) program. Additionally, the bank provides assistance to small and medium businesses through the Small Business Initiative, SBI (www.ebrd.com/what-we-do/sectors-and-topics/ebrd-small-business-initiative.html). Although both above mentioned programs, providing both competitive loan financing and advisory services, are available for established enterprises, and are not critically focused on hi-tech and innovation industries, represent a feasible source of financing for start-ups on the early stage of development.

MOLDOVA

Current situation:

Of the enormity of the mechanisms for encouraging the innovation activities applied abroad, only the following are used in our country:

- promoting the infrastructure of the innovation process (science and technology parks, innovative incubators, technology transfer centres in universities, etc.);

- partnerships between business and academia within science and technology parks and innovative incubators;

- direct co-financing from public funds of innovative technology transfer projects for residents (up to 50%), through AITT;

- financing projects for the development of innovation infrastructure;

- provision of services free of charge or at reduced prices, in particular tariff reductions for the rent of communal rooms and services for residents of science and technology parks and incubators for innovation;

- granting facilities to pay patents, industrial designs and other IP items through AGEPI. (AGEPI Study).

ITU Regional Innovation Forum Regional Forum for Europe and CIS “Strengthening Innovation Capabilities in the ICT-centric Ecosystem and Fostering the Growth of ICT start-ups”, 28-29 March 2017 Chisinau, Moldova CHISINAU MANIFESTO: https://www.itu.int/en/ITU-D/Regional-Presence/CIS/Documents/Events/2017/03_Chisinau/Chisinau%20Manifesto-FINAL.pdf

Good practices:

In the Republic of Moldova, the main support programs of the small and medium-sized enterprises sector, financed by the state and / or the international development partners, include:

- The National Program for Economic Empowerment of Young People;

- The pilot program for attracting remittances to the economy;

- Efficient Business Management Program;

- The Loan Guarantee Fund, managed by the Small and Medium Enterprise Development Organisation (ODIMM)

- The Pilot Program "Women in Business".

https://www.odimm.md/

The contests organised by the Agency for Technological Transfer

http://aitt.md/ro/concursuri.html#1

The contests organised by the Agency for Research and Development of the Academy of Science

http://acd.asm.md/ro/apeluri

The International Projects Centre is facilitating access to Horizon 2020 R&D program

http://cpi.asm.md/

However, very few relevant applied research programs (ONLY 13 ICT R&D projects in 2015) – ICT R&D is definitely not a priority for public funding

Republic of Moldova has full rights for participation in Horizon 2020 Program.

Experts data base:

https://expert.idsi.md/ro

Knowledge data base:

https://ibn.idsi.md/

No innovation tax credit facilities in Moldova.

UKRAINE

Current situation:

Information about financial opportunities is really puzzled. There is no one source where all information is gathered together. Recently some companies and experts have started to provide support for applying projects to EU funds.

There is a functions' overlapping between MEDTU (Ministry of Economic Development and Trade of Ukraine) and MESU (Ministry of Education and Science of Ukraine), in particular with regard to Horizon 2020 (MESU is responsible for general coordination, MEDTU for SMEs), events and activities are poorly coordinated. Horizon 2020 web page (http://h2020.com.ua/en/) is not good navigated.

Good practices:

As of 2017, there are 41 NCPs and 5 Regional CPs, and a lot of them have their own web pages (e.g. http://lp.edu.ua/en/ncpmka) .

COSME page on the MEDTU web site (http://www.me.gov.ua/Documents/Detail?lang=uk-UA&id=8dc8c0b0-4e27-409c-b90e-f076ab2a27d8&title=ProgramiPidtrimkiPidprimtsiv) is lack of information.

There are no tax credits for R&D in Ukraine, while some preferences for importing equipment for innovative projects, which are approved by the Government, could be used.

Most universities have a special department that provides consultations on these issues.

Access to private funding[98] (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.)

ARMENIA
Good practices: A VC fund (Granatus Ventures) was created with support of the Government however they focus on investments starting from USD 50K to USD 1 million. There's a clear lack in later stage funding (more than USD 1 million). 2nd VC fund, the SmartGate, was created in 2017.

BELARUS
In accordance with the «Digital Economy Development Ordinance», the introduction of some English Law components has enabled comfortable conditions for foreign investors and venture capital funds to work in the Belarusian start-up environment. It will help Belarus raise more foreign investments.

GEORGIA
GITA is a key agency, assisting start-ups to enable their access of the private sources of financing through organizing match-making events with investors, guiding and assisting in fundraising, promoting start-ups outside of Georgia and establishing partnership with international venture capitalist networks (Negotiation with JVP (www.jvpvc.com) is ongoing). In 2017, 20 best start-ups, supported by GITA, got an opportunity to present their projects to the Silicon Valley's investors. The availability of private finding of start-ups is limited and fragmented in Georgia. Especially, the lack of legislation is one of the key cause of the problem here. The regulatory framework on investment funds is under development; there is no legislation regarding crowdfunding and crowd investment; B2B lending is fully unregulated. As a result, the private sources, providing equity or mezzanine debt investments, are usually fragmented, not visible and transparent, and not clearly focused on particular segments (industry, stage of development). The first private sector player, implemented the start-up financing program was JSC Liberty Bank: the subsidiary of the bank, the Smartex Group (www.smartex.ge) – the investment firm, focusing on seed and early-stage investments in start-ups in Georgia and elsewhere. All Georgian start-ups are housed under one roof in the Liberty Tower in Tbilisi. The interest of the group is focused on e-commerce, telecom and electronic payments. Overall investment (mainly investment in equity of already established businesses) exceeded one million GEL and included 12 projects. Currently, investment activities of the group are slowed down. However, taking into account the nature of the financed project, the R&D component was not a key issue here.

[98] http://www.investopedia.com/articles/personal-finance/102015/series-b-c-funding-what-it-all-means-and-how-it-works.asp?lgl=rira-baseline-vertical

start-up Marani (www. start-upmarani.ge) project, launched by the Start Business Solutions (www.startbs.com) – a management consulting company, and Green Capital Partners (www.green.ge/eng-sda-das/) – the local venture capitalist fund, is a project aimed at connecting entrepreneurs and investors. Until now, there have been supported four projects with up to USD 100,000 in total funding. However, the program mainly supports traditional businesses and R&D component is not crucial here.

The banking and microfinance sectors are most active here by provision loan financing of start-ups through special programs. However, outside of the special programs, the cost of loans for start-ups are very high and almost not available of the seed stage. It also could be mentioned, that financial institutions are much more willing to provide loan and/or leasing financing to successful start-ups at their early stage.

In addition to above mentioned programs, some financial organizations (commercial banks and microfinance organizations) are proving loan financing of start-ups. **TBC Bank** (www.tbcbank.ge)**, Bank of Georgia** (www.bog.ge) and **MFO Crystal** (www.crystal.ge)are offering loan/leasing financing programs for start-ups. The programs usually include some educational components. The programs are not always specially focused on hi-tech business, provide loans/leasing for capital investments, mainly to fixed assets (rather than R&D) and are dedicated for already launched businesses. In most cases, the driver of financial institutions to run programs is establishment of SME clientele rather than support for development of the innovation ecosystem. The above-mentioned programs are

- TBC Bank / start-upper Program (www.startaperi.ge)
- Bank of Georgia / Women in Business project (www.womeninbusiness.ge)
- MFO Crystal / Crowdfunding Platform (http://www.crystalcrowd.ge).

However, it should be mentioned, that the banks are supportive to finance projects (at development or commercialization stage), initially launched with support of GITA and Partnership Fund.

Another significant player is the Georgian Co-Investment Fund (www.gcfund.ge), which is represented in RCI by its CEO. GCF is a USDUSD 6bn private investment fund, with the mandate to provide investors with access to opportunities in Georgia through a private equity structure. However, currently GCF is heavily focused on large infrastructural projects (investment of 25 – 75% of the total equity investment, with a minimum size of USDUSD 5m) with no particular focus on hi-tech projects.

Finally, the interesting player of the ecosystem is a recently created Georgian Business Angels Association (www.businessangels.ge), established in March 2017 under the program of Private Sector Development Strategies of Swedish International Development Cooperation Agency with the ultimate goal to promote funding on the early stage start-ups by strengthening communication with investors. However, the association is at its early stage and shows no outstanding activities so far.

MOLDOVA

Current situation:

At present, in the Republic of Moldova there are no legal acts or regulations subordinated to the laws on the activity of venture capital funds. The regulations in force concerning the activity of collective investment undertakings in securities are not applicable to venture funds and cannot serve as a legal basis for their occurrence. Equally, there are no regulations that would

facilitate venture investment and would stimulate the funding of new IT initiatives, including innovative projects, start-ups and innovation or technology transfer.

Law No 179 of 21 July 2016 on Small and Medium-sized Enterprises refers to venture capital funds. It should be noted, however, that the rule of law does not refer to venture capital investments and the law does not contain regulations on venture capital funds. As a result, while admitting the right of SMEs to attract funding from venture capital funds, the law cannot serve as the basis for the emergence of funds and does not support or stimulate activity.

As consequence all questions # 28-39 *cannot be positively answered*. All these mechanisms are not available in Moldova. A draft Policy paper on this issue is prepared and is to be discussed. Source: Public Policy Proposal "Enhancing Access to Financing for IT Industry Companies" http://mtic.gov.md/sites/default/files/ppp_it_acces_finante_20160829210.pdf

UKRAINE

Current situation:

Ukrainian ICT firms (start-ups) are main beneficiaries of venture financing in Ukraine. At the same time analysis of the scope and scale of venture financing is limited because of the lack of statistical data and nonsufficient methodological base for venture financing assessment.

Good practices:

There are number of venture and investments funds as well as incubators/accelerators providing access to private financing: for seed stage 20-50 thousand USD and even more, Early stage - 300 -500 thousand USD, round A up to 1 million.

Visibility

ARMENIA

Good practices:

Armenia is very small and if a start-up or a person with idea want to be noticed, it's very easy to achieve it. People in ICT and start-up ecosystem are mostly accessible.

MOLDOVA

Good practices:

The visibility services on innovation activities examples:

http://inventica.usm.md/

http://www.tekwill.md/

http://utm.md/mesager

http://www.md.undp.org/content/moldova/ro/home/operations/projects/effective_governance/moldova-social-innovation-hub.html

http://itmoldova.com/category/it-news-md/

http://www.md.undp.org/content/moldova/ro/home/operations/projects/inclusive_growth/innovative-business-development-for-local-sustainable-economic-g.html

UKRAINE

Good practices:

It seems that IT clusters and other business association provide some regular activities, in particular newsletters. This activity is carried out by most Ukrainian organisations, mainly through Web sites and participation in exhibitions, forums and conferences.

SEED STAGE (IDEA)

Trend-scouting and technologies foresight (ideas for innovative projects)

ARMENIA

Current situation:

It is done informally with some enthusiasts. Few times a year international organisations may organise something contributing to trend scouting.

GEORGIA

GITA and Ministry of Economy and Sustainable Development of Georgia are the only players here. GITA is main requestor of the reports. In 2015, the Assessment Report “Research & Development Projects of Georgia” was prepared by Capital City Venture. In 2017 the first annual report “Innovation and Technology in Georgia was prepared by the support of the USAID/G4G project. The report will serve as a baseline for future evaluation of the ecosystem.

MOLDOVA

Current situation:

Unfortunately, there is lack of coordination authority for Information Society development/Innovation Authority with a holistic vision on involvement of all sectors/industries.

Good practices:

The eGovernment Centre in cooperation with involved public authorities and IT service providers is identifying permanently promising new technologies with great potential for the parties involved. However, the innovative technologies are being implemented based on approved Action Plan on the reform on modernisation of public services for the years 2017-2021 (http://lex.justice.md/viewdoc.php?action=view&view=doc&id=366273&lang=2).

UKRAINE
Current situation: Ukraine has an insufficient level of consulting that would work in this area. Some organisations carry out an overview of technological innovations, but most often it is a duplication of information published in other developed countries.

Identify customers and develop value proposition

ARMENIA
Good practices: There are some training providers who deliver 5-10 times trainings on such topics. www.bsc.am and www.iabcentre.com are leading ones

GEORGIA
GITA is a key player here. Management Academy (www.macademy.ge) is a key partner of GITA, providing trainings to tech start-ups, aimed at development of the business skills of founders. iHub (ihub.world/en/tbilisi-en/) also provides similar trainings. The TBC Bank's start-upper program (start-uperi.ge) and start-up Marani project also provide similar trainings for all beneficiaries - both technological and traditional start-ups. Similar training is mainly provided by financing bodies, both public and private, and usually are aimed at ensuring sustainable development of beneficiaries of financing. The Business and Technology University (btu.edu.ge) propose the curriculum for technology students with integrated business subjects. Similar services are also provided to start-ups by several business/management consulting companies, but these services are usually provided on commercial basis.

MOLDOVA
Good practices: The Business Academy for Women project funded by the European Union and managed by the Small and Medium Enterprise Development Organisation (ODIMM) and implemented in partnership with the International Centre for the Promotion of Women in Business (ICAWB) is helping the business women. The project will employ around 300 female entrepreneurs who will be trained how to streamline their business model and guide their companies to export. At the end of the training, 10 women entrepreneurs will be selected, who will receive grants of 6 thousand euro for the implementation of the projects. http://baw.odimm.md/index.php?option=com_content&view=article&id=76&Itemid=190

More than 650 entrepreneurs participated in the training seminars under the Efficient Business Management Program (GEA), managed by the Organisation for the Development of Small and Medium Enterprises (ODIMM).

ODIMM sources reported that 23 courses were organised this year in 15 localities in the Republic of Moldova and half of the courses took place in the south of the country.

http://www.contabilsef.md/newsview.php?l=ro&idc=13&id=16287&t=/Noutati/Noutati-generale/Peste-650-de-antreprenori-au-fost-instruiti-prin-programul-gestionarea-eficienta-a-afacerii-organisat-de-ODIMM

Trainings

http://macip.md/inscriere-on-line/

http://cursuribp.md/ro/scoala-antreprenori.php

UKRAINE

Current situation:

Initial level of knowledge provided by different trainings, lack of coordination between donors' initiatives.

The low ability of Ukrainian companies to pay for the services of specialised consulting companies.

Good practices:

There are a lot of different trainings and workshops aim on upgrading business skills, in particular a lot of donors provide such trainings (USAID, UNDP, EU Commission, etc).

Some assistance on specialised consulting companies can be obtained from the EU4Business program implemented by the EBRD in Ukraine.

Building a balanced team and finding partners with complementary competencies

ARMENIA

Good practices:

Usually this is done by hackathons. In 2017 it is planned that Founders Institute will launch its Yerevan chapter.

GEORGIA

GITA and TBC Bank start-upper programs are the key supporters here, by providing such assistance through mentoring service.

Additionally, GITA promoting and financing innovation support competitions (like hackathons, makethones), matchmaking events, and demo days, organized for matchmaking purposes jointly with several public and private universities, as well as with non-profit organizations and communities.

MOLDOVA

Good practices:

The Tekwill Centre started organisation of such services (Hackathons, etc.) in 2017

UKRAINE

Current situation:

There is limited access to this service in Ukraine, only some venture capitalists provide such services.

START-UP STAGE (PRODUCT)

Product development

ARMENIA

Good practices:

The same training companies organise also trainings on such or similar topics – www.bsc.am and www.iabcentre.com

GEORGIA

Product development services are provided to start-ups by GITA within the Business Incubator's program. Services are usually delivered by mentors. However, services, offered by GITA are limited by the definition of the product, and don't cover full start-up consulting, including access to distribution channels, development of the supply chain, and etc.

The services, provided to start-ups through the start-up Marani project (www. start-upmarani.ge), driven by the business consulting company, usually cover full business launching activities.

It should be mentioned, that most of infrastructure's organizations, positioning themselves as business incubators, even in the best cases are providing a little consultancy support. The support usually covers marketing support, like development of value proposition and concept of the product, marketing and presentation of the product, but little attention is usually paid to actual business issues, like development of distribution channels, organization of business, financial management and etc.

The last service is usually provided by the business consulting companies on commercial basis without any particular differentiation of start-ups and existing companies. EBRD's Women in Business (www.ebrdwomeninbusiness.com) project provides support for woman-owned start-ups by co-financing consultancy/coaching services. The second product, managed by EBRD

(Advice for Small Businesses) provide support only for established companies (with at least 1 year of operating). It also worth to be mentioned, that most of the programs, offered by financial institutions, with integrated consulting and financing components, like TBC Bank start-upper (startaperi.ge), EBRD's Advice for Small Businesses, BOG's Women in Business, and etc. requires at least one-two years of operations.

MOLDOVA

Good practices:

Innovation Incubators include in the list of their services assistance at this stage

https://dezvoltare.md/

https://dezvoltare.md/lean- start-up-crash-course-chisinau/

https://dezvoltare.md/gratuit-strategii-pentru-creste-afacerea-ta-lorand-soares-szasz/http://odimm.md/ro/suport-in-afaceri/prestatori-sda.html

UKRAINE

Current situation:

There is limited access to this service in Ukraine, only some venture capitalists provide such services.

But there is no information gathered in one place.

Research and development

ARMENIA

Good practices:

If we talk about outsourcing companies, there are a lot such companies in Armenia.

GEORGIA

GITA is almost the sole visible player here. The mandate of the Enterprise Georgia (www.enterprisegeorgia.gov.ge) also partially covers this service by matching R&D and business players, but this service is fragmented and not adopted on the regular basis. No other organizations of the innovative infrastructure actually provide such activities, and even have no resources to do it, even TCO, based on the Ilia State University.

The Technology Transfer Centre, planned to be established, most likely will be positioned as providing such services.

Services, aimed at linking SMEs and R&D resources are available, but quite rare in the private sector. Usually, SMEs, looking for technology, are applying directly to the research organizations, without any structured intermediation.

MOLDOVA
Good practices: SME Internationalisation Portal This site can help to find experts with the know-how and experience to take your business international. Search the database for support services in your country or your target country. http://ec.europa.eu/small-business/most-of-market/business-procurement/index_ro.htm Entrepreneurs from the Republic of Moldova are eligible for financial support in the program COSME Program and may find partners https://odimm.md/ro/noutati/evenimente/item/291-antreprenorii-din-republica-moldova-au-posibilitatea-să-beneficieze-de-suport-financiar-în-cadrul-programului-cosme.html http://aitt.md/ro/press-release/anunturi/suport-pentru-finanțarea-proiectelor-inovaționale-și-crearea-de-parteneriate-în-cadrul-rețelei-een.html

UKRAINE
Current situation: Significant gap, there is no special services to find R&D partners Some organisations in Ukraine provide such services, for example, the Network of NCP of H2020.

Value proposition and business concept testing and validation

ARMENIA
Current situation: There is a lack in Armenia

AZERBAIJAN
Good practice: As many as 172 projects won a chance to get the grant of the State Fund for the Development of Information Technologies of Azerbaijan in the framework of the fifth start-up competition in 2017.

The selection of applications was conducted from April 10 to June 9. The evaluation of projects will be carried out in two stages [primary and complex examination]. Initial examination will take 15 working days.

The second stage will take 20 working days, and independent experts will be involved in a comprehensive examination, after which the final decision on the issue of financing will be taken at the level of the supervisory board of the state fund.

The projects that claim for financial support of the state fund are those related to the development of advanced software solutions, preparation of samples of IT products, development and commercializing innovative infrastructure and new technologies, creating network infrastructures built on the basis of modern technologies, as well as projects aimed at expanding IT services and Services, based on the Internet.

The maximum amount of a grant to support IT projects can reach 300,000 AZN (for a period of 36 months). Small grants are envisaged in the amount of 10,000 to 100,000 (USD 5,877-USD 58,772) AZN, medium - from 100,000 to 200,000 AZN (USD 58,772-USD 117,544), and large ones - from 200,000 to 300,000 AZN (USD 117,544-USD 176,316).

Azerbaijan's State Fund for Development of Information Technologies was created by the presidential decree dated March 15, 2012.

The main objectives of the Fund are conducting of the state policy on development and support of small enterprises in scientific-technical sphere, providing them with direct financial assistance, training, which in turn will contribute to the creation of new jobs in the country.

The State Fund identified 12 criteria that must be met by submitted projects. Criteria prescribe the projects to be clearly justified, have commercial potential, contribute to the development of the Azerbaijani ICT sector, be attractive in terms of investment, have socio-economic importance, be relevant in terms of innovative orientation, etc.

https://www.azernews.az/business/114654.html

GEORGIA

No services are provided by GITA and other state organizations. Some consulting services, if required, could be co-financed by Enterprise Georgia and EBRD Women in Business project. start-up Marani program, as driven by the management consulting company, usually provides such services to its beneficiaries.

Most of such services are provided by the management consulting companies and advertisement agencies on commercial competitive bases with no relief for start-up companies.

MOLDOVA

Current situation:

Lack of such services in Moldova

UKRAINE

Current situation:

It is very difficult to find service providers for this service

Intellectual property management

ARMENIA
Good practices: Legal firms which are doing consulting also on IP.

BELARUS
The Belarus National Centre for Intellectual Property and the World Intellectual Property Organization and signed an agreement on the establishment of Technology and Innovation Support Centres (TISC) in Belarus. The TISC aims to promote innovation and stimulate economic growth by facilitating access to technological information, as well as by strengthening national capacities for the effective use of this information. In the Republic of Belarus, the TISC is planned to be established on the basis of the Republican Scientific and Technical Library and its branches. The TISC will ensure access of innovators in developing countries to sources of high-quality technical information and other services in Belarus.

GEORGIA
On the state level, services are enabled by GITA, in collaboration with the National Intellectual Property Centre Sakpatenti (www.sakpatenti.org), through on-stop-shops, organized on the premises of GITA. Some assistance in registration of the IP rights are provided through the joint program, managed by GITA, Sakpatenti and Rustaveli foundation. TCO, managed by Ilia State University is positioned to provide such services, but is not active so far. Most of IP services are provided by the private sector by consulting companies or law offices, focusing on IP rights. All services are provided on commercial competitive basis without any reliefs to start-ups. Business Intelligence & Valuation Group (BVG) (www.facebook.com/Business-Intelligence-and-Valuation-Group-BVG-204153732998779) is one of the consulting companies, focused on integrated consulting on IP registration/strategy.

MOLDOVA
Good practices: A modern National Intellectual Property System is established in the Republic of Moldova, having a functional institutional structure and an adequate regulatory framework, harmonised with international standards and the acquis communautaire, containing all the necessary rules designed to ensure the protection of IP rights in the innovative activity. The main impediments that persist in the field of IP are not of a legislative nature but are related to the effective enforcement of intellectual property rights, including the exploitation of these rights, which is directly related to the innovation activity. Similar to other countries with economies in transition, the Republic of Moldova is characterised by its insight into the role of IP rights in the transfer of technology and innovation. Lack of

awareness of intellectual property rights is one of the obstacles that SMEs often face when trying to make use of intellectual property to grow their business.

The State Agency on Intellectual Property provides documentary search services against payment. Upon the request of applicants, AGEPI provides ample information from national and international databases.

Intellectual property pre-diagnosis aims to contribute to the improvement of the innovation potential and enhancement of competitiveness.

IP for SMEs will highlight the facilities on fees provided for services rendered by AGEPI, as well as their benefits.

In relation to the need for dissemination of information concerning the national system of protection and enforcement of intellectual property rights, a series of activities are planned for information purposes in the academic, education, economic and social environment, etc.

The IP library within AGEPI provides those interested with information from the National Collection of Documents on Intellectual Property, which includes: DB on electronic media from different countries and international organisations; books and publications in the field of IP; Official Bulletins of the offices from abroad etc.

http://agepi.md/en/services/information-services-provided-agepi

Innovation Incubators are offering some services on IP management

UKRAINE
Good practices: Services on intellectual property rights protection are provided mainly by private firms. Ukrainian state service on intellectual rights is under reforming. Part of these services are provided by patent offices at major universities and research institutions.

Product and Corporate Design

ARMENIA
Good practices: There are some design firms helping start-ups with design work. But very early stage.

GEORGIA
Most of such services are provided by the management consulting/branding companies and advertisement agencies on commercial competitive bases with no relief for start-up companies.

MOLDOVA
Good practices: Branding companies' sources: https://www.sortlist.com/branding/moldova-md https://webmaster.md/ro/servicii/brandbook-ul http://odimm.md/ro/suport-in-afaceri/prestatori-sda.html

UKRAINE
Current situation: A few examples of service providers were found , but in general this service is not developed in Ukraine

ENTERING THE MARKET

Marketing products and services

ARMENIA
Current situation: Lacks in Armenia for ICT, however Armenian ICT companies pay for themselves. Negative impact is only noticeable on start-ups as they don't have enough resources.

AZERBAIJAN
Good practice: Azerbaijani products can be supplied to the European countries' markets thanks to the cooperation between Azerbaijani and Bosnia and Herzegovina's companies. Rufat Mammadov, head of the Azerbaijan Export and Investment Promotion Foundation (AZPROMO), said that Azerbaijani products can be supplied to the European countries' markets due to Bosnia Herzegovina's free trade agreement with the European Union. "We can also offer Bosnia and Herzegovina's companies to supply goods to the markets of the CIS countries with which Azerbaijan has a free trade agreement, that is, the issue is mutual interest," he said. "Of course, we are still at the early stages of bilateral trade and investment relations. But there are so many opportunities that can be used to increase the trade turnover and the presence of Azerbaijani business in this market." "Azerbaijan and Bosnia and Herzegovina held many business meetings and business forums," Mammadov said. "The enterprises and companies from Bosnia and Herzegovina's Olovo town

have been represented at the Azerbaijan-Bosnia and Herzegovina business meeting in Baku Nov. 15."

"Business circles of the two countries are interested in a wide range of issues, primarily in such areas as construction, heavy engineering, automotive industry, agriculture, food industry, textile industry, furniture industry and various sectors of manufacturing industry."

"Azerbaijani companies, working in agriculture, agrarian industry, processing industry and food production, are already operating in Bosnia and Herzegovina's market," he said. "It is a traditional sector for Bosnia and Herzegovina and Azerbaijan."

"The companies of the two countries also cooperate in the furniture industry," Mammadov said. "There are great prospects for establishing cooperation in the textile industry, which is now actively developed in Azerbaijan. Bosnia and Herzegovina also has skills in textile industry."

"We are organizing export missions to the priority foreign markets through the Made in Azerbaijan brand," he said. "It is early to say about the date of the visit of the Azerbaijani exporters to Bosnia and Herzegovina. Nevertheless, if there is an interest, we can organise an export mission to this country to promote Azerbaijani products in this market. Everything will depend on the agreements reached by our companies within today's business forum and previous business meetings."

https://en.trend.az/business/economy/2822296.html

GEORGIA

It should be mentioned generally for the stage of „entering the market", that the innovation infrastructure provides a little support to companies here. GITA and Enterprise Georgia are the only organizations, supporting start-ups during the market entry activities. Other organizations usually have no capacity insight to provide such services.

Most of such services are provided by the management consulting/branding/marketing/research companies, as well as advertisement agencies on commercial competitive bases with no relief for start-up companies.

Programs, supported by EBRD (Women in Business, Advise to Small Businesses) provides co-financing of consulting services. There also are several programs, providing free expertise support, by enabling expertise from Europe (Germany, Netherlands). Most of services, offered by GITA are provided through the mentorship programs. Enterprise Georgia has a technical assistance component, also enabling co-financing of ad-hoc consulting services if necessary.

Programs for start-ups, managed by the financial institutions (TBC Bank, bank of Georgia), usually do not provide consultancy/mentoring services at this level. The start-up Marani project, as driven by the management consulting company, usually can contain services, enabling market entry by their beneficiaries.

MOLDOVA

Good practices:

Examples of subsides for participation at exhibitions:

http://odimm.md/ro/menu-types/117-subventionarel-expozitii.html

> The International Specialized Exhibition BELAGRO 2017 was inaugurated on 6th of June in Minsk, with the participation of the Prime Minister of the Republic of Moldova, Pavel Filip, on an official visit to the Republic of Belarus and his counterpart Andrei Kobeacov.

At this year's edition, Moldova participates with one of the largest country stands, which is financed by MIEPO and located in the central part of the exhibition.

http://www.miepo.md/news/companiile-moldovenești-din-industria-agroalimentară-își-expun-produsele-la-belagro

http://www.moldovafruct.md/ro/news/view/46

http://odimm.md/ro/suport-in-afaceri/prestatori-sda.html

UKRAINE

Good practices:

Primarily provided by Chamber of Commerce and its regional subsidiaries.

Similar services are also provided by some business associations or specialised consultancy companies.

Distribution channels and sales

ARMENIA

Current situation:

Lacks in Armenia - no systematic approach.

BELARUS

In accordance with the «Digital Economy Development Ordinance», **smart contracts** have been recognized as a legally valid tool for sealing deals. This step takes care of one of the fundamental business problems: the execution of mutual obligations by parties to the contract. By introducing smart contracts into jurisdiction and giving companies the right to use them in transactions, Belarus has become the first country in the world to legalize smart contracts at country level.

MOLDOVA

Good practices:

The Chamber of Commerce and Industry is offering such services http://www.chamber.md/

The terms of implementation of the Moldo-German Program on enhancing the qualification of Moldovan companies' mangers will be extended:

http://mybusiness.md/ro/business-nout-i/item/6156-termenul-de-implementare-a-programului-moldo-german-de-cresterea-a-calificarii-managerilor-intreprinderilor-din-moldova-va-fi-prelungit

The model contracts and SLAs can be found on http://www.egov.md/

http://odimm.md/ro/suport-in-afaceri/prestatori-sda.html

It is hard to assess the level of quality offered by listed companies.

UKRAINE

Good practices:

These services are provided by some specialised consulting companies.

Innovation Management / Support of innovation processes (internal, external)

ARMENIA

Current situation:

Commercial courses exist, but very few people appreciate their value and/or are able to pay for such courses.

MOLDOVA

Good practices:

Special courses organised by:

UNDP inobiz.md

http://www.tekwill.md/

Sources for risk management:

http://www.mtic.gov.md/sites/default/files/transparency/plans_and_reports/programul_management_strategic_14.08.2013.pdf

http://mtc.md/consulting/Managementul Riscurilor.htm

UKRAINE

Current situation:

Similar services are practically absent in the Ukrainian market.

Accompaniment after entering the market

ARMENIA

Current situation:

Lack in Armenia

MOLDOVA

Good practices:

In compliance with the provisions of the Law no.451-XV of 30.07.2001 and Law no.176 of 15.07.2010, the services for creation, implementation and ensuring the operation of automated information systems of state importance, including software should be licensed (http://en.anrceti.md/522_conditii_de_licenta).

The Regulator ANRCETI (www.anrceti.md) is offering consultancy and assistance on request.

The existing legal acts provides for the certification of the software products (http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=310896, http://lex.justice.md/document_rom.php?id=DF0B216A:75FB6C91, http://lex.justice.md/md/310116/). However, there is not a unique special state authority responsible for the Information systems audit and software certification. The Court of Accounts (http://www.ccrm.md/en) is undertaking the audit of state information systems (example: http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=343003).

The Ministry of Finance initiated the special Regulation on mandatory certification of computerised information systems and software for cash registers by Fiscal Service

(http://www.particip.gov.md/public/documente/121/ro_2740_Proiect-HG-privind-certificarea-SI.docx), but was not approved yet.

The Excellence Centre Tekwill will provide certification services:

http://atic.md/page/420

So, as of the August 30, 2017, there is no in place a mentoring institution for such services.

UKRAINE

Good practices:

This service is provided mainly by business angels and incubators, and venture capitalists

SCALE-UP, SCOPE-UP, SPEED-UP

Business services for growing and accelerating companies

ARMENIA

Current situation:

In December 2017, Armenia start-up Academy was launched which is going to be a pre-acceleration program.

AZERBAIJAN

Good practices:

The manufacture of 6 new types of unmanned aerial vehicles (UAV) has been launched at the High Technologies Park (HTP) of Azerbaijan National Academy of Sciences (ANAS), in 2017,

Vugar Babayev, director of ANAS HTP, told: “A young and experienced team staff has been brought together in a short time at ANAS HTP. The manufacture of UAVs is going on pretty fast and is almost finished. They have been tested successfully”.

According to Babayev, there are 6 new types of UAV being manufactured at ANAS High Technologies Park.

"Of them, five types are multi-rotors and the remaining one is a type of aircraft. These UAVs are intended to be used in several areas—in agricultural irrigation and pharmaceuticals, environmental monitoring, forestation, aerial photography and mapping, as well as three-dimensional maps,” he said.

The director pointed out that UAVs are used in almost all fields in the modern era, adding that the UAVs being manufactured at ANAS HTP are primarily of civil and military nature.

"Examples include ambulance, postal services, search and rescue services of the Emergency Situations Ministry, aerial photography, etc. Generally, it is possible to modify UAVs and integrate appropriate equipment into the system in accord with consumer demand,” he added.

Speaking about the parameters of UAVs, Babayev said that parameters very depending on the model. “The estimated parameters are as follows: Flight time is up to 30 minutes, carrying capacity ranges from 0-5 kg, and the speed limit is up to 35 km/h,” he said.

The UAVs have not yet been named, added Babayev.

Noting that they have already received orders from several government agencies, Babayev said that negotiations were held with SOCAR, and UAVs will be produced in accordance with their requirements.

“Currently, test flights are being carried out jointly with SOCAR. A presentation will be held in the near future,” he said.

The director general also talked about the expected innovations in the techno-park.

"Though short time passed since the establishment of ANAS HTP, we have succeeded in several areas with 7 local residents operating in the techno-park. We began to implement joint projects with several foreign companies and local government agencies. ANAS HTP closely cooperates with the world's leading techno-parks and brings together science and business in Azerbaijan," added Babayev.

GEORGIA

The situation generally for scaling-up, scoping-up, speeding-up is pretty much as in the entering market services. Even organizations, announcing acceleration programs, provide no relevant services for start-ups.

The difference here is that the programs, managed by EBRD are much more accessible for companies at this stage as already operating. This includes both consulting services and financing growth projects. The banks are also offering more competitive and attractive financial products for business. However, projects, similar to start-up Marani, are not usually available. The role of the private sector business consulting companies is important here.

MOLDOVA

Good practices:

Services are offered at limited scale by the Chamber of Commerce and Industry, ODIMM, Innovation Incubators and private companies.

The Moldovan-German Program on enhancing the qualification of Moldovan companies' mangers:

http://mybusiness.md/ro/business-nout-i/item/6156-termenul-de-implementare-a-programului-moldo-german-de-cresterea-a-calificarii-managerilor-intreprinderilor-din-moldova-va-fi-prelungit

http://odimm.md/ro/suport-in-afaceri/prestatori-sda.html

The Business Consulting and Business Support Centre (CCAA) provides opportunities for professional development in business start-up, development and expansion, promoting support for the Small and Medium Enterprises sector:

http://odimm.md/ro/component/content/article/175.html

Examples of Innovation Incubator services:

http://ias.md/servicii/

UKRAINE

Current situation:

This service is provided mainly by business angels and incubators, and venture capitalists

Business scoping up

ARMENIA
Current situation: Lacking in Armenia

MOLDOVA
Good practices: The services are provided by Business Incubators, ODIMM, Chamber of Commerce and Industry, AMCHAM through training courses and direct contact.

UKRAINE
Current situation: This service is provided mainly by business angels and incubators, and venture capitalists

Business scaling up

ARMENIA
Good practices: Expected that Armenia start-up Academy will deal also with this in a long term.

MOLDOVA
Good practices: Consultancy services offered by Chamber of Commerce and Industry, AMCHAM, Innovation Incubators, Business Associations, Tekwill, ODIMM. Competition of projects for the organisation of international scientific manifestations financed from the state budget for year 2017: http://acd.asm.md/ro/concursul-proiectelor-pentru-organisarea-manifestărilor-științifice-internaţionale-finanţate-de-la-0 http://odimm.md/ro/suport-in-afaceri/prestatori-sda.html

UKRAINE
Good practices:

Regional authorities and Chamber of commerce help SMEs to participate in events abroad (fairs, exhibitions etc.). Sometimes it's not so easy to be included in the participants' list if you have no close relations to authorities.

Regional state administrations in many regions develop catalogues of goods and services produced in the region to advertise them abroad.

Also, in some cases such kind of service could be provided by business angels and incubators, and venture capitalists.

BUSINESS TRANSFORMATION AND STRATEGY

Support to existing small and medium-sized companies in managing the structural transformation and in developing business models

ARMENIA

Current situation:

Lack in Armenia. Nothing similar on a large scale.

BELARUS

1. **Ordinance No. 7 "On entrepreneurship development"** has been signed on 23 November 2017. This is a key document of the package of legal acts to improve the business environment in Belarus. The Ordinance is cutting red tape for businesses by reducing the number of fines that can be imposed on firms for violations and removing most grounds for property confiscation. The ordinance is the result of the unprecedented collaboration between the government agencies and private sector.

http://president.gov.by/ru/official_documents_ru/view/dekret-7-ot-23-nojabrja-2017-g-17533/

Main novelties:

- The ordinance aims to eliminate redundant administrative barriers, which, according to the business community, hinder the development of business.
- The ordinance dramatically changed the way government agencies interact with private companies.
- It minimized the interference of government officials with the operation of commercial entities.
- It gave more leeway to private companies in how they manage their affairs while cranking up the responsibility of private companies before the public.
- The ordinance allowed starting up a private business by notifying the authorities about the intended lines of business. The list includes consumer services, tourism, social services, trade and public catering, transportation of passengers and luggage, merchandise production, production of construction materials, and some other popular types of business. Thus, the document covered the spheres where about 95% of Belarusian small and medium-sized enterprises are concentrated.

2. Some other ordinances were adopted in 2017 to advance the business environment in Belarus:
   - No.337 on regulating economic affairs of natural persons, which lists business operations that citizens can carry out without getting registered as self-employed businessmen;

- No.338 on tax consulting, which introduces the professional institute of intermediaries between business and tax authorities;
- No.345 on developing retail, catering, and utility services, which was adopted to encourage the economic activity and remove excessive requirements for commercial entities;
- No.364 on craft activity regulations for natural persons, which expands the list of types of craft activity in Belarus;
- No.370 on the Business Promotion Council, which increases the council's role by extending its competences.

Belarus hopes that the new regulations will to meet the government's main target to increase the share of small and medium-sized businesses to 40% in the GDP before the end of 2020.

GEORGIA

The situation here is similar to the growing companies market services.

Still, the difference here is that the programs, managed by EBRD are much more accessible for companies at this stage as already operating. This includes both consulting services and financing transformation projects. The banks are also offering more competitive and attractive financial products for business. Projects, similar to start-up Marani, are not usually available. The role of the private sector business consulting companies is important here.

The European thematic expertise is available here through the networks, enabling mentoring by experts from mainly Germany and Netherlands.

MOLDOVA

Current situation:

Limited services and lack of holistic approach in managing the structural transformation and in developing business models.

Good practices:

eGovernment Centre , Tekwill, Information and Communication Technologies Centre in Education are offering services:

http://www.egov.md/ (for civil servants)

http://www.tekwill.md/ (for all)

http://www.ctice.md/ (for school teachers)

UKRAINE

Current situation:

It is very difficult to find good cases of service providers in this area.

Good practices: E&Y start-up program and activities of AgTech and Association of Industrial Automation of Ukraine

Thematic expertise

ARMENIA
Good practices: Such groups will be formed as a result of new innovation and Digitisation strategies being developed by the end of 2017 and in 2018

MOLDOVA
Good practices: Few examples of working groups could be observed, although most important policy documents were developed and discussed within special created working groups. The eGovernment Centre initiated creation of the working group on Open Government: http://egov.md/en/communication/news/open-call-become-part-working-group-open-government The interinstitutional working group responsible for the drafting of the Ecosystem Development Strategy for Digital Innovation and IT start-up Support was created in June 2017. http://mtic.gov.md/sites/default/files/ordin_42_08.06.2017.pdf The Tekwill Centre is supposed to facilitate creation of community and different working groups.

UKRAINE
Good practices: Thematic expertise is provided by professional associations. Most of service providers deal with many topics. Only few of them have clear thematic priorities, like AgTech, Ukrainian Venture Hub, Roman Zinchenko and public advisory groups.

NETWORKING AND COLLABORATION (for innovation infrastructure organisations)

ARMENIA
Good practices: There are some informal networking groups, most popular one is HyeTech, which started from Silicon Valley and spread in Armenia and Europe.

AZERBAIJAN
Good practice: The American Chamber of Commerce in Azerbaijan has 250 members. Member Companies represent themselves in committees in the areas of Tax & Customs, Banking, Finance & Insurance, Human Resources & Labour, Information & Communications Technologies, Travel, Tourism & Hospitality, Corporate Social Responsibility, Healthcare & Medical Insurance to make a real contribution to the future of business in Azerbaijan. Only in 2015-2016 they included 6 Conferences, 10 Monthly Luncheons, 1 General Assembly Meeting, 2 CEO Breakfasts, 37 Committee Meetings, 3 Cocktails, Annual U.S. Independence Day Picnic, CSR Excellence Award Ceremony and so on. Recently, AmCham hosted the first Azerbaijan-USA Business Forum which became a stimulus for the further development of bilateral economic relations, establishment of new partnerships and exploring untried opportunities. The National Confederation of Entrepreneurs (Employers) Organisations of Azerbaijan Republic (AEC) was established in 1999. AEC is a non-profit, a self-governing public union aimed at social objectives which promotes business environment in Azerbaijan, coordinates on voluntary basis activities of legal and physical entities undertaking entrepreneurial activity irrespective of their business entity type and property form (excluding state funded organisations), helps them to find new partners domestically and overseas, protects their legal and economic rights and fosters a healthy business climate.

MOLDOVA
Good practices: Existing Clusters: http://aitt.md/en/scientific-technological-clusters.html - 1 Moldovan Association of Private ICT Companies (ATIC): http://atic.md/page/420 The Platform for discussion of Information Society problems (local public authorities, central public authorities, IT service providers, local and international experts, other stakeholders) to find innovative solutions: http://www.discus.idsi.md/en

UKRAINE
Good practices: Innovation infrastructure organisations, e.g. business associations, organise networking and collaboration events on the regular base Network of NCPs of H2020 and NGO “Agency of European Innovation”

Web-based platforms

GEORGIA

There are two resources, currently at least partially accumulating information, relevant for start-ups:

- GITA's website (www.gita.gov.ge), which covers information regarding several participants of the infrastructure, but mainly about those organizations, which are supported by GITA
- www. start-ups.ge, managed by the start-up Association. However, the last is not functional currently.

www. start-up.ge portal provides general information for start-ups, like ideas, infrastructure, financing sources, and etc. However, the resource is far from the "complete" status. No more resources are available.

APPENDIX 6 TRAINING PACKAGE SPECIFICATION 1: POLICY-MAKERS

Relevant training for policy-makers is targeted at increasing their understanding of the opportunities, limitations of digital transformation as well as advanced tools for fostering the technology- and innovation-driven economic growth. Herewith the main blocks of training for policy-makers include:

MODULE 1. Digital policy basics

1.1. Existing legal framework for digital markets in their country

1.2. Current trends of setting the legal framework for digital markets in foreign countries

1.3. Current digital agenda and tools used by the Eurasian economic commission

1.4. Current digital agenda and tools used by the international organisations (The World Bank, OECD, UN, WIPO, ISO etc)

1.5. Current digital agenda and tools used by the neighbour states and their unions (EU etc).

MODULE 2. Practical applications of digital technologies

This module should be trained across the advanced technological and product trends in an easy-to-understand non-technical language, with the aim to explain the:

- Opportunities of digital technologies to enable self-employment and increase employment in the existing enterprises
- Opportunities of digital technologies to save costs and increase the productivity of non-IT sectors of economy

- Opportunities of digital technologies to back up the innovative business models with high value added and export potential
- Opportunities of digital technologies to increase earnings of state organisations by delivering services to citizens and business
- Opportunities of digital technologies to increase the efficiency of state governance and governmental services and enable e-democracy.

The list of technological and product trends should be regularly updated, as well as the content of the taught material, and should be based on analysis of the advanced and successful practices of both global and local businesses. The cases of local digital businesses are important because not all needs can be covered by global businesses with account of local specifics of demand, because their establishment might be more cost-efficient, and because for many people the link to their region is an important condition for starting a business.

Particular technological trends include:

2.1. eID for citizens and legal entities

2.2. Internet of Things

2.3. Big Data collection, aggregation, analysis, visualisation services

2.4. Electronic data interchange (EDI)

2.5. Electronic digital signature (EDS)

2.6. Interoperability of information systems

2.7. Open API

2.8. Open Data

2.9. Distributed ledgers and blockchain

2.10. Smart contracts

2.11. Cyber currencies (e-money)

2.12. Fintechs

2.13. Industry 4.0

2.14. Smart grids

2.15. Robotics

2.16. eLogistics

2.17. eCommerce

2.18. Telecom

2.19. eHealth

2.20. eSkills

2.21. Artificial intelligence

2.22. Visualisation, virtual reality and augmented reality

2.23. Cybersecurity

2.24. Cloud computing

2.25. Business intelligence and analytics

2.26. Data protection and the legal implications

2.27. CRM - Customer relationship management

2.28. Gamification

2.29. Mobilisation, socialisation and omni-channelled service as trends of digital markets

2.30. UX and UI development

For industry-specific regulating bodies, the focus on specific processes in the industries under control should be done (e.g. financial market, industry, trade, transport and logistics, education etc).

MODULE 3. Digital business management basics

For ministries in charge of economic development and entrepreneurship, additionally the knowledge on specifics of digital business management should be trained with indication of specific problems of businesses at different stages of development, at least on the general level, including:

Seed stage and Start-up stage

3.1 Developing innovative business models based on digital technologies

3.2 Developing digital business strategies and roadmaps

3.3 Preparing a structured digital business plan applicable for fundraising

3.4 Project criteria important for investors, assessment of investor readiness and investor relations

Entering the market

3.5 Standards on the digital market

3.6 Recruitment and personnel management on digital markets

3.7 Value chains on digital markets

3.8 Digital products and services development and design

3.9 Rapid and virtual prototyping techniques

3.10 Customers segmenting and lead management on digital markets

3.11 Conversion management techniques

3.12 Service level agreements (SLAs) and contracts on digital markets

3.13 Marketing on digital markets

3.14 Management on digital markets

Scale-up, scope-up, speed-up

3.15 Distribution channels on digital markets

3.16 Innovation management, change management, risk management on digital markets

3.17 Intellectual property management on digital markets

3.18 Legal enforcement on digital markets

3.19 Large (national and international-scale) information systems and relevant market niches

3.20 Internationalisation specifics on digital markets.

APPENDIX 7 TRAINING PACKAGE SPECIFICATION 2: ICT INNOVATION INFRASTRUCTURE ORGANISATIONS

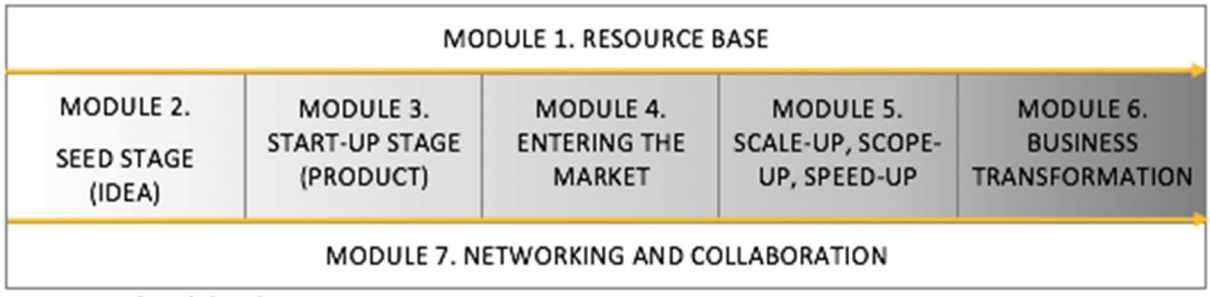
The training package for innovation infrastructure organisations should be organised on a modular basis, where each module can be divided into several micro-modules.

The comprehensive training package follows the logics of the innovation process and differing needs of businesses at different stages of development. Module 1 “Resource base” and module 7 “Networking and collaboration” are the modules addressing the needs of all the lifecycle stages of an innovative business.

However, due to a very extensive body of knowledge summarised in the comprehensive training package for ICT innovation infrastructure organisations, it cannot be expected that each organisation addressing the specific lifecycle stage is well-trained in all of the relevant knowledge areas. Vice versa, the training framework elaborated in this Study should be used to foster the specialisation of the ICT innovation infrastructure organisations.

To provide the good overview of the diverse competencies of the specialised ICT innovation infrastructure organisations, the platform providing a general overview over the ICT innovation infrastructure organisations and their services should be created. It is recommended to create a general platform for both EU and EaP countries, to further foster the harmonisation of digital markets.

Figure 7.1.1. Schematic structure of the training package for innovation infrastructure organisations



Source: authors’ development.

MODULE 1. RESOURCE BASE

Facilitating access to human resources

Knowledge on specific methods, practices and tools to cultivate an entrepreneurial mentality

Knowledge on specific methods, practices and tools to cultivate teambuilding

Facilitating access to technologies

General knowledge equipped with a database of video materials to showcase the latest technologies to existing enterprises and start-ups

Knowledge about existing platforms helping to find appropriate technologies in the market or from research institutes/universities

Knowledge about strategic usage of available international intellectual property

Knowledge about strategic usage of relevant international standards

Facilitating access to digital Infrastructure

Knowledge on the basic digital infrastructure available in the country and in the world to enable the secure, robust, responsive and intelligent communications and computation facilities for digital business, including the mobile broadband infrastructure and the cloud computing infrastructure providers (data centres, IaaS).

Facilitating access to data as a resource

Knowledge on the basic data sources available in the country and in the world to serve the digital business models:

- open data portal with access to state and private information resources (databases)
- open API marketplaces (general or for specific industries, i.e. financial)
- system for unified digital IDs for citizens
- official comprehensive register of legal entities
- unified register of electronic passports of goods

Facilitating access to office premises

Practical knowledge of access to office, co-working spaces and infrastructure.

Production & R&D facilities

Practical knowledge of access to R&D environment equipped with update digital technologies, tools and equipment.

Facilitating access to finance

Practical knowledge of access to public support and private funding (connecting to investors, seed-capital, venture-capital, crowd-funding, etc.).

Building reputation and trust as resources

Industry-specific knowledge on existing labelling and certification schemes.

Visibility

Practical knowledge on the available visibility tools.

MODULE 2. SEED STAGE (IDEA)

Trend-scouting and technologies foresight (ideas for innovative projects)

Knowledge on methods, tools and data sources for trend-scouting and technology foresight;
Knowledge on methods, tools, logical frameworks for analysis of the digitalisation degree of specific sectors/industries (estimate the degree of technologies diffusion, identify the unused technological opportunities, identify the areas where the potential demand and the technological opportunity exist, but the supply is absent or limited etc)

Identify customers and develop value proposition

Knowledge on methods, tools and logical frameworks to segment the market and identify the target group of customers, to detect the customers' needs, develop value proposition for target groups of customers, and develop a business model

Building a balanced team and finding partners with complementary competencies

Practical skills on building a balanced team and finding partners with complementary competencies.

MODULE 3. START-UP STAGE (PRODUCT)

Product development

Knowledge on the existing logical frameworks and practical skills of new product development, including developing creative concepts (conception, campaign, implementation, marketing mix)
Practical knowledge on the available distribution channels and their limitations.

Research and development

Practical knowledge on the existing platforms helping to find partners in joint research and development projects

Value proposition and business concept testing and validation

Knowledge on the existing logical frameworks and practical skills of the selection of profit sources, developing marketing strategy and setting pricing policy

Intellectual property management

Knowledge on the existing logical frameworks and practical skills on analysis of patent landscape and freedom to operate, filing patent applications
Knowledge on the existing logical frameworks and practical skills on concluding patent sales and licensing agreements
Knowledge on the existing logical frameworks and practical skills on aligning the strategy of intellectual property management with the business strategy
Knowledge on the existing logical frameworks and practical skills on managing the relations concerning intellectual property within the firm and with other firms
Knowledge on the existing logical frameworks and practical skills on resolving conflicts apropos intellectual property

Product and Corporate Design

Knowledge on the existing logical frameworks and practical skills on development of the specific product industrial design, user-friendly interface, user-friendly design of products/services; brand/trademarks etc.
Knowledge on the existing logical frameworks and practical skills on the development of the specific corporate design (corporate identity, manuals, business stationery, brand development, wording etc).

MODULE 4. ENTERING THE MARKET

Marketing products and services

Practical skills on event-based marketing

Distribution channels and sales

Knowledge of methods and practical skills on:
extending distribution channels and organizing sales,
organizing lead management,
developing model contracts and service level agreements (SLAs)

Innovation Management / Support of innovation processes (internal, external)

Knowledge of methods and practical skills on:
collecting and managing customers feedback and increasing customer engagement,
specific innovation process management tools/techniques,
risk management.

Accompaniment after entering the market

Knowledge on logical frameworks and practical skills of milestones allowing for mentoring businesses throughout the growth stages.

MODULE 5. SCALE-UP, SCOPE-UP, SPEED-UP

Business services for growing and accelerating companies

Practical skills of collaboration with and consultancy from international business developers – serial entrepreneurs, business consultants, industry experts
Practical skills of taxation and reporting schemes related to business growth stages

Business scoping up

Knowledge on logical frameworks and practical skills on the design and implementation of roadmaps to assist the scoping of companies (growing diversity of products and services; conquering new target groups of customers etc)
Practical skills on positioning of products or services with customers

Business scaling up

Knowledge on logical frameworks and practical skills on:
the design and implementation of roadmaps to assist the scaling of companies (growth of output; conquering new geographical markets with the same products and target customer groups)
Practical skills of:

organizing thematic missions including B2B meetings in foreign countries; support to attend international trade shows and network events to increase business visibility
identifying strategic and operational partners across borders
identifying potential customers (leads) across borders and transforming them into deals or collaborations
export/import regulations
integration into supply chains and distribution channels in foreign markets
international branding and marketing.

MODULE 6. BUSINESS TRANSFORMATION AND STRATEGY

Support to existing small and medium-sized companies in managing the structural transformation and in developing business models

General and specialised knowledge on new opportunities in the sphere of information and (broader) digital technologies, limitations and conditions of their efficient usage
Knowledge and practical skills of carrying out preliminary simulations and visualisations of digital products and services concepts
Knowledge of the logical frameworks and tools and practical skills of digital transformation by assessing the digitalisation opportunities for both the organisational structure of the whole company, production processes, products & services; design and implementation of innovative business models and development of the digital transformation roadmaps

Providing thematic expertise

Practical skills of organizing the specialised expert communities and working groups and sector-specific communities; thematic groups in the area of emerging or breakthrough digital technologies to encourage collaborative innovations; accumulating the network of experts with competencies in specific areas along the entire value chain of digitalisation, including technology and service providers, users, research institutions and multipliers (examples: Automobile & Transports; Digital Trust & Security; Free and Open Source Software; Health & ICT Initiative; Smart Energy Management; System Design and Development Tools; Telecoms)
Practical skills of organizing working groups for innovative digital solutions in non-IT industries including experts from both IT and these industries

MODULE 7. NETWORKING AND COLLABORATION (for innovation infrastructure organisations)

B2B networking (business to business)

Practical skills of coordination and conflict-resolution to drive the networking and clustering of SMEs with SMEs and MNCs

B2G networking (business to government)

Practical skills of coordination and conflict-resolution to drive the collaboration of SMEs and government

B2A networking (business to academia)

Practical skills of coordination and conflict-resolution to drive the collaboration of SMEs and scientific research community

I2I networking (infrastructure to infrastructure)

Practical skills of coordination and conflict-resolution to drive the collaboration of ICT innovation infrastructure organisations within the country and internationally for better servicing the supervised businesses.

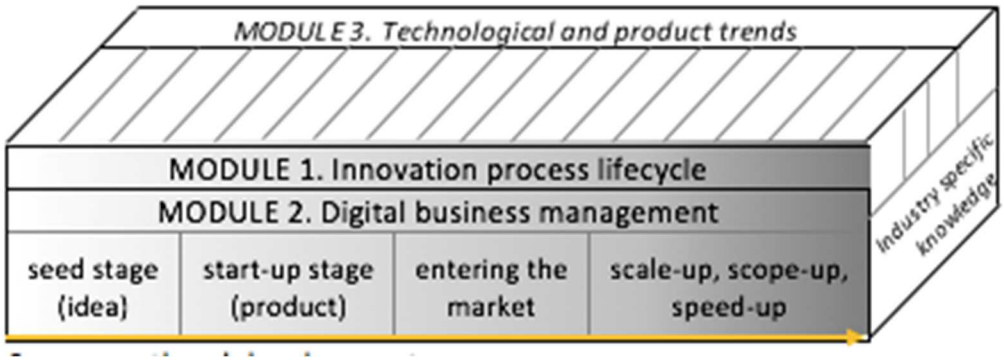
APPENDIX 8 TRAINING PACKAGE SPECIFICATION 3: BUSINESSES

The recommended concept of training is the modular-based training, so that particular topics can be picked up by the students depending on their needs.

The basic introductory Module 1 “Innovation process lifecycle” should be a prerequisite of enrolment into any specific module. The specific modules should always indicate the place of the module’s content on the innovation process map, and the links to the courses that concern the same innovation process stage.

While the **comprehensive training on digital markets and managing digital businesses** should include the minimal knowledge of all the stages of the innovation process and business development, it can be combined with particular modules on **technological and product trends** in a more flexible way, depending on the interest of students. This will enable the growing specialisation of digital specialists and the tuning of their skills to the market needs. The same, specialisation can be developed by a combination of the **comprehensive training on digital markets and managing digital businesses** in a flexible way with knowledge on operation, typical business processes and typical challenges of particular industries of economy (agriculture, construction, logistics, trade, manufacturing, healthcare etc).

Figure 8.1. Schematic structure of the training package for non-IT businesses



Source: authors’ development.

MODULE 1. Innovation process lifecycle

Innovation process and participants of innovation activity

Definition of the term "innovation". Features of innovation. Innovation activity and innovation process. Innovative capacity and innovative potential. Types of innovation and their classification. Driving forces of innovation. Scientific knowledge as an economic resource. Tacit and implicit knowledge. Local knowledge. Specific and interspecific resources. Linear model of the innovation process and its stages. Nonlinear model of the innovation process and its stages. Participants in

the innovation process. Triple Helix and collaboration of business, government and science as participants in the innovation process.

Innovation process in the firm

Development of a new product, its stages; approaches; principles. Open innovation. The life cycle of an innovative product. The diffusion curve of innovation. Disruptive innovations. Concepts of learning of an innovative firm. Lead user. Specific competencies of innovators. Basic types of strategies of an innovative firm in the market. Strategies of innovative leaders.

Dynamics of innovations outside the firm

The technological market, its institutional framework and functions. Goods on the technological market, their properties. Technological transfer. Diffusion of technologies, its factors and models.

External effects in the innovation process

Failures of the technological market. Non-market transfer of knowledge and technology. General-purpose technologies as a source of external effects. Increasing return on technological knowledge. Consumer trends. Technological trajectories (trends). Moore's law. Effect of path dependence. Dominant design. Network effect; the law of Metcalfe. Lock-in effect and switching costs. Open standards. Transaction costs.

Intellectual property resources management

The variety of objects of intellectual property rights, the field of protection of IP rights. High-tech patents. Procedure for obtaining a patent. License agreements. Economic functions of the patent system. Stages of commercialisation of the results of research and development. Tools for managing IP assets within the firm and in relations with other firms. Methods of strategic IP management. Thermal map of technologies. The Nomur scheme for the patents portfolio managing. The system of strategic IP management. System of principles of IP management as economic assets.

Network nature of innovation. Innovative clusters

Interactions in the context of innovation activity. Innovative networks as forms of economic relations. Innovation clusters as forms of organisation of economic activity: nature, boundaries, structure, connections, main features, life cycle, basic models, effects. Innovation cluster management.

MODULE 2. Digital business management

Seed stage and Start-up stage

2.1. Developing innovative business models based on digital technologies

2.2. Developing digital business strategies and roadmaps

2.3. Preparing a structured digital business plan applicable for fundraising

2.4. Project criteria important for investors, assessment of investor readiness and investor relations

Entering the market

2.5. Standards on the digital market

2.6. Recruitment and personnel management on digital markets

2.7. Value chains on digital markets

2.8. Digital products and services development and design

2.9. Rapid and virtual prototyping techniques

2.10. Customers segmenting and lead management on digital markets

2.11. Conversion management techniques

2.12. Service level agreements (SLAs) and contracts on digital markets

2.13. Marketing on digital markets

2.14. Management on digital markets

Scale-up, scope-up, speed-up

2.15. Distribution channels on digital markets

2.16. Innovation management, change management, risk management on digital markets

2.17. Intellectual property management on digital markets

2.18. Legal enforcement on digital markets

2.19. Large (national and international-scale) information systems and relevant market niches

2.20. Internationalisation specifics on digital markets

MODULE 3. Technological and product trends

In the training courses, the most topical trends of digital transformation will be considered from the economic perspective, with the aim to explain the:

- Opportunities of digital technologies to enable self-employment and increase employment in the existing enterprises
- Opportunities of digital technologies to save costs and increase the productivity of non-IT sectors of economy
- Opportunities of digital technologies to back up the innovative business models with high value added and export potential

- Opportunities of digital technologies to increase earnings of state organisations by delivering services to citizens and business
- Opportunities of digital technologies to increase the efficiency of state governance and governmental services and enable e-democracy.

For non-IT businesses, using the easy-to-understand non-technical language, will help to study how the information technologies (IT) enable radical organisational innovations. This module will help students to get a systemic view on possibilities and limitations of contemporary IT-enabled tools and solutions for people, businesses, policy-makers. It will show the role of digitalisation in performance-driven revision of the organisational structure, business processes, functions distribution within organisation. The consequential change of transparency, social accountability and personal responsibility of business and state regulators should be stressed. The transformations in general market structure (changing roles and market shares reallocation) should be observed.

The training courses should introduce the students into the terms and definitions, disclose their essence, contents and forms. The students should look at possibilities of application of particular IT-enabled innovations, discover the existing cases, and review the existing legislation. In the practical part, the students should discuss their individual tasks and prepare in groups the concept of IT-enabled solution to a number of business and social challenges, like bankrupting insurance company, city parking crisis, low-productive farms, inefficient medical treatment system etc.

The list of technological and product trends should be regularly updated, as well as the content of the taught material, and should be based on analysis of the advanced and successful practices of both global and local businesses. The cases of local digital businesses are important because not all needs can be covered by global businesses with account of local specifics of demand, because their establishment might be more cost-efficient, and because for many people the link to their region is an important condition for starting a business.

Particular technological trends (micro-modules) include:

2.31. eID for citizens and legal entities

2.32. Internet of Things

2.33. Big Data collection, aggregation, analysis, visualisation services

2.34. Electronic data interchange (EDI)

2.35. Electronic digital signature (EDS)

2.36. Interoperability of information systems

2.37. Open API

2.38. Open Data

2.39. Distributed ledgers and blockchain

2.40. Smart contracts

2.41. Cyber currencies (e-money)

2.42. Fintechs

2.43. Industry 4.0

2.44. Smart grids

2.45. Robotics

2.46. eLogistics

2.47. eCommerce

2.48. Telecom

2.49. eHealth

2.50. eSkills

2.51. Artificial intelligence

2.52. Visualisation, virtual reality and augmented reality

2.53. Cybersecurity

2.54. Cloud computing

2.55. Business intelligence and analytics

2.56. Data protection and the legal implications

2.57. CRM - Customer relationship management

2.58. Gamification

2.59. Mobilisation, socialisation and omni-channelled service as trends of digital markets

2.60. UX and UI development

APPENDIX 9 TOPICS RECOMMENDED ON ICT INNOVATION SERVICES FOR EAP ROADMAPS

	Armenia	Azerbaijan	Belarus	Georgia	Moldova	Ukraine
RESOURCE BASE						
Human resources						
Technologies						
Office premises						
Production & R&D facilities						
Access to public funding						
Access to private funding						
Visibility						
SEED STAGE (IDEA)						
Trend-scouting and technologies foresight						
Identify customers and develop value proposition						
Building a balanced team and finding partners with complementary						
START-UP STAGE (PRODUCT)						
Product development						
Research and development						
Value proposition and business concept testing and validation						
Intellectual property management						
Product and Corporate Design						
ENTERING THE MARKET						
Marketing products and services						
Distribution channels and sales						
Innovation Management / Support of innovation processes						
Accompaniment after entering the market						
SCALE-UP, SCOPE-UP, SPEED-UP						
Business services for growing and accelerating companies						
Business scoping up						
Business scaling up						
BUSINESS TRANSFORMATION AND STRATEGY						
Support to existing SMEs in managing the structural transformation and in developing business models						
Thematic expertise						
NETWORKING AND COLLABORATION						

LEGEND

The least developed areas of the ICT innovation ecosystem (0-5%)	
The less developed areas of the ICT innovation ecosystem (5-10%)	
The areas of the ICT innovation ecosystem that can be improved (10-15%)	

Appendix 10 Topics recommendations on ICT Innovation-related training for EaP roadmaps

Based on the results of the Study, the following training modules can be considered a priority for *EaP-wide activities on ICT Innovation trainings*:

	Policy-makers	Innovation infrastructure organisations	Businesses
Technological trends	• Artificial intelligence • Big Data collection, aggregation, analysis, visualisation services • Cloud services • Cyber currencies (e-money) • Distributed ledgers and blockchain • eHealth • Fintechs • Industry 4.0 • Open API • Open Data • Smart contracts	• Artificial intelligence • Big Data collection, aggregation, analysis, visualisation services • Business intelligence and analytics • Cloud computing • CRM - Customer relationship management • Cybersecurity • Data protection and the legal implications • eCommerce • eHealth • Electronic data interchange (EDI) • Fintechs • Industry 4.0 • Internet of Things • Interoperability of information systems • Mobilisation, socialisation and omni-channelled service as trends of digital markets • Open API	• Artificial intelligence • CRM - Customer relationship management • Cyber currencies (e-money) • Distributed ledgers and blockchain • eCommerce • eHealth • eLogistics • Gamification • Industry 4.0 • Internet of Things • Mobilisation, socialisation and omni-channelled service as trends of digital markets • Robotics • Smart contracts • Smart grids • Visualisation, virtual reality and augmented reality.

		• Open Data	
Digital business management	• Developing digital business strategies and roadmaps • Developing innovative business models based on digital technologies • Innovation management, change management, risk management on digital markets • Intellectual property management on digital markets • Internationalisation specifics on digital markets.	• Developing digital business strategies and roadmaps • Developing innovative business models based on digital technologies • Innovation management, change management, risk management on digital markets • Intellectual property management on digital markets • Internationalisation specifics on digital markets • Recruitment and personnel management on digital markets • Service level agreements (SLAs) and contracts on digital markets • Standards on the digital market	• Customers segmenting and lead management on digital markets • Developing digital business strategies and roadmaps • Developing innovative business models based on digital technologies • Distribution channels on digital markets • Innovation management, change management, risk management on digital markets • Internationalisation specifics on digital markets • Management on digital markets • Marketing on digital markets • Preparing a structured digital business plan applicable for fundraising

Besides, it is important to provide training for policy-makers on:

- Current trends of setting the legal framework for digital markets in foreign countries
- Current digital agenda and tools used by the Eurasian economic commission
- Current digital agenda and tools used by the international organisations (The World Bank, OECD, UN, WIPO, ISO etc)
- Current digital agenda and tools used by the neighbour states and their unions (EU etc)
- Opportunities of digital technologies to enable self-employment and increase employment in the existing enterprises

- Opportunities of digital technologies to increase the productivity of non-ICT sectors of economy
- Opportunities of digital technologies to increase earnings of state organisations by delivering services to citizens and business
- Opportunities of digital technologies to increase the efficiency of state governance and governmental services.

The identified gaps in knowledge of policy-makers, innovation infrastructure organisations and businesses of particular countries can also be considered as a priority for *training on a bilateral level (EaP country-EU)* and included into the topic recommendations to *EaP national roadmaps* on ICT Innovation-related training.

The largest training gaps for particular EaP countries are summarised below in an alphabetical order.

Policy-makers: technological trends

ARMENIA	AZERBAIJAN	BELARUS
Artificial intelligence	Artificial intelligence	Big Data collection, aggregation, analysis, visualisation services
Business intelligence and analytics	Cloud computing	Business intelligence and analytics
Cloud computing	Distributed ledgers and blockchain	Cloud computing
CRM - Customer relationship management	eHealth	Data protection and the legal implications
Cyber currencies (e-money)	Fintechs	eHealth
Distributed ledgers and blockchain	Industry 4.0	Industry 4.0
Electronic digital signature (EDS)	Open API	Mobilisation, socialisation and omni-channelled service
Gamification	Open Data	Open Data
Internet of Things	Smart contracts	
Mobilisation, socialisation and omni-channelled service	UX and UI development	
Smart contracts		

GEORGIA	MOLDOVA	UKRAINE
Artificial intelligence	Big Data collection, aggregation, analysis, visualisation services	Artificial intelligence
eLogistics	Cyber currencies (e-money)	Big Data collection, aggregation, analysis, visualisation services
Industry 4.0	Distributed ledgers and blockchain	Distributed ledgers and blockchain
Open API	eLogistics	eHealth
Open Data	Industry 4.0	eID for citizens and legal entities
Smart contracts	Internet of Things	Electronic data interchange (EDI)
	Interoperability of information systems	Electronic digital signature (EDS)
	Robotics	Fintechs
	Smart contracts	Open API
		Robotics

Policy-makers: digital business management

ARMENIA	AZERBAIJAN	BELARUS
Customers segmenting and lead management on digital markets Developing digital business strategies and roadmaps Developing innovative business models based on digital technologies Digital products and services development and design Internationalisation specifics on digital markets Marketing on digital markets Preparing a structured digital business plan applicable for fundraising	Developing innovative business models based on digital technologies Internationalisation specifics on digital markets Legal enforcement on digital markets Management on digital markets Recruitment and personnel management on digital markets Standards on the digital market Value chains on digital markets	Developing digital business strategies and roadmaps Developing innovative business models based on digital technologies Internationalisation specifics on digital markets Service level agreements (SLAs) and contracts on digital markets Standards on the digital market
GEORGIA	**MOLDOVA**	**UKRAINE**
Developing digital business strategies and roadmaps Internationalisation specifics on digital markets Large (national and international-scale) information systems and relevant market niches Standards on the digital market.	Developing digital business strategies and roadmaps Developing innovative business models based on digital technologies Innovation management, change management, risk management on digital markets Preparing a structured digital business plan applicable for fundraising Standards on the digital market Value chains on digital markets.	Customers segmenting and lead management on digital markets Developing innovative business models based on digital technologies Distribution channels on digital markets Innovation management, change management, risk management on digital markets Intellectual property management on digital markets Legal enforcement on digital markets

		Management on digital markets.

Innovation infrastructure organisations: technological trends

ARMENIA	**AZERBAIJAN**	**BELARUS**
Big Data Gamification Industry 4.0 Smart grids Distributed ledgers and blockchain Smart contracts Cyber currencies (e-money) Fintechs eHealth Data protection and the legal implications Visualisation, virtual reality and augmented reality	Artificial intelligence Cyber currencies (e-money) Industry 4.0 Smart grids	Big Data collection, aggregation, analysis, visualisation services Cloud computing Cybersecurity Industry 4.0 Open API Open Data
GEORGIA	**MOLDOVA**	**UKRAINE**
Business intelligence and analytics CRM - Customer relationship management	Cloud computing Cyber currencies (e-money) Cybersecurity	eID for citizens and legal entities Big Data collection, aggregation, analysis, visualisation services

Cybersecurity Data protection and the legal implications Distributed ledgers and blockchain eHealth Industry 4.0	Distributed ledgers and blockchain Industry 4.0 Interoperability of information systems Open API Smart contracts	Smart contracts Cyber currencies (e-money) Industry 4.0 Cybersecurity

Innovation infrastructure organisations: digital business management

ARMENIA	AZERBAIJAN	BELARUS
Innovation management, change management, risk management on digital markets Internationalisation specifics on digital markets Preparing a structured digital business plan applicable for fundraising Recruitment and personnel management on digital markets Value chains on digital markets	Digital products and services development and design Rapid and virtual prototyping techniques Recruitment and personnel management on digital markets Value chains on digital markets	Developing digital business strategies and roadmaps Developing innovative business models based on digital technologies Internationalisation specifics on digital markets Standards on the digital market
GEORGIA	**MOLDOVA**	**UKRAINE**
Developing digital business strategies and roadmaps Developing innovative business models based on digital technologies Intellectual property management on digital markets Large (national and international-scale) information systems and relevant market niches Legal enforcement on digital markets Rapid and virtual prototyping techniques Standards on the digital market	Digital products and services development and design, Distribution channels on digital markets Intellectual property management on digital markets Legal enforcement on digital markets Service level agreements (SLAs) and contracts on digital markets Standards on the digital market Value chains on digital markets	Developing digital business strategies and roadmaps Developing innovative business models based on digital technologies Innovation management, change management, risk management on digital markets Intellectual property management on digital markets Internationalisation specifics on digital markets Large (national and international-scale) information systems and relevant market niches Management on digital markets

Businesses: technological trends

ARMENIA	AZERBAIJAN	BELARUS
Business intelligence and analytics CRM - Customer relationship management Data protection and the legal implications Mobilisation, socialisation and omni-channelled service as trends of digital markets	UX and UI development eHealth Artificial intelligence Open Data Smart contracts Industry 4.0	Smart contracts Cloud computing Open API Open Data Distributed ledgers and blockchain Internet of Things Big Data collection, aggregation, analysis, visualisation services Industry 4.0
GEORGIA	**MOLDOVA**	**UKRAINE**
Big Data collection, aggregation, analysis, visualisation services CRM - Customer relationship management eID for citizens and legal entities Smart contracts UX and UI development	Gamification Internet of Things Mobilisation, socialisation and omni-channelled service as trends of digital markets Visualisation, virtual reality and augmented reality	TBC

Innovation infrastructure organisations: digital business management

ARMENIA	AZERBAIJAN	BELARUS
Innovation management, change management, risk management on digital markets	Developing innovative business models based on digital technologies	Developing innovative business models based on digital technologies
Intellectual property management on digital markets	Internationalisation specifics on digital markets	Developing digital business strategies and roadmaps
Large (national and international-scale) information systems and relevant market niches	Large (national and international-scale) information systems and relevant market niches	Internationalisation specifics on digital markets
Legal enforcement on digital markets	Legal enforcement on digital markets	Legal enforcement on digital markets
Standards on the digital market	Management on digital markets	Service level agreements (SLAs) and contracts on digital markets
	Recruitment and personnel management on digital markets	
	Standards on the digital market	
	Value chains on digital markets	

GEORGIA	MOLDOVA	UKRAINE
Digital products and services development and design	Internationalisation specifics on digital markets	Innovation management, change management, risk management on digital markets
Rapid and virtual prototyping techniques	Management on digital markets	Intellectual property management on digital markets
Service level agreements (SLAs) and contracts on digital markets	Value chains on digital markets	

Appendix 11 Glossary of stakeholders

Below the general definitions of start-up ecosystem players are given.

START-UP – (Investopedia) a company that is in the first stage of its operations; a young company that is just beginning to develop.

(BusinessDictionary) Early stage in the life cycle of an enterprise where the entrepreneur moves from the idea stage to securing financing, laying down the basis structure of the business, and initiating operations or trading.

Descriptive definitions:

http://www.investopedia.com/terms/s/ start-up.asp

http://www.businessinsider.com/what-is-a- start-up-definition-2014-12

UNIVERSITY – (Wikipedia) is an institution of higher (or tertiary) education and research which awards academic degrees in various academic disciplines. Universities typically provide undergraduate education and postgraduate education.

PUBLIC ORGANIZATION – (*Core Public Organisation Vocabulary*) any organisation that is defined as being part of the public sector by a legal framework at any level.

INCUBATOR (business incubators) – (Entrepreneur) An organisation designed to accelerate the growth and success of entrepreneurial companies through an array of business support resources and services that could include physical space, capital, coaching, common services, and networking connections. Business incubators are organisations geared toward speeding up the growth and success of start-up and early stage companies. They're often a good path to capital from angel investors, state governments, economic-development coalitions and other investors.

(Wikipedia) Business incubators differ from research and technology parks in their dedication to start-up and early-stage companies.

ACCELERATOR (start-up accelerator, seed accelerator) – (Wikipedia) fixed-term, cohort-based programs, that include mentorship and educational components and culminate in a public pitch event or demo day. The main differences between business incubators and accelerators are that in accelerators, the application process is open to anyone, but highly competitive; a seed investment in the start-ups is usually made, in exchange for equity.

(Techrepublic) Accelerators "accelerate" growth of an existing company, while incubators "incubate" disruptive ideas with the hope of building out a business model and company. So, accelerators focus on scaling a business while incubators are often more focused on innovation.

CO-WORKING SPACE – (Wikipedia) Co-working is a style of work that involves a shared working environment, often an office, and independent activity. Unlike in a typical office environment, those co-working are usually not employed by the same organisation. Typically, it is attractive to work-at-home professionals, independent contractors, or people who travel frequently who end up working in relative isolation. Co-working is also the social gathering of a group of people who are still working independently, but who share values, and who are interested in the synergy that can happen from working with people who value working in the same place alongside each other. Co-working offers a solution to the problem of isolation that many freelancers experience while working at home, while at the same time letting them escape the distractions of home.

(EC) Co-working involves a shared working environment, often an office and communications infrastructure, typically attractive to work-at-home professionals, independent contractors, or people who travel frequently and who end up working in relative isolation. In most cases, these professionals work for a technology start-up

INVESTOR – Individual or Institutional entities investing into different stages of the innovation process (business angels; networks of business angels; Venture Capitalists; Corporate Venture Capitalists; Crowdfunding Platforms etc.).

BUSINESS ANGEL - early stage investor. (Wikipedia) - An angel investor (also known as a business angel, informal investor, angel funder, private investor, or seed investor) is an affluent individual who provides capital for a business start-up, usually in exchange for convertible debt or ownership equity.

BUSINESS ANGEL NETWORK - the early stage investors community.

VENTURE CAPITALIST – (Wikipedia) an institutional investor providing venture capital to small, early-stage, emerging firms that are deemed to have high growth potential (usually with high-risk), or which have demonstrated high growth (in terms of number of employees, annual revenue, or both). Venture capital firms or funds invest in these early-stage companies on the stages after seed funding (for example by business angels) was provided, in exchange for equity, or an ownership stake, in the companies they invest in.

CORPORATE VENTURE CAPITAL – (Wikipedia) is the investment of corporate funds (of the existing corporation) directly in external start-up companies. Examples of CVCs include Google Ventures and Intel Capital.

CROWDFUNDING PLATFORM – (Wikipedia) Crowdfunding is the practice of funding a project or venture by raising monetary contributions from a large number of people. Crowdfunding is a form of crowdsourcing and of alternative finance.

CORPORATE – corporate business, a corporation is a company or group of people authorised to act as a single entity (legally a person) and recognised as such in law.

INFLUENCER – an individual, an organisation or a repeated event who/that foster the start-ups development.

POLICY-MAKING AUTHORITY – national, regional and local-level organisations with authorities of formulating the rules of the game in the market for both ICT start-ups and businesses, informatisation processes of non-ICT enterprises, and general digitalisation processes of the national economy.

SCIENTIFIC AND RESEARCH INSTITUTE – organisation performing the fundamental, applied research and developments connected to both development of new IT and its introduction in the manufacturing, operational and organisational processes in non-IT industries.

ICT TRAINING CENTER – public or private centres fulfilling training in both software development, IT business architecture and ICT-based business models development.

HIGH-TECH PARK (SCIENCE PARK, TECHNOLOGY PARK) – (Wikipedia) A science park is a strategically planned, purpose built work environment designed to locate in close physical proximity university, government and private research bodies involved in a particular field of endeavour to ensure that knowledge can be shared, innovation promoted and research outcomes progressed to viable commercial products.

TECHNOLOGY TRANSFER OFFICE/CENTRE – (Wikipedia) organisation assisting the process of transferring (disseminating) technology from its origination to wider distribution among more people and places. It occurs along various axes: among universities, from universities to businesses, from large businesses to smaller ones, from governments to businesses, across borders, both formally and informally.

FABLAB – (Wikipedia) is a small-scale workshop offering (personal) digital fabrication. A fab lab is typically equipped with an array of flexible computer-controlled tools that cover several different length scales and various materials, with the aim to make "almost anything". This includes technology-enabled products generally perceived as limited to mass production.

BUSINESS ASSOCIATION (CHAMBER OF COMMERCE) - (Wikipedia) is a form of business network, for example, a local organisation of businesses whose goal is to further the interests of businesses. Telecom businesses association, cloud providers association, media association, software developers' association are relevant examples.

PROFESSIONAL ASSOCIATION – (Wikipedia) A professional association (also called a professional body, professional organisation, or professional society) is usually a non-profit organisation seeking to further a particular profession, the interests of individuals engaged in that profession and the public interest. ICT experts with specialisation in various fields, like geo-information systems, cybersecurity, e-government are examples of relevant professional associations, as well as associations of lawyers, bookkeepers etc. in IT.

COMPETENCE CENTRE – (*Enterprise Ireland*) are collaborative entities established and led by industry and resourced by highly-qualified researchers associated with research institutions who are empowered to undertake market focused strategic research for the benefit of industry.

In IT: (Gartner) An organisational structure used to coordinate IT skills with an enterprise. Competency centres provide expertise for project or program support, acting both as repositories of knowledge and resource pools for multiple business areas.

DIGITAL INNOVATION HUBS - (EC) Digital innovation hubs are ecosystems that consist of SMEs, large industries, start-ups, researchers, accelerators, and investors. They aim to create the best conditions for long-term business success for all involved.