Transferring V4 expertise in knowledge/technology transfer

Deliverable	9 Summary report on the current status of SMEs-RI/Academia cooperation in Armenia and Georgia
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Content

1. Introduction

Armenia and Georgia are republics arising from the break-up of the former Soviet Union. Limited international collaboration during the soviet years resulted in the development and manufacturing of local R&D products, which were uncompetitive in the global market, or in many cases they were obsolete, the business activities were limited. The research institutes and universities lost thousands of highly educated and skilled scientists and many engineers continue to abandon their fields of specialization, seeking employment either in less skilled fields or abroad. After the stabilization of the political situation, creation of the strategic programs focused on the economic growth and their interconnection not only to the business activities and industry but also to the education system, science, research and development activities were created. In this way it is possible to improve sustainable development; to increase the number of young researchers, to improve the research infrastructure and also to support SMEs' development, entrepreneurship, and innovation in both countries. Within the previous projects the emphasis has been put on the capacity development of SMEs, but not on researchers/scientists to commercialize their knowledge and technology through an institutionalized dialogue and cooperation with business. This project solved with the support of Visegrad Funds was firstly aimed at introducing and rooting the culture of involving professional intermediaries (technology transfer centres, industrial liaison offices, R&D units) in establishing and managing cooperation between research infrastructures and business. For the first time SMEs, RIs and universities had the opportunity to present their knowledge/technology portfolio to the interested stakeholders from industry through interactive dialogue making it possible to adjust the offer to the existing demand of the business. Another innovative element of the project was the development of knowledge/technology transfer strategies at involved RIs and capacity building of the staff to manage those activities. That will further promote formal establishment and operation of knowledge and technology transfer at the Armenian and Georgian RIs.

During the project solution, V4 partners from Poland, Czech Republic and Slovakia shared their expertise in knowledge/technology transfer in the workshops organized for the Armenia and Georgia. Unfortunately, these workshops due to the pandemic situation had to be organized online using the ZOOM platform. Similarly, the Contest for the best cooperation plan/vision with RI/Academia took place in the virtual environment. Despite the complications caused by the pandemic situation, the participants of the project proved very high level of innovative activities during their presentations, which can be ideally supported by the research, development, marketing or other types of activities performed in cooperation with the research institutes or universities, resulting into the effective knowledge and technology transfer into the practice.

In the summary report, the current situation and perspectives of the knowledge and technology transfer activities in Armenia and Georgia are overviewed. The summary report is supplemented by the successful stories related to knowledge and technology transfer by the SMEs presented on the contest organized during the project solution and in the conclusion, general findings and suggestions are summarized.

2. The current situation in Armenia and Georgia

2.1 Problems with SMEs-RI/Academia cooperation in Armenia

Government

Armenia has a long tradition of excellence in science, technology, and education. As a result of the Soviet influence, Armenian capabilities were in the past strongly oriented to the military and industrial applications. With the disintegration of the Soviet Union, Armenia became isolated from many of its markets, and exports rapidly declined and therefore also well-financed research activities and education lost the strong support. A major exodus of talented people began, although educational standards remained high. It resulted into a deficiency of practicing scientists in the middle age. There also started to arise problems with the capabilities of the research institutions and their infrastructure.

The early elections of 2021 showed the permanence of democratic processes in the Republic of Armenia. These early elections were the second consecutive nationwide elections that were praised by the international community as the elections were free and competitive, fundamental rights and freedoms were respected and there were equal opportunities for campaigning and the elections corresponded to the principles of democracy. Nevertheless, several external and internal challenges posing a threat to the Republic of Armenia have not been overcome. The grave consequences of the 44-day war of 2020 essentially changed the external environment of Armenia, not only escalating several previously existing challenges, but also leading to the emergence of new challenges. Protection of the external security, sovereignty and territorial integrity of Armenia, fair solution to the Nagorno-Karabakh issue has become the priority.

The Government indicates their intention to make Armenia a high-tech, industrial country. Therefore, in addition to the Ministry of Education, Science, Culture and Sport of the Republic of Armenia, which is a central body of executive authority that elaborates and implements the policy of the Government of the Republic of Armenia in the spheres of education, science, culture and sport, the Government in its structure has also the Ministry of High-Tech Industry representing a central body of executive authority that develops and implements the Government's policy in the spheres of communication, information, information technology and information security, postal services, licensing, granting of permits and of course, also of the military industry. It´s aim is to accelerate the foreign investments and it can be done also by the improvement in the protection of IPRs, because transfer of technologies and outputs of intellectual activities are important forms to attract foreign investments. Therefore, the Government has set as a priority the improvement of legal regulations for the protection of IPRs, as well as the development of protection mechanisms.

The Government identified problems also regarding to the cooperation of the industry, SMEs and universities. Therefore, to foster the development of high technologies, the Government has already proposed a set of steps to be carried out, in particular:

- qualitative and quantitative improvement of technology education in the high technology sector;

- continuous increase of opportunities for engaging necessary investments in high technology companies (start-ups) and engaging financial tools for ensuring further development of the high technology companies and their access to the world markets, including through state support programmes;
- implementation of actions for promoting immigration of technological potential;
- ensuring creation of new value and application of technological solutions in the high technology sector and in all sectors of the economy by way of providing funding to newly established companies within the scope of grant programmes;
- implementation of educational and acceleration programmes for the purpose of ensuring inflow of knowledge and skills from technological, educational and scientific-research centres, and promoting development and engagement of investments in the technology sector;
- improvement of capacities of technology centres, techno parks, accelerators and incubators existing in the Republic of Armenia, as well as establishment of new centres in the Republic of Armenia, including on the basis of international cooperation, for the purpose of proportional regional development;
- creation and enhancement of special engineering and industrial zones based on the example of the "Engineering City";
- ensuring and promoting the presence of Armenian high technology sector (companies) around the world, including at prestigious international exhibitions, events;
- promotion of effective cooperation of technology companies for progressive development of the high technology sector by way of preparing new specialists and providing sector-specific specialists with the opportunity to re-specialise;
- implementation of programmes for capacity-building of the companies operating in the sector.

To ensure the development of high-tech companies, it was also planned to establish and develop technological centres in Yerevan and in the other regions, as well as to ensure efficient operation of existing centres, thereby providing adequate technological and production opportunities as a platform for further development.

There should be also performed proactive steps to attract international high-tech companies to Armenia. Other barrier is that awareness of Armenia as a technology hub should be raised to ensure the development of new technologies and know-how, as well as raise. Nowadays, there is still insufficient cooperation between tech SMEs and universities in the area of training of the specialists.

The Government attaches great importance to small and medium-sized enterprises (SMEs), which are being seen from the main goal in this area, which is to take complex steps to eliminate the obstacles existing in the sector. To achieve this goal, many activities are carried out, such for example:

- the support toolkit for beginner entrepreneurs by significantly increasing availability of funds, entrepreneurial skills and contacts, as well as knowledge for innovative entrepreneurs;

- support of implementation of innovative ideas and the creation of alternative sources of income and the use of competitive advantages in the Republic of Armenia in the post-crisis period through the implementation of innovative ideas;
- activities to generate investments in human capital and create new jobs, eliminate discrimination in the economy and raise the level of participation;
- promotion of the SMEs, particularly by increasing availability of financial resources and capacity-building;
- a structure for commercialization of technologies and inventions will be created;
- a social innovation support centre will be established for development of social entrepreneurship and a social environment;
- courses for development of entrepreneurial skills will be introduced in different stages of the educational system.

To support the knowledge and technology transfer, the Government has a plan to:

- ensure more rapid and flexible processes for the implementation of innovative programs that help generate new knowledge, as well as ensuring maximum availability of the factors of competitiveness;
- adopt policy for disseminating business information and markets studies as widely as possible;
- prepare the procedures for the involvement of foreign specialists who are highly qualified;
- neutralize the existing risks in the economy through an innovative support toolkit for investment programs;
- support equality; for the purpose of increasing the role of women and youth in the economy of Armenia, programs for development of their business networking and competitive capacities in international markets will be carried out. This point is especially important considering the cooperation with EU countries, where gender equality and involvement of young researchers into the scientific activities are required.

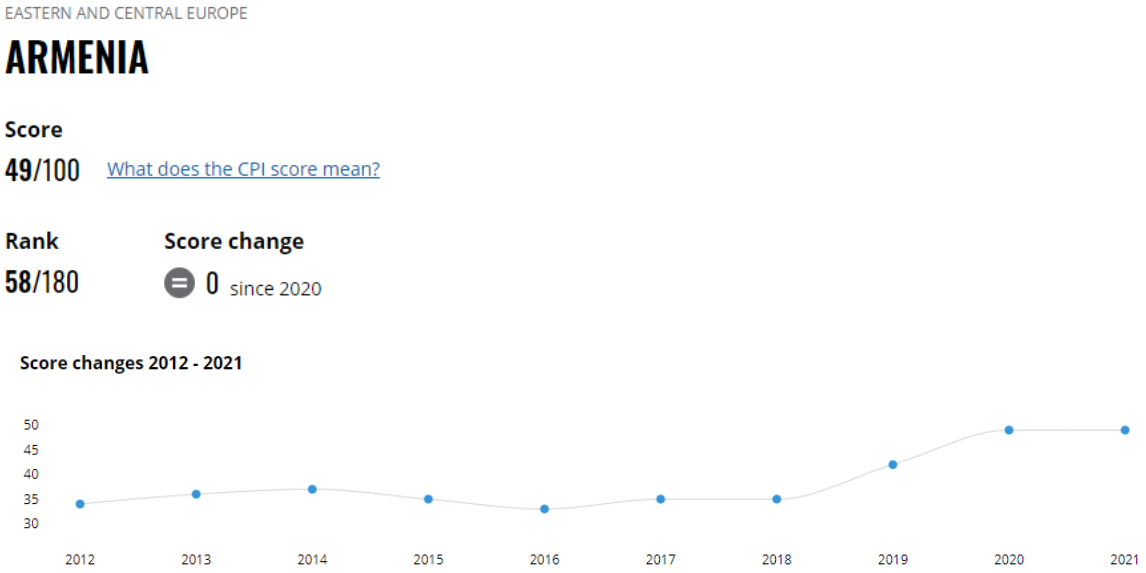
As it was mentioned above, the Government also defines the development of the military industry as one of the key factors to ensure scientific and technological progress. To achieve this goal, they intend to do the following:

- continue the processes of armament and military equipment modernization. More targeted policy will be implemented in the areas of military and military-technical cooperation with allied and partnering states;
- development of military education and science will be one of the key directions for the activities of the Government;
- the sphere of information security and cyber security will be reformed.

It can be expected that investments in the sphere of the defence and military industry can support further development of cooperation between the defence and military industry and the science and education sector, with the objective of attracting young, talented specialists into this area.

One of the factors, which is evaluated regarding the Government, is the Corruption Perceptions Index (CPI) reveals that corruption levels are at a worldwide standstill. The CPI ranks 180 countries and territories around the world by their perceived levels of public sector corruption.

The results are given on a scale of 0 (highly corrupt) to 100 (very clean). Each country's score is a combination of at least 3 data sources drawn from 13 different corruption surveys and assessments. These data sources are collected by a variety of reputable institutions, including the World Bank and the World Economic Forum. The score changes from 2012 – 2021 in the case of Armenia can be seen in the following graph:



However, similarly to other countries, the consequences of the crises caused by the coronavirus pandemic together with the 44-day war unleashed by Azerbaijan, caused a heavy blow to the economy of Armenia, interrupting the high pace of economic growth.

Armenia and the EU

The EU relations with Armenia are based on the EU-Armenia Comprehensive and Enhanced Partnership Agreement (CEPA), which was signed on November 24, 2017. The CEPA will provide for strengthening of cooperation in the areas of mutual interest, in particular in political, economic and sectorial fields.

The CEPA provides for a very solid basis to further enhance reform agenda in the areas of mutual interest. The European Union and the Republic of Armenia have committed themselves to work together for the benefit of the citizens of Armenia and the European Union, notably to contribute to the strengthening of democracy and of political, economic and institutional stability. Both sides committed to promote, preserve and strengthen peace and stability at both regional and international level and to enhance cooperation in the area of freedom, security and justice with the aim of reinforcing the rule of law and respect for human rights and fundamental freedoms.

Armenia was included (as a Southern Caucasus country) in the European Neighbourhood Policy (ENP) in 2004 and in the Eastern Partnership in 2009.

In the framework of the revised European Neighbourhood Policy and the Eastern Partnership, the new Agreement replaces the previous EU-Armenia Partnership and Cooperation

Agreement (1999), which provided for a wide-ranging cooperation in the areas of political dialogue, trade, investment, economy, law-making and culture.

The EU is providing financial assistance to Armenia. As part of the European Neighbourhood Policy, Armenia benefits from the European Neighbourhood Instrument (ENI).

The Mobility Partnership with Armenia was signed in 2011. Both sides committed to improve mobility of people in both directions, whilst working to ensure better management of migration flows, including preventing and reducing irregular immigration. The EU-Armenia Visa Facilitation and Readmission Agreements were signed and entered into force in January 2014. Their overall implementation was assessed as overall good at the last EU-Armenia Joint Committees, which were held in Yerevan in June 2016.

The EU is the first export destination for Armenian products, and one of Armenia's main trading partners. The EU imports from Armenia mainly manufactured goods, raw materials, beverages and tobacco. EU exports to Armenia consist of machinery and transport equipment, manufactured goods, and chemicals.

Negotiations for Armenia's participation to the EU's biggest Research and Innovation Programme HORIZON 2020 were concluded in 2015 and Armenia signed the Association Agreement in May 2016. HORIZON 2020 provided financing for research and innovation and supports Small and Medium-sized Enterprises.

The signature for Armenia's participation in the European COSME programme (Competitiveness of Enterprises and Small and Medium-sized Enterprises) took place at end of 2015. The programme promotes entrepreneurship and entrepreneurial culture, improves access to finance for SMEs and boosts their competitiveness.

The EU Delegation created a budget of more than EUR 23 million from 2016 to 2020 to business development in Armenia. The actions will range from Small and Medium Enterprise

In the area of education, the most important fact was that Armenia signed a Partnership and Cooperation Agreement with the EU in April 1996. Starting from that period Armenia has actively participated in EU funded projects, first through TEMPUS TACIS, then TEMPUS, ERASMUS MUNDUS, Jean Monnet and now Erasmus+ programs. (SME) policy implementation to access to finance. In the past, approximately 800 students and staff of Armenian universities participated in Erasmus Mundus projects and Erasmus Mundus Joint Master Degree Programs over the period 2004 – 2014. The highest rate of participation of Armenian Universities in EU programs was reached during the TEMPUS IV (2007 – 2013) phase, when several Universities have applied to TEMPUS funding not only as Partner Universities but also coordinating ones. Armenia also participated in the eTwinning plus action. Eight out of the 27 projects funded during 2011 – 2012 were coordinated by Armenian HEIs. There has also been a large increase in the number of Armenian students furthering their education abroad on various long-term programs, which has doubled in the past five years. Outgoing long-term mobility takes place within the framework of international agreements with a number of countries (Russia, China, Romania, Bulgaria, Georgia) and fellowship programs (UK, US, Italy, German Academic Exchange Service (DAAD)), etc. The Armenian government-initiated scholarship programs of the “LUYS” Foundation, to help students pursue further education at the world’s best universities in the United Kingdom, USA, Canada, Switzerland and other countries.

The EU is the development cooperation donor in Armenia. It has provided assistance to Armenia since the country gained independence. Annual support has grown progressively since a partnership agreement was in force since 1999.

The financial and technical assistance provided by the EU supports Armenia's development priorities. Currently they are set out in the Armenia Development Strategy until 2030.

Several EU projects assist Armenia to obtain an increasingly close relationship with the EU, to meet EU standards and learn from best practices. The EU project portfolio also includes support for agriculture, migration, environment and nuclear safety as well as energy and innovation among others. Finally, Armenia benefits annually from the Technical Assistance and Information Exchange via the TAIEX instrument and from Twinning projects with EU specialized institutions.

Closer trade and economic integration with the EU can be a key factor for Armenia's economic growth. Both the EU and Armenia are members of the World Trade Organisation and Armenia benefits from GSP+ under the EU Generalised System of Preferences (GSP).

Universities, academy of sciences and research organizations

The goal of higher professional **education** is the preparation and re-qualification of highly qualified specialists; meeting the needs of education development of a person on the basis of secondary general and secondary vocational education.

The following types of higher education institutions are established within higher and postgraduate professional education system of the Republic of Armenia:

- University
- Institute
- Academy
- Conservatory.

All of the above mentioned higher education institutions are independent and autonomous and they are free to carry out academic and/or applied education programmes at all levels of studies based on their profile.

The majority of universities in Armenia focus predominantly on teaching, while research activities are not covered to the same extent. Currently, most of the Armenian universities offer structured scientific-educational programmes for the qualification of Researcher, consisting of 180 credits. In Armenia, postgraduate degree candidates (Doctorate) have student/learner status. They are admitted to postgraduate degree programmes on a competitive exam basis. Doctoral thesis defences are conducted by the Professional Councils of the universities or R&D institutes and overseen and ratified by the Armenian Higher Attestation Commission.

The Ministry of Education and Science is responsible for developing and implementing state policy/strategy, as well as for the observance and improvement of the legislation in higher education. It is also the source of funding and in addition, performs an oversight and auditing function. In 2016, the Government of Armenia assigned the Ministry of Education and Science of Armenia to study and implement emergency funds to foster the financial sustainability of the higher education institutions in the country.

At present, 26 state universities (of which 4 international), and 33 private (licensed) higher educational institutions in the Republic of Armenia.

The most widespread spheres in the scientific and educational system of Armenia are Physics, Mathematics, Chemistry, Microbiology, Engineering, Medicine, Information Technologies, Armenian studies.

To the most important universities (according to the Ministry of Foreign Affairs of the Republic of Armenia) belong:

- Armenian State University of Economics founded in 1975. The foundation sources arise since 1930, from Cooperative-Economics Institute, then as Department of Economics of Yerevan State University for more than four decades. It involves departments of Management, Regulation of Economy and International Economic Relations, Finance, Marketing and Business Organization, Computer Science and Statistics, Accounting and Auditing. Website: www.asue.am
- Yerevan State University founded in 1920 with the Departments of History, Armenian Philology, Chemistry, Physics, Economics, Mathematics and Mechanics, Biology, Geography and Geology, Law, Russian Philology, Oriental Studies, Journalism, Philosophy and Psychology, Informatics and Applied Mathematics, Radio physics, Sociology, Romano-Germanic Languages, International Relations, Theology. Website: www.ysu.am
- Yerevan State Medical University after Mkhitar Heratsi founded in 1930, on the basis of medical faculty of the Yerevan State University, which functioned from 1922 with the departments of General Medicine, Public Health, Stomatology, Pharmacy, Military Medicine, Postgraduate and Continuing Education. Website: www.ysmu.am
- State Engineering University of Armenia as the legal successor of Yerevan Polytechnic Institute founded in 1933 with the departments of Chemical Technologies and Environmental Engineering, Electrical Engineering, Machine Building, Mining and Metallurgy, Cybernetics, Power Engineering, Radio Engineering and Communication Systems, Computer Systems and Informatics, Transportation Systems, Applied Mathematics, Mechanics and Machine Study, Correspondence Education. Website: www.seua.am
- Brusov State University founded in 1935 with the departments of Foreign Languages (English, French, German, Spanish, Italian, Greek, Persian); Russian Language, Literature and Foreign Languages (English, Spanish, German, French); Linguistics and Intercultural Communication. Website: www.brusov.am
- Armenian-Russian (Slavonic) State University founded in 1997. The University was established on the basis of the "Agreement between the Government of the Republic of Armenia and the Government of the Russian Federation on the conditions of establishment and operation in Yerevan Armenian-Russian University", which was signed on August 29, 1997. In its organizational structure it has departments of Applied Mathematics and Informatics, Economics, Foreign Languages, Law, Medicine & Biology, Social & Political Science, Philology, Engineering & Technology, Tourism & Publicity. Website: www.rau.am
- French university in Armenia (UFAR) founded in 2000 in the framework of Agreement on cultural, scientific and technical collaboration signed in 1995 between the

Governments of Armenia and France. In partnership with the University Jean Moulin Lyon 3 – IAE Lyon (https://www.univ-lyon3.fr/ IAE Lyon Bachelor and Master programs are in the top 5 of Eduniversal ranking 2018-2019) and the University Toulouse 3 Paul Sabatier (№ 45 in Academic Ranking of World Universities http://www.univ-tlse3.fr/) UFAR awards a double diploma (Armenian and French state diplomas) both at undergraduate and graduate levels. Departments: Law, Management, Marketing, Finance, Computer Science and Applied Mathematics. Languages of study: Armenian, French, English. Website: https://ufar.am/en/

- American University of Armenia founded in 1991 is a private, independent university located in Yerevan, Armenia. It was established through a partnership between the Armenian General Benevolent Union, the University of California, and the Government of Armenia. AUA is affiliated with the University of California and accredited by the WASC Senior College and University Commission. Through its College of Business and Economics, College of Humanities and Social Sciences, College of Science and Engineering, and School of Public Health, AUA offers five undergraduate degrees, nine graduate degrees, and four graduate certificates. AUA is also a research-oriented institution with nine research centers that attract both privately and publicly funded projects. Website: www.aua.am
- European Regional Educational Academy founded in 2001 with the departments of Information Technologies, Economy and Management, International Relations, Law, Tourism, Linguistics, Public Health Management. Website: http://eua.am/

Armenian universities have several important strengths. First, the country has a long tradition of respect for all areas of science and for science educators. The pride of educators in their profession is evident at each of the institutions.

However, there are also many types of barriers that has to be overcome, such for example that:

- young scientists who had completed their training in the universities but ended up working as waiters or retail clerks because of a lack of opportunities to pursue scientific careers;
- the number of current graduate students is far short of meeting needs to replace faculty members who are retired or will soon retire;
- in particular, software companies pay more than the universities, so graduates are going directly to salaried jobs, when available, instead of graduate school;
- lack of compatible programmes for students to travel to the United States or Europe or to otherwise interact with foreign scientists;
- attracting talented young students to science and retaining them in the professions for which they are trained are also difficult;
- there are not enough scientific or technology-related jobs, and most that do exist are poorly paid;
- lack of support for those students who spend the considerable time and effort required to master a scientific area could well erode the esteem currently accorded scientists in Armenia.

It seems that research in academia remains often at a theoretical level and is carried out without considering the requirements of the relevant business sector. It also seems that most of the Armenian universities have a theoretical structure rather than industry-oriented education traditions. Institutions of higher education should apply necessary measures to promote sectoral initiatives.

The main reasons for the university to cooperate with SMEs are as follows:

- Qualified students adequate training: graduates wishing to work in companies should have necessary expertise and knowledge to satisfy the requirements of the industry.
- Knowledge transfer to industry: companies should be able to take advantage of the practice and theoretical knowledge of the educational sector.
- University has a chance to make use of industrial opportunities: to provide internships or exchange courses to students before beginning their careers.
- Creating synergistic effects: the potential of the collaborators should be brought together systematically, thus facilitating interaction between corresponding actors.

The **National Academy of Sciences of Armenia** (NAS RA) is the most relevant scientific institution in the country. It is called upon to consolidate efforts by scientists to do basic research in many fields of science, to improve national security as well as to address social and economic problems. Currently, the Academy continues to develop various branches of science and effectively cooperates with national universities and state structures of the Republic, as well as with international scientific organisations. It actively participates in numerous international programmes and international projects, including the following ongoing projects financed by the European Commission within Horizon 2020 and COSME: EU H2020 BSH, EU H2020 EaP PLUS, EU H2020 EEN Armenia, COSME EEN Armenia.

As a state scientific organization NAS RA unifies the scientific and research institutes, subsidiary services and governing body – the Presidium of the Academy includes 34 scientific organizations.

The Presidium of NAS RA has five scientific divisions in particular fields of science:

- Division of Mathematical and Technical Sciences,
- Division of Physics and Astrophysics,
- Division of Natural Sciences,
- Division of Armenology and Social Sciences,
- Division of Chemistry and Earth Sciences.

Several Institutes have experimental types of plants, special design bureaus, botanical gardens, etc. The Presidium of NAS RA also includes the Fundamental Scientific Library, International Scientific Educational Center, “Gitutyun” Publishing-House and subsidiary services.

The Law on the National Academy of Sciences from May 2011 allows the academy to carry out wider business activities concerning the commercialization of research 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.

NAS RA is mainly financed from the state budget. Additional finances come from different state and private foundations, as well as from direct contracts between the Academy and other organizations in Armenia and abroad.

The Academy has a staff consisting of academicians, corresponding members, doctors of sciences, candidates of sciences. It has also honorary members, foreign members and honorary doctors.

According to the International Science and Technology Center (ISTC), which is an intergovernmental organization connecting scientists with their peers and research organizations in other countries, Armenia has many **science and technology (S&T) institutions** with qualified specialists, which is a characteristic of modern and dynamic economics. From important educational institutions to state research institutes and innovative science-oriented firms, there is a strong tradition of S&T in the country. International funding is critical for the survival of science in Armenia as well as maintaining the wealth of knowledge that Armenian scientists are able to add to the international community.

There are a number of technology centres and centres of excellence established in the country: Innovative Solutions and Technologies Center (ISTC), Microsoft Innovation Centers (MIC), Armenian-Indian Centre for Excellence in ICT, Gyumri Technology Center (GTC), Vanadzor Technology Center (VTC), Artsakh Information Technologies Center (AITC), Gyumri Information Technologies Center (GITC), and Information Technologies Development Support Council. The Technology Transfer Office (TTO) is established at the Institute for Physical Research of National Academy of Sciences of Armenia to promote applied developments, innovation and market-oriented activities at the Institute. In addition, there are other non-governmental organisations such as the Armenian Technology Transfer Association (TTA) created in 2002 to promote technology transfer mostly by providing information and matchmaking.

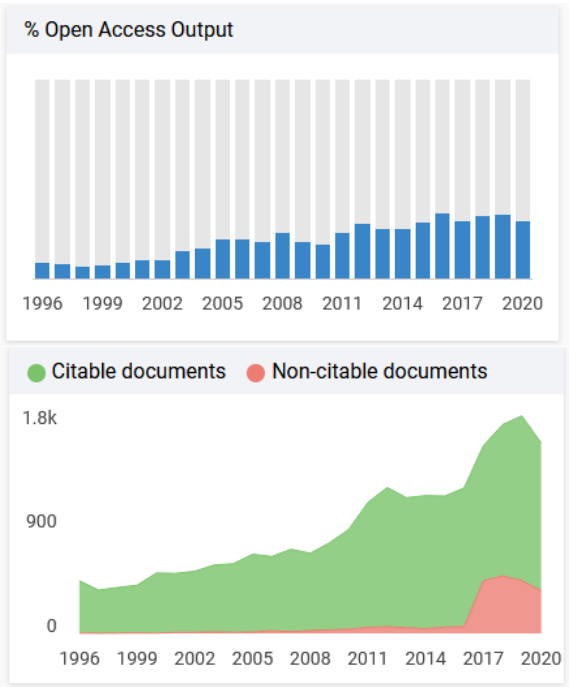
There are active international scientific organisations, laboratories and groups in Armenia. Particularly, local scientific organisations participate in broad-scale international scientific experiments aimed at resolving essential scientific problems in international research centres, or within the framework of scientific cooperation with such centres like the Large Hadron Collider (LHC), the High Energy Astrophysics Laboratory (HESS), the Thomas Jefferson National Accelerator Facility (JLab), Deutsches Elektronen Synchrotron (DESY), the Joint Institute for Nuclear Research (JINR), etc.

Numerous internationally recognised profound works have been published by Armenian scientists or with their co-authorship in prestigious scientific journals. According to the Scimago Institution Rankings, now Armenia has following statistics:

Country	H index	Documents	Citations	Citations per document
89	231	21177	416854	19.68

The focus of the Armenian researchers is obvious from the following statistics:

There can be seen also continuous increasing trend in the area of open access articles, number of citations of the documents, including the increase of the external cites, or international collaboration



Industry

Today multinational enterprises are the most, if not the only effective players in establishing links between universities and industry. The branches of multinational companies in Armenia perform science-based R&D and develop the relevant skills by supporting PhD. studies and Armenian research centres.

In general, according to the sector, Armenian economy is focused on the agriculture and food processing, mining industry, energetics, chemical and pharmaceutical industry and IT and telecommunication technologies. If we consider also services, tourism is one of the most dynamic sectors of the economy.

In the IT sector, the presence of multinationals makes for favourable changes in the university-business collaboration sphere. Many foreign companies introduce the use of disruptive or deep technologies. For instance, Synopsys, a US-based IT company, established several R&D centres in Armenia in close collaboration with universities and mentored PhD. students.

Despite the increasing presence of multinationals, the linkages between industry and universities are still not prevalent in Armenia. Research institutes and the government focus

on strategies more relevant to “science push” innovation, while underestimating the importance of R&D results for commercialisation.

The official registry of Armenia has over 847 000 registered businesses out of which approx. 25 % are active (202 000). Within the information available on the active companies, according to the kind of activity most of the companies are devoted to wholesale and retail trade, manufacturing and transportation and storage. The technology market is smaller and According to GeoStat, the field of professional, scientific and technical activities includes about 7 800 active businesses.

Companies are predominantly small and are confined to a local market and have limited opportunities to search for more innovative ways to increase their productivity. Many companies are aggressively pursuing outsourcing opportunities and envision long term development in designing and marketing IT and software products. Though outsourcing remains a priority specialisation, the Armenian IT companies are now moving to other products and services. This clearly implies that industry is shifting to higher added value services. More companies are now involved in engineering, systems development, and R&D services. The development of mobile applications is expected to have strong potential.

It can be concluded that small and medium-sized enterprises (SMEs) in the sector operate far below capacities and their products are uncompetitive in the regional and international markets. There is a great potential for the rapid development of the SMEs, especially in case if the Government of Armenia focuses on the support of the value-added trade and supports their export, by exploiting a number of comparative and historical advantages both in the region and internationally.

Knowledge and technology transfer

At present the legal field of intellectual property is regulated by laws and legal acts as well as the international agreements of the Republic of Armenia. The Intellectual Property Agency of the Republic of Armenia is responsible for patent, copyright, and trademark registration and was established in 2002. Armenia is a member of the World Intellectual Property Organization (WIPO), joining in 1993, and the Eurasian Patent Office (EAPO) since 1995. The Agency cooperates with the European Patent Office (EPO), other international and regional structures and foreign offices. Despite Armenia’s efforts to meet the international standards, the weak enforcement of intellectual property rights (IPR) by the Government and judiciary can create impediments for investment or interest by businesses that rely on IPR protection.

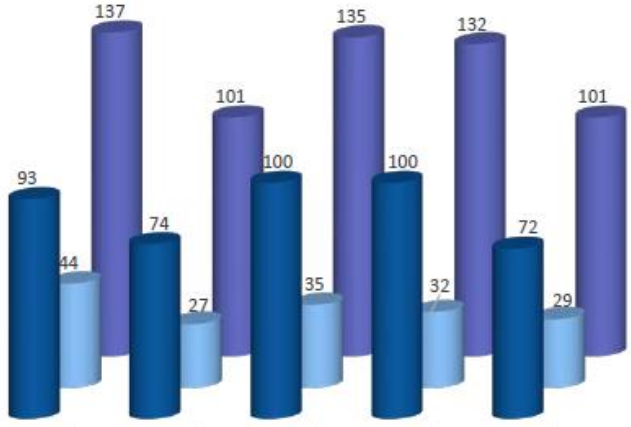
Armenia has signed a number of major IPR treaties, such as the Paris Convention for the Protection of Industrial Property, the World Intellectual Property Organization (WIPO) copyright treaty, the Berne Convention for Literary and Artistic Works, the Madrid System for the International Registration of Marks, and the Patent Cooperation Treaty.

The modernization of the electronic application system has continued. Works towards the creation of a new website of the Intellectual Property Agency were carried out throughout 2020. This is an important step to support the application process because in this way it is possible to eliminate formal mistakes and to evaluate the application faster. According to the Annual report of the Intellectual Property Agency of the Republic of Armenia from 2020 it can be clearly

seen the distribution of applications filed in 2018-2020, by fields of technology corresponds to the research areas and topics solved in the published articles. In the overview only technical field with the percentual ratio achieving more than 5 % are summarized. Also, from this overview, the most important sectors according to the economic impact can be clearly seen.

No	Technical field (according to classes / subclasses of IPC)	2018	2019	2020	Total amount (2018 – 2020)	% in the total number of applications
1.	Medications and pharmaceuticals (A61K)	20	22	15	57	14,5%
2.	Medicine and Veterinary (A61-A63, except A61K)	16	13	15	44	11,20%
3.	Electrical engineering (H01, H02, H05)	9	14	10	33	8,40%
4.	Measurement and Optics (G01-G03)	11	10	8	29	7,38%
5.	Food and tobacco (A21-A24)	11	14	1	26	6,62%
6.	Inorganic Chemistry (C01-C05, C30)	8	9	5	22	5,60%
7.	Organic Chemistry (C07, A01N)	6	8	7	21	5,34%

However, despite the fact that for example in 2020, the Agency participated in 70 court hearings on 162 court cases, the number of valid patents of the Republic of Armenia (2016-2020) is given as a graph has not a significant trend.



	2016	2017	2018	2019	2020
Invention patent	93	74	100	100	72
Utility model patent	44	27	35	32	29
Total	137	101	135	132	101

In this area several barriers related to the intellectual property can be mentioned:

- Patenting is “signposting” more than a step in the commercialisation process of an intellectual output – Patenting is more the response to a policy request than an aware decision within a commercialisation activity.
- Need to connect all the actors and stimulate collaboration between them (have proactive TTOs at university for more active roles on IPR).
- Quality level of IPR – Current IPR is just validated at national level (prior art). Conflicts with other patents/rights at international level block any possibility of extension at the international level (to be further investigated).
- Exploitation of intellectual capital - A lot of larger investments (foreign companies, multinationals) require transferring domestic IP to other countries and to incorporate the company abroad. This takes away future benefit from Armenia.

In addition to the previously mentioned barriers, the European Commission with their Joint Research Centre identified the **main key points of the technology transfer activities** as follows:

Ecosystem

- A country with little budget for R&D and innovation with a technology transfer (TT) infrastructure that is still young launched in 2013, with a strong acceleration in 2018 from the private sector.
- Fragmentation and lack of a common approach on TT between public actors (NAS RA and universities).
- A value chain from “knowledge to market” that is not complete nor inter-connected. The few cases that work is based on networking and personal connections, no institutional approach.
- Artificially transplanted TT offices into organisations with an infrastructure for TT, promoted with a top-down process and lack of a structural approach within an overall collaboration framework at the level of the institution and ministries (for the public side).
- Lack of manufacturing capabilities for small scale production (limited evidence of capability for prototyping innovation). Hardware prototypes need to be developed in the country but there is insufficient manufacturing capacity (researchers and spin-offs need state of the art equipment for prototyping their novel solutions).
- Institutional players showing a reactive rather than proactive approach (waiting for directions instead of building collaborations) with a tendency to focus on easy approaches (interviews showed that, for example, data science and artificial intelligence machinery are considered easy to approach and low cost to develop).
- Interviews highlighted how a key contribution to the ecosystem is given by the Diaspora. The Diaspora is today a necessary ingredient of any initiative. FAST identified 1 200 “active” Armenian researchers in leading R&D institutions worldwide Independence of the private innovation ecosystem from government action (and its dependence on Diaspora).

Capacities

- Skills (researchers) – Armenia is facing the challenge of accessing the needed skills for R&D. Age distribution of researchers is concentrated around two age groups (age 30-39 and 65-69) with very little in the middle). Due to the high turnover of researchers leaving Public Research Organisations (PRO) (young researchers go to domestic industries) the second group remains the most predominant.
- At the PROs level, there is a lack of resources and motivations. This barrier was also motivation for submission of this project, because success stories presented on the Workshop organized during the project solution by V4 countries (namely Slovakia, Czech Republic and Poland) are needed for the researchers to be more motivated.
- Lack of operational experience of the personnel involved in TT at the PROs (but good theoretical/academic experience).

Support schemes

- General training courses – Currently there is a basic knowledge of Intellectual Property (IP) and marketing. Capacity building on general topics (IPR, TT, etc.) is no longer a priority need.
- "Development" gap. The analysis and the interviews performed so far did not map any public support/funding to go to TRL levels greater than 4.

Funding

- The equity funds available so far are designed for mature companies, and there is insufficient funding for early stages (to go from TRL 4-5 to TRL 9). This is creating a lack of financial support in the most critical phase for TT (the need for legislation on exits of private investors should be further investigated).
- Absence of a funding instrument that allows start-up, innovative companies to establish and consolidate in the country before scaling up.
- Inefficient access to external donor funds. Absence of a structured, operational presence close to donors (Brussels for the European Commission). NAS RA has a group working on this matter but does not have a presence in Brussels.

2.2 Problems with SMEs-RI/Academia cooperation in Georgia

Georgia, a middle-income country with the population of 3.7 million and a strong natural resource base, experienced a pro-longed economic crisis after the collapse of the Soviet Union in 1991, with a per capita GDP of 4,274.6 USD (2020). Georgia is located at the crossroads between Europe and Asia. Its strategic location makes it a natural logistics and transit hub along the “New Silk Road” linking Asia and Europe via the Caucasus.

Government

Georgia has, over the previous Country Strategy period, remained committed to application of the political principles. Wide-ranging political and economic reforms implemented in the past two decades have transformed the economy, however, the acceleration of reforms implementation is required to bring tangible results. Also the political polarisation, implementing electoral reform, strengthening the rule of law and ensuring the independence and accountability of the judiciary remained, according to relevant international organisations, important challenges. Similarly, to other countries, also in Georgia the development has been affected by the COVID-19 crisis, which was a significant blow to the economy as the hospitality sector, the main driver of robust economic growth in recent years, became a key source of vulnerability.

Economic policy of the Government of Georgia is based on three main principles. The first principle implies ensuring fast and efficient economic growth driven by the production sector development, which should resolve economic problems that exist in the country, create jobs and reduce poverty. The second principle implies implementation of economic policies that facilitate inclusive economic growth – it envisages universal involvement of the population in the economic development process (including Diaspora, migrants, ethnic minorities and other groups), prosperity for each member of society through economic growth, their social equality and improvement of the living standards of population. The third main principle is based on the rational use of natural resources, ensuring environmental safety and sustainability and avoiding natural disasters during the process of economic development.

During the last five years, the country’s economic development has been moderate with ~2–3 % real growth. In 2018, the amount of budget funding provided for R&D activities remained low at 0.3 % of gross domestic product (GDP) annually which equals USD 51 million. In comparison, in 2013 the research and development (R&D) spending in Georgia was USD 16.9 million and in 2014 – USD 34.2 million. The nominal value of GDP depicted in Georgian lari currency (GEL) grew every year, however, GDP depicted in US dollar (USD) in 2015 and 2016 showed decline due to 50 % devaluation of GEL in 2015 and 10 % devaluation of GEL in 2016 (USAID, 2018), which had a negative impact on the R&D (research & development) spend for the period. Since 2015, Georgia has made great progress in improving the business climate (7th out of 190 countries (World Bank, 2020), economic freedom (8th out of 189 countries (Fraser Institute, 2020), and has relatively low level of corruption as it can be seen from the graph, which is favourable to business development and steady economic growth.

EASTERN AND CENTRAL EUROPE

GEORGIA

Score

55/100 What does the CPI score mean?

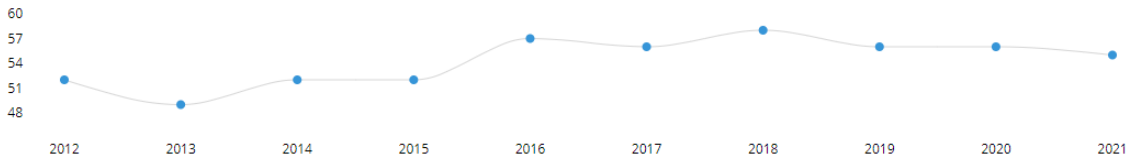
Rank

45/180

Score change

-1 since 2020

Score changes 2012 - 2021



The Government of Georgia in its Social-economic Development Strategy of Georgia (Georgia 2020) identified that the private sector's competitiveness is a very significant driver of economic development. The existence of competition in both the internal and external markets is a necessary precondition for a successfully functioning economy. In this strategy it is stated that to support the economic development it is necessary to reduce the unemployment. According to the official data, Georgia's unemployment rate peaked at 16.9 % in 2009, stabilizing later at 15 % in 2012. About two-thirds of the workforce is self-employed (mainly in the agricultural sector), where most people are engaged in subsistence farming, which is itself largely the result of the government having neglected agriculture for the past decade. On the whole, the unemployed and self-employed account for around 70 % of the country's active workforce. It means that although enhancements in the economic results and growth, the implemented measures failed to have an impact on the unemployment reducing and also the attempt to lay foundations for increasing the competitiveness of the Georgian economy failed. It resulted into the fact that in spite of the average annual economy growth achieving 6 % between 2004 and 2012 as the result of a wave of reforms aimed at liberalizing the country's economy, these reforms were not sufficient to increase the overall productivity, to support the private sector competitiveness, and were therefore unable to stimulate long-term economic growth.

To stimulate the private sector, it is necessary to facilitate investments and to create fair and protected business environment through the development of the innovations and entrepreneurial skills and raising access to finances because the high rates of economic growth could be used for the wider population to support the competitiveness of the private sector. From the governmental point of view, the Government of Georgia in the Strategy stated that will ensure the transparency of public administration and guarantee equal opportunities in terms of starting and doing business for all, also that it will be the main guarantor of property rights (the protection of intellectual property rights is one of the stated priorities), that it will ensure the effective implementation of reforms through the formulation and adoption of relevant legislative initiatives (because the current investment legislation is outdated),

administrative improvements. It is important to note that the Strategy aims to bring the Georgian legislation framework closer to the European Union (EU) regulations, which will provide better access to the EU's internal markets. From the economic point of view, the barrier remains also limited access to finances and economic stability in the country. Therefore, the Georgian government is working to reduce obstacles to doing business in Georgia. Also by the reducing or elimination of the majority of tariffs, and depending on the type of goods, custom tariffs could be 0 %, 5˘%, or 12 %. The majority of imports are subject to an 18 % value added tax (VAT) and some products, such as alcohol, tobacco, and automobiles, are also subject to an excise tax.

Companies have reported problems arising from a lack of judicial independence, inefficient decision-making processes at the municipal level, shortcomings in the enforcement of intellectual property rights (IPR), lack of effective anti-trust policies, selective enforcement of economic laws, and difficulties resolving commercial disputes in a timely manner.

Most business is conducted in Georgian, official laws and regulations are printed in Georgian, and products must be labelled in Georgian. However, many Georgians involved in international business speak English and the use of English is widespread.

Furthermore, to improve the competitiveness of SMEs at the national and also international level, it is also necessary to support the human capital, information technology, systems, and software are needed to support new business growth.

The country's transit potential is supported by the development of the infrastructure. Therefore, the government has increased its focus on developing the infrastructure, energy, tourism, and agriculture sectors and has received substantial support from international donors. Materials, expertise, and equipment for these sectors are in demand.

Another related strategic document relevant to the research, development and innovation (R&D&I) sector in the country is the 4-point reform plan, focused on tax reforms and the development of financial incentives for start-up formation and, importantly, on improving the quality and availability of higher education.

The governance of innovation, knowledge and technology transfer activities, is centralised is focused on domestic technology development but the effective processes of implementation are still missing. The interconnection and the transition from the fundamental to applied researched with the consequent implementation into the technology transfer into the commercial products cannot be evaluated due to the missing effective measure. However, in general it is necessary to support applied research by increasing state funding, to improve access to funding also for especially for SMEs, which are the drivers of innovation but also to support international relations to profit from external founds.

Innovation policy in the country has been supported by the creation of the new state-owned agency coordinating innovation and technology development called Georgia's Innovation and Technology Agency (GITA) created under the Ministry of Economy and Sustainable Development (MoESD) with the support of the Georgia National Innovation Ecosystem (GENIE) project in the amount of 23.5 million USD and acting as the main executive vehicle

for innovation and technology policies and strategies, to is meet the objectives such as providing financial instruments, infrastructure development and improving professional skills essential for innovation ecosystem in general and thus to develop and coordinate policies for research, development and innovations. To the GITA's functional responsibility also belong science and technological parks, business incubators, accelerators, technology transfer centre, laboratories of industrial innovations (FabLabs), innovation laboratories (ILabs) and innovation centres. GITA initiated and executed the first open competitive calls for grant financing of innovative start-ups and innovation projects. Practical implementation was greatly supported by the GENIE project, implemented by GITA with technical assistance and funding provided by the World Bank Group.

Another result of the Georgia Competitiveness and Innovation Project was creation of a new state-owned agency coordination export and SME development (GEDA) with a first-time allocation for SME and export development for GEDA.

Research and Innovation Council (RIC) has been created to develop and coordinate policies for R&D&I, which GITA and MoESCS are empowered to implement. The RIC is chaired by the prime minister and its members are the MoESCS, Ministers of sustainable development, finance, foreign affairs, justice, regional development and infrastructure, defence, labour, health and social affairs, and agriculture, the heads of the two parliamentary committees, three business representatives, the president of the GNAS, the director of the SRNSF, the director of the IPR Agency (Sakpatenti), and four scientists. The RIC does not have its own budget; its main task is to identify the thematic priorities of Georgia by government decree, which has not been done so far. The RIC's operational support structure is GITA. The implementation of the national innovation policy by GITA is carried out on the 'project-based' principle.

As it can be seen, it is important to note that the Georgian government has made significant efforts to improve coordination between relevant ministries, government agencies and private sector stakeholders in order to strengthen the private sector via a separate SME strategy. In 2016, the government established a high-level Coordination Group and a Working Group to oversee the monitoring of the SME strategy. The former is headed by the MoESD, overseeing the implementation progress, whereas the latter is led by the responsible Deputy Minister. Both entities include representatives of Georgian business associations. In parallel, the Private Sector Development Advisory Council (PSDAC) was established. It operates under the supervision of the MoESD. The bi-annual PSDAC meetings formalise public-private consultations, providing the private sector with an opportunity to comment on entrepreneurship barriers and assist with business-related legislation.

Georgia and the EU

The European Union and Georgia enjoy a very close and positive relationship. The EU-Georgia Association Agreement entered into force in July 2016 and strives for political association and economic integration between the EU and Georgia. The EU and Georgia have also entered into a Deep and Comprehensive Free Trade Area (DCFTA), while Georgian citizens have

benefitted from visa free travel to the Schengen area since 28 March 2017. The EU is Georgia's largest trading partner and provides over 100 million euro to Georgia annually in technical and financial assistance.

Guided by their common values, the EU supports peace and stability in Georgia as well as programmes of political and economic reforms to enable social and economic development.

In June 2014, the EU and Georgia signed an Association Agreement (AA), which entered into force in 2016. This, along with the Deep and Comprehensive Free Trade Area (DCFTA) Agreement, builds a foundation for far-reaching Georgian political and economic integration with the EU. The ambition for Georgia includes ever increasing democracy and rule of law, human rights, good governance and economic development. The AA institutional framework establishes bodies such as the Association Council to oversee its application, with the Association Agenda defining priorities necessary for its implementation.

The AA is itself an outcome of the EU's European Neighbourhood Policy (ENP), an important part of the EU’s foreign policy, of which Georgia is one of 16 partner countries. It enhances the prosperity, stability and security of an enlarged EU and its neighbours. The launch of the EU’s Eastern Partnership (EaP) in 2009, which includes Georgia, extended cooperation and further highlighted the importance of the region. As well as bolstering reforms, the EaP works towards greater mobility of citizens and stronger collaboration in a number of sectors, such as transport, energy and the environment.

Additionally, the EU remains firmly committed to its policy of supporting Georgia’s territorial integrity within its internationally-recognised borders as well as engagement with the breakaway regions of Abkhazia and South Ossetia, in support of longer-term conflict resolution. Since 2008, an EU Monitoring Mission has operated in the vicinity of the administrative boundary lines. Additionally, to address wider regional challenges of environmental concerns in the Black Sea region, the EU initiated increased cooperation through the Black Sea Synergy (BSS).

Georgia previously planned to apply to join the European Union in 2024. The move comes after Ukrainian President Volodymyr Zelenskyy called for EU membership amid Russia's ongoing invasion, when Georgia put forward an application to join the European Union.

From the economic point of view, the EU supports Georgia in developing its economic potential through international cooperation. This includes assistance in alignment with EU legislative standards. The EU is also helping Georgia implement systematic Public Finance Management reform, whereby efficient budgeting, accounting and auditing of public resources will result in more effective allocation. The EU also supports the regional economic development policy of Georgia which creates new opportunities.

Trade relations were significantly supported in 2014 when the European Union and Georgia signed the AA, including the DCFTA that has an ambitious objective of integration with the EU’s internal market, therefore is considered as the unique free trade agreement. As the main pillar of the AA, it contributes to modernization and diversification of economy in Georgia. Trade between the EU and Georgia has been growing steadily over the years and today the EU is

Georgia's main trading partner (with around 30 % in 2020), followed by China, Azerbaijan and Russia. The key EU imports from Georgia include mineral products, agricultural products, base metals and chemical products. The DCFTA deepens Georgia's economic ties with the EU, and includes provisions on public procurement, common customs' rules, along with technical and sanitary standards for goods such as food items, intellectual property rights and competition rules.

The EU is also committed to support the Georgian Government in strengthening its export competitiveness, for example, through the setting-up of Quality Management Systems and Quality Infrastructure Systems to assure standards are met.

Technical and financial cooperation between EU and Georgia is also significant. The EU provides over 100 million EUR in assistance to Georgia annually. Funding comes mostly from the European Neighbourhood Instrument (ENI), which supports Georgia in achieving the goals set out in the AA. The EU-Georgia Association Agenda sets out a roadmap to achieve these goals. Georgia also benefits from EU Regional and Multi-country Action Programmes funded under the ENI, which provide contributions for infrastructure development; interconnectivity with neighbours in areas such as energy, transport and environment; support to civil society; and access to EU programmes like Erasmus+, Horizon 2020 and Creative Europe.

The EU also supports education in Georgia through direct contributions to the state budget and by providing funds for specific projects, study and mobility opportunities.

Universities, academy of sciences and research organizations

In Gorgia, there are according to the statistics of Higher Education Central 17 state and 35 private universities. According to the Admission Office LLC, to the top universities in Georgia belong:

- Ivane Javakhashvili Tbilisi State University
- Akaki Tsereteli State University
- Batumi State Maritime Academy
- Caucasus University
- East European University
- Batumi Navigation Teaching University
- Bau International University
- Caucasus International University
- European University
- Batumi Shota Rustaveli State University
- Business Academy of Georgia
- David Tvildiani Medical University Georgia
- Georgian American University
- Georgian Aviation University
- Grigol Robakidze University

- Tbilisi State Medical University
- Teaching University Geomedi
- Georgian National University (SEU)
- Ilia State University
- New Vision University
- Tbilisi Open University
- Georgian Technical University
- International Black Sea University
- Petre Shotadze Tbilisi Medical Academy
- University of Georgia

The National Academy of Sciences of Georgia (previously: the Georgian Academy of Sciences) was founded by a resolution # 183 of the Council of People's Commissars of the Georgian SSR in February 10, 1941. Currently, in its organizational structure it involves 9 scientific departments:

- Department of Mathematics and Physics,
- Department of Earth Sciences,
- Department of Engineering Sciences and Information Technology,
- Department of Chemistry and Chemical Technologies,
- Department of Biological Sciences,
- Department of Physiology and Medicine,
- Department of Agricultural Sciences,
- Department of Social Sciences,
- Department of Language, Literature and Art.

Members are the most distinguished scientists of the country, academicians, but it has also corresponding, foreign and honorary members and research fellows. The GNAS primarily coordinates scientific research in Georgia, acts as a Scientific Adviser to the Georgian Government, develops relationships with the Academies of foreign countries and other scientific centres and carries out an expert assessment of the scientific activities of scientific structural units under different subordination.

All 15 research institutes of Georgia e.g. the Institute of Geology, the I. Beritashvili Institute of Physiology, the laboratories of Psychology, the Institute of Physics and others united under the umbrella of Tbilisi State University (TSU), as well as the State Museum of Georgia and the Academy of Art History of Georgia are subordinate to the GNAS.

GNAS does not monitor the research created by using the budget funds at the institutional level to track budget revenues or budget expenses associated with the creation and use of IP. GNAS is not actively participating in any stage of the innovation process or funding programmes.

There are also several research universities that come under the MoESCS: Technological University of Georgia, Ilia State University, Tbilisi State Medical University, Akaki Tsereteli State University, Shota Rustaveli State University, and the Agricultural University of Georgia.

Apart from the research universities, one legal entity under public law (LEPL) and three semi-independent research centres come directly under the MoESCS: The Georgian Academy of Agrarian Science, Korneli Kekelidze National Centre of Manuscripts, Ivane Beritashvili Centre for Experimental Biomedicine, and Giorgi Eliava Institute of Bacteriophage, Microbiology and Virology.

Finally, there are two public research organisations outside the remit of MoESCS or GNAS: The National Centre for Disease Control under the Ministry of Labour, Health and Social Affairs (MoLHSA) and the Science Technology Centre DELTA under the Ministry of Defence (MoD).

State funding for research is divided into fundamental and applied. The applied research programmes support two stages of technology development: early (to Technology readiness level – TRL 2) and prototype and testing. The 'manufacturing readiness' phase only takes place in the Public Research Organizations (PROs) who have their own small scale sample manufacturing facilities, e.g. Eliava Institute. These facilities are commercially run and generate revenue with focus on manufacturing and selling their own formulations rather than transferring the technology to a larger industrial partner. However, in most PROs the grasp of the requirements of the national industry and its capability to absorb new technologies remain low. Similar challenges were observed within the area of international commercialisation and export of technological solutions.

The SRNSF funds basic and applied research on a competitive basis and runs over 20 different programmes aimed at improving the quality of scientific research, and the internationalisation and support of young scientists. Peer review evaluation is done for the major grants for basic research, post-doctoral proposals, applied research proposals and collaborative research grants with compatriots. The SRNSF organised two public-private joint funding programmes, the State Grants for Applied Research, where financial contributions (at least 20 %) from other sources were initially required, and, together with CRDF Global, the Science and Technology Entrepreneur Programme to which the involved business partners had to contribute 15 % of the projects' budgets. These schemes, however, did not gain popularity.

The association of Georgia with Horizon 2020 was an important step towards wider integration with the EU. Increasing the participation in Horizon 2020 programmes is one of the key objectives. However, despite the fact that the access costs to Horizon 2020, ERASMUS+ and Creative Europe are subsidised via the EU Regional and Multi-country Action Programmes, the participation of Georgian researchers in Horizon 2020 is according to European Commission (statement form 2017) still low. Though this activity attracts foreign currency to Georgia, the results usually do not find commercial use. Despite PROs being the major sources of creation of new technologies, utility models, know-how and other forms of IP, the majority have a weak entrepreneurial culture if any.

Financial instruments used to stimulate innovation and R&D activities are limited to tax incentives. Under the new corporate income tax model established in 2018, companies are liable to pay profit tax only upon distribution of profits or on transfers of a similar nature (non-economic costs), without calculating allowable costs. Also, a special tax benefit scheme exists since 2011. The Law on Information Technology Zone establishes exemptions for virtual zone persons (VZPs) for profits earned from supplying outside of Georgia, for value-add tax (VAT) on the supply outside of Georgia and for export duties.

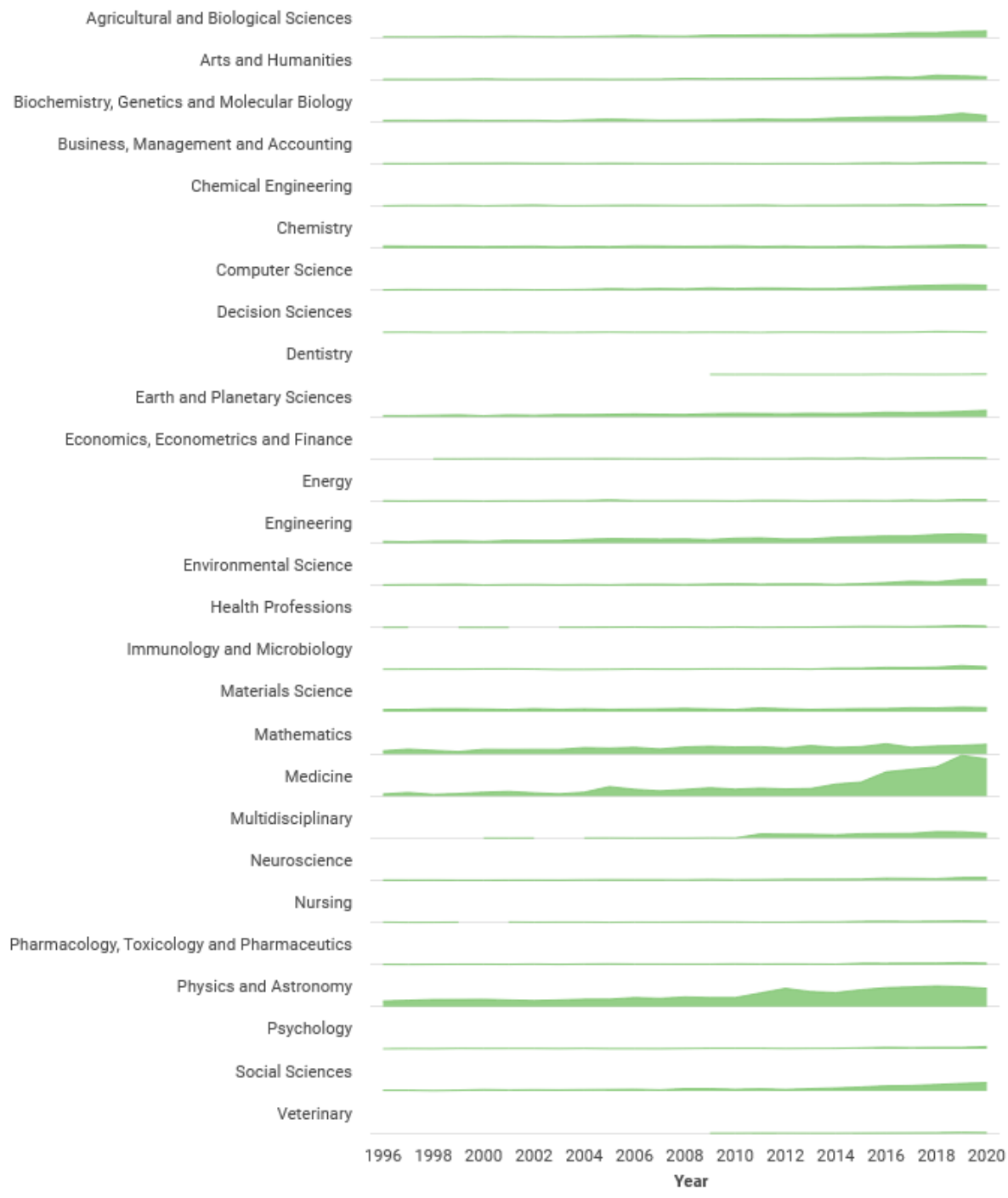
The most mature innovation and, by extension, knowledge and technology transfer activities, are taking place in the biotechnology sector, which is supported by a well-developed pharmaceutical sector. One of the most successful cases is Eliava Institute, which transfers technology to several EU countries and has several spin-off companies that produce unique medications. Most state programmes responsible for funding of innovation or applied science are aimed either at the early stage, low TRL technologies (TRL 2), which are several years away from the market and not yet sufficiently developed for transfer into industry or at the scaling up of existing business (TRL 8). The problem of a high-tech innovative technology reaching manufacturing readiness or obtaining an industrial proof-of-concept is not addressed and the funding to cover this gap is not available. TTPP is the only pilot programme considering the support for projects with TRL 4+ and financing efforts on commercialising R&D results (e.g., via licensing).

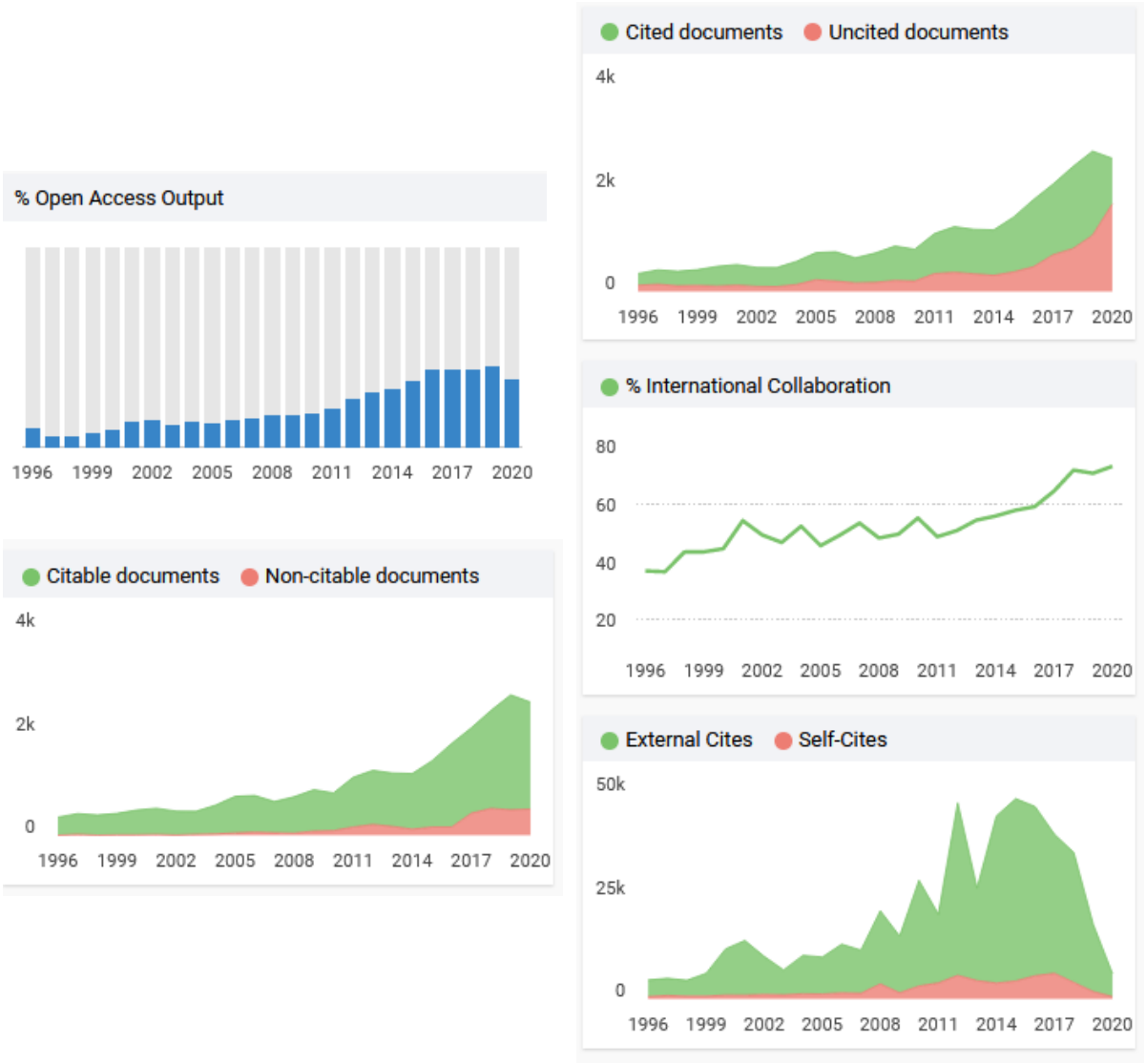
Numerous internationally recognised profound works have been also published by Georgian scientists or with their co-authorship in prestigious scientific journals. According to the Scimago Institution Rankings, now Georgia has following statistics:

Country	H index	Documents	Citations	Citations per document
84	225	24390	467818	19.18

The focus of the Georgian researchers on the medicine and biotechnology is obvious from the following statistics. Long-term research activities are in addition to them performed also in the area of physics and astronomy.

Documents by subject areas





From the performed analysis it seems that researchers from GNAS, PROs or Higher education institutions (HEIs) focused on the applied research prefer to publish their ideas in peer-reviewed papers or form their own companies for their commercialisation, rather than protect their intellectual property. Researchers and scientists can also establish spin-off companies to transfer technologies to the market; e.g., Eliava Institute has several unitary enterprises as separate legal entities with its own production facilities.

The average age of researchers in Georgia is increasing as more graduates are choosing to seek employment in the private sector where remuneration and opportunities for career advancement are higher. Therefore, there is a lack of a qualified labour force and the level of innovation is low. In the last ten years, the science and engineering disciplines have been given the priority in state funding distribution. The IT level significantly increased in the last few years due to wide availability of e-learning, GITA's highly qualified mentors and training programmes, and improving English language skills. In Georgia, 5 % of students continue to the PhD. level and even fewer remain in post-doctorate positions. It is important to note that

though the positive changes in quality of education and training, and a better match with the global market demands have been achieved with a delay. Entrepreneurial skills are not usually taught in HEIs although a recently established IT-focused Business and Technology University (BTU) offers programmes in business administration and has a business incubator, an accelerator and a shared virtual reality (VR) lab on site for prototyping. This is a welcomed initiative, however, in general there remains a lack of entrepreneurial education among Georgian inventors and start-ups founders. Furthermore, there are no systemic programmes in science and technology entrepreneurship (STEP). The previously introduced programmes focusing on this area have delivered mixed results; however, the attempts to use STEP in encouraging technology-based start-ups continue.

The majority of corrective efforts are focused on the improvement of the professional level of students and young researchers, availability of information on global technological trends, low-end free training programmes and state-funded (through GITA) professional development courses offered through networks of innovation centres, FabLabs, some of which are based at partner universities. GITA provides programmes aiming to help start-up companies to acknowledge the full cycle of innovative product or service development via mentorship, intensive training and capacity building events. In addition, tailored training is provided to GITA's Business Incubator residents in finance, marketing, project management, and business idea development. More advanced knowledge and technology transfer tools such as industry forecasts, market research by sector and open innovation models are usually not taught.

Increasing involvement of researchers in collaborations with foreign partners will improve significantly the organisational structures for TT and knowledge exchange in the short-term, but the gain of competitive strength in new technological sectors will be very slow until the problem of skills and the knowledge gap is fully resolved, and the low investment in R&D sector (both workforce and infrastructure) is addressed.

Industry

Compared to other sectors of the economy, Georgia's industrial sector saw the least growth in terms of productivity, and the latter sector's level of development and export potential remain low. Exports are not diversified; their added value is low and new market penetration and expansion rates are weak. All these factors have resulted in the very low rates of growth in terms of employment, which clearly illustrate the fact that the competitiveness of the country's economy and private sector (as its main driving force) remains weak.

Goods produced in Georgia score low in added value. At this stage, only the processing industry is relatively developed. This is directly linked to the country's natural resources and local agricultural production. The major reason for these patterns is the low level of technological development and innovation, which, at the same time, causes irrational use of natural resources and jeopardizes the country's natural wealth.

The official registry of Georgia has over 700 000 registered businesses out of which 25 % are active (168 000). Within the information available on the active companies, 36 % are engaged

in trade and repair services, 8 % in real estate operations, 7 % in industry, 5 % in transport and communications. The technology market is small and includes about 4 000 active businesses, total turnover volume about 600 000 USD, of which only 10 % can be attributed to high-tech industry. According to GeoStat, in Georgia 10 companies are engaged in scientific and technical activities, 92 in manufacturing of pharmaceutical goods, and 108 in R&D activities.

The total number of companies that can be seen as potentially innovative based on their business sector is 210, of which only 19 % export abroad to the EU and the Commonwealth of Independent States (CIS) countries.

However, the real numbers can be even lower, because not all companies have introduced new or significantly improved technology in the last years. The high-tech industry is underdeveloped, with no current activity in many subsectors e.g., nanotechnology, nuclear physics, bioinformatics, advanced computing technologies (Artificial Intelligence and Big Data Processing) and robotics despite these being prioritised by GITA.

The country does not have a smart specialisation strategy aimed at the development of these sectors yet. However, according to WoS database, some promising research is taking place at the institutional level, especially in advanced computing technologies and physical sciences, that can potentially be assessed for commercialisation potential in the next few years.

There are no government statistics on **spin-offs and start-ups**. However, initiatives on creating early-stage technology-based businesses exist and are supported by the government and non-governmental organisations, which allowed several projects to reach the domestic and regional markets, and a few have reached the global markets. Successful innovative entrepreneurial initiatives are concentrated in e-commerce, fintech, logistics and software-as-a-service (SaaS) subsectors. Notable examples include Cnick, whose multifunctional ring that serves as a pass and contains critical personal health data, TTM Group (Total Traffic Management Group) who developed innovative equipment to limit vehicle speed on highways, Skitty, who developed a simple authentication solution with access-keys stored in an e-tattoo, Cardeal, an online e-commerce platform for cross border vehicle trade, Cargon, an online freight forwarding solution, which connects shippers with carriers or Optio.Ai who develop artificial intelligence/machine learning products for the domestic financial industry.

Based on the information available in the public domain, the founders are mostly young, highly skilled, and speak good to excellent English. No official statistics are collected on the level of education (e.g., students, graduate or post-doc level researchers) of start-up founders or the depth of their previous involvement with an academic institution or a PRO. The subsectors, in which most active start-ups operate, are low-tech ICT, which are characterised by low initial investment levels, and high engineer value. More advanced ICT applications e.g., big data in healthcare, analytics, digital twins, Internet of Things (IoT), which have similar characteristics but additionally require well developed digital infrastructure and sophisticated industry, are not present. Similarly, start-ups dealing with the technologies requiring well developed

infrastructure, access to expensive equipment and research facilities and long development cycles are not present among the sectors with high start-up activity.

Georgia currently offers a favourable environment for the development of new software/low-tech start-ups through the tax exemptions, thanks to grants, low level of corruption, the availability of low-cost green energy, access to all types of cargo transportation, costs of running a business are very low due to low cost of labour relative to other countries, stable political situation in the region and the on-going harmonisation with the EU. However, the process of harmonisation of local practices in banking, fintech and insurance industries with EU rules and regulations may cause the start-up companies operating in these sectors to slow down in the near future.

The barriers and challenges, which have to be overcame by the SMEs involve a small volume of available human capital, weak educational system, small domestic market size due to small consumer population and limited access to state financing, very low number of active investors, low trust in the legal system by investors and start-up management.

In the recent years, Georgia has introduced several successful initiatives aimed at supporting early-stage innovative projects and managed by GITA, including:

- Georgian Research and Development Foundation (GRDF), in partnership with GITA, offers global pivot to success (GPS) training and regular competitions under a STEP programme targeting start-up companies with high growth potential with the maximum grant size is 30 000 USD. The main goals of the programme are (1) to support development of a knowledge-based free-market economy in Georgia by fostering innovation and technology entrepreneurship; (2) to encourage the development of new technology-based products and services and their commercialisation in local and global markets; (3) facilitate collaborations between local inventors and investors, global science and technology and business communities and the Georgian-based technology entrepreneurs and private companies.
- 'Startup Georgia', GITA's first investment programme jointly with Startup Georgia under the 'Partnership Fund' (startup.gov.ge) was launched in 2016.
- in 2020, 500Startups launched 500Georgia, the first international accelerator in the country, in partnership with two key drivers of the local start-up ecosystem, GITA and Bank of Georgia.
- TechParks defined as a physical space with complementary access to technological (mostly, basic IT equipment), training and mentorship, and other professional services. They cover the development of a technology from ideation to a business model. There are three Techparks in Tbilisi, Zugdidi, and Telavi.
- Innovation Hubs and Innovation Centres are mini-techparks and offer the same services locally on a much smaller scale.
- FabLabs are digital studios and prototyping centres also known as Fabrication Laboratories. Today, there are a total of 22 industrial laboratories throughout Georgia offering a free prototyping service, the use of computer programmable machines (laser

cutter, 3D printer, etc.), electronics consulting service, professional technical support, testing, small scale on demand manufacturing and training courses. Note that these are commercial entities and the fees are charged for all services apart from prototyping.

- USAID programme “Growth in Georgia” providing 500 000 USD investment to Georgian villages that are located near the borders with self-proclaimed republics of South Ossetia and Abkhazia. The main priority of the initiative is to finance innovative enterprises.
- GENIE is a project, which was already mentioned above.
- Spark platform is a hub for people who have business ideas but do not have access to resources. The platform gives a space for start-ups, assists with business plan development and provides financial and market analysis support for companies working in tourism, professional and higher education, sport and healthcare, IT, or developing energy-efficient technologies.
- Startup Factory of Georgian University provides a co-working space with access to an electronics and engineering laboratory, the Mobile Application Development Centre for non-university-based start-ups for a fee.
- Batumi Business incubator is a project of the United Nations (UN) development programme which is funded by the governments of Romania, Finland and the Autonomous Republic of Adjara. This programme offers a free consultation in international trade, accounting, taxation, business management, financing and logistics.
- Startup Grind Tbilisi is a branch of the global independent start-up community that unites 2 million entrepreneurs. This platform offers access to global success stories, allows sharing of experience and is an informal networking platform for investors and partner search.
- “Silicon Valley Tbilisi” (based in BTU) — the first private hi-tech centre in Georgia that combines a university, a business incubator, an accelerator, an IT-academy and a media centre.

Knowledge and technology transfer

The National Intellectual Property Center of Georgia – Sakpatenti is a governmental agency – a legal entity of public law. In accordance with the Georgian legislation, Sakpatenti determines the policy in the field of intellectual property.

Georgia defined as one of its priorities the formation of a national system for intellectual property protection immediately after gaining the independence. It is noteworthy that Georgia was the first of the former Soviet republics to create its national patent service “Sakpatenti” in 1992, which later on was transformed into the National Intellectual Property Center, dealing with the industrial property, copyright and related rights, new varieties of plants and breeds of animals. The current legislation is in full harmony with international standards, namely, it is in line with the requirements of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) administered by the World Trade Organization and is also compatible with the

European Union legislation. At present Georgia is a member of all main conventions and agreements on intellectual property protection and is a party to a number of bilateral international treaties, such for example Berne Convention for the Protection of Literary and Artistic Works, Rome Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organisations, WIPO Copyright Treaty, WIPO Performance and Phonograms Treaty, Paris Convention for the Protection of Industrial Property, Patent Cooperation Treaty, Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure, Hague Agreement Concerning the International Registration of Industrial Designs, Protocol Relating to the Madrid Agreement Concerning the International Registration of Marks, Lisbon Agreement for the Protection of Appellations of Origin and their International Registration, Nice Agreement Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks, Trade-Related Aspects Related to Intellectual Property Rights (TRIPS) or the International Union for the Protection of New Varieties of Plants (UPOV) Convention because of the importance of the wine production in the country.

In cooperation with the World Intellectual Property Organization (WIPO), the European Patent Office and foreign patent offices, Sakpatenti undertakes educational activities and provides trainings to its staff. To overcome the barrier in the area of human resources, Sakpatenti's employees had an opportunity to participate in the work of various conferences, workshops and seminars, and to raise their qualification through different training courses. In the recent years, particular importance has been paid to the WIPO Academy distance learning system and other IP courses offered by various international agencies.

To overcome the barrier identified for example by the report entitled Georgia's Intellectual Property Rights (IPR) Environment, where it was in 2011 summarized that representatives of Georgian businesses, entertainment industry, the legal community, higher education, and government agencies provided a picture of very low awareness among the general population, which contributes to a domestic market that creates an obstacle to promoting IPR as a tool for business and economic growth, Sakpatenti periodically organizes international seminars, symposia and conferences on matters of intellectual property protection, which are attended by representatives of science, business and law enforcement entities. Specialized literature - books, brochures, visual materials are also continuously published. The Office staff members are engaged in diverse consulting activities providing consultations to applicants and other interested parties. Sakpatenti's representatives are frequently invited by various universities to deliver lectures on the topic of intellectual property.

Furthermore, over the past years Sakpatenti has developed into the patent information center of the country; its library includes a rich collection of IP documentation of different countries and international organizations. At present, the databases of intellectual property subject-matters, previously used only by Sakpatenti examiners during patent search, have already become available to the external users. At the moment, Sakpatenti, with support of USAID, introduced a new e-filing system and the database for all IP subject-matters, which will make business processes inside the organization more efficient, while at the same time will provide an online user-friendly mechanism for all applicants (including trademarks, patents, designs, and other filings).

Although Georgia has signed all relevant treaties and enacted legislation in compliance with its international obligations, as a practical matter, protection and enforcement of intellectual property rights remains problematic. However, the government has taken several steps to introduce better practices.

GITA developed a legislative framework that consists of the Law on Innovations, adopted in 2016, and the Law on Grants that introduces grant financing for privately owned organisations. The regulatory framework further includes Patent Law, Law on Trademarks, Law on Appellations of Origin and Geographical Indications of Goods, Law on Topographies of Integrated Circuits, Law on Design, Law on Copyright and Neighbouring Rights, Law on Border Measures Related to Intellectual Property, Law on Protection of Animal Breeds and Plant Varieties.

The purpose of the Law on Innovations is to establish and improve a national innovations ecosystem required for the social and economic development of Georgia, to build the economy of the country on the basis of knowledge and innovations, to facilitate the use of technologies in Georgia which are created in other states, to promote the introduction and export of intellectual property and technologies created in Georgia, and to ensure the penetration of high technologies into all areas of science and economy in order to increase the competitiveness of the entities carrying out innovation activities, and the infrastructure supporting innovation activities, as well as the financing and commercialisation of innovation activities. The Law is focused on the development of the infrastructure for innovation activities, involving scientific/technological parks, business incubators, business accelerators, technology transfer centres, industrial innovation laboratories (FabLab) and innovation laboratories (ILab), and innovation centres. scientific/technological parks. The scientific/technological parks shall then provide infrastructure and professional services to universities, scientific/research establishments and other interested parties and to support creation of new products and services and their placement on the market. Business incubators provide workspace, administrative assistance and other technical support to persons carrying out innovative activities for a limited period of two years selected on a competitive basis. The Law also involves chapters dealing with the financing of innovation activities from the governmental point of view and commercialisation of the innovation projects also from the IPR related to innovations. In particular, it grants IPR rights to inventions created by employees during the course of employment or contractual obligations within a project funded by GITA to the employer or the client, unless otherwise agreed in the employment contract. Patent holders may be required to license out certain state-funded patented innovations to other applicants chosen by the Government. If the Government and patent holders fail to agree on the licence transfer, the Law allows the Government to deliver a decision on issuing a licence to another beneficiary following the established procedure.

A national legislative regulatory impact assessment (RIA) framework document has been prepared by the United States Agency for International Development (USAID) project “Governing for Growth” in close co-operation with the private sector and academia. This document includes recommendations on the institutional framework, criteria to identify regulations subject to the RIA, the RIA methodology and capacity building needs of local institutions. On its basis, the Government of Georgia elaborated a draft law aiming at making

the RIA legally binding. In addition to the above, RIA guidelines and manuals were elaborated, establishing the framework of the RIA methodology. Once the draft law is adopted, a quality control unit will be created inside the government that will concern all regulatory frameworks.

Georgian legislation prescribes various types of liability for the infringement of IPR (criminal, administrative and civil). The Code of Civil Procedure of Georgia provides for the court's authority to take provisional measures necessary for securing full and proper execution of the court's decision. The Intellectual Property Enforcement Coordinator (IPEC) paper referenced states that "in Georgia… training for judges that handle IP cases has become increasingly important since much of the judiciary remains unfamiliar with IP law despite an increase in the number of IP infringement cases being heard in the courts".

From the performed analysis in compliance with the conclusion of the of European Commission dealing with the Technology Transfer in Georgia, all the aspects of the regulatory and legal framework of Georgia show that in spite of the huge effort in this area, there is still an imbalance between the IPR/TT related laws, complying with international standards, and the efficiency of their practical application or their full understanding by the judiciary and legal practitioners as well as the public. This seems to result more from the lack of expertise in IP and innovation management in general, and the lack of qualified specialists in law enforcement in institutions and enterprises rather than from a lack of law provision or the incompleteness of regulatory framework, which is one of the main reasons why the innovative businesses in the country has still a problem to develop.

There are still significant challenges associated with lack of qualified staff in the research organisations, and the lack of funds dedicated to the knowledge and technology transfer. The majority of patents filed in Georgia originate from public research organizations (PROs) because the patent filing metrics are included in the organisational rankings for PROs and increase their likelihood of a higher R&D allocation. However, they usually have only a little influence on individual career progression of the researchers. International patenting (e.g., filing with the United States Patent and Trademark Office (USPTO), Eurasian Patent Office (EAPO) or using the WIPO administered PCT route) is rarely subsidised by a PRO due to the high costs, low available funds which results in low numbers of European and international patents and trademarks granted. The number of national patents is also declining in 2019 as experienced inventors recognise that filing nationally increases the risk of providing an enabling disclosure to the international community. According to WIPO and Sakpatenti metrics, there are more patents filed in Georgia by non-residents than by residents, although Sakpatenti offers support in drafting patent applications and essential IP management advice, also for example Instruction on Procedures Related with Drafting and Filing Applications for Inventions and Utility Models and Granting a Patent are available.

However, in the area of human resources there are still missing skills within most other aspects of knowledge and technology transfer. As one of the main weaknesses the lack of knowledge, skills and organisational structure nationwide required to effectively scout new home-grown and foreign technologies that can be deployed to renovate the traditional industry sectors and increase domestic production can be considered. Basic training on IP and innovation management is also largely missing at PROs despite a variety of training courses offered by

Sakpatenti. Skills in commercial evaluation, commercialisation strategy, market research and negotiations with the private sector are limited even among staff at GITA.

According to the available information, there is only one important Technology transfer office (TTO) skilled in technology transfer related to the domestic industry in the country in Eliava Institute. It seems that there is a lack of TTOs established by the PROs, which can be helpful to manage relationships with industrial partners to obtain contract research agreements. There is only a Technology Transfer pilot programme (TTPP), financed under the EU-World Bank Partnership Program on Europe and Central Asia (EEPP) and implemented by GITA and the World Bank, which aims to test and demonstrate the viability of technology transfer in Georgia and to support commercialisation. The programme started in 2019 and will run for three years. It is envisaged that capacity building for scientists and the commercialisation teams will be developed via on-the-job training during the programme. This programme should lead to the creation of TTOs in the PROs with high levels of commercialisation potential. Private sector enterprises and investors should get new opportunities for business-academia collaboration and access to the latest applied research and technologies developed by Georgian researchers and RDIs also thanks to the creation of a channel for communication related to the innovation needs of the business sector with the scientific community.

Key points of technology transfer activity in the country

The government plays a leading role in the regulation of all aspects of innovation policy in Georgia and the innovation process is highly centralised. The development of smart specialisation strategies is in an early stage, and the stronger policy aimed at the direction of the innovation activities should be the first priority. The TT policy implementation and state support for innovation are overseen by GITA. The communication and coordination between GITA and the other important government entities supporting innovation e.g., SRNSF and Sakpatenti does not appear effective neither is disseminating the policy and knowledge transfer to PROs. There is lack of support at the policy level from MoESD and MoESCS. R&D activities have historically been the remit of the GNAS and their affiliated PROs, which are the largest source of innovative technologies in the country. The current national TT system is non-existent with only one example of PRO-to-industry transfer via several mechanisms including contract research, licensing and spin-off creation. Collaborative research is not particularly common but is growing. Ownership of the research results and the use/sale of IPR is permitted without restrictions in the private sector while in the public sector the ownership is automatically assigned to the PRO and the use of IPR is regulated by the state. Most universities and PROs have established their own IP policies. TT resources at PROs are not available and TTOs are not present. There are no reversion rights to the employee-inventor and no monetary incentives for researchers outside of the ‘inventor cut’. The interaction between the private and public sector is limited. Public procurement mechanisms for high-tech inventions are not developed. The skills in market research, technology appraisal for commercial potential, international commercialisation, negotiation with the private sector and identification of future technology trends are absent in PROs and limited in the supporting organisations. Non-software and high-tech graduate start-ups and spin-offs from universities/PROs are very few

as Georgia still lacks incubator and accelerator programmes aimed at non-software businesses. This TT route is under-represented. The measures taken to increase the ICT competencies and the number of ICT start-up companies in the country has achieved a demonstrable success in four years. The system of innovation funding is centralised with very few financial instruments available to bolster innovation. However, limited specialised funding to promote TT is available from government sources. The regulatory and legislation framework has been revised and is still undergoing reform to increase the incentives towards innovation activities.

In addition to them, the European Commission with their Joint Research Centre identified the **main key points of the technology transfer activities** as follows:

- There are low overall financial investments in the field of research and development.
- There is a skills mismatch in the labour market.
- The age distribution among R&D personnel is unbalanced
- There is a severe lack of trained TT personnel at PROs.
- There is a lack of expertise in market research, commercial technology evaluation, brokerage and information disseminating on market demand and available funding in private and public sectors.
- There is a lack of dedicated resources for TT and consequently a lack of TT infrastructure and allocated staff positions.
- The lack of unified documented policy on IP management and TT/commercialisation activities in PROs. The detailed understanding of the best practices in IP management and TT in the country and the harmonisation of these practices will be required to create a functioning instrument.
- There is a lack of judiciary and legal personnel trained in IP law.
- The inventors are expected to be able to evaluate the commercial potential of their research results and identify the IPR protection measures without professional support.
- There is very limited understanding of the commercialisation process. Eliava Institute is the only PRO in the country successfully using TT processes and spin-off formation.
- Science-industry relations are absent and there is a lack of collaborative R&D support programmes.
- There is little to no involvement of HEIs and PROs in start-up activity outside of student projects.
- There is a low number of high-tech start-up companies on the demand side.
- Financing channels are not available outside of initiatives supported by the state or the banking sector.
- There is little or no support for proof of concept and prototyping. Tax incentives and debt financial instruments are useful for companies generating profits but not for early-stage ventures or for the development teams in the pre-seed stage.

Additionally, less far-reaching challenges for knowledge and technology transfer (KTT) identified are:

- The lack of basic IP and TT education among researchers.
- The lack of interest in using R&D results and patenting.
- The low level of entrepreneurial culture.
- The lack of clear performance-based criteria/key performance indicators (KPIs) for PROs.
- The lack of official statistics collected on TT metrics and R&D expenditure.
- A higher education system which is mainly devoted to providing teaching only.
- The lack of incentives for innovators within academia and PROs.

Two important comments must be made in this section. Firstly, despite the remarkable infrastructure development overseen by GITA, according to the materials found in the open domain and the interviewees involved in funding or evaluation of the start-up initiatives, start-up founders and new entrants to the competition and GITA's events often lack basic entrepreneurial skills which negatively affects the quality of their proposals and business models. Secondly, it is very clear that the recent focus of the innovation ecosystem developers has been on start-up development though a first pilot project aimed at TT within PROs has now started. Still, there is significantly less focus on the state support available to students and researchers in the HEIs and PROs, only a few incubators in Georgia function on the basis of universities.

3. SMEs-RI/Academia Development Prospective

3.1 SMEs-RI/Academia cooperation's development prospective in Armenia

In Armenia, from the **Governmental** point of view, the strategy presented in the Plan Programme of the Government of the Republic of Armenia for the years 2021–2026 confirms that the strategy at the governmental level is based on the correct identification of the barriers in the area of education and also form the economic, industrial and scientific point of view. In addition to this strategy, only several few recommendations can be added:

- coordinate actions between the Ministry of Education and Science and Ministry of High-Tech Industry to highlight the importance of the application of R&D results and their further use because considering the current situation in Armenia, it is mandatory to benefit from the academic knowledge. Since the generation and diffusion of scientific knowledge are primarily the responsibility of universities, collaboration with a university is inevitable. In regard to this issue also cooperation with other ministries would be beneficial;
- strengthen human resources, research excellence, and research commercialization through government-facilitated collaborative research programs with international universities, private sector, and a targeted visa program;
- facilitate access to services not just from national providers but opening up to the international dimension. Strengthen human resources, research excellence, and research commercialization through government-facilitated collaborative research programs with international universities, private sector, and a targeted visa program;
- to focus on the investment promotion strategy to attract global companies;
- to develop and communicate a clear strategy for resource allocation so that all stakeholders understand the government's priorities and the funding opportunities that will be made available;
- shift focus of publicly funded seed-funding programs (including incubators and accelerators) toward "successful exits" rather than "quantity of firms" in the program;
- to find the optimal ratio between the support of the research and development (R&D) activities and the infrastructure investments;
- it is important to provide resources and support to bridge the developing gap of innovation observed in the country (going from TRL 4, technology validated in lab, to TRL 8, system complete and qualified) to support the creation of relationships among the relevant stakeholders and a more effective use of R&D results for example through the proof-of-concept funds to validate novel solutions. In this area there is a possibility to prioritize research areas;
- to expand targeted financial capability advisory services to SMEs on financial products, financial reporting, financial management, business planning, and marketing to enhance their bankability and discourage informality;
- to extend awareness about the intellectual property rights and their protection, including for example introducing of the software patenting legislation to protect software that demonstrates "further technical effect" (in line with EU guidelines).

Due to the small internal market, expansion of economic growth and related expansion of opportunities will be conditioned by the growth of international competitiveness. The investment attractiveness of the Republic of Armenia will be conditioned also by access to the markets of the Eurasian Economic Union, the European Union and Iran. For the purpose of ensuring growth of international competitiveness, the Government should continue in adopting the vision to establish a knowledge-based and innovative economy and is declaring knowledge and innovation as the main driving force for economic development. The economic policy of the Government is based on the import, creation, export and effective use of knowledge. Regarding these goals, there should be a support for the diversification of the export areas, not only on the dominating products with low added value, but also to the development and support of industrial, technical and technological branches. According to the available statistics, the Republic of Armenia has a strong potential to develop the sustainable economic growth thanks to the innovations published in the highly-cited papers.

Accessing donor funds is important for Armenia, to reward and motivate researchers and to have additional resources because there is only limited venture capital available in Armenia to support innovations and their transfer into practise. Among actions to be considered:

- create or support associations among R&D organizations, institutions, NNAS RA, SMEs and universities with the mission to support applications to international funding schemes;
- Set up an operational presence close to Brussels, the European Commission with a focus on R&D activities and their founding;
- to open up more collaboration opportunities abroad, for example thanks to the presence of their associations in foreign countries;
- to support incentives for marketing Armenia abroad and to join international associations dealing with KT/TT, innovations and creation of the project consortia;
- to organize additional business and financial management training for SMEs to take advantage of project schemes and founding

Motivation is an important driver to retain talent in the country. We suggest promoting initiatives, with a special focus on young researchers. Among possible actions:

- rewards to young researchers that successfully introduce the results of their activities into the market (the reward can be comparable to one year of salary, if the R&D result is used in the country, two years of salary if it is exploited abroad)
- financial motivation is very important, because low research quality and a lack of replenishment in the PhD education system will continue to be issues as long as professor salaries remain below the market rate;
- follow-up funds and services for the researchers willing to further implement their innovative solutions with the creation or cooperation with the spin-off companies;
- give the visibility of successful stories in the media to increase the public awareness about the research and development activities;
- research collaboration agreements with European research centres;

- in addition to international mobility programmes, support national mobility programmes for researchers and students that allows to travel and obtain new knowledge, partnerships and to create a basis for the future co-operation;
- profit-sharing, shared ownership and tax incentives to allow Armenian inventors a higher benefit from the exploitation of their ideas might assist;

The **knowledge and technology transfer** support are provided by professionals with a good theoretical/academic background but lacking long-lasting hands-on experience, especially at the international level. It is important to make sure that the support provided is also backed by experienced professionals.

- we suggest involving Diaspora members with the needed background and having them serve as mentors/coaches of the personnel involved in the operations and work side by side for at least two years;
- we also suggest to create proper mechanisms and a regulatory framework for international recognition and protection of IPRs in Armenia.

Start-ups and spin-offs are key actors in the process of rejuvenating the economic fabric and shifting towards more added-value industries. It is widely accepted that they also have a positive impact on the employment of highly educated people and contribute to the retention and attraction of talent. In addition to several private accelerators that are now operating in the country we suggest considering also the availability of the proper financial instruments. Among possible actions:

- contribute to the establishment and development of start-ups through grant projects;
- promote the creation of a co-investment early-stage risk capital fund to have public money invested alongside private investors and/or business angels, alone or in syndication;
- support the creation of a later stage financial instrument to allow start-up and innovative companies to establish and consolidate in the country before scaling up abroad (to minimise the risk of having them leaving the country);
- support the existing start-ups and spin-offs with innovative ideas and in the perspective or needed areas, not only the creation of high number of new start-ups and spin-offs for example through the creation of a national investment fund that will be able to make necessary investments in the start-ups operating in Armenia to ensure their further development and appearance on the global market or through the establishment and development of accelerators in Armenia and design joint projects to ensure intensive development of the perspective start-ups;
- support the innovations according to the national and also international customers´ needs and requirements – because in the phase of start-up the manufacturing process can be more expensive;
- create support mechanisms for the existing start-ups and spin-offs, to increase their opportunities, sales and their marketing know-how and to utilize the opportunities of partnership with international accelerators and thanks to this mechanism to improve the international rating of Armenia.

Universities are the place where new ideas connect with present knowledge. It is important to make sure that the universities have the resources to allow students and researchers to develop new ideas and the possibility to cooperate with companies. Among possible actions:

- launch national challenges, linked to the country's strategic priorities and to support the cooperation among the researchers and SMEs because small companies usually are not able to perform research and development activities without the support of universities or larger companies;
- spreading the funding too much will have limited overall impact thus concentrating funding in sectors demonstrating excellence and strong potential is recommended;
- to consider decentralization of the university study, which can lead to a better cooperation with the regional SMEs;
- since attracting talented young students to science and retaining them in the professions for which they are trained is often very difficult, to perform the analysis of the professions with the possibility to produce the products or to offer the services with high added value on the national level and to positively support technically oriented or other identified study programmes;
- investments in the science and technology sector of Armenian education and industry should place a high priority on salaries for young scientists, reflecting the great respect of the scientists;
- to allocate money for internal grants within the universities on the transparent competitive basis to support young and motivated students and researchers in their activities;
- to prepare the recommended study plans proactively, with respect to the future national and also international needs and standards and to support the high-tech orientation of the country regarding the persistence of this actions;
- support mechanisms to obtain funds from international donors to complement the national resources.

3.2 SMEs-RI/Academia cooperation's development prospective in Georgia

Georgia has been already employing a variety of mechanisms, including updating policies and regulations to encourage entrepreneurship. These efforts should be focused on the policy development for smart specialisation and development of the strategy for high-tech areas with the focus on the SMEs offering products with the high added value.

The lack of official statistics collected in the area of **research and development activities** dealing with the established innovation infrastructures (such for example FabLabs, Techparks, Innovation Centres) makes evaluating impact of these organisations very challenging. As the impact is unclear, it is hard to understand which kind of infrastructure or intervention works better in Georgia, and to make necessary changes to increase efficiency. Therefore, we recommend to propose statistical and analytical tools for the evaluation of the knowledge and technology transfer activities of these centres, laboratories and parks, from the economic point of view (number/budget obtained from national and international funds, investments on the innovation activities, volume of innovative products produced and exported and their overall share, added value of the offered products or services, revenues received from commercialisation of innovative products and services) and also technological point of view (such for example number of patent or utility model applications, number (or ratio) of researchers from the overall number of employees) also regarding to the geographical placement. After that it will be possible to strengthen the coordination efforts between different innovation actors, as well as the monitoring and evaluation mechanisms in order to create a balance between policies, innovation strategies and action plans.

Considering the cooperation with the EU, the number and value of research contracts between the PRO and enterprises should be monitored, also the number and quality (impact factor) of publications resulting from collaborations between universities and enterprises. In addition to these, also the ratio of women and young researchers involved in the research and development activities should be considered. In addition to that also the involvement of the women in the management activities should be monitored.

Better **research commercialisation** and public awareness about the total number of created start-up and spin-off companies, their funding by the accelerator, incubator programmes in PROs or supported by techno-parks or by the external funding (EU, USA), angel investment, venture capital and mainly the commercialization of the successful start-up/spin-off companies that achieved a successful exit with the deal size indicated could serve as a motivation for other researchers and scientists.

The quality of **education** and public understanding of exploitation of R&D results can be improved for example by:

- improving methodological support in innovation, use and valorisation of R&D results and IPR protection, the latter with a focus on software and algorithm protection to prevent form using of illegal software and applications,

- improving the digital communication on availability of professional services in IP exploitation and IP innovation management to researchers and scientists at universities,
- improving the cohesion and integration among the researchers, inventors, students and young professionals through events or exchange programmes to support collaboration among universities and SMEs and other organisations in different regions,
- universities can strengthen the R&I component through the development and implementation of adequate strategy, which would include reform of the education system in order to produce human capital skilled in carrying out applied research aligned with global technological trends,
- curricula should be aligned with the evolving industry needs where applicable, and the culture of innovation and entrepreneurship should be promoted at all levels of study, because the graduates (especially considering the PhD. graduates) can in future significantly help to support interconnection between the universities and SMEs,
- during the pandemic times it is very advantageous to put emphasis on the distant and e-learning courses, however the main emphasis should be put on the present learning,
- research infrastructure should be updated and upgraded in order to enable PROs to provide advanced services and develop leading-edge technologies,
- implementation of subjects dealing with the IP management and R&D result transfer into practise directly into the education process at universities,
- to support and promote mentoring programmes, mobility grants, R&I grants, etc., to retain and attract a highly qualified researchers in the country,
- provide grant financing to incentivise the technology development to higher TRL within PROs and university spin-off companies,
- to support partnerships with universities in the EU because one of the most important aspects of the education and also further entrepreneurial culture is collaboration. Fostering international collaboration is possible within the Erasmus and similar programmes,
- it is recommended that similar programmes can be considered at the national level, aiming at fostering regional collaboration. Promoting the mobility of young entrepreneurs and young researchers within the country, creating collaboration opportunities, competitions contributing to innovation projects, will speed up the cultural shift and support also collaboration between the university and SMEs.

In the area of **intellectual property**, it is recommended to:

- provide training not only for the researchers, but also for the IP law for judiciary and legal professions,
- improve the framework for commercialisation of state-owned IP on the distribution of profits and responsibilities to the involved organisations,
- to focus not only on the national, but also international patenting activities,
- increased PRO-to-private sector can be achieved by creating a platform for information exchange on start-ups' needs; for this purpose, also the Technology Transfer pilot programme (TTPP) project can be very helpful,

- scientific and innovation potential of the PROs should be mapped or otherwise captured and offered to industry and SMEs as a base for collaboration and knowledge and technology transfer activities,
- consider the strong centralization of the TTOs, because regional TTOs or TTO at the universities can be very helpful not only during the patent, utility model, design etc. application process, but it can be also very helpful and serve as a support for the local spin-off or start-up companies.
- regional TTOs can more effectively participate in activities of international organisations and professional networks because of better information about the innovation potential of the given region.

4. Success Stories Related to Knowledge and Technology Transfer

4.1 The Results of the Contest for the best cooperation plan/vision with RI/Academia

The Contest for the best cooperation plan/vision with RI/Academia was organised within the framework of the "Transferring V4 expertise in knowledge/technology transfer" project with the purpose to develop a vision for enterprise cooperation with research infrastructure representatives, to promote the relationship between the RI/Academic and SMEs, to promote good practices of cooperation between business, SMEs and industry with research institutes and academia and as the encouragement for SMEs to search for and implement new technological solutions in cooperation with the RI/Academia.

The Contest organisers were the Armenian State University of Economics (ASUE), the Ivane Javakhishvili Tbilisi State University (TSU) with the active support of the Center for the Advancement of Natural Discoveries using Light Emission (CANDLE).

The Contest was free of charge and was open to entities representing SMEs from Armenia and Georgia.

The Contest Jury was composed of members (experts) from the project partner universities representing the V4 countries:

- Czech Republic, Brno: Masaryk University
    - Radoslav Trautmann, Head of Technology Transfer Department, Deputy Director
    - Jana Daňková, Business Development Manager
    - Jiří Velinský, Head of Department of Economics and Projectsň

- Poland, Gliwice: Silesian University of Technology (SUT)
    - Zygmunt Łukaszczyk, Director of SUT's Continuing Education Centre
    - Małgorzata Dobrowolska, Director of the International Center for Interdisciplinary Research

- Slovakia, Košice: Technical University of Košice (TUKE)
    - Monika Blišťanová, Vice-dean for science and research
    - Pavol Lipovský, Associate professor

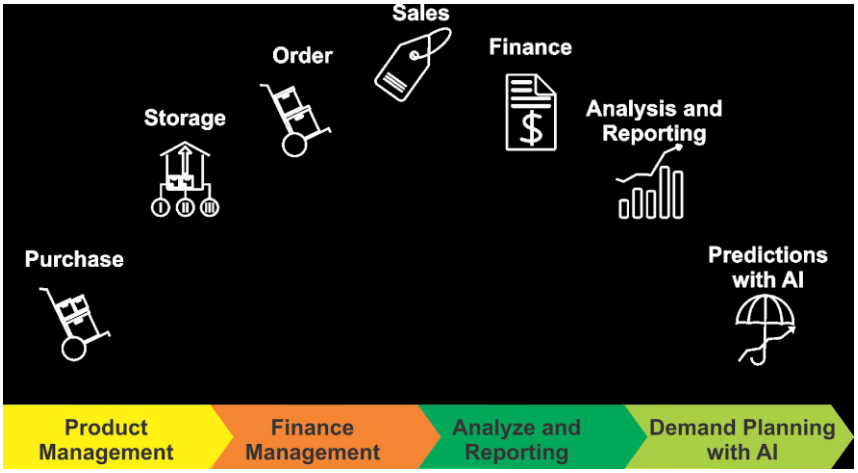
The Contest for the best cooperation plan/vision with RI/academia was due to the pandemics organized in the form of online event using the ZOOM platform on 16th November, 2021.

After the welcome speech of Diana Galoyan, Rector of the Armenian State University of Economics and brief presentation of the project presented by Arpine Jraghatspanyan, chief specialist from the ASUE International Relations Division, 8 presentations of the best cooperation plans or visions with the RI or academia were presented:

Participant 1 – "ElMasys"

Presenter: Roza Avagyan, Project manager

ElMasys as a small start-up IT company and presented their system for automation of purchasing, warehousing and sales processes and optimizing business processes of wholesale and distributing operators. It enables to manage and make business processes of the organization more controllable, increasing the soundness and efficiency of decision-making. The design of the system was started in 2016 on the basis of individual order for the design of a business automation system received from a wholesale company with the import of more than 1000 names of products. Throughout the design of the system, the sectoral characteristics, processes and problems of different target market organizations have been studied in depth in order to include solutions of their problems in the system and make it as multifunctional as possible. The system easily integrates with other systems, allowing consumers to connect their small, local automation solutions to Elmasys database without having to give up or replace certain previously used automation modules (such as accounting or barcode scanning) for a single, automated database.



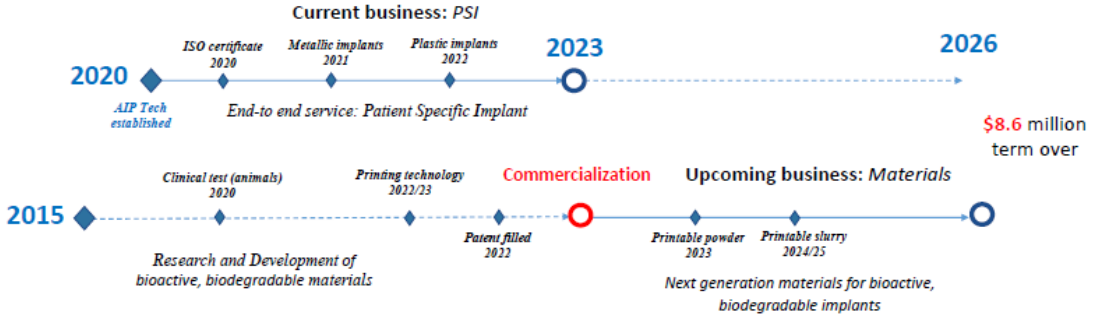
Currently, they achieved TRL 8, their software is ready and used by a number of customers. Their activities have been funded by 50.000 USD grant for the product finishing and marketing. After finishing this stage, they plan to actively engage in cooperation with research institutions and other relevant companies to apply more professional approach for different tasks. They are good at technology development, however they need more deep analysis in markets and to develop a marketing strategy because for the upcoming year they plan to accomplish market research for US market that they will try to enter in 2022. After entering and validating the product in the US market, they plan to add a new line and module to the inventory management software we currently have. The new AI and machine learning based module will deal with different predictions that big businesses need, such as price and demand forecast, best cross-selling opportunities suggestions, etc. AI integration is one line for cooperation. The second line for cooperation could be in the sphere of market research, as we have plans to enter also Canadian and European markets and business processes, the philosophy of which is different and deep research will be needed. Expected outcomes of the cooperation can be articles, AI modules for predictions for different industries in big countries and in the world. Copyrights and patents for outcomes should be protected by local and global legal mechanisms depending on the intellectual property type and its' protection necessity.

Participant 2 – "AIP Tech"

Presenter: Sargis Aghayan, Director

The AIP Tech is a small high-tech company specialized on the design and fabrication of the patient specialized implants (PSI). They provide end-to end service which includes design, modelling, prototyping, surgery pre-training, surgery support.

R&D is one of the strategical directions of the AIP Tech. They have been developing next generation of implant material (biodegradable, biocompatible, 3D printable raw material for implant manufacturing) for bone engineering, which is not available in the market.



R&D is in a research phase granted by two governmental funded project which primary goal is development of new and advanced material for next generation implants. After finishing these projects, the next stage could be international funding (e.g., Horizon Europe) as a primary source of scientific activity up to TRL 7.

Research is performed by 5 dedicated members who are or full either part time involved in the R&D activities – chemist working on the material development, a doctor working on design and optimization of the current PSI and upcoming implants, material scientist focused on the characterizing and optimizing material properties, biologist directing and exploring clinical tests and standardization specialist keeping all developed materials and processes within standards and required specs. In the team there are several interns from universities, partially Yerevan Medical University.

The AIP Tech has been actively collaborating with medical clinics where real surgeries are taking place. Their activities started in 2020 4th quarter and since then they have successfully accomplished more than 20 cases. They have been also actively collaborating with the Institute of Chemical Physics, NAS RA, where they plan to perform scientific collaboration and material synthesis at the laboratory level. Currently they have been negotiating with RAU who will provide laboratory (space, faciality) and AIP Tech will establish clinical test laboratory.

With Research institutes (RI) they can create effective alliance and generate valuable results and plan to establish joint laboratory which will generate applied technologies which can directly go to market and to organize trainings training for doctors that can use this technology.

Participant 3 – "Revalcon"

Presenter: Anna Barseghyan, Financial advisor

Revalcon is a small Armenian start-up company established in 2017 solving complicated technological challenges in the irrigation processes interdisciplinary integrating knowledge from agriculture and technologies. Revalcon offers END to END solutions in agriculture. Based on the new LORA technology, the entire irrigation process is controlled both through mobile and web applications using IOT. The service monitors the operation of pumps and valves, collects information from the fields. Using weather and humidity data, users can adjust the irrigation schedule. In addition, the technology provides inter-machine interaction at a distance of up to 15 km with minimal energy consumption.

HARDWARE	SOFTWARE
■ PSCS - Pumping Station Control System	■ Admin and API APP
■ Server - Sirius	■ Bot (telegram)
■ Nodes	■ Web app - dashboard
■ Repeaters	■ Mobile APP (Android and IOS)

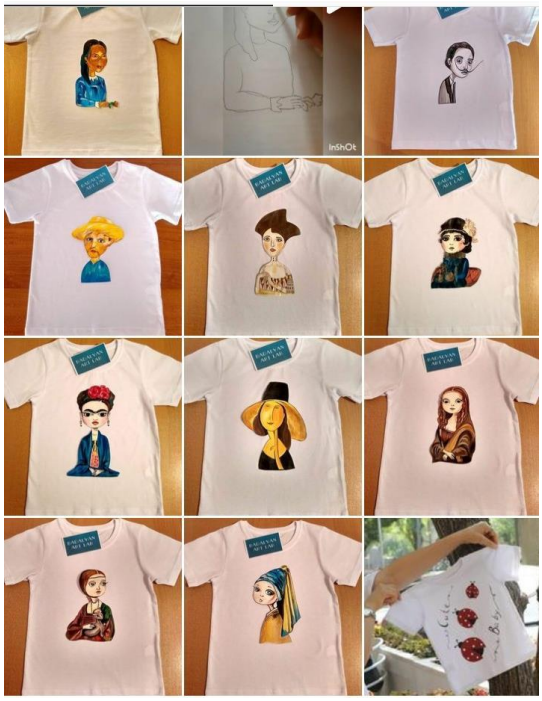
The product is based on the R&D component, 7 of 10 employees are involved in the R&D activities and they have already started close cooperation with the Armenian Agricultural Academy to enhance the capabilities of the products. Moreover, in the future, they are planning to expand the AI segment and it will be possible only in case of more engagement of researches. They are aware of the potential of the cooperation with the scientists and researchers, because thanks to the cooperation they can implement more innovative components into their systems thanks to the discoveries and new knowledge in this area. The codes and hardware can be protected by the intellectual property rights.

Participant 4 – “Badalyan Art Lab”

Presenter: Ani Badalyan, Founder & Owner

Badalyan Art Lab is a concept of experience offering hand-painted unique T-shirts for people aged from 0 to 100.

Thanks to the R&D involvement into its business strategy, the sales can be improved by the better marketing strategy, using the targeting advertising tools or by the effective utilization of the social networks. The analysis of the business model can be performed to increase the situation assessment and setting priorities.



Participant 5 – "Hydroponic Farm Goris"

Presenter: Karen Ordyan, Deputy Director

Hydroponic Farm Goris is a small company dealing with the agricultural industry. Their Hydroponic fodder system (HFS) is located in Syunik Province. The area is specified with its high mountains, which makes difficult to take the livestock for grazing. The hydroponic fodder is nutrient rich green-grass, which is essential for the livestock because it does not require any chemicals to grow. They produce HFS by growing wheat or barley seeds without soil and only with a little water (3-4 liters for 1 kg of fodder) during 7 days, compared to traditional fodder which takes 2 months to grow. The seeds are sprouted and getting to 30–35 cm tall, becoming more nutrient rich fodder because in comparison to traditional fodder, dry food or grain, it contains much carbohydrates, minerals and vitamins.

Hydroponic
Farm Goris

The company cooperates with the Strategic Development Agency in Syunik Region to gain deep knowledge and the technology. In the area of R&D they can in addition to the performed research also to lead trainings, master classes helping the population understand the productivity of the new strategy.

Currently they have 2 persons for the R&D activities working on existing projects on permanent basis. In future, they can lead trainings or master classes. After increasing awareness of employees regarding intellectual property, applying for protection of IPR, trademarks, as well protection of the information in different places.

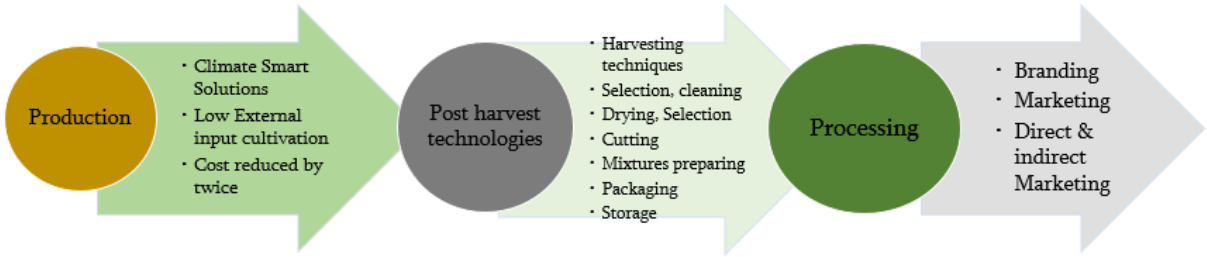
Thanks to the cooperation with RI, they would like to achieve "Smart agricultural networking" and high-level efficiency with less spending for the farmer thanks to the possibilities offered by modern technologies, Nevertheless, education and propagation activities are necessary, because society in the regions has not reached the level of consciousness, that modern technologies can be better than old ones.

Participant 6 – "Symphony of Nature"

Presenter: Armine Abrahamyan, Founder & Owner

Herbal tea production in the community of Surenavan in Ararat region has a unique value proposition in the market with healing mixture of herbal tea that is harvested from its own farm. It has created 5 employment opportunities for local women and established successful cooperation with IFAD, CARD allowing the enterprise to procure production automatization equipment. With UNDP's support the enterprise will upgrade its production area to 70 m^2 and increase its annual production of herbs from 500 kg to 500,000 kg enabling over 20 households

to have steady income-generating opportunities In Ararat Region, the agriculture suffers most due to the mono-cultivation, climate change impacts, scare water resources, unsustainable use of natural resources etc. In addition, tea producing companies in Armenia are mainly harvesting medicinal plants from their natural habitats to bring their populations' loss. Besides, Armine Abrahamyan Vazgen PE realized that in the market most medicinal mixtures are offered to the consumers without any research investigations. To address these challenges, the business project encompasses two value chains: medicinal plants cultivation based on innovative climate smart cropping system and research based healthy tea production.



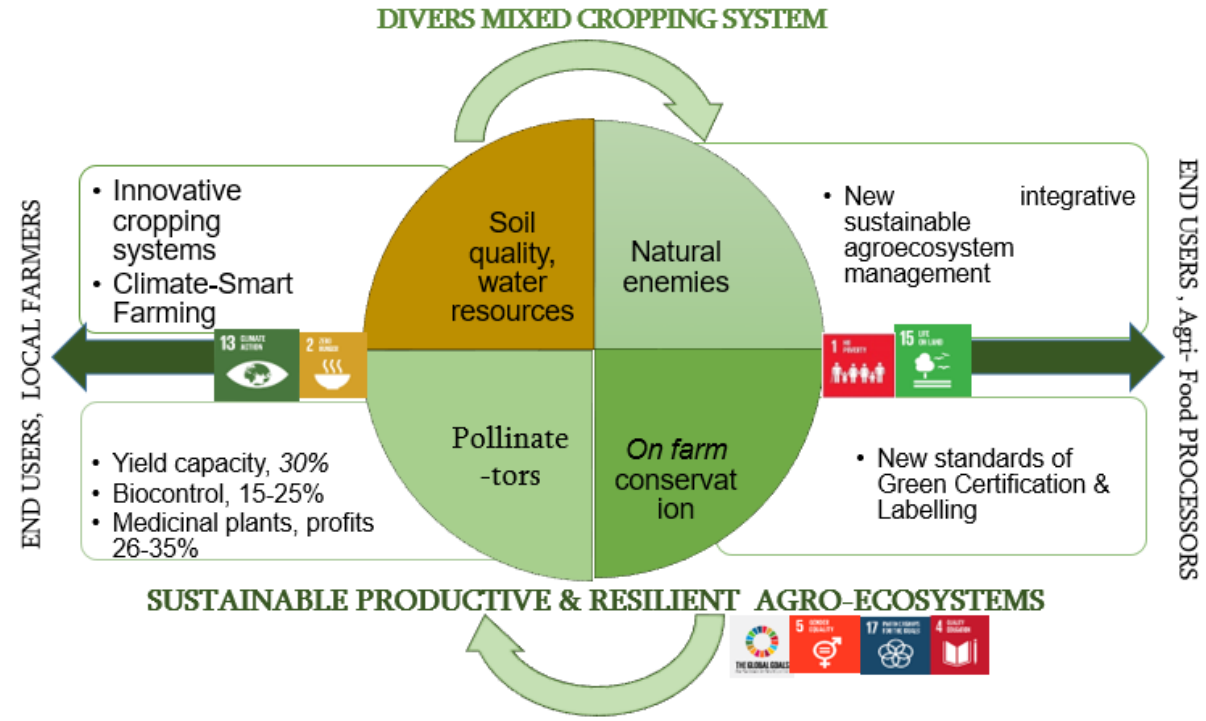
Considering the small family business, where the only permanent workers are family members and local women, there are not enough resources to employ persons for R&D. However, the owner has the academic background in plant breeding (agronomist) from ANAU (2006), Master's in Environmental Protection and Doctoral Degree in Plant Ecology (2015 – DU, Latvia), whereas the doctoral research dealt with the wild medicinal plants' population in Armenia. During the research work, she received tea mixtures that is appropriate with their biological active compounds to be mixed for better flavor, taste and healing proposes. It means that business activities are performed by the researcher with academic background. However, in the near future, the aim is to create small unit/ or a position that will be responsible for research investigations and will collaborate with RI and academia.

The research work is performed in cooperation with the Armenian National Agrarian University (ANAU) and the interest is to share the research results with other people and to show how to conduct business in order to better meet current challenges at the same time producing high quality products for the sake of consumers and for a general good.

The business cooperation with RI in both value chains of tea production: in the production of herbs and also in the processing (post-harvest technologies) as well as in marketing directions.

Since 2009, they have started domestication for several wild species e.g., Oregano, Melissa, Hypercom etc. In addition, they have developed special agri-technological maps for the species cultivation. In 2020, they have introduced climate-smart novel cropping system that was recognized one of the ten innovative ideas of UN Futurearth fund. The idea helps to transfer mono-cultivation into diverse cultivation to improve 4 components of agro-ecosystem: on farm conservation of endangered medicinal plants, improving pollinators population, enhancing biocontrol and also improving soil quality and prohibiting its erosion that is common phenomenon in semi-desert areas of Ararat valley. By introducing climate smart green agriculture practices they aim to decrease the production cost by two times at the same time ensuring sustainable utilization of natural resources and developing diversification in agriculture crops for establishing self-sufficient community that is essential towards global climate change impacts and Covid-19 pandemic.

The business owns 1 ha apricot farmland for herbs cultivation in marginal areas. In the business strategy, they aim to introduce social-component for enlarging herbs production based on climate smart system up to 10-15 ha to reach 5 t of dried herb annual production. During 2021-2025 they would like to involve other local farmers from Surenavan, Armash and Erasgh communities for enlarging medicinal plants cultivation. They will provide the plant seedlings and buy back the ready product. In this way they want to improve the socio-economic conditions of rural people by providing additional incomes for local farmers.



The business cooperation with RI in 2 mechanisms:

1. How can the business contribute the research and innovations in Armenia? (novel cropping system, new agro-technological maps can be adopted in the research, leading of diploma works…)

2. How can RI improve the business activities? (development in vitro growing techniques of medicinal plants for virus free seedlings, analysis of biological active compounds in the tea mixtures, providing essential proves for the best combinations, marketing research and consultations on e.g. food manufacturing ISO standards...).

Intellectual property right would be in vitro growing technique of the medicinal plants that is new for medicinal plants. In addition, it may rise while developing new cropping system based on the investigations. There is also the possibility of joint publications from the research results in cooperation with RI.




Participant 7 – "Kristina G. Zayimtsyan couture"

Presenter: Kristina Zayimtsyan, Founder & Owner

The company produces exclusive and luxury evening party dresses for women and girls, with handmade beads embroidery fabric. Beads it's a small decorative object added on mesh fabric to make a new fabric. They also use silk or different soft fabric for creation of flowers added on the mesh fabric. In this way they get a new luxury fabric from mesh fabric.

They make handmade products, use innovation procedures (for example by cutting the seam process, creation of new designs and ideas in sewing and the seams…). Thanks to the innovations they try to make invisible seams. The procedures are nowadays only handmade, but with the perspective to perform the sewing on machine. This is the challenge where cooperation with the RI would be beneficial because new technology could move on from handmade process to the machine process to make the whole process much more quicklier.

The sustainable cooperation with the RI can start with trainings, secondments, master classes, invited masters from other countries, it can continue with the development of the sewing technology and sharing of the new information.

Participant 8 – "GebeCert"

Presenter: Roman Zakyan, Business Development Director

GebeCert is a solution aiming at the distance validations of physical items. The high volume of counterfeit products in the market, starting with wearing apparel up to the counterfeit medicine, requires clear evidence of the existing issue and its volume. Another issue of distance validation is document/identity validation. The solution suggests using RFID (NFC) chips by attaching them to physical objects, after which the consumer, scans the chip with the use of our special mobile application. Upon receiving the information, GebeCert Distant Validation system checks the validity and provides the consumer with the additional information about the product through the application. In addition to the protection, the solution suggested also creates additional value for the customers, since by obtaining information while scanning, it gives us the opportunity to analyse it. These data have the potential to increase the sales volume of our customers' products.

Gebecert company is using high tech RFID chips and patented software to provide counterfeit protection services to its' clients. In current stage they divide the R&D processes (TRL 9) into business and technology R&D. Like most IT companies, they focus more on the technology development and cooperation with RI would be advantageous for the business development, namely for the business plan development, market research, sales channel identification and legal research for patenting procedures, to increase our sales and involve investment.

In addition to the presented plans or visions, there were several more application forms fulfilled, however due to the technical issues, covid pandemic situation or work load, they were not presented during the contest, although these visions were also very interesting:

Best House Real Estate Agency, which deals with purchase, rent, daily rent, home renovation and design. Their responsibilities involve greeting of the customers, responding to their questions, achieving established goals and maximum results, introducing promotions and new opportunities to customers in a real estate market. The company pays great attention to research and development in its business strategy as it is a valuable tool for growing and improving the business. Not only it gives an opportunity to research the market and the customer needs, but also develop and improve the products and services that can fit to their needs. The role of RI can be in providing insights into the market and in the development of new services, products or improving existing ones ensuring a stable competitive field or organizing of the workshop's trainings, master classes to share together best practices, knowledge or goals.

Sniper Marketing is a company providing digital marketing services. The main directions of their business activities are promoting digital marketing for businesses, business analysis from the perspective of digital marketing for them. Their aim is to promote the businesses of their customers through the social media strategies and their implementation.

The research has a huge place in their main activities, as there is always a need to analyse the customers' behaviours, market changes, competitors, their services, etc. As a result of this they can reveal how to act in the future, what suggestions should be proposed regarding the market, how to make the marketing more efficient and how to increase sales.

For our further collaboration with RI they foresee the following 2 directions: contract research (to understand what kind of products they may have, how to reveal the picture of the market and the customers, their needs and behaviour) or training, master classes in order to import the science in the concrete directions of the marketing, which will make digital marketing services more automated and smart.

W´ARM company is a developing company focused on the producing of the heating clothes. The heating clothing provides additional heat for the wearer due to the special inserted part and electric current. The company currently specializes in warm jackets, which work with three charging options: charging from electricity, solar energy or mechanical motion. Their jackets have the ability to self-adjust, which creates additional comfort for the wearer, especially in case of emergencies.

The organization is specializing in production of heating clothes, which effective organization requires doing regular research. The scope of this research is quite wide. It includes both business (market, competitor research, opportunity and risk assessment, etc.) and technology research to have their products more competitive. Collaboration with RI / Academia is an additional opportunity to receive advice and support from professional circles to conduct the business-technology research at a more professional level, to make it as effective as possible.

Dream Industries LLC is a young company engaged in manufacturing of special type of technological batteries, which are used in uninterruptible power supplies, solar power plants, telecommunication systems, and other fields.

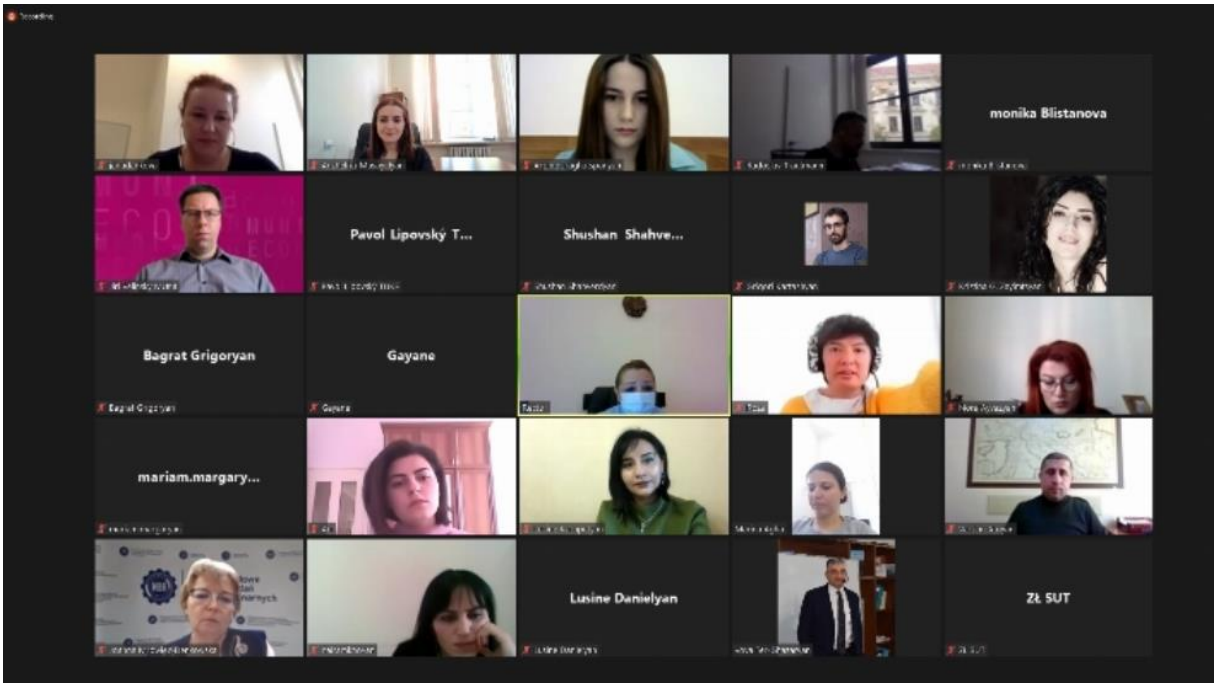
The submitted plans/visions were evaluated mainly from the feasibility of the cooperation plan/directions point of view, sustainability of cooperation with RI, clarity of the identification and description of the main obstacles for the cooperation with RI, company's perspective on how to tackle those problems. Additionally, also the openness of the on-site facilities, equipment, software, etc. for partnering RI staff for the purposes of joint R&D was evaluated. And regarding the main topic of the project, the creativity and originality of the application and intellectual property rights were evaluated.

During the final event, which was held due to the covid-19 pandemics only online on the 16th November 2021, presentation skills and quality of presentation were evaluated, also the answers to the questions asked by the experts, feasibility of the vision/plan and overall idea were evaluated.

The experts from the V4 countries evaluated submitted and presented visions and plans and although it is very difficult and challenging to compare so differently oriented companies and their visions and plans for the cooperation with the RI and universities, according to the final evaluation, the chose following

winners of the Contest for the best cooperation plan/vision with RI/academia:

1st place	**Symphony of Nature**
2nd place	**GebeCert**
3rd place	**AIP Tech**



4.2 Analysis on Business-RI/Academia Relations, Existing Problems and Opportunities

Possibilities of the cooperation between the SMEs and research institutes or universities are very dependent on the field of the activity of the SMEs, as it can be seen from the previous section. However, there are several obstacles and ways how to tackle these problems that were identified by the participants of the contests.

Main obstacles for the cooperation with the research institutes or universities identified by the SMEs, that participated in the contest, can be summarized as follows:

- insufficient financial support, shortages of financial resources, prices for the RI services (that especially start-ups cannot afford),
- absence of clearly defined cooperation strategy at the national level,
- different interests: companies try to patent all novelties and results, whereas RI and academic institutions need to publish and share all data, which may be conflicting,
- cooperation with RI and universities makes the business processes slower and it is a significant disadvantage, as SMEs have to be fast in everything as things are changing too fast in nowadays modern life,
- lack of qualified human resources,
- no guarantee of the offered services or products developed by the RI/universities,
- lack of information about the possibilities and benefits of this kind of a cooperation,
- lack of information about the offered RI services and their capacities,
- political situation and lack of governmental support.

Perspectives, how to tackle these problems and obstacles identified by the SMEs, that participated in the contest, can be summarized as follows:

- funding from the grants for research, development and marketing activities,
- preparing of the cooperation strategy for the national and also international needs,
- expansion of sales can help to invest more money in the development of the R&D capabilities, or even to the possibility to pay researchers by the SMEs,
- with essential marketing research and promotion, it would be possible to show the differences of novel products and to gain the consumers loyalty and trust,
- to solve the issue of IPR and publishing, at first it is necessary to process the patent application and then the results can be published. The patent can be shared or can belong to company depending on the cooperation agreement,
- to use opportunities in the form of available consultations, trainings and so on, in order to develop science-based business or to enhance export activities (for example to EU countries),
- employees working for SME and also research institution or university,
- development of the RI/academia selection process and development of the work quality assurance mechanisms.

The support needed to build a more active and efficient cooperation between SMEs and research institutions and academia identified by the SMEs, that participated in the contest, can be performed by:

- governmental support and continuous financial resources are required, also after the company loses the designation “start-up”,
- identification of people convenient for the cooperation,
- preparation of guides dealing with the cooperation strategy,
- sales consulting lectures, workshops or analyses performed by RI/academia,
- helping with the marketing strategies offered by RI/academia,
- solution of joined projects among SMEs and research institution or university to strengthen the collaboration,
- increasing of the awareness about the benefits and services the RI/academia offer, as well as about the efficiency of this kind of cooperation.

5. Conclusion/Suggestions

The purpose of this project was to show and explain cooperation models between SMEs and universities existing in the V4 countries, namely in the Republic of Poland, Czech Republic and Slovak Republic. The models and experience shared by the experts dealing with the knowledge and technology transfer in the V4 countries and good but also bad practises, success stories and other information presented by the researchers working at the universities in the different areas of applied research were presented during the organized workshops. The plans and visions prepared by the representatives of the SMEs during the contest organized for the Armenian and Georgian SMEs can also serve as a valuable source of information for different national and international organizations, governmental institutions, universities, research institutes and SMEs for the development of the cooperation between a RI/academy and SMEs.

In Armenia the Government clearly indicates the intention to make Armenia a high-tech, industrial country and makes an enormous effort to accelerate foreign investments also by the improvement of the transfer of knowledge and technologies into practise and by the enhancements of the activities in the area of IPR, mainly by the improvement of legal regulations for protection of IPRs, as well as the development of protection mechanisms. Even though the governmental budget for research & development is relatively small, various types of public funding are available for research in Armenia: indirect funding for innovative companies (tax relief), loan guarantees, innovation matching grants and other instruments.

Armenia has a well-established education system with the tertiary education performed mainly by the state and private universities and several branches of foreign universities located in the country. The Ministry of Education and Science is responsible for developing and implementing state policy/strategy, as well as the observance and improvement of the legislation in higher education. It is also a source of funding, and in addition, performs an oversight and auditing function. However, connection between universities, industry and SMEs are not supported enough at the national level. Innovations, research and development activities performed at the RI/universities are not commercialized enough and therefore SMEs are not many times aware of the capabilities of the researchers and scientists.

A lot of R&D activities have been performed by large foreign multinational companies. Armenian companies are predominantly small and are oriented only to a local market and have limited opportunities to search for more innovative ways to increase their productivity because of weak linkages between SMEs and universities, although there are a number of technology centres and centres of excellence in the country.

Armenia is a small country with little budget for R&D and with a relatively young technology transfer infrastructure, therefore an integrated support system covering the whole processes from fundamental and applied research until the finished commercially offered product or service is neither inter-connected nor complete. There are only several exceptions based on the personal connections or informal relationships. Therefore, the activities of the Technology Transfer Office or other non-governmental organisations such as the Armenian Technology Transfer Association should be supported to promote knowledge and technology transfer advantages because in this way it is possible to support cooperation of the SMEs with RI and universities.

In **Georgia** the economic model characterised by a liberal economic regime which offers supportive framework conditions to do business has been implemented. The regulatory framework regarding intellectual property rights (IPR) is relatively new and inter altera defines several types of innovation infrastructures (such for example FabLabs, Techparks or Innovation Centres). Their impact is due to the lack of official statistics difficult of evaluate. The economic development in recent years has been positive, as proved by many different types of international indicators and statistics. Knowledge and technology transfer offices are not very common, innovation activities within the public sector and PROs are regulated and supported by the Georgian Innovation and Technology Agency (GITA). However, many PROs have an internal intellectual property policy and internal funds to maintain patents.

Innovation policy initiatives are adopted more efficiently in the private sector than in PROs. The government has introduced some tax reliefs for innovative companies. Start-ups can effectively use incubators and other types of acceleration support. Therefore, the support system offers very good opportunities for example for ICT start-up companies with no need of developed infrastructure and with low initial costs required for the business activities. However, is seems that there is an absence of the subsequent support for their further sustainability and development, because SMEs are from this point of view neither the leading supplier nor adopter of innovative technologies. In this area, funding programmes supporting technology development through a full cycle from the innovative idea to their implementation into the manufacturing process should be launched.

The support for non-software based high tech businesses with long development cycles and high research infrastructure requirements is also rare. Some business angels are active, focusing on short-term investment goals. Strategies dealing with the high-tech industry, smart systems or other areas offering products or services with high added value are in early stage

The system of innovation funding and technology transfer is centralised with very few financial instruments available to support innovation. Lack of information on opportunities for cooperation in the private sector and internationally, lack of TT-related knowledge, and the lack of availability of private capital have been identified as hindering TT. The culture is not encouraging cohesion, collaboration or cooperation between PROs, inventors, industry and investors or Diaspora.

From the overview of the current state in Armenia and in Georgia it is obvious that these countries in spite of their continuous economic growth and the efforts and desires of governments in recent years do not have a mechanism for the appropriate **cooperation between the SMEs and RI/universities**. However, this is a common problem in many countries.

Basically, the concept of this cooperation should include all the systematic activities (sharing of the facilities, laboratories and human capital) to carry out the research, development, innovative and business tasks that each of these two institutions cannot perform alone or can perform only in a limited measure. The goal of such cooperation between the university and the industry is to enhance access to technologies, the development of new knowledge, the expansion of financial resources thanks to the business activities and the use of the innovative capabilities of universities. Also, by cooperation it is possible to prepare more specialized future

employees from the students, thus reducing the initial financial costs if we consider the initial in-company training of new employees. As a benefit can be also seen the creation of bond between people (students) and national/local companies.

As it was mentioned, the cooperation can be based on the technological – for the exchange, sharing and development of technology cooperation as one of the important sources of innovation. The reason is that for the SMEs research and development activities, the limited financial resources and specialized human resources together with the increasing complexity and interdisciplinarity of technologies can introduce high risk. Analysis of the internal and external strengths and weaknesses, as well as an investigation of the potential of the cooperation, can have an important role in the success or failure of this type of cooperation.

Another type of cooperation is entrepreneurial cooperation formed between two or more SMEs and the institution or a university to strengthen and develop the entrepreneurship dimensions within them and in this way to support business activities.

From the national point of view, it is suggested to choose the type of the supported cooperation and to implement motivation mechanisms based for example on the financial benefits (tax privileges, targeted founds) or scientific advancement and innovations (access to new knowledge, information, access to laboratories, facilities, access to workshops, courses etc.). This type of cooperation is valuable also for universities, because in this way they can reduce their dependence on the government, they can obtain cheaper laboratory equipment etc. The profit can be achieved also using the reputation of the partner's name and access to skills, knowledge or facilities, which can be very important mainly in case of possible future international cooperation. Thanks to the cooperation, the gaining profit and strengthening the position on the national and international markets through the development of new scientific tools, methods and development of new products are among the most important motivational factors of cooperation for the industry sector with the academic researchers.

It is obvious that for the beginning the financial issues and personal motivations become the most important factors towards the cooperation. If this level is accomplished, the cooperation should continue by creating a communication network, to support the trust between parties after deeper analysis of their skills and possibilities. The final step of the cooperation can be the modification of the organization structure of the university and for example creation of a specialized department or the whole research and development institute.

It is also very important to define the scope of cooperation. This can vary according to the goal of cooperation, cooperation content and the typology and areas of interest of partners. Together with the definition of the scope it is necessary to choose the most convenient method of cooperation – such for example joint venture, joint cooperation or outsourcing. The scope has to be also in compliance with the perspective of relationship length. The scope of the cooperation can involve for example product testing and evaluation using the equipment of the institution, open use of testing and the evaluation of equipment by users alone or for example services including technical advice and guidance, engineer training, lectures, workshops, study groups organized by the institute and joint or customized research.

The role of intermediary institutions by transferring the demand of SMEs to universities on the one hand and familiarizing the industry and SMEs with the scientific capabilities and human resources existing in universities on the other hand can be crucial because these institutions

can contribute to the formation of relationship and cooperation between universities, SMEs and industry. Problem is that managers/owners of SMEs have often difficulties in recognizing their needs and problems, so that in finding the source of their problems they do not have a clear and accurate understanding about their current and future needs, and thus no desire to resolve these problems. On the other hand, university members are usually not supported and motivated to cooperate with the SMEs.

In comparison to the large enterprises, the SMEs have several disadvantages, which create barrier for their cooperation with universities and the intermediary institutions should be aware of these differences. For example, they cannot offer intensive research activities and they can only cooperate on big research projects together with large enterprises or research institutes. The cooperation is usually based on the individuals, many times only informal communication is used. Consultations in the area of IPR, but also in the areas of commercialization, marketing or project management are limited and large enterprises are prioritized or these services are too expensive for the SMEs with limited budget. Also, the specific services are usually too specialized for the needs of SMEs and are not considering the general context and the building of the SMEs and RI/university relationships. High-tech and innovative SMEs are practically not present outside metropolitan areas because the beginning of the cooperation is usually performed on the local basis and relationships between the individuals, not universities and companies as a whole.

Suggestions in this area of cooperation between the SMEs and RI/academia involve recommendations to set up flexible mechanisms to promote research collaboration between SMEs and RI/universities and to optimize intermediation bodies' and authorities' contribution to establish open-innovation practices.

These mechanisms should be based on the standard co-operation models and should involve preparation of guides for this kind of collaboration involving for example also drafts of agreements for further co-operation, preparation of guides on principles and good practices of open innovation and technology transfer and promotion of best practices of the technology transfer in the media, publications, journals or specialized blogs.

Furthermore, the lack of adequate understanding and tools for the management of intellectual property and possibilities of their protection was identified as a major inhibitor of open-innovation practices, to which SMEs should pay specific attention. SMEs usually do not care about understanding and improving their capabilities about IP and are not equipped with adequate tools and best practices for managing IP and for managing the overall collaborative mechanisms in general. The gap in preparation for open innovation is persistent, since even the intermediaries, whose role is to support this kind of collaboration, suffer themselves from the lack of appropriate IP transfer and sharing tools, and do not perceive the need to offer better support in this regard and in general, current IP-transfer and collaboration-management tools are not sophisticated enough to provide appropriate support for the implementation of open innovation, by which we mean more open and collaborative innovation in the context of SMEs and RI/academia collaboration.

In addition to the continuous development of **technology transfer offices** working at the national level, it suggested to create smaller technology transfer offices on the decentralized principle, in the proximity or directly at the universities, research institutes or science parks.

Technology transfer activities within universities, research institutes or science parks are generally best served through the establishment of a dedicated office. The advantage of having a technology transfer office is specialization in the field of technology transfer so that it enables respective institutions to professionalize their technology transfer activities.

Technology transfer offices are generally defined as bodies that oversee managing the transfer of technology to industry and are often in charge of managing its institution intellectual property assets. Technology transfer offices serve to ensure the transfer of science and technology results into economic and social practice, the aim of which is to connect its institution with industry. Its main task is to collect information on intellectual property created in the institution, to provide advice on the proper protection of intellectual property rights, to provide advice around settlement of rights and to commercialize intellectual property of its institution by arranging and concluding license agreements, transfer agreements and other types of agreements with industry or partners with similar focus.

Technology transfer offices can be a separate private entity, or they can be an organizational part of the universities, research institutes or science parks. These offices may be internal to the institution, attached to the university or faculty or faculties, or responsibility for technology transfer may be transferred to a separately owned company. There is also a possibility for establishment of joint technology transfer offices for groups of universities, research institutes or science parks that are based in the same region or specialize in similar fields. One of the main reasons for establishing joint technology transfer offices is that individual institutions may not generate sufficient work to justify the creation of a specialized office with skilled human resources. On the other hand, having technology transfer office within the own institution may benefit in having more direct interaction with the researchers, while avoiding situations of mutual mistrust when the technology transfer office is shared with other institutions.

The advantages of institution's **internal technology transfer office** are increased revenues from the commercialization of inventions, which are fully redistributed only internally within the institution's budget, or direct connection to researchers and close cooperation with them. Disadvantages include possible problems with financing the services provided in the initial stages, excessive emphasis on profit maximization and problematic application of inventions with lower commercial potential. Although much of the technology transfer process is handled internally, in some cases the necessary cooperation with external subcontractors or consultants takes place.

Technology transfer office as an independent company may reflect the institution's effort to separate some form of technology transfer activities from other institution's activities. The institution may initiate the establishment of a private company, in which, it retains a majority stake by default. It provides the company with the necessary financing in the first years of operation until the company starts to produce its own profit. An independent company tends to bear the name of the institution in its name and acts by default as a mediator of technology transfer between the university and industry. However, it has its own management and decision-making processes independent of the institution, which gives it greater opportunities for business development, for example by building relationships with venture capital providers.

The disadvantage may be weaker ties to academics, which may result in insufficient development of existing opportunities.

The combination of the previous two technology transfer office models results in a so called **hybrid model of technology transfer office**. The hybrid model combines elements of the previous two models with other unique solutions tailored to specific circumstances. For example, an institution may work with an existing external company to perform some of the office's tasks, but part of the responsibility will continue to be handled internally within the institution. In this way, the reporting of new inventions can be solved, which will remain within the competence of the institution, and only after the assessment of the possibilities of commercialization of the invention by the institution and the subsequent recommendation will the external company take over responsibility for its transfer. Another example may be the merging of several smaller institutions into a consortium that uses one external company to transfer technology, which can reduce their costs. One institution may therefore enter into a contract with an external company that has sufficient financial capital to cover the costs associated with the commercialization of the invention, for which the company will acquire majority rights to the revenue that will accrue from the invention commercialization.

Notwithstanding the legal status, the technology transfer office shall be responsible for commercializing institution's owned technology, knowledge, or intellectual property through the core activities of, e.g., attracting and assessing invention disclosures, choosing the right intellectual property protection strategy, licensing, spin-off or start-up company formation, material sales and managing financial funds. The technology transfer office's mission, approach and activities should always be consistent with the institutional mission and activities. This office and the institution should agree upon what adds value. There are not only financial gains that relate to technology transfer, but also long-term gains, such as sustained business partnerships, job creation and economic, cultural, and societal support for the region, in which the institution is located.

When establishing a technology transfer office, a respective institution presupposes that it would be self-sufficient and that it would, eventually, generate additional income for the institution. However, not all technology transfer offices manage to become self-funded, and when they eventually do, support funds are generally required for a first few years. Personnel requirements will also depend on the institution, the volume of work and the role and function of technology transfer office, which may range from an assorted team of people with legal, scientific and commercial expertise to a single individual that is capable of leveraging the necessary support from external experts. However, a crucial point for any technology transfer office is to have the full support of its institution.

University or research institution's statutory bodies, when setting up technology transfer office, must understand the importance of intellectual property rights to its overall goals, vision and mission and must develop and implement a relevant intellectual property management strategy in accordance with those goals. In developing of an intellectual property management strategy, institution needs to understand the potential benefits of intellectual property rights. For example, intellectual property rights can attract money from investors, provide revenue from licensing, prevent competitors from entering the market, and allow for premium pricing of a product or service. Understanding how intellectual property rights can benefit the institution will guide how that institution can implement its office and strategy.

The intellectual property rights have always been an important part of technology transfer. Intellectual property rights give creators, innovators and authors a reward for their efforts, while public also gets to benefit from their creative efforts. In essence, intellectual property rights are a compromise between the interests of creators, innovators and authors and the part of society that aims to achieve a socially beneficial pace of innovation and progress.

Industrial property rights are a key component of intellectual property rights, focusing on protecting the commercial use of the products and services embodying these rights, thus supporting inventive and innovative efforts.

There are many ways of protecting a creative activity and many forms of protection. Depending on the subject-matter, one product can also be protected by a patent, while also the same product can be simultaneously protected by a design or a trademark. The next step after deciding the best form of protection is to decide the best way to obtain such protection for the territory in which the relevant objectives are pursued, since the industrial property rights are territorial in nature.

Therefore, every actor dealing with outputs of creative activity must understand the importance of industrial property rights and must develop and implement a strategy in accordance with pursued goals. Benefits or risks of industrial property rights must be clearly understood. Understanding how industrial property can benefit its creator, will guide how that creator can implement a strategy of its protection.

One of the side effects of technology transfer for universities, research institutions and science parks is creation of partnerships with private sector. However, an important first step for any institution that intends to build partnerships with the private sector for technology transfer of technology and intellectual property is to have a clear and transparent **intellectual property policy** that is formally approved by the institution. Internal policy can be developed and approved before establishing a technology transfer office, or it can be developed and approved with the help of technology transfer personnel, who should be experts in the field of technology transfer. For a private sector, it is essential to know conditions, under which the university or other research institution can and would cooperate with private sector.

These policies should provide rules and guidelines for the commercial exploitation of intellectual property generated within the institution. Internal policies should define the responsibilities, rights and obligations of all stakeholders, establish ownership criteria, ensure that intellectual property created by its employees are utilized in ways most likely to benefit the institution and public. It is also important to establish basic guidelines for the administration of the intellectual property policy and to define rules for royalty sharing if the commercialization of intellectual property generates income.

While the general provisions on ownership of research conducted by university or other research institution’s researchers should be defined by national legislation, the institution’s internal intellectual property policy should establish precise rules for specific circumstances, such as:

- when intellectual property is generated by researchers who are not bound by employment contracts, such as under-graduate or post-graduate students,

- when intellectual property is generated as a result of funding by a public sector organization that has specific contractual terms associated with the funding,
- when intellectual property is generated as a result of research sponsored by private sector in the framework of research contracts,
- when intellectual property is developed in partnership with third parties (individuals or institutions).

Key element of all intellectual property policies should be income distribution, which provides an important incentive for researchers to ensure that they disclose their inventions to their employer and seek to find the best avenue for commercialization. Provisions on income distribution should clearly define what type of income and how it is to be distributed. Intellectual property policies generally specify, that income generated by commercialization of intellectual property must firstly cover any expenses related to the protection and exploitation of the intellectual property and the net income is subsequently distributed between various actors. These are generally the researchers {authors, inventors}, their department at the university, the technology transfer office and the university.

Another area that should be defined by internal policy is a conflict of interest. Conflict of interest occurs when an entity or individual becomes unreliable because of a clash between personal interests and professional responsibilities. Such a conflict occurs when an institution or person has a vested interest which puts into question whether their actions, judgment, or decision-making can be unbiased. Conflict of interest can also be described as a situation in which a public obligation competes with financial interests. In particular, universities or research institutions are often concerned that research is not skewed towards the interests of private companies or that the university is not distracted from its core mandate. In technology transfer activities, there may be specific types of conflict of interest that need to be addressed, including situations in which a researcher may have a financial interest in any of its university's licensees. To avoid such situation, policies and procedures should be developed for the disclosure and management of conflicts of interest. This may be critical for the credibility and esteem of the university or research institution and its researchers. Such policies also ensure that technology transfer activities are conducted in the public interest and not exclusively for personal gain.

Internal intellectual property policies should also state certain obligations for the institution and for the researchers as well. Obligations of a researcher may include the need to disclose the inventions to the technology transfer office or other appropriate institutional body and also the prohibition to not disclose the invention to third parties in a way that may compromise its protection. Researcher shall also be required to assist the technology transfer office with the protection and management of intellectual property and also to disclose any conflicts of interest.

Obligations of the institution should include, for example evaluation of every disclosure, minimizing delays, maintaining confidentiality and facilitating technology transfer according to the goals and mission of the institution.

Rules should be put in place so that all stakeholders abide by any agreements signed with external parties.

When it comes to sponsored or collaborative research involving a university or other research institution and a private company, on many occasions, the private company funds the research, which is undertaken within the university or other research institution by its researchers while using institution' equipment. It is therefore important to have clear rules on intellectual property ownership in such cases as well as guidelines on whether the sponsor is entitled to an exclusive or non-exclusive license, whether it would have to pay royalties to use the technology that results from such research and whether it would have the right to license or sub-license to third parties. These issues should also be regulated by the contract signed between a sponsor and research institution and agreed upon beforehand as a matter of institution's policy.

Internal policies should also define rules and guidelines with regards to the creation of spin-off and start-up companies for the commercialization of research results developed within the university or other research institutions. These may include, for example, whether the university is entitled to own equity over a company, whether the university can or should participate in the board of directors of a spin-off or start-up company and whether researchers are entitled to work in such a company.

With intellectual property policy, institution should also establish a sound and relevant intellectual property management strategy. The justification for the establishment of intellectual property management as a field separate from the legal practices of intellectual property rights protection and enforcement is driven by fundamental shifts in how value is created and measured in academic and business sector. It should be bear in mind that although the main goal of university or research institution is not to directly sell goods and services on the market, these institutions should know what the goal of the business companies in relevant field is. Especially when university or research institution strives to license or sell or otherwise commercialize its research outputs. For companies, access to raw materials, energy sources and global markets remain important component of competitive advantage, globalization and commoditization of production inputs coupled with their price volatility has shifted long term competitive advantage towards those that know how to innovate.

The assets legal entities possess in the form of research outputs, technologies, designs and trademarks, is what increasingly determines their value. By protecting their intellectual property by patents, trademarks, designs, trade secrets and copyrights, legal entities transform their ideas into intellectual property.

Historically, intellectual property was always primarily within the domain of lawyers. Legal professionals play a critical role in making markets and their environments predictable and manageable. Entrepreneurs, executives and managers on the other hand typically have different sort of responsibilities. They are tasked with the responsible management of legal entity's assets to benefit all stakeholders. Responsible management means actively searching the opportunity to allocate resources to successfully commercialize its intellectual property. This requires knowledge of management disciplines such as economics, marketing, operations, finance, accounting, technology, organizational form, distribution and all their possible combinations.

Therefore, intellectual property management does not only rely on appropriation and protection of intellectual property created by the respective legal entity. Instead, it combines these with the best opportunities in the market which are dictated by a legal entity's specific factors such

as size, knowledge-specific factors, technology specific, industry specific factors, and the country's legal background.

Intellectual property can be commercialized. Business can sell goods and services bearing these intellectual property rights on the market. Universities and research institutions can commercialize its intellectual property by licensing their patents. Intellectual property now makes up a large proportion of business market value, and intellectual property management can no longer be left to technology or legal departments alone.

The management of intellectual property is a core competency for the manager of a successful technology transfer office of the university or other research institution, as well as of an enterprise.

Technology transfer office should have clearly defined **roles and activities in the technology transfer process.** These may vary and should be in line with institution's policy, its goals, mission and basic function.

Internal policy should define the steps subsequent to discovery of technology by the researcher of university, research institution, science park or other relevant organization. It could be the researcher's independent activity based on his/her job, or a grant could be awarded to the university, which the researcher used to reach this knowledge. The initiator of the research could also have been a third entity, in relation to targeted cooperation in a joint project or possibly on contract research.

However, the researcher should be obliged to **inform his/her employer about the creation of the technology.** Subsequently, it is up to the legislation of respective country and rules of specific employer whether to exercise property rights to this technology. Technology transfer manager or employee should therefore receive notices on the creation of an intellectual property in the prescribed form from obligated persons and in a specified manner. Such notifications {disclosures of inventions} should be checked, administered and registered by the technology transfer office. The reporting obligation shall be applied to each employee. Such obligation shall also apply mutatis mutandis to third parties in the case of a specific agreement between a third party and an institution. There should be an obligation of professional secrecy regarding the disclosed technology. Afterwards, technology transfer office should continuously inform the researchers about the way the institution will deal, protect and commercialize disclosed technology.

The development of simple and transparent procedures for disclosing inventions and negotiating with external partners is important so as not to unnecessarily delay technology transfer activities and ensure that the technology transfer office is perceived as an efficient unit by researchers themselves. The existence of a standard invention disclosure form is essential to make it easy for inventors to disclose their inventions to the appropriate body.

In the next phase, the technology transfer office should **evaluate the technology** and based on this evaluation, should determine the next step. There are several technology assessment procedures, but usually considering technical uniqueness, the possibility of obtaining industrial property protection, customer value, market applicability, team assessment, external environment involved in commercialization, stage of development, financial security of technology transfer and non-financial benefits. The evaluation of technology is the process of

obtaining information essential for deciding whether or not to protect and commercialize the disclosed technology. The result of the evaluation is the elaboration of a written evaluation report, which contains in particular the identification and description of markets, the competitive advantage and the stage of technology development. The evaluation should be carried out by the technology transfer office of the institution (internal evaluation) or a third party authorized by the institution (external evaluation).

Technology transfer office, or the relevant body in charge of evaluating invention disclosures, should be in charge of responsible for taking decisions on what to patent, where to patent and when to patent. Most institutions rely on external patent agents with specialized knowledge to draft patent applications if the relevant expertise does not exist in-house, even if this is likely to raise the costs. It is crucial that patents be properly drafted for them to be of any value to business. As concerns costs, it is important that universities (or research institutions) allocate funds for filing patent applications. Institution may also rely on private commercial partners to shoulder part or all of the patenting costs.

Other activities carried by technology transfer office are **monitoring of the results of science and research**. This can also be provided internally or by an authorized third party (external pre-diagnostics). Monitoring the results of science and research includes the identification of intellectual property, in particular on the basis of verification of its novelty, legal status (topicality of protection and its territorial scope), verification of competition activities in the given area. Pre-diagnostics has a recommendatory character for the selection of a suitable strategy in the technology transfer process.

After evaluation is exercised, technology transfer office should **choose the right form of protection** of technology based on his / her expertise, in close cooperation with the researcher and based on the relevant data provided in the disclosure of technology and the evaluation report.

The choice of the method of protection should result in

- registration of the relevant industrial property at the relevant authority (the so - called registration principle) or
- non-registration and use of the principle of so-called informal protection.

If the registration principle is applied, the technology transfer office shall arrange for the relevant application to be drawn up through a patent attorney {e.g., patent application, utility model application, design application, trademark application} including the payment of the relevant fees.

Another role of technology transfer office is to **manage the institution's intellectual property portfolio**. This consists of all assets of at least potential value that arose during the technology transfer at any stage of this transfer, e.g., chronologically from the disclosure of invention, through the assessment of its feasibility and usability (evaluation), ensuring its protection (for example in the form of registration of industrial property), maintaining this protection, commercial use, monitoring of infringements and possible enforcement until the termination of industrial property rights. The institution's portfolio should also include information on yet unprotected results of scientific research and shall require special attention from the point of view of maintaining confidentiality and security in accordance with the principles of protection of trade secrets. The administration of the portfolio shall include internal file management,

documentation records, time limits, internal database management, documentation of intellectual property rights infringements, archiving and shredding.

Technology transfer office also provides complete **methodological, administrative and legal support** for researchers (employees or students). Methodological support is provided by developing manuals, instructions or other materials and documents that provide practical information on how to implement technology transfer from the beginning. The office shall update all materials and documents as necessary so that the data in them are in accordance with the legal status. Administrative support consists of providing a complete administrative service at all stages of technology transfer. Legal support consists of developed contracts, the creation of new contracts, the control of already concluded contracts with third parties, consultations, legal advice on the protection of intellectual property and other forms of support.

Technology transfer office should maintain a central database of intellectual property, which shall record in particular:

- the date of the technology disclosure,
- the description of the technology,
- method or type of intellectual property protection,
- an indication of whether the university has exercised its right to an intellectual property and, if so, the date of such exercise,
- the filing date of the industrial property application (e.g., filing date of the patent application, filing date of the utility model application),
- type of filed application according to territorial protection (national, international, regional),
- the date on which protection was granted (date of grant of the patent, date of registration of the utility model),
- form of commercialization (license, transfer, trade secret, know-how).

In addition to a central database of disclosed intellectual property, other databases can be maintained as required (e.g., a database of authors, inventors, a database of collaborating institutions in contract and joint research etc.).

The institution's strategy in the process of implementing intellectual property protection may be to submit as many patent applications or utility model applications as possible for those technologies that have been disclosed by researchers, in order to create a portfolio containing several valuable patents. Another strategy may be to implement the protection of only selected and most valuable technologies so that the most valuable technologies are not overlooked. When searching for commercialization partner, the institution should consider the conflict of interests and values between the institution and industry, as well as between the institution and researchers as the innovators of the technology. The connection of technologies of research institution with industry has several advantages for both parties. Technology transfer is a valuable source of income, and researchers can use this income for further research. It is not uncommon for technology transfer between the university or other research institution and industry to initiate long-term beneficial cooperation between these entities. The benefits of technology transfer from research institutions to industry are not negligible for industry either, starting by saving time, money and other resources on technology research and development and gaining a competitive advantage in the market.

Activities of the technology transfer office in the field of **commercialization of intellectual property** should ensure in particular:

- publication of the offer of intellectual property/technology intended for the licensing or transfer of rights in available places (e.g., international databases of industrial property objects, own website etc.),
- creation of a database of potential candidates from the relevant field of technology and addressing potential candidates through marketing presentation,
- maintaining the confidentiality of potential licensees and protecting confidential information,
- evaluation of intellectual property/technology,
- holding meetings with potential candidates, negotiating appropriate conditions,
- drawing up a license agreements or similar agreements,
- distribution of income from the licensing agreement according to the internal guidelines of the institution.

The granting of a license means the granting of the institution's consent to the use of the technology. The technology transfer office should be entitled to inform the researcher in connection with the granting of the license, about the choice of the licensee and about other relevant facts related to the licensing of technology. Commercialization of technology may also be realized by establishing a spin-off or start-up company, where a new technology created within the institution is applied.

Licensing practices may vary considerably between institutions and fields of technology. Many institutions are keen to promote non-exclusive licenses and seek to ensure that any exclusive licenses that are granted will include clauses to protect against failure by the licensee to carry out effective development and marketing of the invention. Thus, clauses requiring to implement the invention within a given time frame or clauses stating minimum royalties to be paid regardless of whether the technology is commercialized or not are provisions sometimes used by some institutions to ensure that the goal of commercialization is met. Also, a significant number of technologies developed by university or other research institution may be licensed as technical know-how without having been patented, and that such institutions often license inventions for which a patent application has been filed but has not yet been granted.

Spin-off in the conditions of a university or other research institution is a company (legal entity) which was established by the separation of a certain activity or group of employees of the university, while the university retains influence over the activities of the newly established company. Technology transfer office should ensure the implementation of the establishment of a spin-off in close cooperation with a group of employees of the university.

Another role of technology transfer office shall vest in negotiation of license conditions, or conditions for the transfer of technology rights. Given that the terms of licensing agreements are negotiated before the end of the research related to the relevant technology and before the fair value of the technology is known (e.g., before launch), the negotiations are based on subjective estimates of the expected value of the technology. Royalties most often range from 1 % to about 10 % in the case of a patent with direct or significant commercial potential in the market. In most cases, royalties range from 3 % to 6 % depending on net sales. After the conclusion of a license agreement or an agreement on the transfer of rights to technology, its

commercialization is started. The technology can be licensed to an existing business company or a newly established company (spin-off, start-up). The creation of new spin-off companies often benefits from the structures of universities, such as incubators and science parks.

The activities aimed at **enforcing intellectual property rights** are important. In the event of an unauthorized infringement of intellectual property rights, the university or research institution may request that the infringement or threatening of the right shall be prohibited and that the consequences of the infringement shall be remedied. If damage has been caused by the interference with these rights, the damaged institution is entitled to compensation, including lost profits. If non-pecuniary damage has been caused by an interference with or a threat to these rights, the damaged institution shall have the right to adequate compensation.

Technology transfer office, depending on its mission, may also provide support in the area of **contract research, joint research and consultations**.

Contract research means a type of contract where one contracting party (client) orders the creation of a research result or the implementation of a research task with the other contracting party (university). Technology transfer office personnel may enter into cooperation with a private entity or other institution in order to obtain a contract for the implementation of contract research. Establishing cooperation is implemented e.g., by participation in relevant scientific and professional events, publishing in peer-reviewed and non-peer-reviewed journals, searching in designated databases, searching through relevant agencies, addressing on the basis of so-called vouchers for innovation, independent active search and direct addressing of a potential client. Upon cooperation with a potential client, the technology transfer office should provide full support (internal, external) related to the possible creation of research results (identification of parties who may use, dispose of and license the research result) and should subsequently inspect and oversee the fulfilment of contractual conditions related to the implementation of custom research.

Technology transfer office should keep a list of the entities contacted in its database, all concluded contracts related to contract research, newly created technology, etc.

Joint or collaborative research means a type of research where all stakeholders participate in the research task (by pooling their staff, financial and material resources) and jointly exercise rights in the technology created or license them free of charge. The legal basis for the implementation of joint research is a joint research agreement. Technology transfer office shall, as far as possible, cooperate with a potential joint research party and obtain a joint research project. Establishing cooperation is implemented e.g., by participating in relevant scientific and professional events, publishing in peer-reviewed and non-peer-reviewed journals, searching in designated databases, searching through relevant agencies, independent active search and by direct address of potential partners.

In the case of consortium projects technology transfer offices should ensure the correct share to the results of research outputs between the members of the consortium. If the consortium members, by their joint activity under specific agreement that deals with the rights to the research outputs, create a research output that is eligible for protection under industrial property law, the rights to such an output shall be generally derived from the extent of their participation on this specific research output. However, members of the consortium should enter into a separate special written agreement governing the handling of the object of

industrial property. Clear division of the rights to the research and development results has a significant impact on the cooperation among partners during the project, as well as in the subsequent commercialization and distribution of profits.

Consultation is a form of service provided by the university or other research institution in solving specific problematic issues and tasks to a third party (the client of the consultation, natural or legal person). The consultation is usually carried out through a consultation agreement. The form of consultation may be oral counselling, oral counselling with written output, analysis, expertise, expert opinion, research, comparison. Technology transfer office should ensure contact with the potential consultant, manage the processes leading to the negotiation of conditions for the provision of consultations, which are implemented by the consultancy agreement and should be responsible for the contract preparation of consultations. Technology transfer office should, in cooperation with the head of the relevant research institution, ensure the selection of a suitable consultant responsible for the implementation of the consultation. Technology transfer office should keep records in its database of all documentation relating to the provision of consultations under the consultation agreement.

Technology transfer office may also exercise activities in the field of **education of researchers, other staff and students**, which shall include in particular:

- information on generally binding legislation and directives governing the activities of the technology transfer office and the related process of protection of the institution's intellectual property, technology transfer, etc.,
- information on the possibilities and conditions for the protection and commercialization of new technologies,
- informing about the organization of events focused on the topic of technology transfer in its region, country and abroad, or in their own organization (seminars, workshops, trainings),
- the availability of information materials containing detailed information on the activities of the technology transfer office and the services provided to institution’s researchers, other staff and students.

Technology transfer offices are generally responsible for marketing its institutions’ technology and searching for commercial partners. This is generally one of the most challenging tasks for such offices. If commercial partners cannot be found and patented technology is not transferred to industry, patenting will only result in costs for the institution. It is important, therefore, that technology transfer office take an active role in seeking targets for technology transfer and establish close relations with companies in the specific fields of expertise of the institution.

Information about the educational opportunities and the availability of the necessary materials may also be provided electronically and published in available places (office’s website, institution’s website, information board located on the institution’s premises etc.).

The activities of the technology transfer office in the field of **promotion of research results** may include in particular:

- the creation and regular updating and publication of all databases relating to intellectual property; in particular updating the database of eligible industrial property rights,
- organizing specialized presentations of research results with a commercial potential for those interested in industry,
- proactive communication with industry,
- the distribution and availability of promotional material containing detailed information on the activities of the technology transfer office, the results of scientific research and other services intended for industry,
- participation in conferences, fairs and other events to present activities technology transfer office and research results,
- information on the services, analyses, professional consultations, devices and equipment available to the institution and the possibilities of their use,
- the creation and regular updating of the technology transfer office's website,
- informing about own activities (including reports published in the media) and highlighting the achievements.

For the proper functioning of the technology transfer office, it is necessary to define its **organizational structure**. This depends on the range of services offered and the number of employees. In addition to job positions, the organizational structure must also include their job description and responsibilities. In the case of larger technology transfer offices, their structure can be divided into individual departments. The core of the team should be adopted before it becomes official. The staff of the office may be either the staff of the institution itself or may be selected from outside of the institution. Technology transfer is a talent-based business. It is difficult to find people who can speak the two languages of academia and industry and who also have the creativity to craft agreements that meet the needs of both sides. Success does require establishing business processes from the start. Adequate attention should be paid to information management and realistically setting budgets. The technology transfer office should be led by an individual who understands the details of running a business. It is also useful to have staff with experience working in the relevant business sector. To be able to recognize new opportunities, the technology transfer manager needs to win the confidence of academics, which is why it is helpful for the technology transfer office to be embedded within the institution. Staff should be exposed to both academics and businesspeople. Core skills should be fostered via networking, training, and literature.

Networking among people in any profession is generally understood to be beneficial, building relationships between individual practitioners and strengthening profession. By working through networks, practitioners exchange ideas and experiences, forming best practices that become performance standards. Networks thereby contribute to intellectual property management capacity building at both the individual and institutional levels, and this then feeds back to further

support and expand the network. Networks can be formed at different geographical levels in order to serve various functions.

The staff and employees of the technology transfer office is a key component in the technology transfer process. Technology transfer office is, by its function and set activities, positioned

between the academic and business sector. The role of the staff of such offices is to find common ground between the two sectors, which in many cases is a difficult mission. The biggest challenge in building and operating technology transfer office is therefore to find suitable people who are able to communicate with scientists and company representatives.

Historically, intellectual property as a key component of technology transfer process was always primarily within the domain of intellectual property practitioners. As this process involves legal processes such as filing, prosecuting, maintaining and enforcing relevant intellectual property rights. Even though the main purpose of having an intellectual property was to protect the competitive position of the business's products and markets and to commercialize research outputs of universities and research institutions, intellectual property was almost universally thought of as a legal process, and therefore in the past the responsibility for intellectual property decisions fell outside the responsibilities of managers.

The perception of relevant stakeholders about intellectual property management started to change as soon as the economic implications of intellectual property rights became apparent.

Managers need visibility and control over the things they manage. Managers also want and need to know and ask questions, such as why do we need this technology or intellectual property, what will it cost to acquire it or develop it, what is the eventual income when commercializing this technology or intellectual property, what objectives of the main institution does it support, who and how is using this technology or intellectual property, who is the competitor on the market etc.

Such questions are not easily answered by only lawyers. Patent agents file patent applications when they are instructed to do so by their clients. The patent agent pre-supposes that the client knows why, when and where a patent should be filed. However, intellectual property management requires an integration of the legal processes of intellectual property acquisition, intellectual property maintenance, intellectual property exploitation and intellectual property enforcement with business strategies and objectives.

It is essential that intellectual property policy and management is integrated into a university or research institution or company's main goals and activities.

The number of staff of technology transfer office should depend on the number of services that the technology transfer office provides and the size of the institution's research program or research output. While in the process of building the technology transfer office, the university or research institution should develop a recruitment plan that includes job descriptions, training strategy, amount and method of remuneration. In relation to staff, policies should also be developed to address classified material, ethical issues and conflicts of interest. In technology transfer office the following categories of staff positions can be described:

The director or head of technology transfer office represents the office inside and out and manages its operation. Ideally, it should combine business experience with scientific education, with experience in technology transfer being a prerequisite. Research institutions most often hire people with vast experience in existing technology transfer offices for this position. The director should have excellent communication skills. The personality of the director is already crucial in the preparation of the technology transfer office establishment, as

together with the representatives of the research institution he should be involved in setting up all processes and preparing guidelines. The director decides on the personnel policy and selects the employees. In many offices, the director also holds the position of license manager.

The role of the **license manager** is to manage the entire process of intellectual property protection and commercialization of research results. In doing so, it cooperates with inventors, researchers and potential licensees. The license manager evaluates the commercial potential of the invention, decides on the appropriate form of commercialization of research results, prepares documents for its protection, selects a suitable law or patent office, cooperates in marketing, identifies suitable business entities, negotiates the terms of license agreements and monitors their fulfilment. The license manager should have an education in the relevant scientific field.

Patent manager is also often associated with the license manager position. In most technology transfer offices, the role of the patent manager is to prepare the documents for patent applications (or utility model, design application etc.), with the offices using the services of external law firms, mainly due to the complexity of the whole process and the high costs of employing lawyers specializing in patenting inventions in a particular scientific field. At the technology transfer offices, patent managers can also fill in the patent applications themselves.

The role of the **entrepreneur liaison manager or networking manager** is to establish relations between the research institution on the one hand and industry on the other. It is looking for partners for joint research, contract research and consulting. Identifies suitable partners in the research institution to work with entrepreneurs, together with the license and marketing manager looking for suitable companies that might be interested in licenses. He can also support the establishment of spin-off companies.

Marketing manager has also a crucial role at the technology transfer office, which marketing activities have a dual focus. On the one hand, it is the marketing of technology transfer office itself and its presentation to the research institution and potential licensees. On the other hand, the marketing manager works with the license manager and the entrepreneur liaison manager to find suitable partners from the industry and to promote research results. Education and marketing experience are an advantage.

There are many financial transactions at technology transfer office (licenses, patents, projects, business support), so it is essential that it employs at least one **accountant**. He also deals with accounting within the office (payments, purchase of materials, etc.).

The functioning of the whole technology transfer office requires qualified **administrative support**. The entire process of the administration should be managed by a specific employee, who manages human resources, the office's property, the archive, the library, takes over phone calls, and distributes mail.

Technology transfer is a fast-growing and ever evolving industry, so it is essential that the staff of the technology transfer office not only have **adequate training**, but that they are constantly expanding it. Currently, there are several associations, companies and universities providing **education in the field of technology transfer**, in various forms:

Short-term courses are mostly focused on a specific issue and the target group is experienced managers. The advantage is that the employees are not out of the office for a long time, but

also the fact that the courses are not costly. The disadvantage is that it is a non-formal education, and the courses are not generally completed with an official document.

Long-term courses provide education in individual integrated modules, and thus allows the use of new knowledge in a structured form. The courses are full-day and take place for a long time at regular intervals (e.g., once a week).

The elementary advantage of full-time study is that it provides broader education in the whole field, direct access to study materials and the opportunity to establish good personal contacts. Such studies are often completed in a formal manner (diploma, certificate of completion, etc.). The disadvantage is that the employee is away from the workplace for a long time and such a study can be expensive.

The advantage of distance learning is its flexible structure, as the employee does not have to attend courses outside the workplace. At the same time, training materials can be used by several employees. The disadvantage is the lack of personal contact with the trainers, as well as the problems that may arise from the conflict of work and study obligations.

The advantage of internships is that they are based on an individual basis, so the employee can gain practical experience with a specific job in the technology transfer office, while during the internship the specific job can be assigned to more employees. In terms of employee training, this is the most effective form of knowledge acquisition. The downside is that the employee is out of the workplace and internships can be costly.

Internal education, where the technology transfer office or its research institution’s staff participate in the training. Educational activities can be better focused on specific issues and can go deeper in relevant field of study. Such training helps to create and improve the intellectual property protection system in the research institution. The dates of the courses and their content must be well planned so that they do not take place at the expense of the office's activities.

It is obvious that one of the most important motivation types, which can be applied for the support of the cooperation between SMEs and RI/universities, is the financial motivation. For the perspective and sustainable research and development activities it is necessary to use possibilities offered by the **national or international funds or grants**. Thanks to the project activities it is possible to directly support target groups or activities. For example, it is possible to support transformation from start-ups to SMEs, to support cooperation between the SMEs and RI/universities by the necessity to create either this kind of partnership or the consortia with specific conditions defined in the project call. It is also possible to support the awareness about the intellectual properties and their protection, by the required project outcome (deliverable) in the form of patent, utilization model or other type of intellectual property application. Thanks to the created cooperation, the awareness about the IPR would be also increased because the ownership of the IP will have to be solved. It is also necessary to mention that patent applications, or IP applications in general are common measurable outcomes, especially of the applied research project solved in the cooperation of the companies with the universities. The basis of the competitive environment created for the support of the cooperation between the SMEs and RI/universities will lead to the enhancements in the area research and development activities and product or service

innovations. Financial support is important for the innovation activities, but it is suggested to offer support also for the business and marketing activities, to increase sales and also the chance of new client adoption. To other advantages belong increased visibility of the activities performed by the universities or research institutes and also SME, especially in case of the condition that during the implementation phase of the project and in the defined time period after the project completion, the publicity of the project has to be ensured. Reaching out to stakeholders and building alliances increases credibility and exposure in the given application area and helps to ensure future success, because thanks to the clear and detailed project activities and timelines it is possible to establish effective measurement tools for the comparison of different types of innovative companies and structures.

Commercialization of the R&D research results is other very important task, which serves to the transformation of knowledge into new products, services, technologies and organizational solutions. Thanks to the commercialization the intellectual property or rights owned by the RI/universities these knowledge or technology are available to other entities (involving SMEs) in order to obtain financial benefits. Or ideally, in case of closer cooperation, the IPR can be shared by the RI/universities and SMEs.

Technology transfer should be used for the practical implementation of the developed advanced technical knowledge to meet requirements of modern market and needs of business, industry and services.

The main commercialization tasks involve assessment of IP in terms of economic application and commercialization opportunities, searching for market applications of research results, offering the intellectual goods and rights in order to make them available to third parties, market analysis, advertising and marketing of intellectual goods and also mediation and negotiation in step-by-step commercialization process implementation and its further development.

To the commercialization direct (sale of the results of scientific research, development works or know-how related to these results or giving them use, in particular on the basis of a license, rental and lease agreement or indirect (taking up shares or stocks in companies in order to implement or prepare for implementation the results of scientific research, development works or know-how related to these results) methods can be used. Additionally, technology transfer centres can be very helpful by the commissioned research (performed for or jointly with external entities and strengthens cooperation between science and business, because commissioned research contributes to the prestige and brings the worlds of science and business close together), during the R&D project proposals preparation, during the consortia formation and also during the project solution in its implementation phase or during the project monitoring after the main project activities were accomplished. These centres should be also used for the support of spin-off or start-up companies.

In **conclusion**, we hope that the workshop materials and summary report prepared by the experts from V4 countries will be helpful to increase the awareness in Armenia and Georgia about potential benefits from collaboration between SMEs and public research organisations, institutes and universities and that helped to understand the importance of the need investments for the research and development activities not only during the starting phase of

the business through the support of large amount of start-ups but also to support the development of the innovative business activities for all SMEs. For the sustainable development it is also important to follow not only national, but also international support mechanisms and schemes and therefore not only the enhancement and support in the area of research, development and innovations, but also the development of the business (economic, marketing and promotion) skills and project management are required not only for the SMEs, but also for the research institutes and universities, where scientists and researchers have often limited income that is not in compliance with their capabilities, skills and experience and the business and project activities and related financial assessment can serve as a strong motivation not only at the level of individuals, but also as a strong motivation for the cooperation with SMEs and private sector as a whole.

We also hope that V4 experts sufficiently explained necessity to promote research activities of RI and universities and also to commercialize innovative products of solutions of SMEs to increase the visibility in the research, development and innovations and in this way to start up the mutual cooperation.

And finally, we hope that the information related to the knowledge and technology transfer activities and related suggestions helped to increase the awareness about the intellectual property rights and necessity of their protection.

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