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NoGAP

Knowledge Transfer Community to bridge the gap between research, innovation and business creation

Deliverable

Technology Transfer Environmental Analysis Report

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1. Foreword

The present report has been elaborated as deliverable D3.3 Technology Transfer Environmental Analysis Report of the project FP7-INCO-2013-9/R2I-ENP/609531 – Knowledge Transfer Community to bridge the gap between research, innovation and business creation – NoGAP, funded by the European Union through the 7th Framework Programme. The document is based on the activities undertaken by a team from the Technical University of Cluj-Napoca, responsible for Work Package 3 – Improving of competencies and mutual learning, which included trainings, innovation audits and consultancy in the three partner Eastern Partnership (EaP) countries (Georgia, Ukraine and Belarus), as well as on information and analyses provided by the technology transfer (TT) teams based in these countries.

The report is aimed at scanning and describing the TT Environment in the EaP, revealing on challenges and improvement opportunities that can form the basis for development of public policies in this field in the future. Also, the report builds upon a literature survey of existing documentation and project results that addressed related or component issues, and which we consider important to value and put into the specific context of the Eastern Partnership. Among the main issues addressed in the report, we can mention the situation of TT legislation and institutions, the existing and possible procedures and administration models, as well as aspects related to developing the proper culture for TT in these countries and stimulating financing, at the same time with the increasing of spending efficiency.

Georgia, Ukraine and Belarus, along with Armenia, Azerbaijan and Moldova, constitute an important partner for the countries of the European Union and a good and open policy dialogue will strengthen these relationships in the future. Economic and social success in a global and accelerated world is strongly dependent on the ability to generate new knowledge through research, transfer it to the economic environment and concretize it through innovation into products and services. This is especially true in the field of renewable energy, which constitutes and important challenge for all the countries involved in the NoGAP project and which urgently needs to “bridge the gap”, not only in terms of TT actors, but also in terms of international cooperation.

We would like to thank our partners and contributors in Georgia, Ukraine and Belarus: Givi Kochoradze, Vadym Yashenkov and Alexander Uspenskiy.

August 2015 The reporting team

2. Introduction

Continuous innovation and intensive research efforts brought the level of economic development of European countries much closer, than it used to be. The success story of the European Union is currently in the process of being spread out and replicated as part of the relationships promoted by the policy framework approach known as the Eastern Partnership that started in 2009 and includes 6 countries: Armenia, Azerbaijan, Belarus, Georgia, the Republic of Moldova and Ukraine (EEAS, 2015). The main goal of this instrument is to foster mutual cooperation and understanding between countries in the EU and its eastern neighbors, by addressing the following main topics (EEAS, 2015):

- Differentiation and inclusivity
- Multilateral cooperation
- State building and rule of law
- Mobility and people-to-people contacts
- Market opportunities
- Interconnections
- Financial cooperation
- Involvement of broader society

It is known and well documented, that for a country to improve on its economic growth it has to “capitalize on its knowledge base and develop its capacity to innovate” (MED Programme “MET3”, Responsible Partner: CITAndalucía, 2009). Both are highly important aspects, in which the concept of technology transfer (TT), and its associated concepts such as innovation, international cooperation, intellectual property, plays a key role. Moreover, according to the same source, “(…) success will depend on the distribution of knowledge and a genuine partnership amongst individuals, enterprises, research institutions, associations, and regional administrations. EU has identified the transnational dimension of technology transfer as one of the key areas for action on its Innovation Strategy” (MED Programme “MET3”, Responsible Partner: CITAndalucía, 2009). In this context, it becomes clear that technology transfer – i.e. supporting and helping ti develop and grow – in the EaP countries must be an important part of the ENI. Our FP7 project, acronym NoGAP, is a part of this effort, together with its sister projects from the INCO 2013 call for proposals of the EU. Among the means employed by our consortium to help consolidate the TT environment in Georgia, Ukraine and

Belarus, we can mention: development of teaching materials, direct trainings, studies and reports, handbooks to answer the most pressing questions, direct support and consultancy in fields such as IPR and business plan development, etc.

The current report proposes not only to raise the awareness of the importance of TT in EaP, but also gives an overview of the current situation in these countries and identifies all stake-holders that could have an impact on its successful development.

Generally, the term “Technology Transfer” can be defined “as the process through which an entity acquires certain knowledge, technology or innovative process or product that another agent has developed or created” (Schumpeter, 1935). This means that technology transfer includes the detection, accurate targeting, and finally proper sharing of new technologies and innovation activities (MED Programme “MET3”, Responsible Partner: CITAndalucía, 2009). Based on the same source, the MET3 project, one can say that technology transfer includes the following categories of activities:

- Introduction of new products
- Introduction of new production methods
- Opening of new markets
- Development of new supply lines of raw materials and other resources
- Development of new market structures in a sector

From an organizational perspective, TT includes all the activities that facilitate the acquisition of innovation that comes as a solution for a problem that cannot be solved from within the organization. As a direct effect, its competitiveness is increased, and, as secondary effects, we can mention the development of a culture of cooperation, the appearance of synergies between public and private sectors and generation of increased added value for the targeted customers, the general market and the society that interacts with it. In our concept, which aims for a holistic approach, “technology transfer is the process of transferring knowledge, skills, technology or solutions generally between public or research intensive entities and the industrial environment” (Dragomir & Iamandi, 2014). Within this conceptual space, the means through which TT can occur is through publications, educated students entering the work-force, exchanges at conferences, and relationships with industry. (Massachusetts Institute of Technology, 2005). Being based on a relationship that requires mutual trust and the achievement of mutual interests, TT is much better understood in the form of a process, with

clear stages and resposbilities. We include below, in Figure 1, such a description of the cooperation effort between the actors involved:

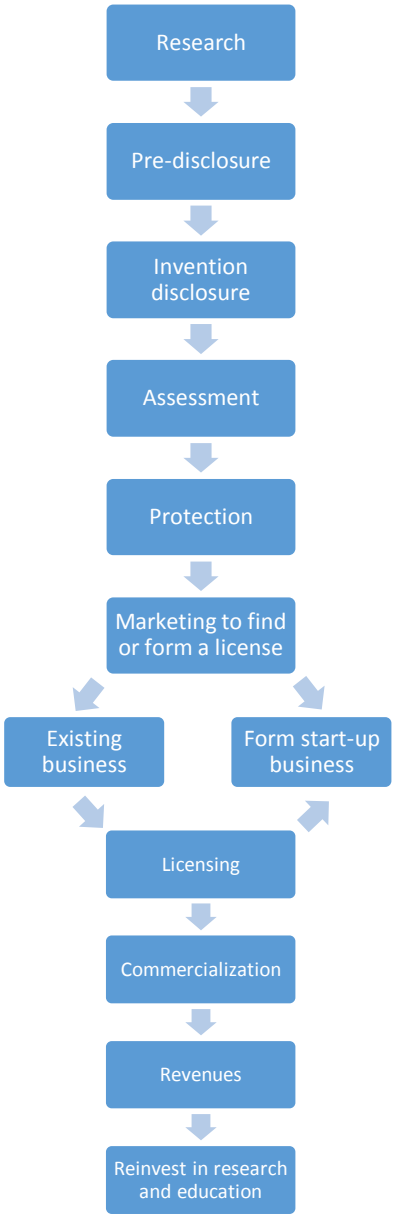

Figure 1 Main stages within the process of TT
(Massachusetts Institute of Technology, 2005)

As this is only a brief introduction to the topics, for a more detailed overview of the knowledge related to innovation and TT, we would kindly direct our readers to the various deliverables of the NoGAP project, which are available at this web address: www.no-gap.eu

3. The technology transfer process

At a first glance technology transfer looks like a process which helps disseminate information. However, due to the complexity which it embodies it is much more than this, in the sense that it brings progress and growth, it accelerates know-how sharing and it builds a bridge between knowledge generating organizations and entities that need it. Moreover, it can also be stated that it features marketing techniques as well, because in some cases the utility of a new technology has to be demonstrated and/or promoted.

According to the Technology Transfer Handbook for the U.S. Geological Survey (2003), new technologies with high comercial potential should be identified and matched with adequate market niches and user groups through proper marketing and assistance. The target of the process should be to make product more competitive and to enable the inventions and technologies developed with public funding to become successful on the market with the help of the private sector, in manner that serves the community (US Geological Survey, 2003).

3.1. Main advantages of technology transfer

Research entities have to be viewed as drivers for generating knowledge and innovation, sitting at one end of the endeavor. At the end of the TT process, there are the various organizations that operate in the economic sector. TT bridges the gap between them and facilitates collaboration to ensure development, progress and prosperity.

TT has a great variety of benefits to offer, both to giver and the receiver of technology. On a large scale, one could say establishing a fully cooperative environment between the economic field and academia contributes to the achievement of both their missions, meaning profit for the companies through increased customer satisfaction, and advancement of knowledge through applicative innovation in real world cases. TT can be brought about as a form of implementation of policy instruments, whether they are public or private, or it can spring into existence as direct manifestation of market mechanisms. It is rather irrelevant what the case is in a given situation, it is, however, more important to nurture and support this type of arrangement on the long run. The most important concrete advantages of carrying out TT are illustrated in the following figure:

Figure 2. Benefits of technology transfer

Although, technology transfer targets the industry directly, by making improvements in that sector, social, economic and possible environmental benefits are also reached in a global valuation of knowledge and societal relations. Moreover, the overall standard of living is also increased within a region / industry that employs successful TT processes and projects, making it felt to the regular citizen / taxpayer.

In our study, we have come to the realization that Georgia, Ukraine and Belarus have a strong scientific potential, an important interest in cooperating with the EU countries and bringing wellbeing to their people, but are lacking in terms of scientific infrastructure, investment in research and cultural adoption of TT processes within the mainstream of the economy, legislation and society. The NoGAP project, aiming to jumpstart this field, has contributed to the dissemination of specific know-how, and, in equal manner, to the transformation of attitudes related to the topic. At the moment, both the project, which uses EU funding from the FP7 program, as well as many of the entities involved in TT in the three countries rely on a model of public fostering and demonstration of the utility and benefits of implementing these approaches in the EaP countries.

3.2. Challenges to overcome in technology transfer

According to (UNICO Practical Guides, 2006), when dealing with TT, the following key aspects have to be considered for managing agreements and they usually follow in the order presented below:

- identifying technologies that may be suitable for commercialization;
- market research and marketing activities;
- managing relationships within the university and with external advisers (e.g. patent agents and lawyers);
- negotiating contracts and, in some cases, contract drafting; and
- managing relationships with existing licensees and others.

The same guiding documents mentions also the additional support activities that a TT office might need to undertake in order to ensure its success (UNICO Practical Guides, 2006)

- due diligence, particularly in relation to IP
- obtaining assignments from inventors and others
- negotiating term sheets
- implementing and devising policies on IP ownership, publications, liability, conflicts of interest, etc
- monitoring licensee performance and enforcing existing agreements

According to (Merylin, Martinot, & Onchan, 2000) a number of policy tools are proposed to tackle the most common challenges in the TT implementation:

- **National systems of innovation and technology infrastructure**

- Increase awareness and absorption effectiveness of innovation for companies
- Support of research and knowledge creating institutions
- Increase the technology level for facilitating communication between synergetic entities

- **Social infrastructure and recognition through participatory approaches**

- Increase awareness for the selection of proper technology, applicable by NGOs
- Support and stimulate the newly developed social entities, capable of replicating and facilitating the technology transfer process
- Create infrastructure for capitalizing on the knowledge of NGOs

- **Sustainable markets for environmentally sound technologies**

- Increase the level of technology integration in SMEs

- Increase the consumer awareness for sustainable technologies

- Replace existing technologies with sustainable ones in the public sector and focus future acquisition on the latter ones.

- **National legal institutions**

- Develop and improve on existing mechanisms for protecting intellectual property rights

- Develop new legislature that support transparency and independent review

- Shorten the time elapsed from application to granting the patent

- **Codes, standards, and certification**

- Increase the importance of support certification entities

- Elaborate new codes and standards and review existing ones

- Create competent and independent TT facilitating organizations

- **Research and technology development**

- Create state of the art public research laboratories for tackling problems that arise in the private sector

- Finance knowledge creation and research entities

In the three analyzed countries, as observed during our study and even before that, there exists a strong need to improve many, if not all, of these areas simultaneously and rightfully so. However, it is our belief that such an approach would prove more damaging than beneficial, so a considerable planning effort should be dedicated to prioritizing and maximizing effect with limited resources, at least in the beginning. Some possible measures are presented further on in this document.

3.3. Stakeholders and connections

An important aspect regarding TT is analyzing the entities that are directly involved in this process, as TT is reflected in the actions taken by them. Strategic decisions regarding investments and established trading practices, the support of knowledge acquisition and training of personnel, the absorption capability of public or private research, the focus on research, development and innovation activities, the dissemination of knowledge through relo-

cation of skilled personnel to critical sectors, all of the above mentioned activities include factors through which TT is impacted upon from within a private organization. However, there are also external entities that have to be taken into account and could potentially have a major impact on the TT process. The regulations given by governments, the financial benefits / stimulations offered by them, the ease of obtaining funding from financial institutions and also pressure exercised by NGOs can also have a significant impact on the TT process, although these actions relate to entities that supersede the power of influence of a single organization, or the two main parties (academia and private business) directly involved in the TT process (IPCC, 2000).

In a well functioning economy, governments should stand by and promote actions that do not necessarily generate huge amounts of profit in a short period of time, but support job creation and create long term benefits. In the context of TT, the main goal of the involved financial institutions is to provide the necessary capital to assure a continuous flow of the TT process. It should be noted here that these institutions have the capability of creating trends, as they can finance one area in favor of another one, depending on potential revenues that will be generated. NGOs focus on the more social aspects of TT. They are actively involved in providing various trainings, raising awareness and knowledge dissemination activities. (IPCC, 2000)

The authors of (Merylin, Martinot, & Onchan, 2000) suppose that TT can be either accelerated or slowed down by different motivations stakeholders have. Their policies can be divergent, thus the TT process is impeded. The following table presents relevant stakeholders regarding TT and their motivations:

Table 1. TT actors and motivations. Source: (Merylin, Martinot, & Onchan, 2000)

TT actors	**Possible motivations**
Transnational or multinational corporations	- seek international sales, market share, and cheaper production costs through equipment transfers and foreign direct investment - are primarily concerned about profits, acceptable risks and ensuring protection of intellectual property
Recipient-country firms	- motivated to transfer technology to minimize costs, just as with transnational corporations
Recipient governments	- may seek to increase capabilities for domestic technology-development and promote foreign investment in their country
Provider or donor governments	- may set up policies to encourage technology transfer and fund transfers of research and expertise via Official Development Assistance (ODA) to support development and political goals, but more often are interested in policies that expand foreign markets for their national firms and increase exports
Multilateral agencies with development goals	- pursue technology transfer to support development and as an instrument for achieving desired economic and policy reforms

Multilateral agencies with environmental goals	- have the transfer of ESTs as an explicit objective, and explore new and effective means to accomplish these objectives, by catalyzing sustainable markets and enabling private sector involvement in the transfer of these technologies
Non-governmental organizations	- have been at the forefront of concerns about technology choice and the "appropriateness" of technologies transferred through development assistance and commercial channels, the social and cultural impacts of such transfers, and the needs for technology adaptation to suit local conditions and minimize unwanted impacts

A separate classification, different from the one above, based also on (Merylin, Martinot, & Onchan, 2000) is presented in the following table, which includes also the decisions of stakeholders that can affect TT (positively or negatively):

Table 2. TT stakeholders and their policies. Source: (Merylin, Martinot, & Onchan, 2000)

Stakeholders	**Motivations**	**Decisions or Policies that Influence Technology Transfer**
Governments - national/federal - regional/provincial - local/municipal	Development goals Environmental goals Competitive advantage Energy security	Tax policies (including investment tax policy) Innovation policies Regulations and institutional development Direct credit provision
Private-sector business - multinational - national - local/microenterprise (including producers, users, distributors, and financiers of technology)	Profits Market share Return on investment	Technology R&D/commercialization decisions Marketing decisions Capital investment decisions Skills/capabilities development policies Lending/credit policies (producers, financiers)
Donors - multilateral banks - GEF - bilateral aid agencies	Development goals Environmental goals Return on investment	Project selection and design criteria Investment decisions Procurement requirements Conditional reform requirements
International institutions - WTO - UNCSD - OECD	Development goals Environmental goals Policy formulation International dialogue	Policy and technology focus Selection of participants in forums Choice of modes of information dissemination
Research/extension - research centres/labs - universities - extension services	Basic knowledge Applied research Teaching Knowledge transfer Perceived credibility	Research agenda Technology R&D/commercialization decisions Decision to transfer technology Choice of pathway to transfer technology
Media/public groups - TV, radio, newspaper - Schools - Community groups - NGOs	Information distribution Education Collective decisions Collective welfare	Acceptance of advertising Promotion of selected technologies Educational curricula Lobbying for technology-related policies
Individual consumers - urban/core - rural/periphery	Welfare Utility Expense minimization	Purchase decisions Decision to learn more about a technology Selection of learning/information channels

From a system wide perspective, innovation and technology transfer must be integrated as part of the national economic system, in order to be productive and reach their full potential (see Figure 3 for a description of the means and channels identified for achieving this goal).

Channels for TT

Market channels	← →	**Non-market channels**
Trade in goods and services Foreign Direct Investment Licensing Joint Ventures Cross border movement of personnel		Imitation Departure of employees Data in patent applications and test data Temporary migration (mobility of people)

Figure 3. Channels for international technology transfer. Source: (IDEA Consult, 2012, p. 26)

The case of the three analyzed EaP countries shows preference for FDI and joint ventures as market related channels, with licensing further behind in the preference of current or potential stakeholders. On the side of non-market channels, the departure of employees and their know-how is the most important flow for TT among stakeholders.

3.4. Main tendencies and activators

As it can be expected, economic development, especially in the era of sustainability, is mainly influenced by international financial flows. In a report by (See-Yan, 1997), the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992 started an initiative and since then three major trends in finance for sustainable development have occurred:

- development of both domestic and international financial mechanisms
- the objectives set for development assistance and domestic resource mobilization were not reached
- exponential growth of private financial flow between developed and developing countries

The technology transfer process is an instrument for supporting this orientation and it cannot be perceived outside the same context.

For this purpose, sustainable technology transfer involves and needs to include numerous entities and enabling factors, from all levels of a national economy, working together to achieve sustainability, regardless if it is the case of a developed or a developing country. According to (Merylin, Martinot, & Onchan, 2000) such entities and enablers are listed as follow:

- national institutions for technology, innovation and research;
- national legal institutions (for reducing risk and protect intellectual property rights);
- national NGOs;
- technology developers;
- businesses and corporations;
- human and institutional capacities for selecting and managing technologies;
- macroeconomic policy frameworks;
- the underpinnings of sustainable markets for environmentally sound technologies;
- legislation, codes and standards;
- research and technology development
- other means for addressing equity issues and respecting existing property rights

To determine in which sectors innovation is more present and which are the trending ones, we must look at the number of patent applications. For this we propose to analyze the number of patents that were submitted to the World Intellectual Property Organization (WIPO), between 1990-2007 (Foster, 2012, p. 14).

Table 3. Patent application by technology field

Technology field	Patent applications	Share in total patent application	Growth rate of patent applications
I – Electrical engineering	383,385	29.78	5.88
Electrical machinery, energy	77,332	6.01	4.54
Audio-visual technology	60,961	4.74	3.38
Telecommunications	58,138	4.52	6.39
Digital communications	29,852	2.32	12.37
Basic communication processes	15,562	1.21	1.49
Computer technology	77,990	6.06	7.07
IT methods for management	11,034	0.86	27.82
Semiconductors	52,516	4.08	5.80
II – Instruments	192,933	14.99	3.70
Optics	59,137	4.59	2.99
Measurement	53,115	4.13	2.67
Analysis of biological materials	8,244	0.64	4.20
Control	22,516	1.75	3.63
Medical technology	49,921	3.88	6.19
III – Chemistry	292,974	22.76	2.89
Organic fine chemistry	42,558	3.31	2.25
Biotechnology	26,866	2.09	4.98
Pharmaceuticals	44,435	3.45	6.49
Macromolecular chemistry, polymers	26,336	2.05	0.20
Food chemistry	16,738	1.30	5.68
Basic materials chemistry	33,694	2.62	2.13
Materials, metallurgy	28,153	2.19	0.85
Surface technology, coating	23,330	1.81	3.20
Micro-structural and nano-technology	1,025	0.08	31.73
Chemical engineering	31,047	2.41	1.19
Environmental technology	18,793	1.46	3.68
IV – Mechanical engineering	307,361	23.88	2.32
Handling	41,292	3.21	1.74
Machine tools	35,359	2.75	1.11
Engines, pumps, turbines	34,932	2.71	3.48
Textile and paper machines	35,496	2.76	0.57
Other special machines	44,184	3.43	0.97
Thermal processes and apparatus	22,220	1.73	2.83
Mechanical elements	39,097	3.04	3.10
Transport	54,780	4.26	4.57
V – Other fields	110,656	8.60	3.83
Furniture, games	34,357	2.67	5.85
Other consumer goods	27,208	2.11	3.74
Civil engineering	49,091	3.81	2.59

Table 3 shows which are the main sectors in which considerable knowledge growth is present and based on the growth rate it can be determined which are the trending sectors. From this table it can be observed that the patent applications are mainly concentrated in three technology fields: electrical engineering (30%), mechanical engineering (24%) followed by chemistry (23%) totaling 77% of all applications. As it was to be expected, computer technology is the leading domain in patent application, closely followed by electrical machinery. Turning to the mechanical engineering field, it can be seen that transport has a considerable lead, while special machinery and handling are the next two areas of preference for appli-

cants. With a slight difference of only 1% between mechanical engineering, chemistry is the third largest field in which patents were submitted. In this case, the areas of pharmaceuticals and organic chemistry stand out from the rest. Now looking at the growth rate, it can be seen that although having a low share, the sub-fields of Micro-structural and nano-technology, IT methods for management and Digital communication experienced considerable growth, in comparison with the others, which maintained a slow, but graduate climb with up to 7%. Most of these fields can find application in the societal challenge “secure, clean and efficient energy”.

As stated in the previous section, the financial aspects play a key role in trend setting. In the following we analyze the Seventh Framework Program budget (which has already completed and made available its final financial data) to identify which fields are supported by the EU through financial stimulation.

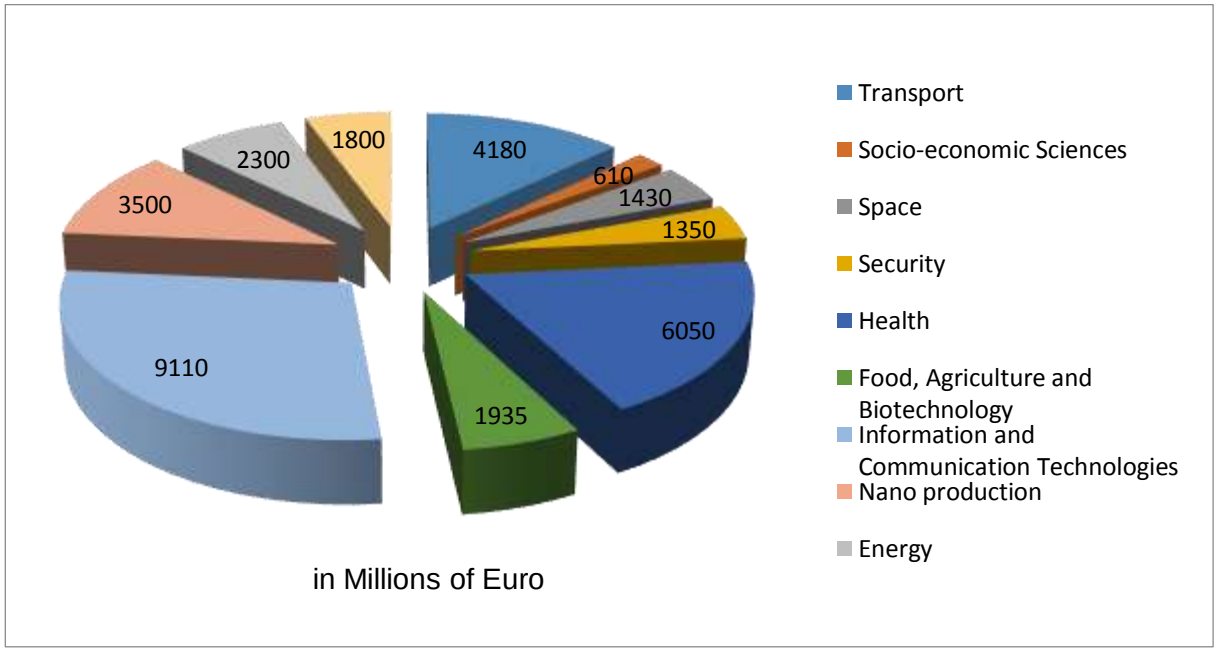

Figure. 4 FP7 budget breakdown

Source: (Penny, 2014, p. 3)

There is no surprise that the biggest budget, by far, is allocated to the IT sector followed by Health, Transport and Nano production. If we look at Table 3 we see that there is a slight correlation between the budget allocation and the technology fields with considerable growth rate meaning that those areas are conducive to rapid development due to financial support as well, including renewable energy.

An important trend, which preoccupies decision makers and scientists alike, is related to the need for internationalization of research, development and innovation, as a means of achieving interdisciplinarity and of stimulating creativity (see Figure 5). This is also very relevant for higher education and research instructions in the EaP countries, which still experience a degree of disconnection with other regions of the world.

Potential impacts of the internationalization of R&D for host countries	
Opportunities	**Challenges**
1. Improved structure and performance of the National Innovation System (NIS) 2. Innovative expenditure and capacity increases 3. Knowledge and information spilovers 4. Contribution for human resource development (R&D employment, training, support to higher education, reverse brain drain effects) 5. Contributions to industrial upgrading: structural change and agglomeration effects	1. Downsizing of existing local R&D and less radical innovations 2. Unfair compensation for locally developed intellectual property 3. Separation of R&D and production and loss of control over domestic commercialization 4. Crowding out in the labour market, potential to harm to basic research 5. Technology leakage 6. Race to the bottom and unethical behaviour

Figure 5. Internationalization of R&D. Source: (UNCTAD, 2005, p. 180)

In relation to funding opportunities, according to the **Invalid source specified.**, the following financial instruments for cooperation between Ukraine and EU in the field of research, innovation and technology transfer are available for entities from the public and private sectors:

- Horizon 2020 programme for research and technological development;
- Erasmus+;
- Tempus;
- INSC - Instrument for Nuclear Safety Cooperation (from 2007 onward since it replaces the Tacis Nuclear Safety Programme) - funded though ENPI European Neighborhood and Partnership Instrument;
- ENPI CBC (Cross-Border-Cooperation) Poland-Belarus-Ukraine Programme;
- ENPI CBC (Cross-Border-Cooperation) Latvia-Lithuania-Belarus Programme;
- Hungary-Slovakia-Romania-Ukraine ENPI Cross-border Cooperation Programme;
- Joint Operational Programme Romania-Ukraine-Republic of Moldova;
- Black Sea Basin Joint Operational Programme;
- INOGATE Interstate Oil and Gas Transport to Europe - funded though ENPI European Neighborhood and Partnership Instrument ;
- Nuclear Safety Co-operation Instrument (NSCI);
- South East Europe Programme;
- Central Europe Programme.

The cooperation in this sector is regulated by a considerable number of agreements and strategic documents, and it followed a concrete course of action as laid out in the European Union-Ukraine Cooperation In Science, Technology And Innovation Road Map Of Cooperation 2011-2013, available here http://ec.europa.eu/research/iscp/pdf/policy/ukraine_road_map_2011-2013.pdf#view=fit&pagemode=none. This cooperation culminated with the signing of the Horizon 2020 Association Agreement between the two parties, which took place on March 20, 2015. This will give Ukrainian R&D and TT entities access to European funding for research within international consortiums and on the priorities agreed upon the EU (and EaP) levels. A large portion of these opportunities are also available for Belarus and Georgia and, even further within the EaP, for Moldova, Armenia and Azerbaijan.

The general TT landscape for the Republic of Belarus, includes the following innovation support organizations (Uspenskiy A. , 2010):

- Hi-Tech Park (specialization - IT-industry and related branches);
- Technology parks - 10 organizations, 3 have correspondent status;
- Belarusian innovation fund;
- Business incubators 9;
- Centers for Technology Transfer (including the Republican Centre for Technology Transfer, its 5 regional offices and 26 branches in research organizations) - 32
- Innovation centres - 5
- Scientific and production (scientific practical) centres – 56
- Information and marketing centres - 10

Also, according to (Grishanovich, 2012), the following results have been registered for the national State Program of Innovative Development 2011-2015:

Priority directions of innovation development	**The number of created enterprises and productions**
Energy and energy efficiency	30
Agro technology and manufacturing	17
Industrial and building technologies and production	76
Medicine, medical engineering, technology and pharmacy	33
Chemical technology, nanotechnology and biotechnology	21
Information, communication and aerospace technologies	20
New materials	4
The development of transit potential	14
Harmonious exploitation, resources saving and protection of emergencies	3
National security and defence	17
Total	235
Development programs of economic activity or region, state complex target scientific and technical programs, SNTP	More than 900

In Georgia, it can noted the good collaboration among the institutions of Sakpatenti (the national patent office) and the newly established Technology Transfer Center of Georgia. According to (WIPO/TTCG, 2014) a number of over 6000 patents have been classified, abstracted and prepared for being the basis of new collaborations among Georgian inventors / researchers and companies, national or international.

The core aims of the TTCG are to provide services to enterprises in need of expertise and technology upgrade and a platform for industry-research collaboration, connecting the demand coming from the private sector with the supply coming from R&D institutions in Georgia, as well as abroad. That way, the expertise and the existing research base can be used by Georgian companies to become competitive on the Georgian as well as on the international market. Further services of the center include technology audit and matching as well as legal advice. In the future the service portfolio will be expanded to international and local patenting and commercialization support of local know-how.

3.5. PEST Analysis for EaP countries

In the following, we will present a short PEST analysis of the TT environment in the 3 EaP countries visited and where we have worked together with the stakeholders involved in this system. The focus of this analysis is not on comprehensiveness, but rather on showcasing the relationship between the general, overall, picture that one might find in a number of studies and reports available online, such as the ones used by us for reference, and the particular aspects one might encounter when discussing the everyday aspects that a TT specialists runs into when doing their jobs. We would also like to reminder the users that PEST stands for Political, Economic, Social and Technological aspects, which constitute the main guiding directions of our discussion.

Political aspects

As it is already known, the political climate in the EaP countries is a complex and dynamic one. Although the countries themselves are diverse, there are both historically and cultural similitudes that stem from their participation in the Soviet Union. Furthermore, on a dimension that affects the innovation and TT environments, their economies are strongly depended on the collaboration with Russia and other CIS member states. Also, there are still open and unresolved foreign policy issues with Russia, from the part of Georgia and Ukraine, which

negatively impacts economic and scientific flows among them. An orientation of the scientific community towards he EU is natural, but it is taking place at a slow pace required by trust building and obtaining tangible first results as demonstration of possibilities.

Moreover, the internal political environment is still working on reforms in the science and innovation domain, which will take a long time to achieve. State property and state implication in funding research is highly present and the private sector is still timid to invest in these areas. A good tradition of creating institutions and projects for the benefit of the national economy and the society at large is present, albeit marked by lack of financial resources. This is especially visible in the system of National Academies of Sciences, composed of cvasi-independent institutes working to solve concrete problems (e.g. related to energy efficiency of power plants), and being more focused on this than on publishing and patenting the results of research.

We must not forget that these 3 countries have very different sizes of territory and population (e.g. Georgia is comparable in population to the Kiev Metropolitan Area) and that their evolution after the break-up of the Soviet Union has been very different in terms of political and, even, economic systems (e.g. state ownership in Belarus is very high). This prompts for different approaches in thinking up a functional TT system in terms of geographical distribution, staffing and form of ownership (NGOs, government agency or SME), as well as in the way the society is ready to embrace a culture of technology transfer, collaboration and partnership.

Legal framework is still evolving, but most basic provisions specific to international best practices in the field of TT can be found in the legislation of these countries, as well as the adoption of the main international instruments (e.g. WIPO treaties and conventions).

Economic aspects

One thing that significantly influences the TT landscape in the EaP countries is a different approach to entrepreneurship than EU countries have, especially the Western countries. Most of the TT efforts are directed towards the big companies, many times state owned companies, who are interested in collaborating with academia and the researchers in order to achieve their objectives. Entrepreneurs, and even more developed SMEs, are still rare and

mostly oriented towards simple, fast and direct business ideas and less towards knowledge based business models.

It is important to note that these economies are struggling with low growth and they exhibit rather high inflation (especially Ukraine, after the conflict started in its Eastern part in 2014). Under these conditions, it is hard to make long term predictions and forecasts that could help a (new) business on the long run. Even if they are growing, they are still behind both the EU and Russia, which comes to show how hard it is nowadays for a country to be outside a trade or political block (Belarus is an exception to this because it is a member of the Euroasian Economic Union).

The economic crisis of 2008, which still affects even the more developed countries, is also felt here, especially in the form of lost markets and delayed development. These issues plague the development of businesses and projects in the field of renewable energy and diminish the need for technology transfer. When coupled with the complex political situation, these economic action act like deterrents to the appearance of future projects, creating an unwanted status quo.

It should also be mentioned that new developments are appearing, with Georgia becoming in the past few years one of the best countries in the world to start a new business, which can be very attractive for foreign investment, with direct implications for energy related companies and their collaboration with the research domain.

Also, all three countries have a well-known and documented potential for renewable energy from various sources (solar, wind, hydro) and a need to ensure their energy independence and replace old and outdated power plants. The governments are poised to commission more studies and prepare public or stimulate private investment in new facilities for producing energy. Going green and clean is, in these cases, a need as well as an opportunity.

Social aspects

From a social point of view, it should be noted that in each of the countries there is good distribution of the population pyramid, with a strong young generation, capable of rebuilding a better future. Unlike the former Eastern European countries that have acceded the EU, the

young population is still in the country and, although it might be more difficult to succeed like this on a personal level, it might prove useful on long term.

Although in need of reforms, the education system is producing high quality graduates and technical disciplines, such as the ones needed for energy projects or innovation and technology transfer, are actually preferred by students. An important issue to solve here is the percentage of people, either young graduates or more experienced professionals that speak English, or another international language, outside Russian (which was and is the lingua franca of the former Soviet Union countries). The ability to obtain knowledge, to communicate and familiarity with Western values that comes with learning a language, will contribute significantly to the increase of international collaborations and investment in all domains.

The accession to treaties and agreements with the EU will open up new collaboration possibilities and will stimulate investment and common ventures in all scientific and economic fields. This can be reflected in large undertakings at national level (e.g. the visa regime of Belarus) or in direct small scale actions (e.g. contributing to an EU funded project).

Technological aspects

From a technological point of with, with respect to TT processes, we should mention the fact that the scientific infrastructure in these countries is now old and out of date, much of it dating back to Soviet times. It lacks new capabilities, it is not interactive, automated or computer based and it has stopped being attractive. Although in the past, many researchers and many labs have been involved in high level research and development, such as for the Soviet space program, in the past 25 years the equipment remained largely unused and it now evokes memories of long gone by era.

The cost of investment new and up to date scientific equipment is very high and in a scientific system with little exposure to the market mechanisms, the willingness to invest is reduced. Meanwhile, the states themselves cannot supplement this need, as it also has strained resources and is, strategically, committed to investing in other areas of the economy and society.

Two other issues that are also important in understanding the relationship between technology and successful TT which are visible in these 3 countries are the fact that they have low internet penetration and low internet connection speeds, which spawn also the issue of the difficulty to access new know-how (coupled with the international language aspect). Any development towards the modern means of performing research or business will require in the future considerable upgrades in the technical base of internet connection and distribution, as well a large scale dissemination of the possibilities that open up along with the implementation of digital technologies and their online connectivity.

3.6. Legal framework for TT

There are a few aspects to consider when referring to the legislation that applies within the TT environment. Mostly they clarify ownership issues in different situations, which is also one of the major sources of conflicts and disagreements. To discuss these issues a few specific terms are described as follow (Ecke, Kelly, Bolger, & Truyens, 2009):

a) professors' privilege – is a concept that states that the results of research that has been performed with public funding should be the property of the researcher/professor and not of the host institution;
b) prior user right – it is a concept applicable when the inventor gains the right to make use of the invention after it is patented by another entity/person;
c) experimental use exception (also known as the “research exception” or “research defense”) – permits third parties with legitimate research interests to use a protected result without the explicit consent of the rights owner
d) difference between publications and patents – these two options are used to disseminate knowledge resulted from an endeavor, but their exclusivity options, as well as other characteristics (e.g. duration of protection, cost, geographical coverage) are very considerably different;
e) technological know-how – is a concept related to confidentiality of information and trade secrets and it is usually subject to protection by legislation by states in the context of unfair competition or other illegal economic practices;
f) IPR co-ownership provisions (a.k.a “joint ownership”) – new intellectual property is more and more a team or collaboration effort (sometimes with persons working for companies) or this situations can appear following an IP contract of some kind (sale, license, etc.).

In the following will make a short overview of the main legislation and other regulatory documents that apply to the field of technology transfer (and related domains) in the three studied countries from the EaP.

Ukraine – Technology transfer related legislation (main)

- Law of Ukraine of 13.12.1991 No. 1977-XII „On scientific and technical activity" (as amended).
- Law of Ukraine of 25.06.1993 No. 3322-XII „On scientific and technical information" (as amended).
- Law of Ukraine of 10.02.1995 No. 51/95-VR „On the scientific and technical expertise" (as amended).
- Law of Ukraine of 04.07.2002 No. 40-IV „On Innovation Activity" (as amended).
- Law of Ukraine of 11.07.2001 No. 2623-III „On the priority directions of science and technology" (as amended).
- Law of Ukraine of 16.01.2003 No. 433-IV „On priorities of innovation" (as amended).
- Law of Ukraine of 09.04.2004 No. 1676-IV „On national complex program of high technologies".
- Law of Ukraine of 16.07.1999 No. 991-XIV „On special regime for innovation activity in technological parks" (as amended).
- Law of Ukraine of 25.06.2009 No. 1563-VI „On science parks' (as amended).
- Law of Ukraine of 22.12.2006 No. 523-V „On Scientific park Kyiv polytechnic".
- Law of Ukraine of 14.09.2006 No. 143-V „On state regulation of activities in the field of technology transfer."
- Decree of the President of Ukraine of 20.04.2004 No. 454/2004 „On financial support of innovation activity of enterprises of strategic importance to the economy and security."
- Decree of the President of Ukraine of 30.12.2005 No. 1873/2005 „On establishment of the State Agency of Ukraine for Investments and Innovations."
- Decree of the President of Ukraine of 18.08.2006, the No. 691/2006 „On the National Council of Innovation Development Ukraine" (as amended).
- Resolution of the Verkhovna Rada of Ukraine of 21.10.2010 No. 2632-VI „On recommendations of parliamentary hearings strategy of innovative development of Ukraine for 2010-2020 in the conditions of globalization challenges."
- Cabinet of Ministers of Ukraine of 31.03.1992 No. 162 „On State Registration of research, development work and dissertations".

- Cabinet of Ministers of Ukraine „On Approval list of paid services that can be provided by budgetary scientific institutions" from 28.07.2003 No. 1180.
- Cabinet of Ministers of Ukraine of 25.08.2004 No. 1084 „On approval of the formation and execution of orders for research and development, design and development work from the state budget" (as amended).
- Ministry of Education and Science of Ukraine of 17.04.2003 No. 245 „On Approval of the Procedure to monitor implementation of innovative projects in the priority areas of technological parks", registered with the Ministry of Justice of Ukraine on 10.07.2003 No. 575/7896 (amended).
- Ministry of Education and Science of Ukraine of 12.10.2006 No. 699 „On ensuring the effective implementation of the Law of Ukraine dated 14.09.06. No. 143-V „On state regulation of activities in the field of technology transfer."
- Ministry of Education and Science of Ukraine of 05.04.2007 No. 281 „On the application form for state registration of the technology park."
- Order of the Ministry of Industrial Policy of Ukraine of 07.05.2007 No. 203 „On approval of the agreement on cheaper loans raised for innovation or investment projects," registered in the Ministry of Justice of Ukraine on 20.06.2007 No. 681/13948.
- Ministry of Education and Science of Ukraine of 10.07.2007 No. 594 „Criteria for project evaluation and development technology park."
- Instructions for completing the state statistical observation number 4-nt „Report on the acquisition of intellectual property rights and use of intellectual property rights was approved by the State Statistics Committee of Ukraine of 20.08.2007 No. 306 and registered with the Ministry of Justice of Ukraine 06.08.2007 year No. 1038/14305.
- Ministry of Education and Science of Ukraine of 15.10.2007 No. 900 „On Approval sample form Technology Park project."
- Ministry of Education and Science of Ukraine of 21.02.2008 No. 114 „On Approval of the Methodology for state examination of innovative projects".
- Ministry of Education and Science of Ukraine of 14.05.2008 No. 409 „On approval of state registration of technology transfer and the State Register of agreements on technology transfer", registered with the Ministry of Justice of Ukraine on 28.05.2008 No. 464/15155.
- Order of the State Agency of Ukraine for Investments and Innovations from 23.10.2008 No. 88 „On approval of the formation and use of the State innovation financial and credit institutions" registered with the Ministry of Justice of Ukraine on 13.11.2008 No. 1104/15795.

Belarus – Technology transfer related legislation (main)

- Law of the Republic of Belarus of 14.11.2005 No. 60-З “On approval of the main trends in the domestic and foreign policy of the Republic of Belarus”.
- Law of the Republic of Belarus of 19.01.1993 “On Fundamentals of State Scientific and Technical Policy”.
- Edict of the President of the Republic of Belarus of 03.05.2001 No. 234 “On State Support of the Development and Export of the Information Technologies”.
- Resolution of the Council of Ministers of the Republic of Belarus of 30.01.2004 No. 95 “On Approving the Model Regulations on State Scientific and Industrial Centers”.
- Edict of the President of the Republic of Belarus of 08.07.1996 No. 244 “On Promoting the Creation and Development in the Republic of Belarus of Industries Based on New and High Technologies”.
- Resolution of the Council of Ministers of the Republic of Belarus of 21.03.2009 No. 346 “On Registration of License Contracts, Contracts of Assignment, Contracts of Pledge of the Rights to Industrial Property Objects”.
- Resolution of the Council of Ministers of the Republic of Belarus of 27.02.1997 No. 139 “On Priority Directions of Creation and Development of New and High Technologies and On Criteria of Their Assessment”.
- Directive of the President of the Republic of Belarus of 31.12.2010 No. 4 ”On the Development of Entrepreneurship and Stimulating Business Activity in the Republic of Belarus”.
- Law of the Republic of Belarus of 05.01.2004 “On Technical Regulation and Standardization”.
- Law of the Republic of Belarus of 16.12.2002 “On Patents for Inventions, Industrial Models, and Industrial Designs”.
- Law of the Republic of Belarus of 05.02.1993 “On Trademarks and Service Marks”.

Georgia – Technology transfer related legislation (main)

- Patent Law Georgia of 04.05.2010 No. N3031 (as amended)
- Trademark Law of Georgia of 05.02.1999 No. N1795 (as amended)
- Law on Appellations of Origin and Geographical Indications of Goods of 22.06.1999 No. N2108 IIs (as amended)
- Law on Copyright and Neighboring Rights of 22.06.1999 No. N2112 (as amended)
- Law on Design of 04.05.2010 No. N 3030 (as amended)

- Law on protection of Animal Breeds and Plant Varieties of 15.12.2010 No. 4066 (as amended)
- Law on Tophographies of Integrated Circuits of 22.06.1999 No. N2110 (as amended)
- Law on Border Measures Related to Intellectual Property of 23.06.1999 No. N2159 (as amended)

4. Analysis of the technology transfer environment

4.1. SWOT for TT environment in Ukraine

Strengths

To implement the provisions of the Ukrainian Law from 14.09.2006 N 143-V on “State regulation of activities in technology transfer” the infrastructure for the technology transfer was embedded in the National Technology Transfer Network (NTTN).

On 19.01.2010 the Ministry of Education and Science of Ukraine, the Academy of Technological Sciences of Ukraine and the State Enterprise “Ukrainian Center for Technology Transfer” concluded the Memorandum “On the creation and development of the National Technology Transfer Network (NTTN) by state and non-state subjects of technology transfer.” This Memorandum provides involvement of the other subjects of technology transfer, provides the standards of the European Enterprise Network (EEN) and principles of the creation of a national network of technology transfer.

The principal tasks of NTTN are as follow (NTTN Conception & Methodology):

- transfer of technologies and know-how between science sectors and industry;
- partner and investor matching for cooperation regarding the development and implementation of advanced technology products, both in Ukraine and abroad;
- organization of NTTN cooperation with other international technology transfer networks.

The main principles of creating NTTN are (Kateshova, Luksha, Pashin, & Yanovskiy):

- **Uniformity of formats.** Technological information used by participants of national network for exchange between one another is given in one format.
- **Compatibility with EEN (IRC) and RTTN.** Working techniques as well as formats of technological inquiries/offers in NTTN are compatible with those of EEN (IRC) and Ukrainian network UTTN. Uniformity of formats of Ukrainian and European networks creates conditions for efficient cooperation.
- **Professional participants of technology transfer process orientation.** NTTN foresees transfer of network working techniques to existing subjects of innovation infrastructure. Such organizations already have clients database to provide technology transfer services.
- **Quality control of incoming information.** Quality and authenticity of information in technological inquiries are ensured by the right to place information in the network’s

database only by certified network participants who are responsible for the data content and its quality.

- **Network accessibility for new participants.** The active process of attracting new network participants allows the provision of clients with the unique possibility for advancing their technological offers/inquiries not only in Ukraine but also abroad.

The creation of industrial parks in Ukraine aims to commercialize scientific and technical activities, promoting more rapid scientific advances in the financial sector. Furthermore, in a crisis situation in Ukraine, the academia knowledge can be capitalized in these technology parks and this will allow scientists to be involved in more creative activities that bring also financial benefits to them.

The main objectives for which technoparks were created in Ukraine:

- The preservation of the transition to the market economy of the scientific and technical potential of Ukraine and focusing on solutions for actual problems from the industrial production and agriculture to overcome the crisis in the economic and social development
- Facilitate the transition of innovation to the domestic industry to facilitate development
- Development, implementation and production of high-tech production and products that will be competitive on world and domestic markets, which will increase the export potential of Ukraine and reduce dependence on imports
- Training of scientists and specialists to work in the domestic market, including in the commercialization of scientific research
- Attracting domestic and foreign capital for scientific and technical development.

Table 4 shows the performance of technoparks, recorded in departmental reporting of the Ministry of Education and Science of Ukraine. Monitoring these indicators annually conducted both by the ministry and other central executive authorities help in supervising the progress of each project. Not all of them were able to organize their activities.

Table 4 Volume of innovative products per technopark (NTTN data)

No.	Technopark	Registration Date	Volume of innovative products, mln. UAH.
1	"Semiconductor technologies and materials, optoelectronics and sensor technique" (m. Kyiv)	June 2001	495,2
2	"Paton Institute of Welding "(Kyiv)	July 2000	8535,4
3	"Institute for Single Crystals" (Kharkiv)	July 2000	3456
4	"Vuhlemash" (Donetsk)	November 2001	146,3
5	"Institute of Technical Thermal Physics" (Kyiv)	September 2002	5
6	"Kyiv Polytechnic" (Kyiv)	June 2003	30
7	"Intelligent Information Technologies" (Kyiv)	December 2003	–
8	"Ukrinfoteh" (Kyiv)	November 2002	14
9	"Ahrotehnopark" (Kyiv)	October 2007	–
10	"Eco-Ukraine" (Donetsk)	–	–
11	"Scientific and teaching apparatus" (Sumy)	–	–
12	"Textile" (Kherson)	December 2007	–
13	"Resources of Donbass" (Donetsk)	–	–
14	"Ukrainian microbiological center of synthesis and new technologies" (UMBITSENT) (Odesa)	–	–
15	"Yavoriv" (Lviv region)	August 2007	1
16	"Engineering Technologies" (Dnipropetrovsk)	November 2008	–
Total			12681,9

Weakness

However, the experience of technology parks in Ukraine demonstrates that their functioning is associated with a number of problems. Firstly, more than 99% of innovative products were developed in only three parks created in the leading scientific organizations of the National Academy of Sciences of Ukraine. Secondly, policy instability affected their effective operation. Imperfect legal framework regarding innovation reinforces the practice of the suspension of certain articles of existing laws or legal regulations.

Thirdly, complicated internal governance structures, the low motivation and payment of personnel and the low ability to conduct businesses with the economic sector of Ukraine or export towards the EU or other international markets are some of the issues that stop the model of science parks from achieving its full scientific potential. The success of such an endeavor is both a scientific one and a managerial one, and there seems to be a long way ahead in converting many good research ideas into applicable innovative products with increased market value.

Opportunities

All technology park projects are approved by law and meet the needs of specific innovative technoparks. The projects usually include all stages of the innovation cycle - from applied research and development to production and release of innovative products to market. As an example, world achievements of Paton Institute which are as follows: automatic welding of T-

34 armored body - the best tank of the Second World War; welding technologies of virtually any materials of any thickness (from microns to meters) in any environment (including underwater and in space). Other achievements of the Institute: high-frequency welding of soft tissues of the human body.

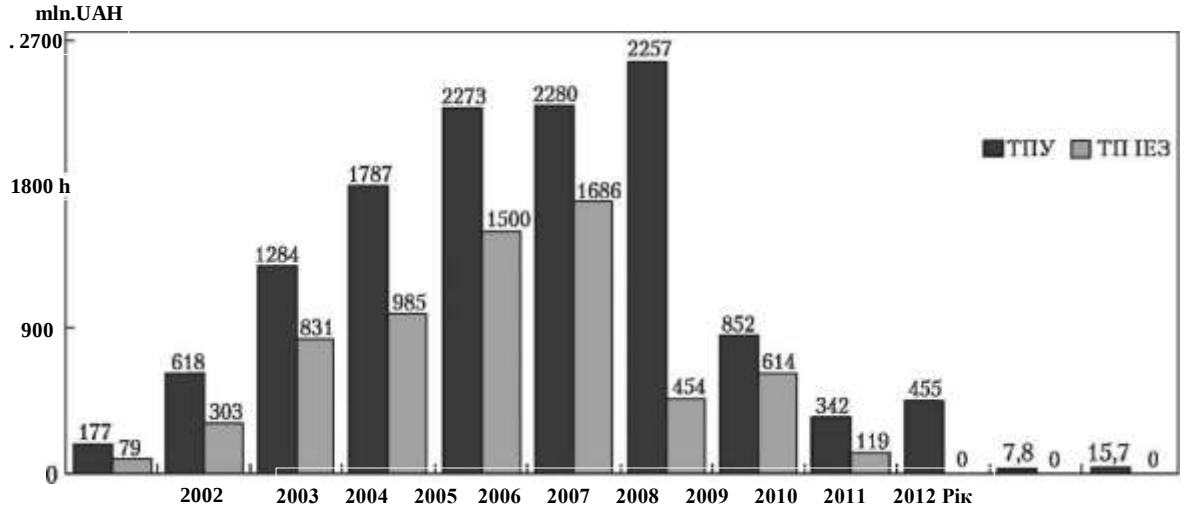

Figure 6. Total volume of sales (in Million UAH)

The evolution of the activity of technoparks in Ukraine is shown in Figure 6.
Annual output of innovative products for projects within industrial parks increased 16.7 times (from 0.18 bln UAH in 2001 to 2.6 bln UAH in 2007). Annual output growth is about 50%. The positive balance of foreign trade activities of technoparks was 148 million UAH. (1859 mln. UAH. - import, 2007 mln. UAH. - export). The budget balance of technoparks amounted to 516 million UAH. (payments to the budget – 1.02 UAH., other state support - 510 million UAH).

Practice shows that Ukrainian technoparks model is a highly effective measure that allows development and is able to significantly speed up production of higher technological structures for the world market.

Following the activities in the last years, Ukrainian technology parks provide a surplus in budgetary balance and in the balance of foreign trade.

Over 98% of the economic implementation of innovative products is accounted for from three parks created in the leading institutions of NASU: Paton Institute (67.4%), the Institute for Single Crystals (27.3%) and the Institute of Semiconductor Physics (3.9%).

Threats

Creation a network of technoparks is affected by many factors. Here are the most important ones:

- limited demand for innovative offers within the country;
- low solvency of domestic consumers of new technology;
- limited capacity of innovation funding from the state budget;
- lack of interest of financial and banking and credit systems in supporting innovative projects;
- existence of competition in the domestic markets of western firms, technology developers, manufacturers and suppliers of materials, equipment and technologies in general.

Today the technology park is the only form of innovation that really works in Ukraine. Many regions of Ukraine are actively seeking viable solutions in this time of crisis and have limited financing forms for integrating science into production.

4.2. SWOT for TT environment in Georgia

Strengths

The terms innovation and innovation-driven economies have become integral parts of the international discussion about economic development. Most transition countries after the fall of communism and the economic turmoil in the 1990s attempted to achieve economic growth by upgrading their technology base and stimulating innovation in the productive sector in order to diversify their economic and export structure. In 2013, Georgia was for the first time ranked as an efficiency-driven economy in the Global Competitiveness Index by the World Economic Forum. This indicates that also the Georgian Government faces a myriad of decisions of how it can improve the country's business and innovation climate. One of the crucial questions will be how the country can move from the stage of technology absorption to the increased creation of knowledge and solutions "in house". In the case of Georgia, no coherent policy framework for innovation has yet been defined.

Weakness

The main barrier between business and research is that today business apply only individual scientists, researchers and inventors, whereas such cooperation must be conducted by such legal entities as universities, scientific institutes and private companies. At the same time the mentioned universities and institutes must take into account market opportunities/interest

and have to estimate their own potential. They must make audit of their research possibilities - defining in such way what kind of problematic are more progressive for the future, its actuality in the current situation, how it appropriates to market demands, etc. Only such approaches will be successful for the cooperation between research and Business.

At the same time it is necessary to increase financial support of Government and Universities with regard of scientific institutes. This support must be directed towards the creation of the pilot samples and prototypes of the suggested ideas, as today the proposed ideas are remaining on the paper and their modeling and analyses are not doing. All the listed barriers hamper development of science.

It is important to underline that at present there are not exist legislative bases for innovations, innovative production, role of Government in the development of innovations, support and stimulation of the entrepreneurship, etc. These are the complex problems and they need quite a fast solution. At the same time this barriers have negative influence on the development of cooperation between innovation and business. First of all Government must have the will and must take into account world experience in this area, it is necessary to make import of the well known tendencies and experience. Consequently this will facilitate development of small and medium business in the country and will create working places in the field of science and technology which is so important on the current stage of development of the country.

Opportunities

According to (Export.gov, 2008), the main characteristics and their associated opportunities in the Georgian economic environment are the following:

1. The Georgian government has increased its focus on developing the tourism and agriculture sectors, but also furnishings and equipment for these sectors will be in demand.
2. Construction of infrastructure is booming across Georgia, presenting opportunities for producers of building equipment and materials and providers of architectural and engineering services. This started with a $4.5 billion in international assistance in 2008 and is continuing from various financing sources.
3. The food processing industry is an important outlet for Georgia's agricultural potential, and this also brings about an elevated demand for agricultural machinery and processing lines.
4. Information technology, systems, and software that go hand in hand with new business growth are very sought after.

The main achievement of the country is conclusion of the association agreement between EU and Georgia including Deep and Comprehensive Free Trade Area (DCFTA). This agreement is opening ways to EU market. Probably these great opportunities will be used by Georgian private companies and other country structures.
Also, Georgia has, together with Ukraine, signed in 2014 the Association Agreement with the EU, which opens up a wide range of favorable economic, scientific and technological conjunctures.

Threats

Main political and economic threats are going from neighbor country – Russia. In 2008 there was war between Russia and Georgia after which Russia occupied two Georgian territories: Ossetia and Abkhazia. Because of an embargo imposed by its traditional main trading partner, Russia, Georgia has reoriented its trade patterns and continues to search for new trading partners in Europe, North America, and Asia. After the war, based on negations by third parties, a partial recovery of exports has taken place, mainly concerning the food industry.

4.3. SWOT for TT environment in Belarus

Strengths

Innovative development of the Republic of Belarus is the basis of the country's economic security. Formation of a new technological base to improve competitiveness of Belarusian products on foreign markets is the goal of the State program of innovative development for 2011–2015. According to State program this should be done through introduction of new and high technologies, contributing to the creation of new types of goods and services, and ensuring the production of traditional goods and services with new properties and parameters.
To modernize the economy on the basis of technological innovation, it is planned to implement more than 500 projects in the creation of innovative enterprises and advanced technologies. By 2015, it is planned to bring the share of new products in total industrial output to 25%. The share of innovation active enterprises in the total number of industrial enterprises shall amount to 30.5%.

To accomplish this transformation it is necessary to develop innovation infrastructure that is a link between an innovator/inventor, a manufacturer of a new product and an investor or a consumer of the high technology, and as the result – market.

In Belarus the creation of innovation infrastructure began more than 10 years ago. In 1998 was created the Belarusian Innovation Fund, in 2003 – the Republican Centre for Technology Transfer, in 2005 the Hi-Tech Park. In 2007, the Presidential Decree approved the Regulations on the order of creation of innovation infrastructure entities. The Presidential Decree of June 5, 2012 № 253 “On Sino-Belarusian industrial park” was created and develops the Sino-Belarusian industrial park. At present in Belarus there are more than 80 different entities of innovation infrastructure.

Besides innovation infrastructure for SME support in Belarus were established and are active (as of 01.01.2014) 90 entrepreneurship support centers and 14 incubators of small businesses. Their activity is regulated by the Law of the Republic of Belarus from 01.07.2010 "On support of SMEs", President Decrees №255, №150 and Resolution of Council of Ministers №1911. 23 entrepreneurship support infrastructure entities are more than 10 years old.
Centers, as defined in legislative acts, provide informational services and advises to citizens, willing to start their own business (unemployed, youth, women etc.), organize courses/seminars, assist in receiving of material and technical resources, participation in exhibitions, trade fairs, help establish new business contacts, promote products on the markets, train and provide specialists, do marketing research etc. 116 760 persons turned to the centers for advise in 2013.

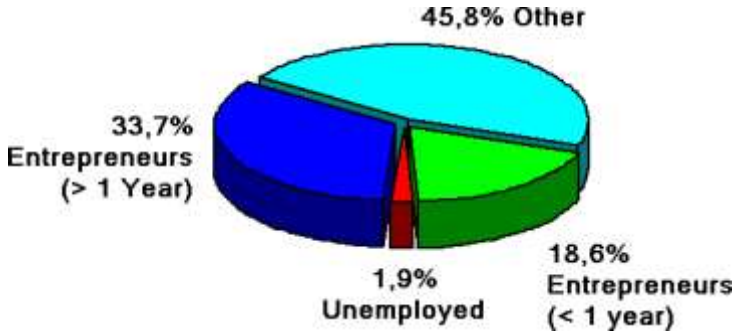

Figure 7. Types of advised people by the centers

As seen from the diagram experienced entrepreneurs refer to centers more often.
Incubators have to create conditions for growth and development of small business by renting premises, office equipment and other assets. Incubator's personnel render information and consulting services, organize seminars, provide assistance in finding business partner and financial resources, introduction of new manufacturing technologies etc. Distribution of incubator's residents by activity (in 2013) is shown in diagram bellow.

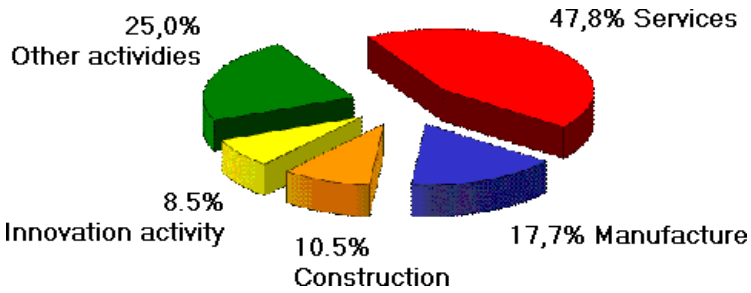

Figure 8. Distribution of incubator's residents by activity

As seen from the diagram the share of innovative businesses is modest with 8.5%

Other actual activities of centers/incubators include: promotion of manufacturing cooperation (subcontracting), involvement of youth in entrepreneurship, start-up schools.

State financial support to entrepreneurship support infrastructure entities is provided according to President Decree №255 from 21.05.2009 in the frame of the State program to support small and medium enterprises. The state support to centers/incubators in 2013 amounted to ca. 250 000 EUR (in 2012 – ca. 500 000 EUR). This financial support is later returned to state budged in form of taxes from centers' and incubators' activities as well as incubators' residents. In 2013 centers returned to budget ca. 1 260 000 EUR, incubators – ca. 550 000 EUR, small businesses (incubators' residents) – ca. 3 800 000 EUR.

Small businesses can become residents of incubators only on competition basis. The priority is given to manufacturing and innovative enterprises.

Weakness

In order to accelerate the commercialization of developments created through the budget, the RCTT offers based on the study of the legislation in the field of technology transfer of United States, Germany, Japan, China and others prepare and adopt in Belarus the following laws and regulations:

- According to which the ownership of the results of research and developments, implemented through the budget, should belong to organizations involved in their implementation. They should be given the right to determine the cost of the license agreements, based on the market value of the technologies (necessary to amend the President Decree № 59 from 04.02.2013). This will place all responsibility for commercialization to the developer, who then becomes interested in the introduction of innovations into circulation, as well as to protect the results of research and developments of patents, where the patent holder will be the direct perpetrator, not the state customer or performer with the permission of the government customer;
- Allowing R & D organizations restrict access to research results and inventions, if it is, according to the developer, may be contrary to its commercial interests;

- Prohibiting the sale of technology that are created using budget funds abroad as long as they have not mastered the territory of Belarus;
- Introducing into the job descriptions of employees of all government organizations involved in R & D, obligation to participate in the process of technology transfer and administration of these structures - consider this activity when evaluating employees;
- Promote the creation and financing of organizations (agencies) responsible in the country for technology transfer, developed with the involvement of the budget;
- Initiating the primary donation of small businesses created through public funding of technology.

It is also necessary to prepare and approve:

- Advice on licensing agreements, payment of royalties and the distribution of proceeds from the sale of licenses (completed contracts) between the organization, a division which carried out research and development, and developers;
- Model agreement on joint work, taking into account at the stage of conclusion of the contract all possible relationships that can occur between the customer and organizations subcontractors and developers. This will solve the main problem of commercialization - has not yet received the results, each participant will know exactly which of them will belong to this or that artist at the end of the project, and how it can dispose of them.

In addition, it is necessary to open in Belarus auction of intellectual property and to develop mechanisms that allow enterprises of all forms of ownership to attract foreign experts to solve their technical problems and to introduce into the curricula of institutions of higher education course on "Technology Transfer".

Opportunities

Opportunities are offered of important organizations of the Belarus innovation system for innovation activity agents.

Innovation Association "Republican Centre for Technology Transfer" (RCTT)

Web: http://ictt.by

RCTT's mission is to promote the co-operation between developers, users of high technologies and investors with the aim that existing knowledge, facilities, or capabilities developed under a government or a private research and development (R&D) funding are utilized to fulfill public and private needs.

RCTT is a consortium that includes:

- the headquarters in Minsk;

- 5 regional offices and 30 branch offices at research organizations, institutes, universities, enterprises in Brest, Vitsebsk, Homel, Hrodna, Lida, Minsk, Mahileu, Novapolatsk and other cities and towns across Belarus;
- 82 foreign partners in 23 countries;
- 2 overseas field offices in China.

Tasks set for RCTT:

- Creating and maintaining information databases meant for serving clients in the technology transfer sector;
- Creating a unified national network of technology transfer centres;
- Search of technologies, professionals, business partners and investors in Belarus and abroad; assistance in establishing of joint ventures;
- Assistance in development of innovation and investment projects; placing the project-related information in the UNIDO, IRC, EEN, and YET2.COM formats on RCTT's e-portal, in the specialized databases, particularly in the Russian Technology Transfer Network (RTTN), the Ukrainian National Technology Transfer Network (NTTN), the Internet platform for communities of trade and economic, scientific and technological cooperation between China and the countries of the CIS, the European Enterprises Network EEN, yet2.com Inc. Network (USA), Association of University Technology Managers Network (AUTM) etc., in foreign agencies, media and published editions;
- Development of business plans;
- Carrying marketing research;
- Organizing RCTT clients' participation in exhibitions, conferences, seminars and other events in the innovation activity domain;
- Organizing and delivering refresher, upgrading and advanced training courses, seminars and workshops for the personnel of research institutions, higher-education institutes and universities, SMEs.

Belarusian Innovation Fund (BIF)

Web: http://www.bif.ac.by

Activity:

- Innovation projects and industrial application of R&D output, and highly effective inventions financing.
- Market of technologies and scientific and innovation and venture business infrastructure development.
- Carrying out of scientific and technical production exhibitions and fairs, seminars, conferences, symposiums, other scientific and practical activity, etc.

Major functions: Complex support for innovation and venture activities in Belarus.

High-Tech Park (HTP Belarus)

Web: http://www.park.by/

HTP Belarus provides special business environment for IT business with incentives unprecedented for European countries. Due to the legislative initiative of the Belarus government, IT companies are exempt from all corporate taxes, including VAT, profit, real estate and land taxes. Individual income tax has a fixed rate of 9% for the employees of HTP companies. That resulted in a fast boost of IT industry in the country.

Technopark "MOGILEV"

Web: www.technopark.by

Services:

- Provision of quality and accessible infrastructure.
- Wide range of consulting and information services, including investment planning, business planning, technological marketing, accounting and taxing.
- Organization of educational activities on improving competence in essential business fields.
- Assistance in financial assets receiving.
- Activities on business start-up encouraging.
- Assistance in strategic alliances forming.
- Development of horizontal links and links with new knowledge centers.
- Support in internationalization of small and medium size innovation enterprises.

Technopark "Polytechnic"

Web: http://park.bntu.by/

Services:

- Organization of international technology transfer.
- Consulting services.
- Informational and analytical services.
- R&D implementation.

Threats

The main economic threats that impact the TT system are going from the neighbor countries with whom Belarus has strong relations: Russia, EU, Ukraine and Kazakhstan.

According to the (Ministry of Foreign Affairs of the Republic of Belarus, 2015):

- over than 50 % of Belarusian production is delivered for export;

- increase of scientific and technical and transit potential is one of the growth factors of the economy;
- there is a high diversity of exported products: oil and oil products, potash and nitrogen fertilizers, metal products, trucks, tractors, chemical fibers and yarns, tires, dairy and meat products, sugar;
- Russia accounts for 40% of exports / 50% of imports and the EU for 30% of exports / 20% of imports;
- the main imports of Belarus are energy resources, raw materials and components and manufacturing equipment;
- export of services mostly concerns transport, construction and IT services.

Table 3: Belarus foreign trade in good (in millions of USD)
Source: (Ministry of Foreign Affairs of the Republic of Belarus, 2015)

	2000	**2005**	**2011**	**2012**	**2013**	**2014**	**Jan-May 2015**
Trade turnover	15 972	32 687	87 178	92 464	80 226	77 180	23 213
Export	7 326	15 979	41 419	46060	37 203	36 392	11 046
Import	8 646	16 708	45 759	46404	43 023	40 788	12 167
Balance	-1 320	-729	-4 340	-344	-5 820	-4 396	-1 121

4.4. Proposals and recommendations

The NoGAP tasks in the EaP countries were focused on the societal challenge “secure, clean and efficient energy” of the EU and involved the following main activities and deliverables:

- 6 trainings for companies (start-up, entrepreneurs, SMEs, etc.), 2 in each country, on the topics of Innovation Management and Transnational Partnership;
- 3 trainings for researchers, 1 in each country, on the topics Innovation and Knowledge Support and IPR Management;
- 3 trainings for multiplicators, 1 in each country, about Training the trainers, to prepare future project promoters and information disseminators;
- Preparation of 6 business plans, 2 in each country, as demonstration for companies in the field of renewable energy and energy efficiency;
- Preparation of at least 8 innovation audits per country, to investigate the potential for innovation and TT of companies in the field of energy;

- 2 consultancy projects per country with respect to IPR issues in companies;
- Various handbooks and brochures to further disseminate knowledge and bring together stakeholders from the EU and the EaP. Best Practices Methodology, Handbook for services in IPR and Innovation Management, Brochure related to financing issues in Technology transfer and Innovation, Brochure related to technical assistance services related to market access, etc.

All these activities have been geared towards providing a bridge in the field of renewable energy and energy efficiency, both between researchers and business people, but also between EU and EaP countries. The deliverables and event reports of the project are available in extenso on the project website: www.no-gap.eu

The current report is based mostly on the activities of Task 3.1 - trainings for researchers, Innovation and Knowledge Support, IPR Management which has experienced 54 participants in the events, who have received training handbooks and have been registered into the project communication means (email groups, Facebook page). Together with the above activities and their related participants, an overview of the TT environment in the three countries could be achieved, in which the existing information sources have been filtered through our own experiences.

During these activities we have had the opportunity to meet a considerable number of researchers (>50), business people (>90) and project promoters (>60), and discuss many of the issues presented and analyzed in this document. Also, so far a number of 8 companies / NGOs have been visited by project members and innovation audits have been performed for 20 organizations (activities are still undergoing). Based on these, some conclusions and recommendations can be made.

So far, the INCO projects, as well as other project funded by the EU to foster cooperation with the EaP Countries, have been met with enthusiasm and are progressing nicely. However, their reach is still reduced and they impact mostly people who are prepared to receive this type of assistance. Therefore, we consider that the EU, together with the governments of these states, should **extend the scope, duration and available budget for this type of projects**. As public finances are strained, it might be of interest to attract private financing into scheme of public-private partnerships. The directions upon which the projects can focus are very diverse, but education, research and development, innovation support, technology

transfer and entrepreneurship should be amongst them. The ultimate goal of such collaboration would be ensure that the countries in EU neighborhood represent robust partners for the countries within the union. For this, the citizens need security and welfare, and companies need business opportunities.

A possible direct instrument which can be made available rather soon is the use of H2020, COSME and other current programmes of the EU to **expand upon the ways they fund cooperation within the EaP**. Also, synergies should be established with national funding there, as well as with other international funding taking place. It would be of interest to see more project funded locally (by one or more governments in the area) that require participation from more EaP countries, in order to help create a climate of cooperation among themselves, beside the cooperation with EU and other international partners. This is applicable to TT as well as other areas.

With respect to implementing specific improvements to the TT environment, it would be important for the three EaP countries to **align their policies (i.e. their legal system) with the current practices within the EU**. More than just adopting new laws, this task should be followed by a prolonged and constant educational and dissemination effort, until the institutions and mechanisms are both functioning on their own and are known and accepted by the large mass of potential users.

An important means of ensuring more cooperation is to stimulate and **fund mobility of people**, especially young people, through programs such as Erasmus+. A constant exchange of persons and ideas is perhaps the best way to ensure future generations will grow closer together in ideas and action, as it is already considered in the European Union where the Erasmus programme is credited with contributing to creating a new generation of European citizens, for which national lines are blurred and European consciousness is accentuated.

Until communication will be eased up by the increasing number of speakers of foreign languages, it would be wise to ensure that all information and knowledge (e.g. knowledge passing through the international TT process) is **translated in the national languages** or in Russian. This is an arduous task (event when it is applied for the 24 languages inside the EU), but it could be incorporated within the framework of the future projects or relegated to machine automated translation. In any case, availability of information that is easily accessible

would considerably increase the involvement of partners from the EaP countries, as well as the common results obtained in various endeavors.

Perhaps the most important change that could be implemented is to draw in this effort not only the researchers and the industry or economic environment, but also the various government agencies and ministries that could implement legislative and executive changes in the TT environment in the three countries. **The model of the Triple Helix** is a well-known approach to stimulating cooperation within an innovation ecosystem and its achievement in the studied countries of Georgia, Ukraine and Belarus could spell out significant improvement for the TT system in terms of institutions, competitiveness, workforce occupation, financial flows, etc. We believe, in this context, that an important role will be reserved also for NGOs seeking to stimulate and support technology transfer in order to plan and animate this landscape. A triple helix approach only functions properly when all three components are present and proactive, so we believe that an approach of going together from “small victories” to fully fledged projects will yield the best results in the long run.

5. Acronyms

CBC – Cross-Border Cooperation
CIS – Commonwealth of Independent States
EaP – Eastern Partnership
EEAS – European Union External Action Service
ENI – European Neighborhood Instrument
ENPI – European Neighborhood and Partnership Instrument
EU – European Union
FP7 – European Union's Framework Programme 7 for Research and Techn. Development
INCO – International Cooperation
IP – Intellectual property
IPR – Intellectual property rights
NGO – Non-governmental organization
NTTN – National Technology Transfer Network (Ukraine)
RCTT – Republican Centre for Technology Transfer
TTCG – Technology Transfer Center of Georgia
WIPO – World Intellectual Property Organization

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