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TECHNOLOGY TRANSFER IN UKRAINE 2019-2020

SCIENCE, TECHNOLOGY, INNOVATION

Joint Research Centre

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Introduction

The present report contributes to the European Commission's commitment of bringing the EU and its neighbours closer. The EU's European Neighbourhood Policy was launched in 2004 to help the EU support and foster stability, security and prosperity in its closest neighbourhood, and it governs the EU's relations with 16 of its closest Eastern and Southern Neighbours.

The EU is committed to supporting the economic development of its partner countries. Technology transfer represents a central area where distinct sections of society including academia, private research, government and public and private enterprises interface with one another to improve the overall economic and social conditions for those involved and the communities around them. By investing in the facilitation of technology transfer, governments can direct policy and funds to ensure the greatest outcome for society. With this process in mind, the ultimate objective of the present study is to inform policymaking in technology transfer and build stronger cooperation between the EU and its Eastern and Southern neighbours.

Methodology

The Competence Centre on Technology Transfer of the Joint Research Centre launched this study to conduct a brief diagnostic analysis and comparative overview of the state of Technology Transfer in twelve Eastern and Southern neighbouring countries, including Armenia, Azerbaijan, Belarus, Georgia, Republic of Moldova, Ukraine, Algeria, Egypt, Jordan, Lebanon, Morocco and Tunisia.

The study describes the main characteristics of the landscape, including relevant stakeholders, players and technology transfer models, identifies strengths and weaknesses of the ecosystem, and provides conclusions and recommendations for each country, with the aim of informing policymaking in this domain.

To achieve this objective, the Expert Group commenced with a desktop review to gather, examine and understand relevant policies, laws and literature concerning technology transfer in the respective study countries. This preliminary phase was employed in order to characterise the status of the technology transfer in the region, to identify the key stakeholders, crucial issues and possible areas of improvement.

Secondly, the identified issues served as guiding material in the design of questionnaires for relevant stakeholders. The list of stakeholders included: Government bodies (Ministries with role in intellectual property and innovation, *i.e.* Ministry of Science, Education, Economy, etc., Innovation Agencies), Universities, Academies of Sciences (management, technology transfer offices, researchers), Industry (incubators, science and technology parks, companies), and private investors.

On-site interviews with stakeholders took place in some of the study countries before March 2020, however, in order to respect health and safety concerns of the Coronavirus disease (COVID-19), all interviews that took place after March 2020 were online via video conferences. Both the information from questionnaires and interviews helped as source data for the diagnostic country reports – an analysis of the technology transfer ecosystem and country specific recommendations.

Lastly, the study will conclude with a benchmark report to detail some of the similarities and differences between the countries to give relevant comparisons.

EXECUTIVE SUMMARY

Government

Technology transfer (TT) from publicly funded research organisations does not currently play a central role in the national economic strategy for Ukraine. Policy towards innovation and, by extension, towards TT from Public Research Organisations (PROs), is the remit of a number of different Ministries and associated strategies, although coordination between policy makers is not always optimum and so policy initiatives do not reach all the different stakeholders *e.g.* PROs, start-up companies and small and medium enterprises (SMEs).

A number of reforms have recently been implemented as a follow up to the 2017 Policy Support Facility (PSF) Peer Review Report. The Government is allocating increasing resources to support research and the recent 2018 European Research Area (ERA) roadmap foresaw the creation of a National Research Foundation (NRF) to be a powerful instrument of project (grant) financing for all sectors of Ukrainian science.[1] The NRF has been provided by the government with a financial allocation which is ten times more than what is currently allocated to fundamental research.

A comparative analysis of the innovation ecosystem in the country was undertaken in 2018 by the Ministry of Education and Science. The findings are shaping the new 'Strategy of the Development of Innovation Activity' (ongoing June 2019). Amongst the main strengths identified for the country were (1) high local market capacity, (2) high quality of higher, professional and vocational education, and (3) high human capital in technical areas, which effective realisation could provide the country with a competitive advantage. The review also revealed that the innovation process and TT in the country have shown negative growth since 2015, and the ecosystem is deteriorating rapidly. The main barriers to TT that this review identified were a) weak institutional support of the innovation process and relative absence of supportive political, regulatory and legislation frameworks and b) undeveloped and underfunded innovation infrastructure.

The country is also in the process of conducting systematic legislative reforms, with the overall aim of improving the science, technology and innovation system. There is a comprehensive legislative framework that addresses ownership and remuneration, but this is not always consistent, leading to ambiguity and uncertainty for those using the framework, and potential conflict regarding ownership and commercialisation rights.

Overall, the present legislative environment is regarded as being 'overregulated' to the point of inhibiting TT activity and in need of reform and improvement[2]. In contrast, Rule of Law in this field is still regarded as weak with the lack of special Intellectual Property (IP) courts and enforcement acting as a disincentive for TT to make use of the national regulatory system. In 2016, the Parliament of Ukraine adopted a law on reforming the national judicial system, which provides for establishing a High Court on Intellectual Property Issues as a court of first instance for copyright, trademark, and patent disputes. However, despite the target date of 2017 the court is not yet functioning.

1 In 2019, the Procedure for Competitive Selection and Financing of Research and Development Projects by the National Research Fund was approved. In 2020, the first two NRF competitions were held – "Science for the safety of peoples and society" and "Support for research of leading and young scientists".

2 Update: since the initial research work was completed, the Government of Ukraine has approved the Strategy of Innovation Sphere Development till 2030 (July 2019): https://zakon.rada.gov.ua/laws/show/526-2019-%D1%80?lang=en#Text

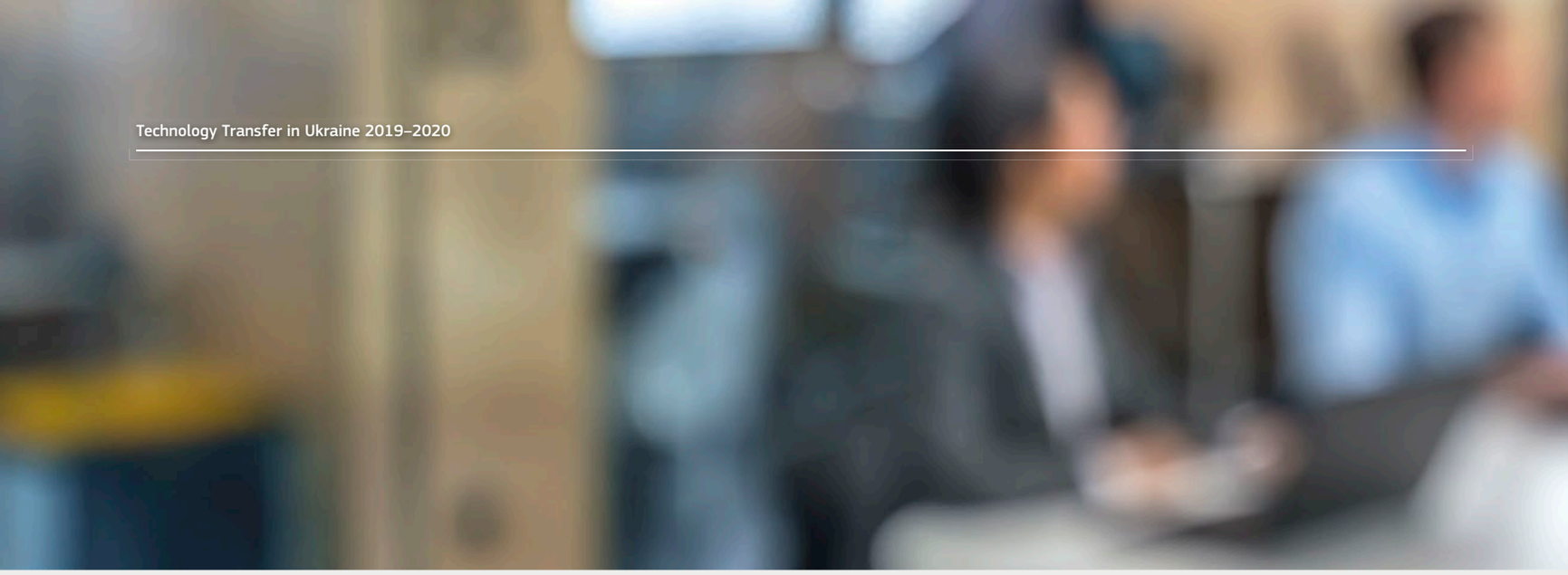
Universities and Research organisations

Intellectual property plays a role in the evaluation, ranking and therefore funding of PROs and in career progression of researchers; this provides an incentive to disclose new inventions and file for patent protection. However, the present lack of a rigorous and robust methodology within PROs for appraisal of inventions for technological and commercial potential, and significantly lower rates for utility models vs utility patents results in a high number of protected 'minor inventions' *i.e.* minor improvements of existing products with low innovative factor and/or low commercial value.

Most PROs have an internal IP policy to regulate ownership and benefit sharing. However, required use of the policies *e.g.* to share revenue with an inventor, is reported to be very low, assumed due to the low level of commercialisation of inventions. Current legislation restricts use of income from sale or licencing of innovations to activities that are foreseen in the general budget for the PRO. Use of IP licencing to develop more financial independence is therefore limited under the present system. Staff in Technology Transfer Offices (TTO) are weighted towards legal protection rather than marketing and transfer.

Few PROs have internal funds to maintain patents in the domestic system or to seek protection abroad without an international partner to help cover costs, guide prosecution and drive the commercialisation in return of a share in the profits. Publishing a patent application enables domestic companies to freely harvest ideas without fear of infringement action. Some PROs deliberately avoid the Intellectual Property Right system (IPR) and focus on contract research that will transfer the technology without the need for a patent but with some level of remuneration.

Overall, interaction between the business and research sectors is weak. PROs suffer from a weak entrepreneurial and research commercialisation culture and poor incentives for collaboration. Most Ukrainian academics are not entrepreneurial and this skill set is not presently being taught or nurtured in young researchers. Lack of information on opportunities for cooperation, high costs faced by organisations in search for partnerships, lack of commercial orientation among research institutes and universities, and inefficient TT infrastructure have all been identified as hindering collaboration opportunities (World Bank Group, 2017a). Ukraine's state policies aim at closing this gap through different strategies including: creation of research infrastructures for joint use by different research organisations, creation of organisations facilitating TT, provision of grants to promote research & development (R&D) cooperation between universities and research centres, and establishment of technology parks.



Industry

According to the State Statistical Service of Ukraine (SSSU), in 2015, Ukrainian companies bought 1 131 new technologies, while they sold only 98. Less than 20% of these technologies were bought from abroad, the rest came from domestic organisations. 44% of new technologies were received in the form of new equipment, 38% in the form of R&D results. Only 11% of the cases of TT are associated with the purchasing of patents and the obtaining of licences.

The local private sector is neither a leading technology supplier nor a source of demand for IP. They do not conduct activities that would create demand for R&D from PROs; there are few policy instruments to stimulate demand and linkages with PROs are weak. Some TT to domestic companies in Ukraine from PROs is taking place as evidenced by the reports of technology licensing, collaboration and contract research. However, revenue from such 'sale of a licence' is extremely low. International transfers are very low although some interest is being shown by China as part of their Belt and Road Initiative (BRI).

While graduate start-ups are on the increase, classical 'spin-off' where the PRO holds an equity stake in a company has been challenging to adopt in Ukraine, due to legislative restraints on the activities of universities, including their ownership of other companies.

Support organisations

Overall, the National Innovation System (NIS) in Ukraine is at an early stage of development. The start-up and entrepreneurial ecosystem has been described as 'promising but nascent' (World Bank Group, 2017). Some universities have used the legislative framework to establish incubators and these are able to hold an equity stake in a spin-off company on behalf of the parent organisation. There are examples of accelerators although these are largely the result of international donor projects. The country has an established Angel Network and evidence of venture funding and as well as of private investor activity by successful business people from the Diaspora.

Technology transfer

TT from PROs to domestic and international companies is reported to be ‘very low’ in Ukraine. Enterprise demand is low and supply side interest is very limited. TTOs do exist but focus on protection rather than transfer. Current legislation is more inhibiting than catalysing, and the policy mix does not yet include a mixture of stimulating financial and non-financial instruments. There is little evidence of frameworks, guidelines or internal expertise within TTOs or TT support bodies for invention appraisal for commercial potential, technology marketing, or IP valuation. The Ministry of Education and Science is committed to making TT a stronger part of national strategy; however, reforms are slow and are not prioritised by the current Cabinet.

GENERAL FINDINGS

Government

Relation of technology transfer with national economic strategy

TT from publicly funded research organisations does not currently play a central role in the national economic strategy for Ukraine. When considering this situation and benchmarking with other countries it is important to bear in mind the ongoing situation caused by the Russian military intervention in Eastern Ukraine that started in February 2014 and its associated funding needs, and the multiple changes in political leadership that have taken place in the last decade.

Policy towards innovation and, by extension, towards TT from PROs, is the remit of a number of different Ministries and associated strategies, including the Ministry of Economic Development and Trade who has overall authority for applied research, innovation and TT, the Ministry of Education and Science who oversees basic research, and the Ministry of Culture.

Despite a number of attempts to bolster innovation activity in the country, this has not yet been successful. The state economic programme "Creation of the innovation infrastructure in Ukraine 2009-2013" did not receive any financial support from the state budget. As a result, none of the planned activities were carried out, and the state initiative of developing a system of informational and analytical support for innovation policy and monitoring the state of the economic development of the innovation ecosystem was not fully realised. The activities, prescribed by the plan for developing innovation policy in 2015-2019 in the Cabinet Decree 575-p from 4th June 2015, developed for one isolated centralised unit of governance, have not been realised due to a lack of integration into the overall system and non-involvement of other Ministries in its effective function. In addition, these activities did not have the support from the wide circle of interested parties – business, community and academia.

One of the key points of the Medium-Term Priority Action Plan to 2020 (approved by the order of the Cabinet of Ministers of Ukraine dated April 3, 2017 No. 275-p), is an expansion of financial support for R&D projects and scholarship with programmes for young scientists.

Ukraine
Research support

The Government has provided
the NRF
National Research Foundation

with a financial allocation
X10 more
than what is currently allocated to fundamental research

The Government is allocating increasing resources to support research and a number of reforms have also been implemented as a follow up to the 2017 PSF Peer Review Report. The recent 2018 ERA roadmap foresaw the creation of a National Research Foundation (NRF) to be a powerful instrument of project (grant) financing for all sectors of Ukrainian science and this has now taken place. The NRF has been provided by the government with a financial allocation which is 10 times more than what is currently allocated to fundamental research.

The 'Strategy of the Development of Innovation Activity until 2013' is presently under review (June 2019[3]), following comparative analysis of the innovation ecosystem in the country in 2018 by the Ministry of Education and Science. Amongst the main strengths identified for the country were (1) high local market capacity, (2) high quality of higher, professional and vocational education, and (3) high human capital, which effective realisation could provide the country with a competitive advantage. However, the Ministry noted that all these strengths are weakly implemented in national economic structure. The review also revealed that the innovation process and TT in the country have shown negative growth since 2015, and the ecosystem is deteriorating rapidly. The main barriers to TT that this review identified were a) weak institutional support of the innovation process and relative absence of supportive political, regulatory and legislation frameworks and b) undeveloped innovation infrastructure.

The revised policy draft was submitted to the Cabinet in January 2019 and a new strategy is expected to emerge in late 2019. This will seek to address the identified barriers and to improve the overall innovation ecosystem in the country as well as improve TT[4].

The country is also in the process of conducting systematic legislative reforms, with the overall aim of improving the science, technology and innovation system. The Law on Scientific and Technical Activity (adopted on 26 November 2016) is a starting point for endorsement of the reforms as well as for setting the conditions for building the ecosystem. Two other important Laws, adopted by the Verkhovna Rada of Ukraine, addressing national Science, Technology and Innovation (STI) priorities are the Law of Ukraine on the Priority Directions of Science and Technology (2010), which defines the national Science and Technology (S&T) priorities for the period 2010-2020 and the Law of Ukraine on Priorities in Innovation Activities in Ukraine (2011). Another forthcoming Law is the Law on Innovation (this Law will have the title Law on Support of Innovation Activities, as in the draft, submitted by the Ministry of Education and Science, which is still under preparation (June 2019).

Relation of technology transfer with national regulatory framework of IP

Ukraine has a relatively well-developed normative IP framework, which consists of the Civil Code, Law on Protection of Rights to Inventions and Utility Models, Law on Protection of Rights to Industrial Designs, Law on Copyright and Related Rights, Technology Transfer Law, Innovation Law, Law on Scientific and Scientific-Technical Activity, and Law on Higher Education. The normative framework follows the latest global developments in regulating IPRs, such as the main types of rights, their duration, and limitations/exemptions. Legislative changes to bring Ukraine closer to the EU IPR framework are also taking place; this may have a strong effect on domestic utility patents.

However, the existing legislative framework is not always consistent leading to ambiguity, uncertainty for those using the framework, and potential conflict regarding ownership and commercialisation rights. For example, according to the Technology Transfer Law, Ukraine has an institutional, automatic ownership system for publicly funded technologies. The Technology Transfer Law specifies that the PRO is the first owner of the IPR over publicly funded technologies, except in the case of secret technologies. There are no reversion rights to the employee-inventor. In contrast, the Law on Inventions and Utility Models stipulates that, under certain circumstances, the ownership rights can revert to the inventor.

3 Update: since the time of investigation, the Government of Ukraine, in July 2019, approved the Strategy of Innovation Sphere Development till 2030. See Recent Policy Update.

4 Update: since the time of investigation, the Government of Ukraine, in July 2019, approved the Strategy of Innovation Sphere Development till 2030. See Recent Policy Update.

The issue of remuneration of researchers for invention disclosure is usually governed by contract law but also by the restrictions stipulated in the Technology Transfer Law (Article 19 that stipulates the main conditions for TT contract formation). The Technology Transfer Law provides for monetary incentives for researchers to disclose their inventions to the PROs. The law stipulates that the PRO should remunerate the researcher in the amount of the economic value of the technology, or based on the value of other benefits that the PROs may be able to obtain from the use of the technology (Article 11). The Cabinet of Ministers of Ukraine establishes the minimum rates of remuneration[5].

OVERALL, THE PRESENT LEGISLATIVE ENVIRONMENT IS REGARDED AS BEING 'OVERREGULATED' TO THE POINT OF INHIBITING TT ACTIVITY, AND IN NEED OF REFORM AND IMPROVEMENT.

5 On December 4, 2019, the Cabinet of Ministers of Ukraine approved Resolution No. 1030, which established minimum rates of remuneration for authors who created technologies.

In contrast, Rule of Law in this field is still regarded as weak, with the lack of special IP courts and enforcement acting as a disincentive for TT to make use of the national regulatory system. IPR protection standards in Ukraine are generally recognised to be considerably below the levels of many developed and developing countries, with significant counterfeiting across the Ukrainian economy (International Chamber of Commerce, 2014), including software, agrochemicals, pharmaceuticals, clothing, food, tobacco products and alcoholic beverages. Ukraine also has become a hub for massive digital copyright piracy of recorded music, films, software and books. There are anecdotal reports of PROs deliberately adopting a strategy of avoiding the national IP system entirely, to avoid publishing an enabling disclosure that can be freely adopted, and of working directly with domestic companies to transfer technology without the use of the IPR system. In 2016, the Parliament of Ukraine adopted a law on reforming the national judicial system, which provides for establishing a High Court on Intellectual Property Issues as a court of first instance for copyright, trademark, and patent disputes. Judicial decisions will be reviewed in the Court of Appeal within the chamber of the Supreme Court of Ukraine. However, despite the target date of 2017, the court is not yet functioning.

Relation of technology transfer with national IP and innovation strategy

Ukraine drafted a National Strategy for the development of the intellectual property field in Ukraine for the period up to 2020 but this has not yet been adopted and the country still lacks a unified, cross Ministerial Innovation Strategy. Currently, Ukraine is developing a National Strategy for the Development of Intellectual Property in Ukraine for the period 2020-2025[6]. Notably, one of the recommendations of the recent European Commission (EC) PSF review was that the country should develop a 'cross-governmental Research and Innovation Strategy and Action Plan, focusing on priority domains for science and technology-based innovation, including corresponding instruments aimed to facilitate economic growth and societal well-being by acknowledging the importance and exploiting the potential of science, research and innovation'.

Alignment of TT activities from PROs with national strategies and legislation will be challenging for policy makers due to the very high level of autonomy at Ukrainian Higher Education Institutions (HEIs) and the National Academy of Sciences (NASU). Universities are strongly focused on a teaching mission and facing a decline in student numbers; this in turn affects their main budget. The NASU is also extremely independent in its functioning both as an overall institution and at individual institute level. Strong drivers do not exist to induce alignment and rewards for reform and reorganisation are scarce under the existing policy mix.

INCREASED ALIGNMENT OF THE OUTPUTS OF PUBLIC RESEARCH ACTIVITY WITH IP PROTECTION HAVE BEEN ACHIEVED THROUGH THE INCLUSION OF PATENT FILING IN THE EVALUATION OF BOTH INDIVIDUAL CAREER PROGRESSION AND ORGANISATIONAL RANKINGS.

This has made the IP system more important to PROs and researchers than it was previously. But it has still not increased the drivers for research commercialisation and TT, and has had a negative effect on the quality and innovative strength of patented inventions due to prioritisation of utility models over utility patents. The increase in the TT activity is only likely to come with a general improvement of the ecosystem, including increased demand for domestic innovation, increased new technology adoption within industry, and improved rule of law relating to IP protection and monopoly rights.

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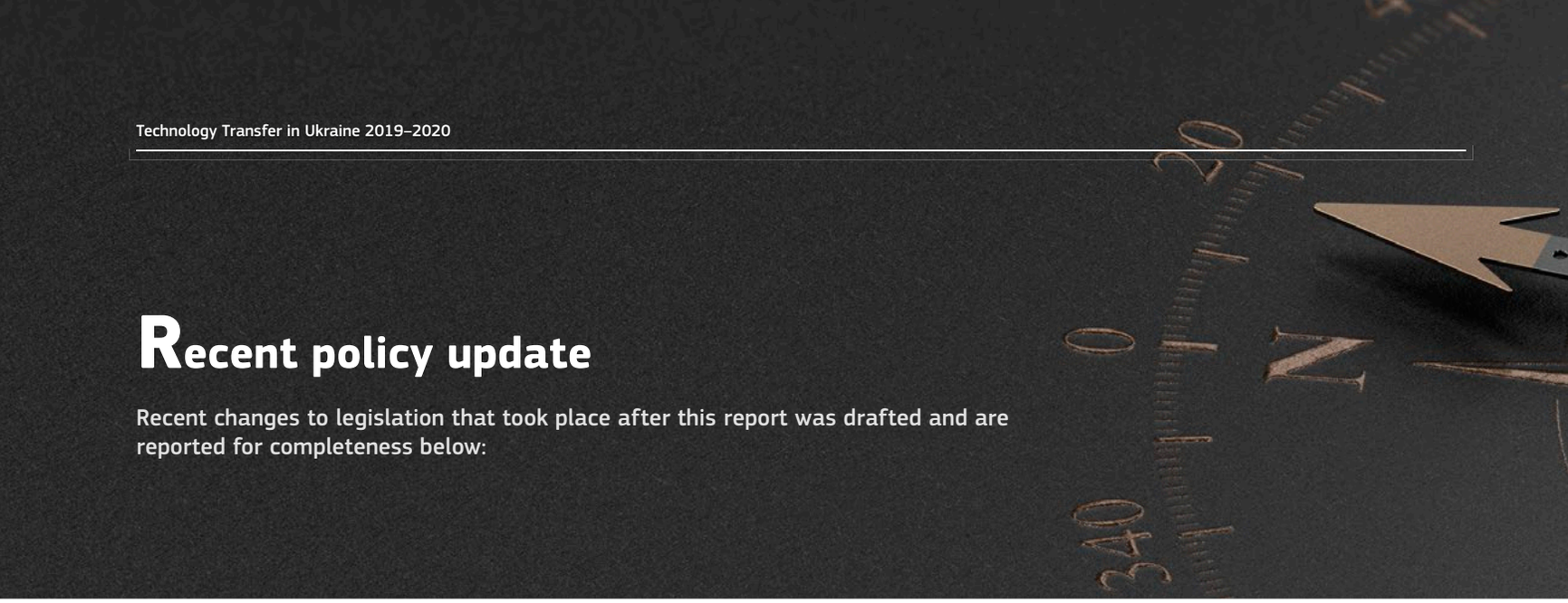
6 Available at (in Ukrainian): http://strategyip.info/



Recent policy update

Recent changes to legislation that took place after this report was drafted and are reported for completeness below:

Strategy of Innovation Sphere Development till 2030

In July 2019, the Government of Ukraine approved the Strategy of Innovation Sphere Development till 2030. This is the first such strategy document to be approved since Ukraine gained independence. The Strategy outlines the basic principles of state policy in the field of innovation and lists measures, which will help the country to reverse negative trends and create favourable conditions for innovators and inventors to transform their creative ideas into innovative products and services.

In order to ensure the implementation of the Strategy, the Ministry in collaboration with stakeholders, has developed a plan of measures for its implementation for 2020-2022. These define specific measures of innovation policy, as well as the authorities, which will be responsible for their implementation. After its final adjustment with interested ministries and other authorities, the Cabinet of Ministers of Ukraine will send the document for approval[7].

State Aid

The underlying legislation of Ukraine has been amended to provide opportunities for Ukrainian higher education institutions and business entities to receive financial support for innovation activities.

Resolution of the Cabinet of Ministers of Ukraine No. 981 (November 27, 2019) permits the provision of minor state aid (up to EUR 200 000 for three years) for higher education institutions and business entities. The minor state aid can be used to cover certain types of costs for innovative activities such as marketing research, the cost of obtaining security documents for intellectual property rights, consulting services of the using of intangible assets and transfer of innovations.

The implementation of this resolution will provide financial support to participants in EU research and innovation programmes, regardless of their legal form and subordination, which will stimulate the innovation activity of higher education institutions and small and medium-sized enterprises.

Cooperation between science and business will be intensified. The Ministry is developing regulations for the competitive selection of projects that will be able to receive this aid. The first competitive selection of projects is scheduled for December 2020.

Intellectual property

At the beginning of February 2020, the Verkhovna Rada of Ukraine adopted laws aimed at improving the protection of intellectual property rights in Ukraine, namely:

- "On Amendments to Certain Legislative Acts of Ukraine on the Establishment of a National Intellectual Property Authority"(No. 2255) "On Amendments to Certain Legislative Acts of Ukraine on the Establishment of a National Intellectual Property Authority"(No. 2255); The Law was subsequently signed by the President on 07/10/2020[8];
- "On Amendments to Certain Legislative Acts of Ukraine on Strengthening the Protection and Protection of Trademarks and Industrial Designs and Combating Patent Trolling"[9] (2258); The law was signed by the President on 21.07.2020 and entered into force on 16.08.2020.
- Draft Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine (on Reform of Patent Legislation)" (No. 2259); The Law was subsequently signed by the President on 08/14/2020[10]; The law was signed by the President on 21.07.2020 and entered into force on 16.08.2020.

7 https://zakon.rada.gov.ua/laws/show/227-2016-%D0%BF?lang=en#Text
8 See https://zakon.rada.gov.ua/laws/show/703-20?lang=en#Text
9 Available at: https://zakon.rada.gov.ua/laws/show/815-20?lang=en#Text
10 Available at: https://zakon.rada.gov.ua/laws/show/816-20?lang=en#Text

Increased rewards for innovators

The government has increased the remuneration for the inventors of those technologies, which are being implemented in the real economy.

On December 4, 2019, the Cabinet of Ministers of Ukraine approved Resolution No. 1030[11], which established minimum rates of remuneration for the creators of new technologies. The rates are approximately 20% of the funds received by their institutions from the conclusion of TT agreements, as well as a minimum rate of remuneration for specialists from TT offices equal to 2% of the funds received from institutions from the conclusion of TT agreements.

Previously, the minimum aggregate remuneration rates for the inventors of new technology and specialists from TT offices ranged from 0.5% to 3% of the funds received from agencies from TT agreements. This increase in remuneration is designed to encourage inventors and innovators to communicate with potential investors and search for opportunities to use technologies created from the public budget, in the 'real' economy.

Use of the National Research Fund

The Cabinet of Ministers of Ukraine approved the procedure for using the funds of the National Research Fund of Ukraine (Resolution No. 1007, adopted on December 4, 2019[12]).

The Government also determined the procedure for competitive selection and funding by the National Research Fund, of Research and Development Projects (Resolution No. 1170[13], adopted on December 27, 2019).

Ukrainian Start-up Fund

The Ukrainian Start-up Fund was launched and is funded through the state budget of Ukraine. In December 2019, the first call for projects was announced[14].

11 Available at: https://zakon.rada.gov.ua/laws/show/1007-2019-%D0%BF?lang=en#Text
12 Available at: https://zakon.rada.gov.ua/laws/show/1007-2019-%D0%BF?lang=en#Text
13 Available at: https://zakon.rada.gov.ua/laws/show/1170-2019-%D0%BF?lang=en#Text
14 Available at: https://usf.com.ua/en/#usf-sc-1

Universities and research organisations

Most PROs do have an internal IP policy to regulate ownership and benefit sharing, and this has been supported by the World Intellectual Property Organization (WIPO) Universities Initiative

Intellectual Property

As outlined above, intellectual property plays a role in the evaluation of PROs and in career progression of researchers, and this provides an incentive to disclose new inventions and file for patent protection. Innovation is also a tradition for the National Academy of Sciences. Most PROs do have an internal IP policy to regulate ownership and benefit sharing, and this has been supported by the World Intellectual Property Organization (WIPO) Universities Initiative. However, required use of the policies *e.g.* to share revenue with an inventor, is reported to be very low. Current legislation means that money that returns to the PRO from licencing may need to be spent only on activities that are foreseen in the general budget *e.g.* linked to an existing approved budget line for a PRO, and therefore predominantly linked to teaching activity. Use of IP licencing to develop more financial independence is therefore limited under the present system.

Staff at TTOs and associated units are traditionally weighted towards securing legal protection rather than transferring it to the commercial sector for economic benefit. Patent filing fees have risen sharply in recent years, but they are still low in comparison to EU countries and at a level where institutional filing is still attainable. The increase in filing fees, especially for utility models, may encourage higher quality filings and reduce 'vanity' patenting for career progression.

Few PROs have internal funds to maintain patents in the domestic system or to seek protection abroad *e.g.* by filing with the United States Patent and Trademark Office (USPTO), European Patent Office (EPO) or using the WIPO administered Patent Cooperation Treaty (PCT) route. While a licence to some patents can be 'sold' to domestic companies and the royalties used to maintain the patent, the lack of rule of law to address infringement means that the patent may be used by other domestic companies, without any payment to the PRO or the benefit of the monopoly right for the licensee. Universities see the risk of publishing an enabling disclosure through a patent filing and suspect that some domestic companies use patent databases to 'harvest' ideas, knowing that either the patent will be allowed to lapse or that no effective action can be taken against infringement. Some PROs have managed to secure patents in other territories but this has largely been dependent on having a local partner *e.g.* a US PRO, who will help get the patent through the US system and assist in commercialisation, in return for a share in profits. Such partnerships have been seen to arise through research collaborations *e.g.* H2020, and could be the basis for institutionalising a partnership between PROs and their TTO unit with the international partner acting as the broker for a Ukrainian university.

Contract research

Undertaking contract research for companies is a tradition for the National Academy of Sciences of Ukraine but much less so for the universities. This partly reflects the level of demand from the private sector, but also the time available to undertake such work by teaching staff and their interest in this activity. Support exists to help draft contracts, but cultural differences between the public and private sector and the tendency for PRO research to focus on fundamental/basic science also affects demand.

Collaboration with industry

Collaboration with industry is perceived to be a better method for transferring technology in Ukraine than the Westernised model of licencing IPRs. Once again, the model is most established within the NASU but the Ministry of Education and Science sees the future of such activity to be within universities. This will require a strong change in culture and in the role and remuneration of university teaching staff.

There are scientific areas that have been identified as having particular strengths for the country, including nuclear physics and agriculture, but there will need to be a pivot towards more applied research if universities are going to become the R&D partner for domestic and international companies.

Overall, PROs suffer from a weak entrepreneurial and research commercialisation culture. Innovation capacity of research organisations and poor incentives for collaboration hinder potential cooperation between science and industry. The interaction between the business and research sectors is weak. Lack of information on opportunities for such cooperation, high costs faced by organisations in search for partnerships, lack of commercial orientation among research institutes and universities, and inefficient TT infrastructure have all been identified as hindering collaboration opportunities (World Bank Group, 2017a). Ukraine's state policies aim at closing this gap through different strategies including: creation of research infrastructures for joint use by different research organisations, creation of organisations facilitating TT, provision of grants to promote R&D cooperation between universities and research centres, and establishment of technology parks. However, the lack of state funding provided to support the commercialisation activity of the projects residing in the technology parks has resulted in a very limited output of such organisations to date.

Faculty and researchers

Science and teaching as a profession was traditionally highly regarded in Ukraine under the Soviet system but this is changing. More graduates are choosing to seek employment in the private sector where remuneration and opportunities for career advancement are higher. The average age of researchers is increasing, particularly in the NASU, and brain drain to other countries including Poland, the USA and Israel has played a significant role in weakening the science base.

Universities primarily employ lecturing staff who are able to undertake some research if they have time around teaching duties and can secure a grant. However, grants for research are very limited. The NASU employs more scientists who are primarily hired to carry out research activities. Most Ukrainian academics are not entrepreneurial and this skill set is not presently being taught or nurtured in young researchers. Some educational classes that historically covered IPRs were lost when the Bologna process was introduced and the number of mandatory classes needed to be reduced.

Start–ups / spin–offs

Graduate start-ups in Ukraine are on the increase, supported by a number of incubator and accelerator programmes across the country. These are largely funded by international organisations but there are domestic examples of universities who are driving an entrepreneurship programme for their students and young researchers *e.g.* the Kyiv Polytechnic Institute "Sikorsky Challenge".

CLASSICAL SPIN-OFF WHERE THE PRO HOLDS AN EQUITY STAKE IN A COMPANY HAS BEEN CHALLENGING TO ADOPT IN UKRAINE DUE TO LEGISLATIVE RESTRAINTS ON THE ACTIVITIES OF UNIVERSITIES, INCLUDING THEIR OWNERSHIP OF OTHER COMPANIES.

Some universities have found ways to circumvent this constraint *e.g.* by wholly owning an incubator that then takes small and dilutable equity shares in spin-off companies. Spin-off from the NASU is also at an early stage of development, with some pilots taking place under projects, including those funded though the EU. Service companies that might be regarded as spin-offs have long existed. Such companies are largely established to offer services to commercial companies, based on the R&D facilities of the Institute. They are not intended to break free of the parent and tend to be strongly size limited. Legislative reforms to improve the environment for spin-off/start-up activity are currently taking place.

Funding and support for start-up/spin-off[15] exists with many universities using the national legislative framework to establish their own incubators. PRO incubators are highly dependent on securing project-based funding or relying on the parent institution. There are also a number of private accelerators and incubators. These are concentrated in the main cities, predominantly have a strong Information and Communications Technology (ICT) focus and do not often have a tangible link to a specific PRO. Some PROs have established connections with individual private investors. These tend to be alumni who have acquired significant wealth abroad and are interested in reinvesting it in companies emerging from their alma mater. These business angels are also able to mentor early stage companies and help them to enter international markets.

15 Ukrainian Start-up Fund update presented in Recent Policy Update.

Industry

Technology transfer with PROs

According to the World Bank, the local private sector is neither a leading technology supplier nor a source of demand for IP. They do not conduct activities that would create demand for R&D from PROs; there are few policy instruments to stimulate demand and linkages with PROs are weak.

According to the SSSU, in 2015, Ukrainian companies bought 1 131 new technologies, while only 98 were sold. Less than 20% of these technologies were bought from abroad, the rest came from domestic organisations. 44% of new technologies were received in the form of new equipment, 38% in the form of R&D results. Only 11% of the cases of TT are associated with the purchasing of patents and the obtaining of licences.

The privatisation of many large national companies and the loss of linkages with companies in the ex-Soviet Union has reduced demand for new technology from PROs. There is an increasing tendency for domestic companies to buy fully developed solutions from abroad rather than investing in developing technology themselves with the aid of a university or research institute.

Some TT to domestic companies in Ukraine from PROs is taking place as evidenced by the reports of technology licensing, collaboration and contract research. However, revenue from such 'sale of a licence' is extremely low. There is much less evidence of international companies using Ukrainian PROs as a source of new technology, although they do see the country as a destination to recruit young programming talent.

Possible demand from companies in China is being explored through the Belt and Road Initiative (BRI) with the understanding that the Chinese commercial partner will support prosecution of a counterpart patent for China. However, Chinese companies are also seeking technology with a high Technology Readiness Level (TRL) and where this is not present they require that national researchers relocate to China to support the transfer. This is not a welcome option for the Ukrainian research community.

Identified barriers on the "demand side" include insufficient interest in R&D activities from the side of the economic actors; lack of awareness and capacities of SMEs to undertake innovation; a need to reinforce managerial competences in start-ups established by scientists and technicians; lack of visibility and understanding of the potential in Ukrainian PROs from the side of companies; public authorities not ready to use STI results in their field (*e.g.* acting as "first buyer of innovation") (European Commission, 2014).

IP awareness / knowledge of the IP system

Professional advice and support to use the IPR system is available but this is very strongly focused in the capital. Companies are aware of the potential benefits of the system but also of the associated expenses and the high risk of patent infringement in Ukraine.

Obtaining international protection is made complex by the differences in national systems and the need to translate and adapt the original Ukrainian language application.

THERE WOULD BE BENEFIT FROM ESTABLISHING AND PUBLICISING A NETWORK OF UKRAINIAN SPEAKING, US BASED IP ATTORNEYS WHO WERE ABLE TO ASSIST UKRAINIAN COMPANIES TO OBTAIN A COUNTERPART PATENT IN THE USA.

Relation with PROs

Some companies are open to the idea of working with PROs to develop new technology, but those working at the cutting edge of new technology do not see a good fit between their own needs and the quality and focus of research being performed at universities. They are more likely to consider a relationship with an excellent research team abroad than one in their own country. International PRO collaborations both provide access to and partnerships for non-domestic grant funding *e.g.* H2020, as well as potential access to wider distribution and end user networks.

Support organisations

Ukraine does have an emerging innovation support ecosystem and this has been affected in different ways by the ongoing conflict with Russia in the Eastern part of the country. International donor projects have shifted west, focusing their activities on Kiev, Lvov and Odessa and withdrawing as much on-the-ground support from cities like Kharkov and Donetsk: this has affected some incubator and mentoring initiatives. In contrast, awareness, availability and use of crowdfunding has been accelerated by the conflict, with the establishment of platforms such as the People's Project[16].

Legislation makes it possible for PROs to establish wholly owned incubators and these are then able to operate an accelerator model of holding small equity stakes in start-ups. However, funding for incubators and S&T Parks remains challenging with many being reliant on securing projects for financing; this business model then dictates the aims, objectives and activities of the organisations for the duration of the project. The following paragraphs highlight noteworthy examples of existing infrastructure of innovation support in Ukraine.

Acceleration has emerged in the last five years with international accelerators including Growth Up, International Seed Forum and iHUB as well as national ones like Politeco - the business incubator of "Kyiv Polytechnic Institute" (KPI). Happy Farm and WannaBiz also launched start-up accelerators, in Ukraine (Kiev and Odessa respectively). Happy Farm has subsequently moved to Kazakhstan, and WannaBiz was transformed into a seed fund in September 2015 (see below).

Private Business Angels (BAs) and organised BA networks both exist and function in Ukraine including the UAngel network[17].

Accurate statistics on the number of active BAs are hard to obtain because individuals are reluctant to make statements about income and assets and, unlike the USA or UK, Ukraine does not issue any legal certification confirming the status of an accredited investor *e.g.* a Sophisticated investor or High Net Worth individual.

There is also evidence of larger venture funds operating for some sectors including life science, (health and medical care) and digital. These include TA Ventures, WannaBiz (see above) and AVentures. In parallel, Ukraine has also seen the emergence of organisations like the Ukrainian Venture Capital and Private Equity Association[18] (UVCA) to promote this activity.

Some formal linkages do exist between these support organisations and PROs, for example, Kyiv Polytechnic Institute has systematically developed its own micro-ecosystem in a series of phases, fuelled strongly by the Sikorsky Challenge. But many PROs still do not have any formalised linkage to an incubator and there is no link between formal teaching and applied entrepreneurship. Even more importantly, with the exception of KPI, there is no systematic attempt to use the ecosystem to help PROs to transfer their technology through start-ups and spin-offs.

Overall, the NIS is at an early stage of development. The start-up and entrepreneurial ecosystem has been described as 'promising but nascent' (World Bank Group, 2017).

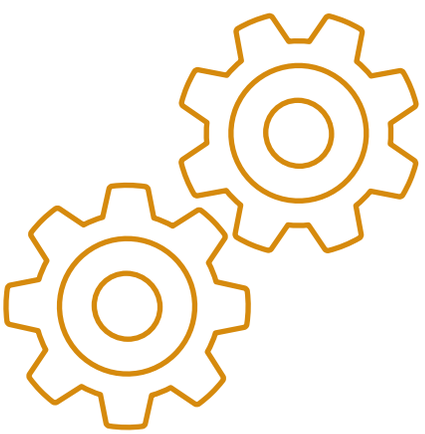
16 See https://www.peoplesproject.com/en
17 See http://uangel.com.ua/
18 See http://www.uvca.eu/en

Key points of technology transfer activity in the country

TT in Ukraine has historically been the remit of the NASU and their individual institutes. The present Ministry of Education and Science sees this role as shifting to the universities in the future.

Ownership of research results funded by the State budget can be claimed by the research institute and transferred by them to a new owner to facilitate commercialisation. However this situation is not without legal ambiguity due to overlap in the present legislative system, and the different laws that address the issue of different forms of industrial and artistic IPRs. Some researchers adopt 'Professors' Privilege' and seek to commercialise their research independently of their employer.

Most universities in Ukraine have established IP Policies with revenue sharing schemes. Policies follow the practices proposed by the WIPO University Initiative. However, the present level of actual TT resulting in licencing or sale of IPR is reported to be very low and the policies themselves are not often required. When a transfer does result in financial return for a university, there is lack of legislative freedom and flexibility for it to be used for any other purpose or activities than those anticipated in the state budget framework for PROs. This reduces the incentive to engage in TT as a way to increase institutional financial autonomy.



PROs do report licencing technology to domestic companies although this is often done without the need for a patent. Published patent applications are regarded as an expensive way to publicise the technology available to the domestic market, without the hope of recourse under law if it is copied or infringed. Licencing to international companies is much less common: it requires IPRs to have been awarded in a foreign territory and there is very little funding available to pursue patenting abroad.

Most PROs in Ukraine have a unit that acts as a contact point for industry and supports researchers to protect their research through the IPR system. These units have a variety of names and vary considerably in size. The balance of skills in larger units is weighted towards protection and legal advice on contracts rather than marketing and transfer.

Alongside securing a monopoly right for transfer, the IP system is used alongside the journal system to help an organisation or a researcher to gain 'points' that will improve their relative ranking and position. Because of the low rule of law, lack of specialised IP courts and low internal funding for enforcement, this can create a tension between filing a patent that will create benefit in the points system for the PRO and researcher, and keeping it a secret so it cannot simply be freely replicated by companies from the published application, but could be sold as know-how in a controlled transaction.

THE MOST COMMON FORM OF TT IN UKRAINE IS VIA CONTRACT AND COLLABORATIVE RESEARCH WITH DOMESTIC COMPANIES.

This focuses more on knowledge exchange and use of specialised facilities and can take place without the need for the IPR system. This approach ensures an end customer but puts a stronger emphasis on bridging cultural differences between research and commerce, that are presently seen to be extremely large in Ukraine.

Spin-offs and start-ups to commercialise research are not common but instances do exist, particularly in larger technical universities and with Master's level student cohorts. Holding a small equity stake in a spin-off company is legally difficult for a PRO. They can achieve this by setting up a fully owned incubator company and then having the incubator hold stakes in start-ups and spin-offs. Legislative changes are anticipated that will make it easier for universities to start new companies in the future.

Specialised funding to promote TT *e.g.* to increase TRL above 2 in the PROs, secure international patent applications, support university-industry collaborations, offer specialised training for TTO personnel or establish seed funds is not currently available from government sources. However, the topic is receiving significant more attention at present and there are initiatives to establish more centralised TT faculties under projects funded by the European Commission.

RECOMMENDATIONS

Based on the general findings of the team and the in-country interviews, a number of recommendations are made below for the development of TT in the country. These are divided between top-down legislative and policy reforms and some bottom-up suggestions for smaller pilot actions.

1. LEGISLATION

LEGISLATIVE REFORM

The present environment is considered to be 'over-regulated' to the point where it inhibits TT. It is recommended that the Government continues with its present programme of legislative reforms with a focus on simplifying legislation, reducing ambiguity and improving consistency between Laws related to individual and institutional ownership of research results. Particular areas where reform to encourage TT is recommended include rules related to use of licencing revenues and those restricting direct equity ownership by PROs in spin-off companies. Other inhibiting legislative issues relate to the legal requirement that the technology developer must pay the taxes on services, funded out of support grants, and restrictions on the use of a mix of public and private funds in TT-appropriate financial instruments.

To support this process the Government could consider using a working group from PROs and enterprises to offer feedback on the effectiveness of new legislation. If doing this, the Government could consider the example of Poland where the Polish Association of Centres of Technology Transfer (PACTT)[19] has emerged as a powerful 'sounding board' for national policy makers as they seek to improve the framework for TT in Poland.

LEGISLATIVE ENFORCEMENT

Rule of Law in Ukraine remains low in the area of intellectual property rights. This dissuades PROs and enterprises from making use of the IP system as a tool for transferring technology and realising commercial value from the associated rights.

It is recommended that the Government continues to push for the establishment of a special IP court and takes strong action to un-hold the rights of inventors and assignees of those registering industrial and artistic rights in the country.

2. POLICY

Several recent and substantial policy reviews, including the 2017 PSF, and 'Strategy of the Development of Innovation Activity until 2013' have recommended Ukraine to focus on priority domains for science and technology-based innovation, including 'corresponding instruments aimed to facilitate economic growth and societal well-being by acknowledging the importance and exploiting the potential of science, research and innovation'.

The expert team recommends that, as part of the review of their current policy mix, the Government and implementing Ministries and Agencies consider an annual funding stream from the state budget reserved for academic institutions for the purposes of TT by:

1. Provision of Proof-of-Concept funds to increase the TRL of scientific research beyond TRL2.
2. Capacity building for TTOs e.g. to help them develop skills and processes for invention appraisal, IP evaluation and protection, and licencing and spin-off creating activities. Capacity building could also be addressed through better networking of the Offices e.g. through a national network such as the PACCT mentioned above.

The latter could be used to help address the issue of internationalisation outlined below.

Incentives for the enterprise sector should also be revisited, including wider use of innovation vouchers schemes to support more knowledge exchange and R&D credits to encourage early adoption of emerging technology from PROs. A tax relief or a tax credit scheme for the R&D companies with high innovation impact, and institutional and private investors with early stage technology portfolios could also be considered.

Alongside the creation of policy instruments to support TT it also recommended that the present system incentivising disclosure and patent filing, linked to institutional and individual ranking and career progression, is revisited. Stronger recognition of international patenting activity, and also transfer of patent rights to a company with evidence of an associated revenue stream, could be used to encourage more patenting for industrial purposes and diminish patent

19 See http://pactt.pl/

filing used simply to improve an institutional ranking or advance an academic career. In this respect, Ukraine may find it helpful to benchmark their present approach with that of Poland, who are also experimenting with patenting activity in their metrics as a way to encourage more TT from their PROs.

In addition to the reform in IPR metrics, the following additional metrics for measuring the TT activity are suggested for consideration (Aridi & Cowey, 2017):

RESEARCH COMMERCIALISATION

1. total number of invention disclosures;
2. total number of licences under negotiation;
3. total number of licences granted;
4. total size of royalties received from the licencing activity;
5. total number of start-up and spin-off companies created;
6. total number of start-up and spin-off companies funded by the Proof of Concept fund of the PRO;
7. total amount of funding attracted by the start-up and spin-off companies, including both internal research grants and external funding i.e. EC, crowdfunding, angel investment, venture capital, etc.; and
8. number of start-up and spin-off companies that achieved a successful exit with the deal size indicated.

KNOWLEDGE TRANSFER

9. The total number and value of research contracts between the PRO and enterprises;
10. Number of and quality (impact factor) of publications resulting from collaborations with enterprises.

3. STRATEGIES TO SUPPORT INTERNATIONAL COMMERCIALISATION

INTERNATIONAL 'TWINNING' OF TTOS

Examples of successful commercialisation of technology originating from Ukrainian PROs have been linked to formal and informal commercialisation agreements involving a PRO and their TTO abroad. In this situation the international partner supports the costs and manages the national process of patent prosecution and commercialisation in their own territory in return for a share in profits.

It is recommended that PROs in Ukraine investigate 'TT twinning' with counterpart PROs abroad, especially where there is a good match in research strengths and ongoing or past research collaborations. Such an initiative could be supported in the early days by a specialised grant from the Ministry of Education and Science as part of their policy incentives mix.

Universities who have been open to formalising a role in the commercialisation of research from other PROs include Icahn School of Medicine at Mount Sinai (SIMMS) in the USA. There are also ongoing examples of twinning arrangements between Universities in the Western Balkans and Chinese counterparts.

NETWORKS OF UKRAINIAN SPEAKING IP PROFESSIONALS ABROAD

National and regional patent systems have their own particularities *e.g.* in the precise format or structure of the patent application. These are not always well understood by nationals of other countries. In addition, the precise wording of a patent affects its strength and subsequent legal interpretation.

It is recommended that a list of registered patent attorneys who are based abroad, but who are native Ukrainian speakers, is established through self-registration and made available to innovators in Ukraine, perhaps on the website of the Intellectual Property Office. This would help inventors who need support, for example in preparing and prosecuting their patent though the US system. While no quality assurances could be given it would be possible to use a system of customer feedback to help identify the best representatives in different fields.

4. STRENGTHENING OF SKILLS

Most PROs in Ukraine currently focus efforts on legally protecting technology rather than on commercialising it. In addition, the technology pipeline they have access to is shaped by the present focus on fundamental research and the low overall level of Gross domestic expenditure on research and development (GERD) and research intensity in the country. With a few notable exceptions, researchers themselves are not offered access to training or support that would help them shape their research towards market needs and industrial demand.

It is recommended that more investment is made into skills development in the TT units to commercialise technology and knowledge to both domestic and international markets. To be successful, such an initiative should be clearly linked to a PRO development strategy *e.g.* for research or internationalisation. It is therefore also recommended that as a precursor to skills development, PROs are encouraged to develop clear strategies with respect to their TT activities that realistically reflect strengths and resources as well as opportunities and ambitions. Skills development should be part of an associated Action Plan.

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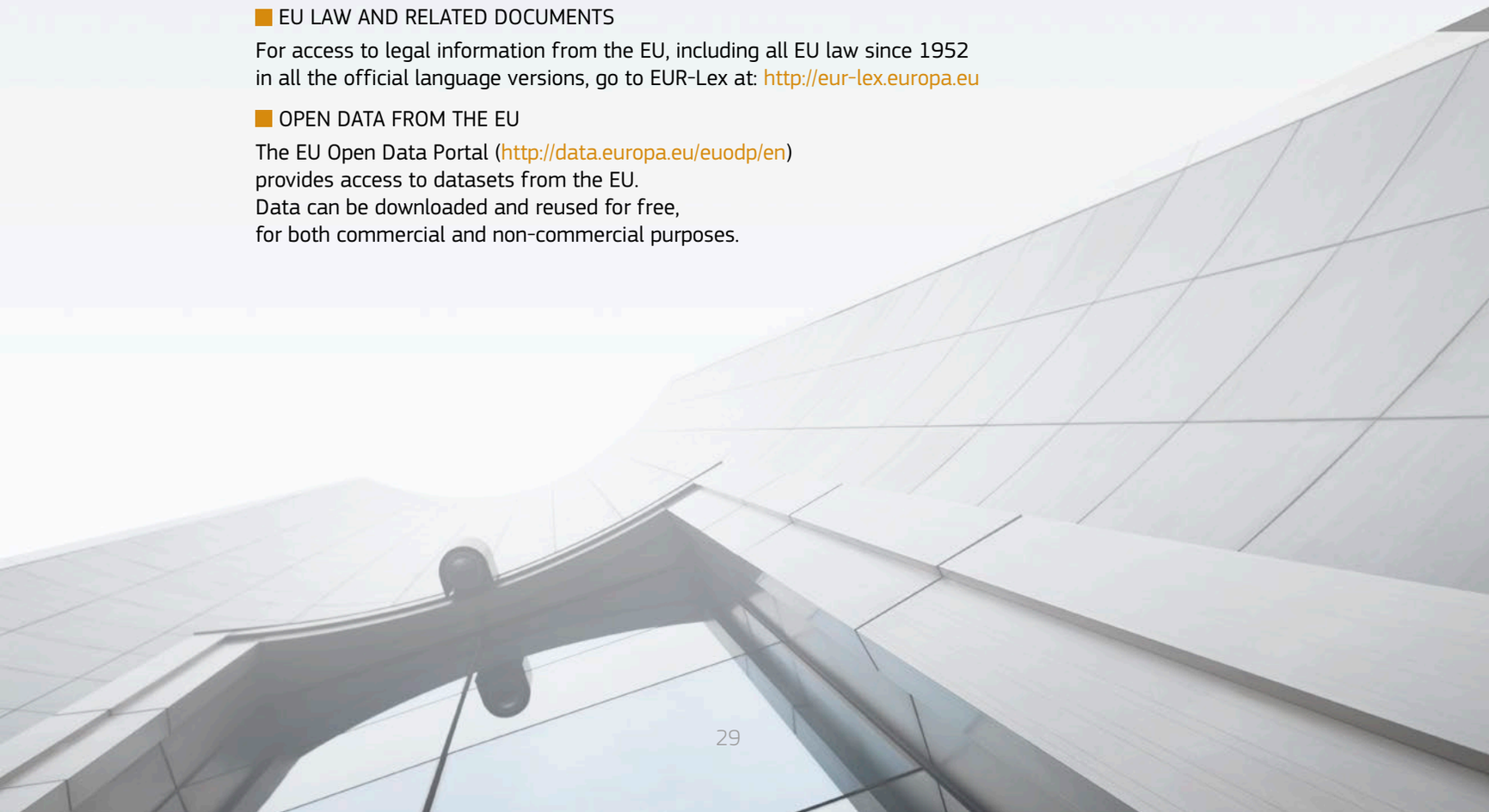

Acronyms

BA	Business Angels
BRI	Belt and Road Initiative
EC	European Commission
EPO	European Patent Office
ERA	European Research Area
EUR	Euro
GERD	Gross domestic expenditure on research and development
HEI	Higher Education Institution
ICT	Information and Communications Technology
IP	Intellectual Property
IPR	Intellectual Property Right
KPI	Kyiv Polytechnic Institute
NASU	National Academy of Sciences of Ukraine
NIS	National Innovation System
NRF	National Research Foundation
PACTT	Polish Association of Centres of Technology Transfer
PCT	Patent Cooperation Treaty

PRO	Public Research Organisation
PSF	Policy Support Facility
R&D	Research & Development
SIMMS	Icahn School of Medicine at Mount Sinai
SME	Small and medium enterprise
SSSU	State Statistical Service of Ukraine
S&T	Science and Technology
STI	Science, Technology and Innovation
TRL	Technology Readiness Level
TT	Technology Transfer
TTO	Technology Transfer Office
USPTO	United States Patent and Trademark Office
UVCA	Ukrainian Venture Capital and Private Equity Association
WIPO	World Intellectual Property Organization

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