UKRAINE

INTELLECTUAL PROPERTY AND TECHNOLOGY TRANSFER REGULATORY REVIEW

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Acknowledgments and Disclaimer

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List of Acronyms

AUTM	Association of University Technology Managers
EPO	European Patent Office
EU	European Union
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on Research and Development
HEI	Higher Education Institution
ICT	Information and Communication Technology
IP	Intellectual Property
IPO	Initial Public Offering
IPR	Intellectual Property Right
ITN	Innovation Transfer Network
KPI	Kiev Polytechnic Institute
MES	Ministry of Education and Science
MEDT	Ministry of Economic Development and Trade
NAS	National Academy of Sciences
OECD	Organisation for Economic Co-operation and Development
PCT	Patent Cooperation Treaty
PO	Parent Organization
PoC	Proof of Concept
PRO	Public Research Organization
R&D	Research and Development
RPA	Regional Patent Agency
SIPS	State Intellectual Property Office
SOE	State-Owned Enterprise
SME	Small and Medium Enterprise
STI	Science, Technology, and Innovation
TCC	Technology Commercialization Center
TRIPS	Trade-Related Aspects of Intellectual Property Rights
TT	Technology Transfer
TTA	Technology Transfer Alliance
TTO	Technology Transfer Office
UNC	University of North Carolina
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

Executive Summary

This report is one of several analytical pieces developed by the World Bank's Ukraine Technical Assistance on Innovation Support project, supported by the Swedish Ukraine Financial and Enterprise Sector Recovery and Growth Trust Fund. This report attempts to identify regulatory and framework impediments for the commercialization of publicly funded research and recommends reforms and policies that could improve the framework conditions for intellectual property (IP) and technology transfer (TT). The three supporting analytical pieces performed by the Ukraine Innovation Support project team are as follows:

- **Ukraine Science, Technology, and Innovation Public Expenditure Analysis,** which attempts to evaluate the quality mix of public support programs for science, technology, and innovation (STI) and provide recommendations for the improvement of the support programs' effectiveness;
- **Ukraine Innovation and Entrepreneurship Ecosystem Diagnostic,** which attempts to (a) identify the gaps that impede enterprise innovation in Ukraine and (b) develop recommendations for policy reforms and support instruments;
- **Fiscal Incentives for Science, Technology, and Innovation Best Practice Review,** which reviews different international good practices in introducing fiscal incentives for supporting STI and provides policy recommendations relevant to the implementation of such incentives in Ukraine.

This review presents an in-depth analysis of Ukraine's intellectual property (IP) system regarding its support to technology transfer (TT) and commercialization of publicly funded research and development (R&D). The review uses an analytical framework that considers the following factors: (a) overall effectiveness of the IP system, (b) clarity of the normative IP ownership and exploitation framework, (c) clarity of the normative framework for the establishment and financing of academic spin-offs, (d) clarity of the normative framework for intermediaries and bridging organizations, (e) clarity of the normative framework for stimuli of researchers to disclose research results and inventions, and (f) safeguarding of the public interest in the commercialization of publicly funded research. Based on these factors, the review offers policy recommendations for successful TT and commercialization of publicly funded research.

The analysis is based on available legal, regulatory, and policy documents and information from secondary resources. It included a desk review of relevant laws and policies and a content analysis synthesizing the regulatory IP and TT framework in Ukraine. In addition, the analysis benefited from qualitative interviews with representatives of the Ukrainian government (Ministry of Economic Development and Trade, Parliamentary Committees), the research community (National Academy of Sciences of Ukraine, Kiev Polytechnic Institute), and a few private sector firms.

Ukraine's national innovation system is at an early stage of development. Academic and publicly funded research rarely reaches the market due to its inherently basic research orientation; its lack of relevance to local industry needs; low capacity and demand for research by the private sector; legal, institutional, and administrative hurdles; weak culture of research commercialization; and limited incentives for commercialization of research results.

The following features shape the IP and TT regulatory landscape in Ukraine:

(a) Lack of clear division of roles and responsibilities across different institutions, poor coordination across various ministries and other actors in IP and TT matters, and weak institutional capacity in implementing the IP and TT normative framework

There are two ministries in charge of science, technology, and innovation (STI) whose responsibilities are divided between basic and applied research: The Ministry of Education and Science (MES) oversees basic research, whereas the area of innovation and applied research falls under the authority of the Ministry of Economic Development and Trade (MEDT). The natural overlap between these areas requires coordination to ensure cooperation between Ukrainian academic, research, and business sectors that the current system lacks. The pending Law on Technology Transfer attempts to separate TT responsibilities between the MES and the MEDT.

Until recently, the State Intellectual Property Office (SIPS) was in charge of processing applications for granting intellectual property rights (IPRs). In 2016, the Cabinet of Ministers decided to transfer the functions of the SIPS to the MEDT to consolidate the IP governance structure and establish a National IP Authority. In 2017, the Cabinet of Ministers has granted powers to the MEDT to issue patents and certificates for IPRs.

In 2016, the Parliament of Ukraine adopted a law on reforming the national judicial system, which provides for establishing the High Court on Intellectual Property Issues by the end of 2017 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. It remains to be seen how these changes will be implemented in practice.

(b) Public research organizations (PROs) suffer from a weak tradition of research commercialization. Engagement of higher education institutions (HEIs) in R&D and commercialization activities is limited.

There is a lack of incentives for both PROs that perform basic research and, to a lesser extent, former industrial branch-related research organizations and design bureaus (which traditionally performed applied research for state-owned enterprises) to conduct innovation-related activities. HEIs are mainly teaching institutions with relatively low engagement in R&D activities. PROs suffer from weak entrepreneurial and research commercialization culture. They typically lack experience, capacity, and resources for IP management and commercialization despite the presence of technology transfer offices (TTOs) in some. PROs rely heavily on public funding, with absent or weak relationships with the private sector. In addition, there is less focus by PROs on non-technological innovation, on modern organization principles and management methods, on the uptake of information and communication technology (ICT) and other enabling technologies to raise efficiency, and on the commercialization phase of the innovation process.

(c) The local private sector is neither a leading technology supplier nor a source of demand for IP.

Private sector investments in R&D are low and generally declining compared to international and European standards, making public R&D funding of greater importance (but of less commercial relevance due to its basic orientation). There is scarce evidence of public incentives for private sector investments in R&D or for R&D-related collaborations.

Ukraine's private sector does not conduct the needed innovative activities to create demand for R&D services from local knowledge providers. The start-up and entrepreneurial ecosystem, although

promising, is still nascent and has not realized its potential for innovative activities. Few small and medium enterprises (SMEs) are innovative with export orientation. Ukraine's industry is concentrated in typically low R&D industries and exporting has trended toward less R&D-intensive industries. The local market provides little motivation for innovation due to low competitive pressures and the dominance of state-owned enterprises in basic R&D. Weak competition policy has led to lack of competition and market demand for innovation. Overall, these factors result in low demand for local R&D services and TT by the private sector.

The links between the private sector and the PROs are frail. Innovative private sector activities are not aligned with the capacity and orientation of PROs (which are mainly focused on basic research). At the same time, researchers and academics are not aware of private sector needs or problems and are not incentivized to engage in contract research or spin-offs' activities. Consequently, outputs of research activities remain in the realm of publications and rarely translate into commercial or innovative solutions to industry and private sector problems.

(d) Ukrainian TT intermediaries are not effective in their commercialization efforts despite their official existence in most R&D active institutions.

The legal acts envisage creation and operation of different types of intermediaries and bridging organizations in the field of TT, such as TT centers, business incubators, technological parks, science parks, and so on. Even though the normative framework allows for the formation of these organizations, TT centers are rarely involved in technology commercialization through licensing or formation of academic spin-offs. Few resources have been devoted to innovation infrastructure and innovation-focused financial support schemes.

(e) The IP ownership rules for publicly funded technologies are scattered throughout different legal acts, which have conflicting provisions. This creates ambiguity and uncertainty for IP creators and user.

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. The discrepancy between the two legal acts with respect to IP ownership of publicly funded technologies creates confusion that can hinder TT and the commercialization of inventions.

Against this backdrop, the report provides a comprehensive list of policy recommendations along the institutional and normative frameworks. On the institutional level, the recommendations focus on disseminating coherent IP ownership across PROs and funding agencies; developing and implementing IP policies at the institutional level; developing competent intermediary and bridging organizations; better monitoring of publicly funded IP activities; in addition to other areas. On the normative framework level, the recommended reforms address publicly funded IP ownership legal rules and touch upon contingent legal acts beyond IP and TT regulations. Importantly, the report calls for reforms that provide better incentives for researchers at PROs to disclose inventions, collaborate with local and international private firms, and/or commercialize research.

Introduction

Intellectual property (IP), in the broadest sense, refers to the intangible assets resulting from an intellectual activity in the fields of industry, science, literature, and the arts. Intellectual property rights confer to their holders the monopoly to control the use of the IP for a limited period. IPRs include patents, utility models, industrial designs, and trade secrets for inventions; copyrights for the arts and literature; and trademarks for business development and promotion.

The purpose of the IPR system is to stimulate innovation by providing the opportunity for IPR holders to be compensated for their intellectual and R&D efforts in creating the IP (Stiglitz 2008). The IPR system also stimulates investments from other innovators who want to avoid infringing the creator's IPR. In the case where disclosure of the IP right is a prerequisite for obtaining legal protection (patents), the IPR system acts as a stimulator for dissemination of knowledge and as a facilitator for follow-on innovation. An efficient and equitable IPR system can play an important role in stimulating innovation and fostering economic development, and social and cultural well-being.

Developing countries often face certain contextual challenges in designing an adequate IPR system. First, in these countries, only a small percentage of the population has access to wider innovation resources and opportunities. The greater part lacks access to even the most basic resources. Second, the private sector plays a marginal role in the national innovation system, with public research organizations (PROs) having a more prominent role. Third, the performance of the national innovation system is challenged by "institutional weaknesses and market failures, which weaken the 'innovation performance' and hinder the public policy efforts aimed at transferring and commercializing IP" (OECD 2014).

Technology transfer (TT) refers to "the process of transferring scientific findings from one organization to another for the purpose of further development and commercialization."[1] TT can have a particularly important role in a country's economic development. Improving the transfer of knowledge from PROs to the market can increase the country's productivity, create job opportunities, and thus stimulate economic growth (Zuniga and Correa 2013). The effectiveness in transforming research results into innovative products and processes will define the impact that public investments in research and development (R&D) will have on the country's economic development (Zuniga and Correa 2013).

Stimulating an adequate level of TT might be particularly challenging in developing countries. In contrast to the United States and Western Europe, where PROs have always had a recognized role in providing knowledge to the private sector, PROs have had a different role in centrally planned economies. Research commercialization is not, and never has been, the PROs' core mission. As a result, many developing countries struggle with crafting and implementing adequate public policies aimed at stimulating knowledge transfer and public research commercialization.

Successful public policies that aim to stimulate TT imply a multistage, interactive learning process encompassing a multitude of actors and channels. In developed countries, regulatory reforms in the areas of IPRs and TT aimed at academia have been tied to more general reforms in contract and property laws, different IP laws (patents, trademarks, copyrights, and utility models), labor law, higher education laws, laws regulating the national science, technology, and innovation (STI) system (Zuniga and Correa 2013). Even though patent licensing and academic spin-offs remain important channels for public research

[1] About Technology Transfer, Association of University Technology Managers (AUTM) http://www.autm.net/autm-info/about-tech-transfer/about-technology-transfer/

commercialization in developed countries, other forms have gained importance such as student and faculty mobility, contract research, and faculty consulting activities. Another trend is the push by some Organisation for Economic Co-operation and Development (OECD) countries' STI funding agencies for greater access to publicly funded research through promoting the concepts of open science and open innovation. Technology transfer offices (TTOs) are undergoing operational changes by accepting new models of operation such as regional hub-and-spoke TTOs that service multiple research institutions. Some PROs experiment with implementing new IP ownership systems, by vesting some rights with the academic inventor while maintaining university ownership. New approaches to financing commercialization are also emerging. Many PROs are complementing government funding academic spin-offs by setting up their own proof-of-concept (PoC) and seed funds (Zuniga and Correa 2013).

It remains to be seen which of these trends would be useful and replicable in Ukraine. The Ukrainian government and relevant institutions should design and implement a regulatory IP and TT framework that is best suited to their needs, resources, and objectives. This framework should also be compatible with the local, regional, and global research environment. The public policies in the field of IP and TT need to be complemented with adequate policies in the field of labor law, higher education law, access to research results, data and instruments, awareness raising, training, and creating links between PROs and firms.

Analytical Framework

For the reasons outlined earlier, this review will use the following analytical framework to examine the factors that affect successful knowledge transfer and commercialization of publicly funded technologies.

Overall Effectiveness of the IP System

A prerequisite for any national policy framework that aims to facilitate the transfer of technology from academia to industry is the existence of an effective IPR system, comprising modern legislation in the field of patents, trademarks, copyright, industrial designs, and trade secrets; an IP office in charge of examining and registering/granting IPRs; and the availability of qualified IP professionals (for example, attorneys, agents, and licensing professionals) who can assist universities throughout the patent life cycle, including, in particular, the application process, the negotiation of licenses over patented technology, and the settlement of disputes over IPRs. It is also necessary to ensure that there is an effective enforcement of the existing IPRs. An IPR will have little effect on innovation if the owner cannot effectively enforce its IPR when infringed.

Clarity of the Normative IP Ownership and Exploitation Framework

Clear and transparent rules covering the ownership and exploitation of any IP developed within PROs or funded with public resources are critical. Countries have enacted varying legislation to deal with the PROs' IP and TT, ranging from provisions in patent, innovation, or employment laws. Regardless of how the issue is addressed, there is a strong case in favor of having a nationwide policy that defines issues of ownership of IP for PROs, of researchers receiving public funds, and of how inventors should share benefit from the transfer of IP. This not only provides clear and predictable rules of the game for all stakeholders but also facilitates joint research between different organizations.

Clarity of the Normative Framework for Establishment and Financing of Academic Spin-Offs

The creation and financing of academic spin-offs is an important pathway for the commercialization of publicly funded technologies, especially when the technology is considered high risk. Public policies regarding the creation of academic spin-offs often address issues such as: (a) whether state-owned PROs can hold an equity stake in the spin-offs, (b) under which circumstances researchers may work in spin-offs, and (c) conflict of interest. The latter is often linked to academics consulting to their own spin-off and the spin-off gaining access to the PRO research faculties. Finally, there may be a need to compensate academics who are not involved in the spin-off but may be asked to take on more work to cover for a colleague working in the spin-off. An institutional conflict of interest policy and a specific memorandum of understanding play an important role in such frameworks.

Clarity of the Normative Framework for Academic Consulting Activity

Knowledge exchange, in the form of contract research, individual consulting, and expert opinion, is becoming an increasingly important part of TT from PROs to the private sector. The existence of clear frameworks enables a fair balance to be struck between core employment activities (teaching and research) and individual entrepreneurial activity. The frameworks encourage, legitimize, and professionalize such activities and act to benefit and protect both the PRO and the individual researcher.

Clarity of the Normative Framework for Intermediaries and Bridging Organizations

TT intermediaries provide a range of services that assist research activities and product commercialization, including market research, grant development, brokering, and technical support. Due to the changing global STI environment, traditional TT intermediaries and bridging organizations are evolving by adding new functions to the TT process. Such functions include IP management and supporting activities (for example, patent scouts, consulting), marketing non-patent services, administering PoC and seed funds for entrepreneurial activities, and promoting a culture of innovation.

It is necessary that the normative framework for intermediaries and bridging organizations allows for enough flexibility for the current structures to adapt and evolve into modern intermediaries and bridging organizations, such as technology transfer alliances (TTAs), Internet-based models, for-profit models, or vesting rights with inventors while maintaining university ownership.

Clarity of the Normative Framework for Stimuli of Researchers to Disclose Research Results and Inventions

The ability of public research systems to benefit from the dissemination and transfer of knowledge generated by researchers depends on the incentives for researchers not only to carry out R&D and innovation activities, but also to disclose their own research results so that they can be accessed and used by other researchers, as well as by TTOs and industry.

Policy makers, agencies responsible for academic incentives, and TTOs need to consider nonmonetary and monetary mechanisms that can be used to stimulate researchers to disclose their inventions. The role of disclosure incentives should not be limited to technology disclosure but should also include knowledge disclosure (for example, data sharing) (WIPO 2007).

Safeguarding of the Public Interest in Transfer of Publicly Funded Technologies

The main aim of a public policy is to ensure that the results of research funded with public money will intimately benefit tax payers. To achieve that goal, some countries have public policies that envisage a specified time when the PROs might exercise their ownership rights; otherwise, the ownership title reverts to the government or the funding agency who can then take over the IP and ensure its transfer. National public policies may also require mandatory licensing to local industry or domestic manufacturing of products developed from publicly funded IP (WIPO 2007).

IP and TT Regulatory Landscape in Ukraine

This chapter provides an overview of Ukraine's IP and TT regulatory landscape. It begins with an analysis of the overall effectiveness of the IP system by assessing its legal quality. The legal quality can be assessed by looking at two factors: the institutional IP framework and normative IP framework. The institutional IP framework consists of institutions in charge of governing IP (legislative, executive, and judicial institutions), IP creators (private and public stakeholders involved in production of intellectual creations that can be protected by IPRs), and IP users (private and public sector stakeholders involved in using IP). The normative IP framework consists of all the normative acts (international, regional, and national laws and bylaws) governing IP, as well as IP operations and procedures.

The main obstacle to the overall effectiveness of the IP system in Ukraine is not the substantive law, but rather the way the law is implemented. This is affected by the lack of coordination between the institutions in charge and the constant changes of legal acts, which in turn lead to lack of clarity, stability, and certainty as the main preconditions for legal quality of the IP system. This chapter analyzes different IP legal institutions, which are important for effective commercialization of publicly funded technologies; IP ownership of publicly funded technologies; establishment and financing of academic spin-offs, intermediaries, and bridging organizations; and incentives for researchers to disclose knowledge and inventions.

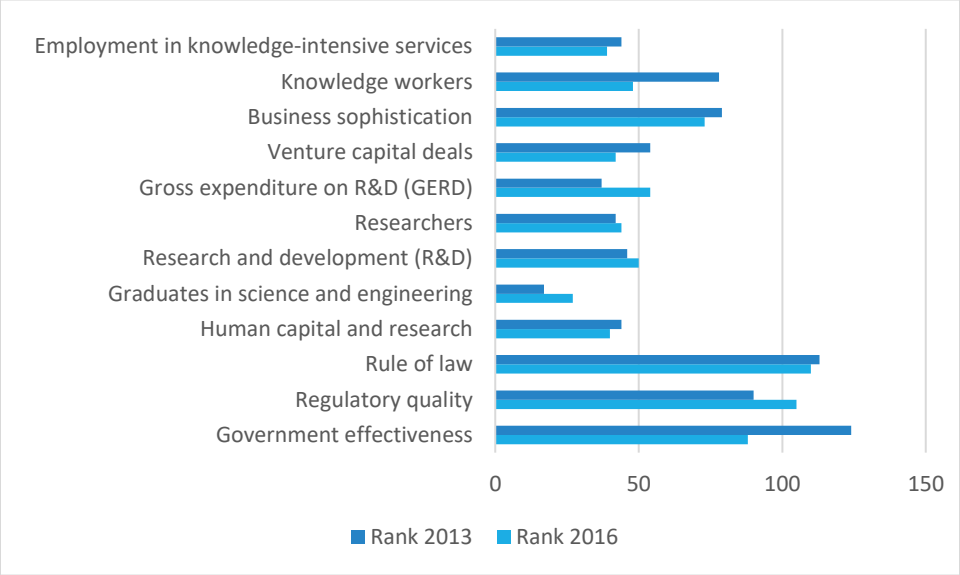
Overall Effectiveness of the IP System

An effective IPR system is a prerequisite for any national policy framework that aims to facilitate TT from academia to industry. The ability to stimulate the commercialization of publicly developed technologies will depend on whether the legal and administrative conditions provide IPRs' owners the necessary protection.

The strength of the IPR protection depends on factors that ensure 'legal quality'—that is, the stability, clarity, and certainty of the national IP system. This system has two parts: (a) the institutional IP framework, which includes institutions in charge of governing IP (legislative, executive, judicial), IP creators (private and public stakeholders involved in production of intellectual creations that can be protected by IPRs), and IP users (private sector and public sector stakeholders involved in using IP), and (b) the normative IP framework, which consists of all the normative acts (international, regional, and national law and bylaws) governing IP, and IP operations and procedures. The legal quality of the IP system is influenced by a myriad of factors affecting the institutional and normative framework governing IP and TT in Ukraine and, in a broader sense, by the overall conditions of the national STI system.

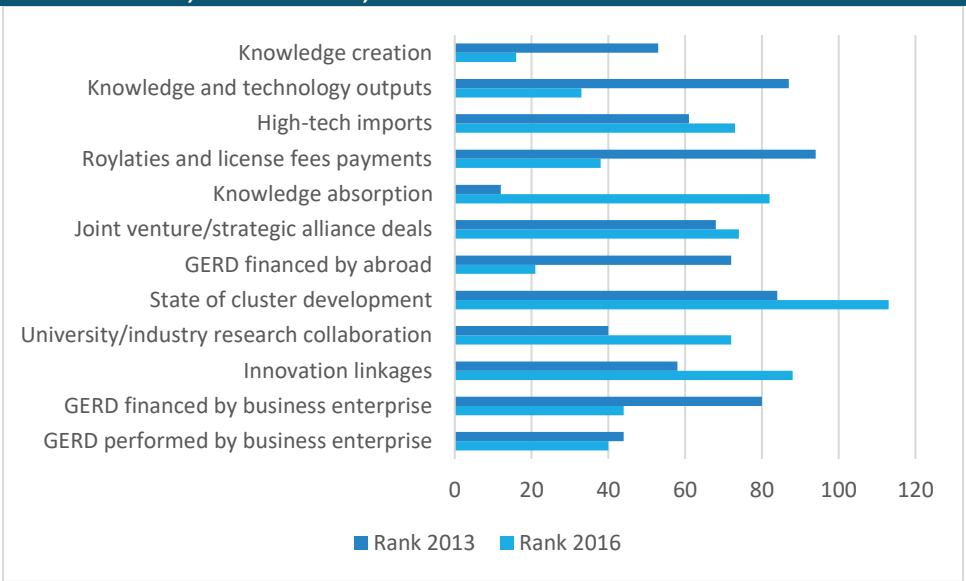
The World Intellectual Property Organization (WIPO) Global Innovation Index data show that Ukraine has the following STI strengths: (a) graduates in science and engineering, (b) international funders for gross domestic expenditure on research and development (GERD), (c) knowledge creation, (d) national office resident patent applications, (e) national office resident utility model applications, and (f) national office resident trademark registrations. The Global Innovation Index also highlights the following weaknesses: (a) government effectiveness, (b) regulatory quality, (c) rule of law, (d) state of cluster development, (e) information and communication technology (ICT) and business model creation, and (f) ICT and organizational model creation (figures 1, 2, and 3).

Figure 1. Selected Indicators I, 2013 and 2016, WIPO Global Innovation Index



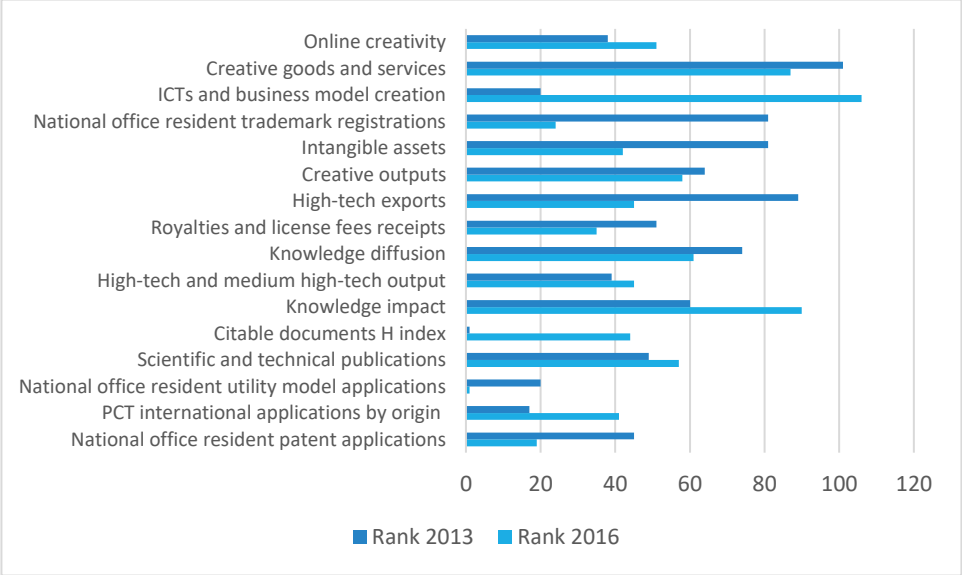
Source: WIPO 2017. Author's own calculations, based on the Global Innovation Index 2013 and 2016, at https://www.globalinnovationindex.org/analysis-economy. Where 1 is the highest ranking and 128 is the lowest ranking.

Figure 2. Selected Indicators II, 2013 and 2016, WIPO Global Innovation Index



Source: WIPO 2017. Author's own calculations, based on the Global Innovation Index 2013 and 2016, at https://www.globalinnovationindex.org/analysis-economy. Where 1 is the highest ranking and 128 is the lowest ranking.

Figure 3. Selected Indicators III, 2013 and 2016, WIPO Global Innovation Index



Source: WIPO 2017 Institutional Framework. Author's own calculations, based on the Global Innovation Index 2013 and 2016, at https://www.globalinnovationindex.org/analysis-economy. Where 1 is the highest ranking and 128 is the lowest ranking.

Governance

There is a lack of clear division of roles and responsibilities across different institutions, poor coordination across various ministries and other actors in IP and TT matters, and weak institutional capacity in implementing the IP and TT normative framework.

There are two ministries in charge of STI: The Ministry of Education and Science (MES) oversees basic research, while the Ministry of Economic Development and Trade (MEDT) is in charge of applied research and innovation. The natural overlap between these areas requires coordination to ensure seamless cooperation between Ukrainian academia and private sector. In practice, however, their activities are not synchronized. The lack of coordination is exacerbated by the pending legislation, the Law on Technology Transfer, which attempts to separate TT responsibilities between the MES and the MEDT.

Until recently, the State Intellectual Property Office (SIPS) was in charge of processing applications for granting IPRs. In 2016, the Cabinet of Ministers decided that the functions of the SIPS will be transferred to the MEDT with an aim of consolidating the IP governance structure under a new National IP Authority. In 2017, The Cabinet of Ministers has granted powers to the MEDT to issue patents and certificates for IPRs.

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 by the end of 2017, 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.[2] It remains to be seen how these changes will be implemented in practice.

[2] Online articles: http://www.ipwatchdog.com/2016/06/19/intellectual-property-court-ukraine/id=70082/. Conclusions of the 14th EU-Ukraine IPR Dialogue - Kyiv, July 6, 2016. http://trade.ec.europa.eu/doclib/docs/2016/september/tradoc_154969.pdf (last accessed April 24, 2017).

Publicly Funded IP Creators (Supply Side)

The Ukrainian STI system relies heavily on PROs, which in turn rely heavily on public funding. There is a lack of incentives for PROs to get involved in innovation-related activities and a noticeable absence of entrepreneurship and innovation culture in the public research sector. PROs lack experience, capacity, and resources for dealing with all the tasks related to IP management and commercialization. The links with the private sector are weak. Little attention has been paid to non-technological innovation, modern organization principles and management methods, the uptake of ICT and other enabling technologies to raise efficiency, and the commercialization phase of the innovation process.

The public nature of Ukrainian PROs and former industrial branch-related research organizations, their mission, and the business model have evolved over time. However, the practice of research commercialization and transfer of publicly developed technologies to the private sector is still in early phase of development. PROs, under the old system, used to serve the research needs of major state-owned enterprises (SOEs) (such as ship building, energy generation, or defense industrial complex). Thus, the research customer was pre-defined and there was no need to engage private companies to collaborate. PROs are formally subordinated to ministries and state agencies, although their ties with the ministries have weakened recently (Yegorov 2013). The boundaries between the state and private R&D organizations in Ukraine have blurred and a number of mixed-ownership organizations exist (co-owned partly by the state and employees). These organizations receive a portion of their financing from the state as block grants, which give the ministries the right to be involved in the nomination of their directors. The share of direct financing from the ministries is usually not higher than 25 percent of an organization's total budget. The remainder of the financing is contracted both from SOEs and private companies.

The National Academy of Sciences (NAS) is the main research institute in Ukraine. In addition, there are several specialized academies of sciences that are responsible for basic research.[3] These academies have coordinating and delivery functions in many R&D and innovation-related programs. They also provide scientific advice to different ministries. They have relative autonomy, and their work is overseen by the Cabinet of Ministers. They are mandated to coordinate their activities with the MES. The academies, together with the PROs, produce most of the R&D that can be technologically commercialized. However, as the experience of the Ukrainian Biochemistry Institute shows, these R&D activities rarely reach the technological market (see box 1).

Box 1. The Experience of the Ukrainian Biochemistry Institute in Technology Commercialization

The Ukrainian Biochemistry Institute has no experience with establishing academic spin-offs. The private sector is not interested in funding R&D that will be carried out by public research institutes. The institute has a functioning TTO that acts as an intermediary in the licensing and assignment of technologies to the private sector. The institute has collaborated with Chinese partners through licensing and assignment contracts. In the past decade, the institute has faced brain drain of young scientists due to unfavorable conditions for professional advancement of researchers and scientists in Ukraine (low salaries, corruption, and small budget for purchase of equipment). It has licensed technologies to only two pharmaceutical companies. The representatives of the institute indicated that in one instance their technological know-how was 'stolen'. The institute is trying to establish collaboration with international partners; however, this has proven difficult due to lack of funding.

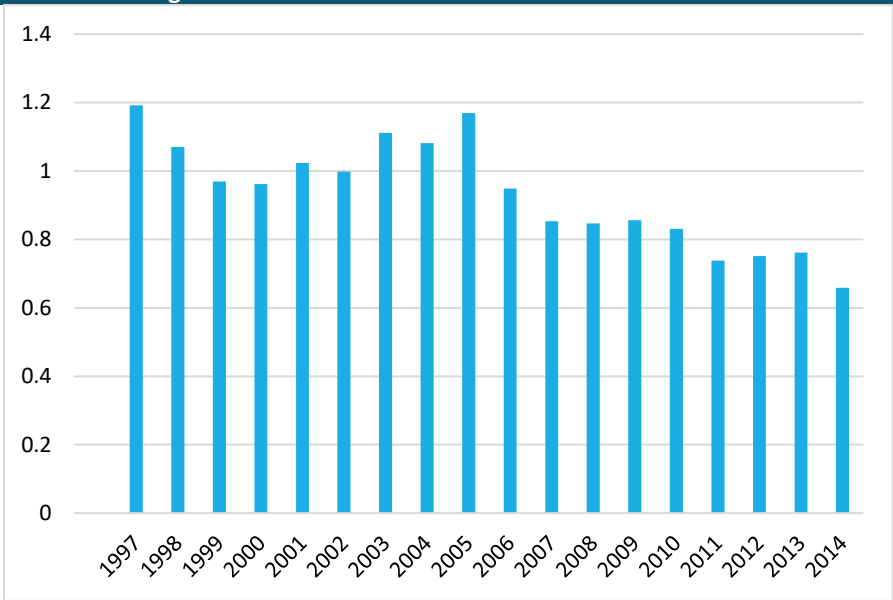
Source: Interviews with the representatives of the Ukrainian Biochemistry Institute, Kiev, February 2017.

[3] Including the Ukrainian Academy of Agrarian Sciences, the Academy of Medical Sciences, the Academy of Pedagogical Sciences, the Academy of Legal Sciences, and the Academy of Arts.

Ukrainian universities, although capable, are not a major player in the R&D arena. In 2011, only half of the slightly more than 350 universities (all supervised by the MES) performed any kind of R&D (Yegorov 2013). The low levels of funding from state block grants and other programs undermine the universities' ability to perform R&D.

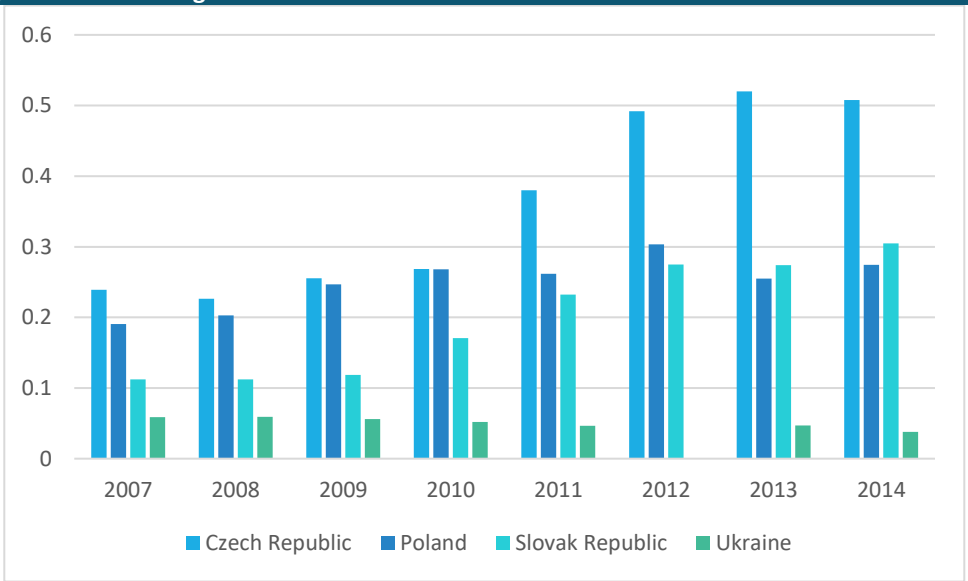
In fact, the Ukrainian GERD as a percentage of gross domestic product (GDP) has been declining over the years and has reached only 0.6 percent in 2014 (figure 4). Figure 5 compares GERD by higher education institutions (HEIs) as a percentage of GDP in Ukraine, the Slovak Republic , Poland, and the Czech Republic (2007–2014) and shows that Ukrainian HEIs' share is significantly below the share in other countries. That could partially explain the low levels of TT in Ukraine.

Figure 4. Ukraine GERD as Percentage of GDP



Source: United Nations Educational, Scientific and Cultural Organization (UNESCO) Statistics 2017.

Figure 5. GERD by HEIs as Percentage of GDP



Source: UNESCO Statistics 2017.[4]

Local IP Users (Demand Side)

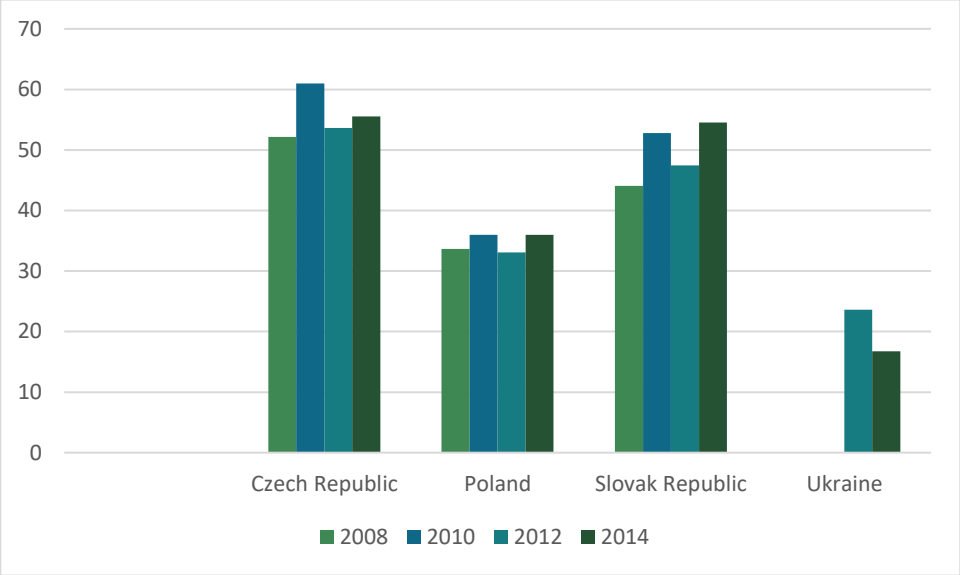
The private sector falls short of being a leading technology supplier or adopter of IP in Ukraine. The Ukrainian private sector is still dominated by large firms (mainly SOEs) that benefit from public subsidies and market domination. The private sector remains curtailed by structural problems that are shared across industries and types of firms (startups, small and medium enterprises [SMEs], and big firms), such as access to finance problems, uncompetitive markets, low innovative capacity, weak managerial practices, and lack of public support for R&D investments. In addition, the entrepreneurial ecosystem, despite the human capital potential, is still nascent with few functioning entrepreneurial support and intermediary organizations. In 2014, there were 82 incubators for innovative start-ups, although only 27 were functional. Of the 50 technology parks, only 13 were operational (OECD et al. 2015).

Figure 6 gives a comparative overview of the percentage of manufacturing firms with in-house R&D in Ukraine, Poland, the Czech Republic, and the Slovak Republic between 2008 and 2014. Ukraine lags behind all these countries, while additionally showing a relative decline from 23.6 percent to 16.7 percent over the period 2012–2014. The numbers are even more disappointing in comparison to the relative number of manufacturing firms that engaged in contracted-out (external) R&D in Ukraine, Poland, the Czech Republic, and the Slovak Republic (figure 7). The relative number of Ukrainian firms engaged in external R&D decreased from 10 percent to 7.5 percent during 2012–2014.

[4] Methodological note: GERD by sector of performance: Total domestic intramural expenditure on R&D during a given year, broken down by the institutions corresponding to each sector (business enterprise, government, higher education, and private nonprofit organizations), independent of the source of funds.
Higher education sector (for R&D data): In the context of R&D statistics, the higher education sector includes the following:

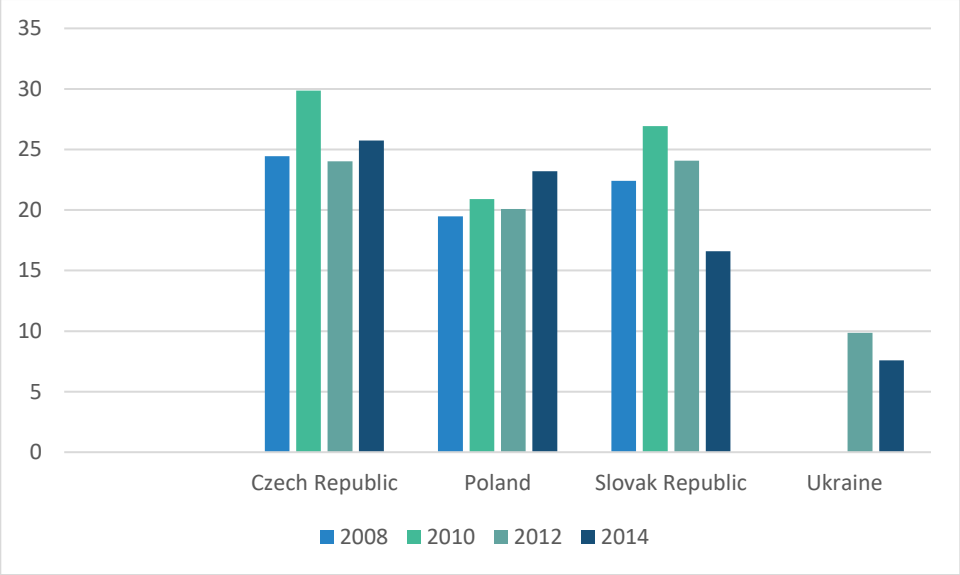
- All universities, colleges of technology, and other institutions of post-secondary education, independent of their source of finance or legal status
- All research institutes, experimental stations, and clinics operating under the direct control of, administered by, or associated with HEIs.

Figure 6. Percentage of Manufacturing Firms That Engaged in In-House R&D



Source: UNESCO Statistics 2017.

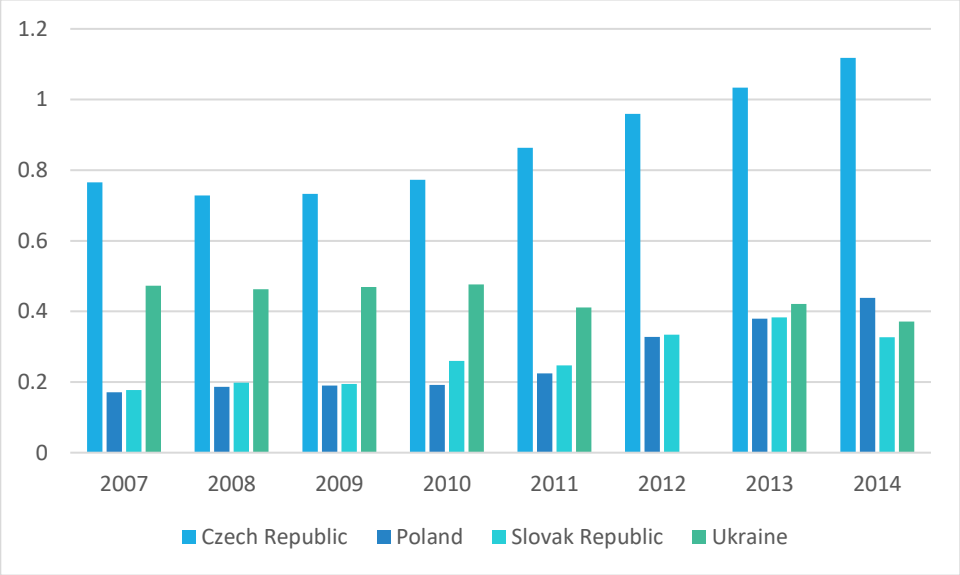
Figure 7. Percentage of Manufacturing Firms That Engaged in Contracted-out (External) R&D



Source: UNESCO Statistics 2017.

The Ukrainian private sector invests little in building local R&D capacities. There is meager financial support from grants and tax incentives for R&D by the private sector (OECD 2015). The development of local technological capacities is crucial for absorbing and adjusting technologies developed abroad to the local conditions in Ukraine. Figure 8 shows the data for GERD performed by the private sector as a percentage of GDP. Ukraine outperformed the Slovak Republic and Poland from 2007 to 2013 (with the exception of 2012, for which there are no data available). However, these data might be skewed because the private enterprise data also include data on public enterprises (SOEs), and in Ukraine these are dominant in the R&D sector.

Figure 8. GERD by the Private Sector as a Percentage of GDP



Source: UNESCO Statistics 2017.[5]

The links between the private sector and academia are also frail. From the private sector's perspective, there is uncertainty regarding the potential value of publicly funded technologies, as these are seen as high-risk investments. Consequently, many inventions remain dormant. The lack of a clear legal framework regarding the creation and exploitation of IPRs resulting from research is an additional hurdle in effective TT from academia to the private sector.

Normative Framework

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 (see appendix I). The normative framework follows the latest global developments in regulating IPRs, such as the main types of rights, their duration, and limitations/exemptions.

Membership in International/Regional Organizations

Ukraine is a member of the WIPO and World Trade Organization (WTO) and has acceded to the most important treaties administered by these international organizations. It is a member of the Patent Cooperation Treaty (PCT), administered by WIPO and the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), administered by the WTO. Ukraine signed an Association Agreement

[5] Methodological note: GERD by sector of performance: Total domestic intramural expenditure on R&D during a given year, broken down by the institutions corresponding to each sector (business enterprise, government, higher education, and private nonprofit organizations), independent of the source of funds.
Business enterprise sector (for R&D data): In the context of R&D statistics, the business enterprise sector includes the following:

- All firms, organizations, and institutions whose primary activity is the market production of goods or services (other than higher education) for sale to the public at an economically significant price
- The private nonprofit institutions mainly serving them
- Private enterprises (core of the sector) as well as public enterprises

with the European Union (EU) in 2014. In accordance with it,[6] Ukraine must ensure an adequate level of effective protection and enforcement of IPRs. There has been considerable progress in recent years, in particular in IP legislation, but Ukraine is expected to improve its legislation even further in a number of areas, including geographical indications, designs, trademarks, data protection for pharmaceuticals, enforcement measures (including at its borders), and the liability of Internet service providers.[7] Article 159 of this agreement deals specifically with issues of TT and IPRs. Ukraine is a member of the Eurasian Patent Organization, which could give the national inventors and patent holders access to holding a single Eurasian patent valid in the member countries. Ukraine is not a member of the European Patent Office (EPO). The Ukrainian IP creators, and more specifically PROs that create publicly funded technologies, are unable to file for EPO patents.

Inventions and Utility Models

The current law uses the same term 'patent' for IPRs over inventions and IPRs over utility models. Furthermore, the subject matter of protection for inventions and utility models is the same. This creates confusion and a potential statistical problem in counting the number of 'patents', as these would be considered a bundle of patents over inventions and patents over utility models.

Software Patents

The current legal system does not support registration of software patents. Nonetheless, software can be copyrighted. Copyrights can be registered with the Copyright Office, serving as evidence in infringement court proceedings.[8]

Exceptions to Patent Infringement

Ukraine does not have a Bolar-like exemption, which is particularly relevant in the market for generic drugs. Manufacturers of both branded and generic drugs need to obtain market approval for their products. The Bolar-like exemption provides that conducting research and submitting testing data to a regulatory agency for obtaining a drug market approval does not constitute patent infringement, if specific conditions are met. The exemption allows manufacturers to prepare generic drugs in advance of the patent expiration. However, Ukrainian courts have found the start of any preparation for market entry by a generic drug manufacturer to constitute patent infringement.[9] Consequently, efforts to obtain market approval, including conducting premarket clinical trials, may be regarded as patent infringement in Ukraine. The absence of a Bolar-like exemption might hinder the development of the Ukrainian generic pharmaceutical industry.

Trade Secrets

The provisions pertaining to know-how and trade secrets law can be found in the Civil Code and Technology Transfer Law. The law defines 'know-how' as information obtained through experience and

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[6] Association Agreement between the European Union and Ukraine, http://trade.ec.europa.eu/doclib/docs/2016/november/tradoc_155103.pdf (last accessed April 24, 2017).

[7] Ukraine IP Factsheet, Office for harmonization in the internal market, https://euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/observatory/documents/News/Ukraine-guide_en.pdf (last accessed April 24, 2017).

[8] Interviews with PwC and MEDT representatives during World Bank mission to Kiev, February 2017.

[9] See, for example, H. Lundbeck A/S versus Farmak JSC; H. Lundbeck A/S versus. Chemo Iberica, S.A.

tests, which (a) is not in the public domain or easily accessible as on the date of conclusion of a TT agreement, (b) is essential (that is, important and useful for manufacture of products and/or the provision of services), and (c) is defined (that is, described with the sufficient details making it possible to check if such technology meets the non-public-domain and essentiality criteria). The Civil Code (Articles 505 and 506) defines a 'trade secret' as confidential information that has a commercial value for its owner and for which the owner takes reasonable steps to protect its secrecy. The Ukrainian trade secrets law is fully compliant with the international legal standards set up by the WTO's TRIPS Agreement.

Licensing in TT Agreements

The issue of licensing is regulated by 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, and Technology Transfer Law. They stipulate that a licensing agreement must be in writing. The laws do not require registration of the agreement, although this can be done at the SIPS for evidentiary purposes. In the case of publicly funded technologies, the government reserves a 'march-in' right, which permits the government to compel the IPR owner to offer a royalty-free license to practice any publicly funded intellectual creation. The law does not envisage any further restrictions with regard to licensing.

Legal Status and Autonomy of PROs

In Ukraine, there are no legal requirements for state-owned PROs to ask for permission before filing a patent application and/or entering into a TT contract. PROs are also allowed to use normal bank accounts for their financial operations. However, when using funds obtained through licensing royalties and other types of proceeds from transfer of publicly funded technologies, the PROs are required to use special accounts of the Ministry of the Treasury and in accordance with a procedure prescribed by the Cabinet of Ministers of Ukraine.[10] Even though the procedure is flexible, it acts as a limitation to the ability of PROs to dispose freely with the funds. Thus, from a strictly legal point of view, the normative system acts as an obstacle for TT.

IP ownership of Publicly Funded Technologies

The IP ownership rules for publicly funded technologies are scattered throughout different legal acts, which have conflicting provisions. This creates ambiguity, uncertainty, and confusion.

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 that covers technologies developed through publicly funded research. There is an exception in a case when the innovation has not been publicly disclosed and has been instead maintained secret. In that case, the secret belongs to the commissioner of the work. The Technology Transfer Law provides no reversion rights to the employee-inventor, although the employee is entitled to a compensation. The government reserves the 'march-in' rights.

In contrast, the Law on Inventions and Utility Models stipulates that under certain circumstances the ownership rights can revert to the employee-inventor. The employer can file an application to obtain the ownership of the IP within four months. The employer should also reimburse the inventor for the

[10] Procedure for the use of proceeds obtained as a result of transfer of technologies created with the state budget, http://zakon4.rada.gov.ua/laws/show/300-2013-%D0%BF/paran8#n8 (last accessed April 24, 2017).

economic value and other benefits obtained from the invention. If the employer fails to file an application within the provided time, the rights revert to the employee-inventor.

The discrepancy between the legal acts with respect to IP ownership of publicly funded technologies (table 1) could negatively affect the successful transfer of the latter. These conflicting provisions might create confusion among inventors, researchers, and investors. Such regulative gaps could discourage researchers from conducting cutting-edge research that can be commercialized and transferred to the private sector. These gaps could also discourage firms, potential partners, or investors from funding technology development and engaging in collaboration with academia, as they are uncertain about the ownership of the IPRs vested in that technology.

Table 1. IP Ownership Rules for Publicly Funded Technologies

Regime	Civil Code	Law on Inventions and Utility Models	Law on Copyrights and Related Rights	Technology Transfer Law
IP ownership (in general)	Author/inventor	Inventor	Author/researcher	
IP from employment contract	Author/inventor for personal nonproprietary rights. Jointly author/researcher and employer for proprietary rights (Article 429).	Employer must file application/transfer the right or maintain it as a trade secret within 4 months and reimburse the inventor for the economic value and other benefits obtained. If it is not done within 4 months, the rights revert to the inventor and the employer has the right to license first.	Employer	IPRs for publicly funded research belong to the institution (public or private) that performed the work. Within 2 months of receiving the inventor's notification of disclosure, the institution needs to conclude a contract/file application to remunerate the inventor (Article 11). The law fails to regulate what happens when the institution does not conclude a contract within 2 months. It is unclear if in this case the researcher has the right to the IP and to collect revenue freely from its commercialization. If the technology is secret, it is transferred to the commissioner of the work. If research is sponsored with mixed funds (public/private), the property rights are distributed in accordance with the TT agreement.
IP for students/visiting researchers	No specific regulations			

Establishment and Financing of Academic Spin-Offs

The term spin-off (or spinout) is generally used to describe a legal entity created by a parent organization (PO) to bring its IP assets into the market. The PO might hold the entire new entity or only an equity stake. The IPRs, which are typically assigned or exclusively licensed by the PRO to the spin-off, are often the spin-off's most important intangible asset. Spin-offs are an alternative instrument for technology commercialization, alongside licensing. They might be particularly adequate in cases where the specific technology embedded in the patent may be too embryonic or too high risk to attract licensees (European Commission 2016).

The new Law on Scientific and Scientific-Technical Activity (see appendix I) contains the procedure for establishment of academic spin-offs by scientific institutions and universities. Academic institutions (public or private) can establish different forms of legal entities to achieve their objectives with respect to the exploitation of IPRs. PROs have the right to be founders and cofounders of companies and take part in the authorized capital of legal entities to exploit their IPRs (Article 60). The IPRs over publicly funded technologies will belong to the institution that carried out the research (Article 64).

The Law on Scientific and Scientific-Technical Activity also stipulates that PROs can become shareholders in the academic spin-offs. However, investments in science and technology-based start-ups entail the highest uncertainty of all investments. Having a PRO or HEI as a shareholder in an academic spin-off (coupled with risk of corruption and red tape) could deter investors and thus hinder the spin-off's growth. There are no specific financial and tax incentives for the formation of spin-offs and their development.

Under both the Law on Scientific and Scientific-Technical Activity and the Law on Higher Education, researchers can enter into contractual relationships with external partners (private enterprises or academia, national or international). However, there are also no clear rules that address the possible conflicts of interest.

The representatives of the NAS[11] have indicated that there is no evidence of academic spin-offs and academic entrepreneurship in Ukraine. It is also unclear what the main mechanisms for technology commercialization of publicly funded research are (for example, licensing/assignment of IPRs through TTOs, creation of spin-offs). Most often, publicly funded technologies are being licensed (although it is not clear if this is done through TTOs) to the private sector. Since the researchers working at the NAS research institutes are not civil servants, there is no legal obstacle for them to work part-time as consultants for the private sector and possibly commercialize their intellectual creations through consultancy contracts.

Intermediaries and Bridging Organizations

Intermediaries and bridging organizations represent an alternative tool that can foster the transfer and commercialization of the results of a publicly funded research. They act as an intermediary between the supply side (for example, PROs that offer inventions) and demand side (for example, companies that seek innovation solutions for their products or services). Examples of intermediaries and bridging organizations included TTOs, TTAs, and Internet-based platforms.

The Technology Transfer Law, the Innovation Law, and the Law on Scientific and Scientific-Technical Activity (see appendix I) envisage the creation and operation of different types of intermediaries and

[11] Notes from the meeting held with the NAS during World Bank mission in Kiev, February 6, 2017.

bridging organizations, such as TTOs, business incubators, technological parks, science parks, and so on. Although the normative framework allows for the formation of these organizations, in practice, TTOs are not active and are rarely involved in technology commercialization through licensing or formation of academic spin-offs. This is because few resources have been devoted to innovation infrastructure (for example, technological parks and incubators) and innovation-focused financial support schemes.[12] The links with international technology markets are weak.

Ukraine has two Internet-based platforms for TT-related services. The Ukrainian Institute of Scientific, Technical, and Economic Information manages one, under the auspices of the MES. It functions as an automated database of integrated international information resources in the field of TT.[13] The second is the state enterprise Ukrtechinform, which is in charge of the Ukrainian integrated TT system. It offers services to find local and foreign TT partners and assists in developing technological cooperation among different stakeholders.[14]

The establishment and operation of science parks is carried out in accordance with the Law on Science Parks. In 2010, the government approved the compulsory criteria for the establishment of envisaged 14 research universities in Ukraine. To obtain the status of a research university, the PRO had to establish a science park. The expectation of the government was that within five years, universities would start to earn half of the amount that the state allocated to them annually for research. However, there were a lot of hurdles: (a) the government did not develop the mechanisms and conditions necessary for the development of knowledge transfer in the economy, (b) the tax system did not motivate business to participate in knowledge transfer, and (c) the IPRs enforcement was rather weak.

The establishment of technology parks is in accordance with the Law on Special Regime of Innovation Technology Parks. The main difference between science parks and technological parks in Ukraine is that the science parks are legal entities created by PROs or private entities, and they combine the contributions of the founders for the organization with coordination, control, process development, and project management of the science park. In contrast, technological parks are joint ventures where several PROs or private entities act in accordance with the agreement on joint activity without creating a legal entity (for a successful science park in Ukraine, see box 2).

Box 2. The Example of Kiev Polytechnic Institute (University) Science Park

The Kiev Polytechnic Institute (KPI) Science Park was established as part of the EU-sponsored Tacis-Tempus project (2004–2006), to bridge the gap between the university and businesses. The university and its partners devised a connected system to provide financial resources and business support services for innovation projects from the early stage to scale up. Under this regime, KPI graduate students are groomed—spend up to 30 percent of their learning time on innovation studies. A selected few attend a 'start-up' school to become entrepreneurs and then to join the 'business incubator'. Then a few of them compete in a festival of innovative projects, 'the Sikorsky Challenge Startup Contest', to win prizes and publicity. The first such festival was held in 2012. As a result of five contests, over 80 projects have received investment and/or grant support. Since its establishment, more than 110 start-ups have been created in the KPI Science Park, and more than 150 different products have been commercialized. Total financing from businesses reached UAH 23.4 million in 2014. The university's vision is to build a special 'Science City' with approximately 5,500 employees and US$170 million of investment (Yegorov 2015).

[12] One of the new initiatives in the Fostering Productive Innovation Project, launched in 2016 with the World Bank, is to develop an association of Kazakh TTOs to support capacity building at individual existing TTOs.
[13] Website of the Ukrainian Institute of Scientific, Technical and Economic Information http://www.uintei.kiev.ua/main.php (last accessed April 24, 2017).
[14] Website of the state enterprise Ukrtechinform http://www.untt.com.ua/ (last accessed April 24, 2017).

Researchers' Incentives for Knowledge and Invention Disclosure

The issue of remuneration of researchers for invention disclosure is usually governed by the contract law and 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.

The legal acts do not provide for any other incentives for knowledge or invention disclosure. In accordance with the Law on Higher Education and the Law on Scientific and Scientific-Technical Activity, obtaining tenure is not related to the issue of knowledge and invention disclosure or protection.

In practice, the uncertainty about IPR ownership and distribution of income might contribute to the unwillingness of university personnel to disclose their knowledge and inventions to PROs. Instead, they carry out contractual research with foreign or domestic customers, where often the contracts are not officially registered through PROs.

Policy Recommendations

Governments and institutions should design and implement TT and IP systems that meet their own needs, resources, and objectives in a realistic manner. Successful policy and institutional approaches from one environment may not work in another. Stimulating successful commercialization of publicly funded technologies is a complex endeavor that needs to consider the needs of the IP creators and the IP users, the local and the global STI environment, and the need for retaining the fundamental integrity of research institutions. The public policies in the field of IP and TT need to be complemented with adequate policies in the field of labor law, higher education law, access to research results, data and instruments, awareness raising, training, and creating links between PROs, HEIs and firms.

While legislative reform may sometimes be necessary for building adequate IP and TT systems for commercialization of publicly funded technologies, other government policy instruments can be deployed as well, such as 'codes of practice' or general guidelines on IP ownership and management.

Ukraine is a net importer of IP. It is of paramount importance for Ukraine to maintain connections with international sources of knowledge. Public policy makers should provide incentives to attract foreign direct investments from collaborative research alliances that bring new technologies into the local technology market and generate knowledge spillovers into the local economy. It is also important to seek international IP protection of cutting-edge research developed by local stakeholders and to support their international technology commercialization efforts.

Institutional Framework Policy Recommendations

Provide for clear competences in the areas of IP and TT between different institutions. It is advisable that the legal acts stipulate clear competencies between different institutions that do not overlap but complement each other. Thus, there will be lower transaction costs and less waste of human and financial resources.

Give more financial autonomy to PROs. Ukrainian PROs should be given a certain degree of financial autonomy. This will allow them to quickly perform certain financial transactions and avoid the bureaucracy of the Treasury of Ukraine. An additional incentive for commercialization could be to grant universities the rights to freely distribute funds derived from contract research and to utilize revenues from the licensing of IP. A greater degree of autonomy of universities will allow them to use venture capital for technology commercialization. Another source of funding might be specialized investment funds, whose activities are concentrated in potentially profitable innovation projects.[15]

Promote better monitoring of IP activity with respect to publicly funded technologies. Requirements by government funding agencies for invention disclosures and reporting by PROs might assist in this regard.[16]

Make IP ownership policies coherent across PROs and funding agencies. Regulatory action needs to ensure that PROs have a common basis for allocation ownership of IP to contracting parties. This will reduce transaction costs, increase transparency, and facilitate exploitation of IP by third parties. Government agencies might also use non-legislative actions, such as codes of practice (OECD 2003).

[15] Egorov, Puginsky, Afanasiev and Partners., Lex Mundi, Guide to doing business, Ukraine.
16 Egorov, Puginsky, Afanasiev and Partners, Lex Mundi Guide to doing business, Ukraine.

Encourage development and implementation of IP policies at the institutional level. Policies on IP ownership should be better disseminated among personnel of PROs. For instance, institutional regulations requiring research staff to disclose and report inventions allow for greater oversight by PROs. National funding regulations should require PROs to report IP to funding agencies (OECD 2003). Apart from setting up rules on IP ownership by faculty and researchers, the institutional policies should also focus on IP ownership by non-faculty members and students.

Design and disseminate conflict of interest rules. PROs should develop clear guidelines on conflicts of interest. National agencies can help by promoting guidelines (OECD 2003). For instance, academic staff could have specific employment conditions, which indicate their tasks and the length of time they are expected to spend on teaching and research. Such employment conditions provide a frame of reference for the time that can be dedicated to private work (Thorn and Soo 2006).

Develop adequate intermediary and bridging institutions. Policies should be implemented in the areas of IP licensing and management, for the establishment of TTOs or similar licensing centers within the PROs. These policies should encompass the financing and human resources of these structures within the PROs. Given the structure of Ukrainian academia, it is advisable that these structures are on-site and integrated into the PROs, so that they can develop close working relationships with the faculty and researchers and thus facilitate invention disclosures, patent prosecution, and finding licensees (often the most important channels for finding licensees are the researchers' contacts). However, the structures of the TTOs should differ in accordance with the nature of the PRO (university, government lab, fundamental research organization, contract research organization, and so on).

It would also be useful to create a national association of TTOs to focus on sharing practices and developing joint training activities, while linking with international associations of TT professionals (such as the AUTM or the European TT Offices Circle).[17]

It is also important to have guidelines to determine royalty rates. The data on royalty rates and other marketing information, as well as marketing information about national and foreign markets, should be collected and analyzed (Kelli et al. 2016).

It is advisable that the PROs draft model transfer technology agreements, nondisclosure agreements, and material transfer agreements.

Normative Framework Policy Recommendations

The reform should be broad and go beyond regular IP and TT legal acts. It should also encompass labor and fiscal legal acts whose implementation influences successful IP and TT policies. The reform should also encompass laws and regulations, such as public sector pay scales, that make it difficult for PROs to recruit qualified TT personnel. Fiscal rules that prevent PROs from receiving and retaining royalty income from licenses can also weaken incentives for TT.

The reform should not focus not only on patents but also on other IPRs. Copyrights, utility models, industrial designs, trademarks, and trade secrets often play an important role in the commercialization of

[17] One of the new initiatives in the Fostering Productive Innovation Project, launched in 2016 with the World Bank, is to develop an association of Kazakh TTOs to support capacity building at individual existing TTOs.

academic public research. The reforms should thus not be limited to patents but should encompass all forms of IPRs.

Moreover, there are substantial differences in intensity of TT channels between different disciplines. For instance, the biotechnology sector (of which R&D is a major part) relies heavily on TT channels, such as patenting, licensing, publications, industry hiring, students' placements, and contract research. Computer sciences are not as dependent on patenting and licensing. Social sciences and humanities rely heavily on personal contacts and labor mobility. These differences affect the importance of different IPRs across disciplines and sectors.

Set up clear and complementary legal rules regarding IP ownership over publicly funded technologies. Given the structure and the dynamics of the current STI system in Ukraine (professional IP management, knowledge transfer experts), it is advisable that Ukraine maintains the system of institutional ownership of IPRs created by PROs. This might also help increase international scientific and research collaborations, since most of the European countries have institutional ownership of their STI systems. However, it is advisable that the contradictory rules for IP ownership in the Law on Inventions and Utility Models and the Technology Transfer Law are amended and made complementary.

When IP ownership arises from research carried out by PROs and is jointly funded by the private sector, the IPRs should remain with the PRO and the firm should have the right to license the patent on an exclusive basis. If the firm funds more than 50 percent of the research, the firm can claim the ownership of the IP. In cases where the research problem is specific to the firm, the PRO might be granted the right to relinquish the IPRs in return for a financial compensation (for instance, research costs plus a share of PRO overhead and staff costs).[18]

Provide incentives to researchers for knowledge and invention disclosure. Encouraging PROs to commercialize research results by granting them title to IP can be useful but is not sufficient to get researchers to become inventors. Institutions and individual researchers should have incentives to disclose their inventions. Incentives can be 'sticks' such as legal or administrative requirements for researchers to disclose inventions or 'carrots' such as royalty sharing agreements or equity participation in academic start-ups. Recognition of patent activity in the evaluation and recruitment of faculty can also provide incentives for young researchers. For instance, Tsinghua University in China offers its young researchers prizes for inventions that are commercialized.

It is important that incentives are set at the institutional level, but national guidelines can help bring about coherence and the sharing of good practices. As important as incentives is the need for research institutions to clarify IP rules and disseminate them among faculty, staff, and graduate students who are increasingly involved in public research activities.

[18] http://zakon3.rada.gov.ua/laws/show/1556-18/page5 (last accessed 04/24/2017).

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Appendix I. Relevant Legal Acts

National Law

1. Civil Code[19]

The fourth section of the Civil Code regulates IPRs. It contains a general provision, the general principles of copyright, related rights, IPRs in scientific discovery, invention, utility models, industrial design, innovative proposals, the layout of integrated circuits, plant varieties, and animal breeds, as well as trademarks, geographical indications, and trade secrets.

Technological Know-How

Technological know-how is a term that is often used in the wider context of the protection of confidential information and trade secrets. The scope of protection of technological know-how depends on the extent to which it falls within the specific protection afforded by a country, either in the context of regulations regarding, for example, trade secrets, business secrets, and confidential information (labor law), or unfair competition.

The term 'commercial (trade) secret' is defined by the Civil Code (Articles 505 and 506).[20] The Ukrainian trade secrets law is fully compliant with the international legal standards set up by the TRIPS Agreement.

IPR Co-ownership

Co-ownership is typically created when an IPR comes into existence by the efforts of two or more persons, such as through a collaborative invention or joint creation. For IPRs that are subject to registration (patents, utility models, industrial designs, and trademarks), it will be clear, on the basis of the registration, who need to be considered as co-owners. For joint copyright works, however, it will be less obvious who needs to be considered a co-owner, as copyright is not subject to registration. Co-ownership can also arise through subsequent dealings, such as a transfer of the IPR, either deliberately (for example, by selling the right to several persons at once) or due to a transfer of the right after the original owner's death (for natural persons), merger, or liquidation (for legal entities).

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[19] http://zakon4.rada.gov.ua/laws/show/435-15 (last accessed April 24, 2017).

[20] Article 505. Commercial Secret

1. A commercial secret shall be the information is as a whole or as a specific form and in the aggregate of its component is unknown and is not easily accessed by the persons who usually deal with the type of information it belongs to and due to this has a commercial value and was a subject of the measures, adequate to the existing circumstances to preserve its secrecy, undertaken by a person who legally controls this information.
2. Information of technical, organizational, commercial, industrial and other nature can be a commercial secret, except for that which cannot be attributed to a commercial secret pursuant to the law.

Article 506. Proprietary Intellectual Property Rights to a Commercial Secret

1. Proprietary intellectual property rights to a commercial secret shall be:
   1) the right to use a commercial secret; 2) an exclusive right to permit the use of a commercial secret; 3) an exclusive right to prevent unlawful divulgation, collection or use of a commercial secret; 4) other proprietary intellectual property rights established by the law.
2. Proprietary intellectual property rights to a commercial secret shall belong to the entity that lawfully established the information as a commercial secret, unless otherwise established by the agreement.

Co-ownership rights are usually defined contractually (Article 428, Civil Code). If there is no contract, the rights will be exercised jointly. Article 436 (Civil Code) deals with coauthorship where the rights can be defined contractually. If there is no contract, the rights will be exercised jointly. If a part of the work has independent significance, the author might preserve his/her copyright over that right.[21]

2. Technology Transfer Law[22]

TT legislation in Ukraine was amended in 2012 through changes to the law 'On state regulation of activities in the field of TT', reflecting demands from research institutes, universities, and companies. The changes were aimed at intensifying activities in TT to create better legal conditions for the commercialization of research results.

Transfer of Technology and Know-How

The transfer of technology is formalized by entering into a TT agreement[23] that provides certain property rights and duties with respect to technology and/or components thereof, as well as granting the support to operate such technology by means of a wide range of know-how/trade secrets, schemes, and instructions.

The TT agreement should stipulate a list of technology components to be transferred, the period of such transfer, and the price or fees for the use of such technologies. The agreements should also specify the special terms and conditions for transfer of technical knowledge (know-how) required for installation, operation, and maintenance of equipment, as well as the purchase, lease, and use of such machinery, equipment, components, and materials. The agreements could also specify (a) territory restrictions, (b) exclusivity, (c) restrictions on the use of technologies, and (d) sub-licensing of technology components to third parties. An exclusive license grantee shall have enough skills, experience, and remedies to market the technology in the licensed territory as required by the transferor who provides the special targets for

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[21] http://www.lawkneu.org.ua/wp-content/pravo/Civil%20Code.pdf:

Article 428. Exercise of Intellectual Property Right Vested with Several Persons

> Intellectual property right vested with several persons jointly can be exercised under the agreement between them. In absence of such an agreement the intellectual property right vested with several persons shall be exercised jointly.

Article 436. Coauthorship

> 1. The copyright to a work created in co-authorship shall belong to the co-authors jointly, irrespective whether such work is a single inseparable item or consists of parts, each of which has independent significance. Part of the work created in co-authorship shall be deemed as such that has independent significance provided it can be used separately, regardless of other parts of this work.
> 2. Each co-author shall preserve his copyright to the part of the work he has created which has independent significance.
> 3. Relations between the co-authors can be established by the agreement. In absence of the agreement the copyright to the work shall be exercised jointly by all the co-authors. (last accessed April 24, 2017).

[22] http://zakon4.rada.gov.ua/laws/show/143-16. Subsequently, it was followed by the relevant government acts: Resolution of the Cabinet of Ministers of Ukraine "On Certain Issues of TT" (2007) and Order of the Ministry of Education and Science of Ukraine "On Procedure of State Registration of TT Agreements and Administration of the State Register of TT Agreements" (2008) (last accessed April 24, 2017).

[23] This is a non-exhaustive list of TT contracts that can be concluded under the Ukrainian law: (a) industrial technology supply contract, (b) technical/industrial cooperation contract, (c) technical services contract, (d) engineering contract, (e) joint venture contracts, (f) technology components or equipment lease or leasing contracts, (g) commercial concession (franchising) contracts, and so on. (last accessed April 24, 2017).

incomes and returns. Often, TT agreements entitle the transferor to cancel the exclusivity if a licensee fails to meet the said targets.

The TT Act specifies the restrictions with respect to concluding a TT agreement: (a) payments under TT agreement shall not considerably exceed the price of the technology and its components, (b) the transferor shall have no right to provide the sales or the reexport price of products manufactured with the application of the technology transferred or to prohibit or limit the export of such products, (c) it is prohibited to introduce inconsistent restrictions on the volume of product manufacture, (d) illegal restrictions on the use of property rights to technologies and their components are prohibited, and (e) the transferor is not entitled to prohibit the use of similar or better technologies and components thereof.

Article 11. Procedure for transferring property rights to the technology created for the budget:

> Property rights to the technology and/or its components that are created in the process of research and development work funded through the budget belong to the institutions, organizations and businesses - the performers of these works according to the Civil Code Ukraine, except as provided for by this article.
>
> The institution acquiring the property rights (IPRs included) should resolve the issue of concluding a written agreement with the IPR author on the amount and conditions of its remuneration in accordance with the economic value of technology and / or its components or other benefits that may be obtained from the use of the technology.
>
> Central executive bodies, National Academy of Sciences of Ukraine and sectoral Academy of Sciences are entitled to freely use the technology and / or its components in order to perform work or supply goods for state needs necessary for the performance of public functions.
>
> If the technology/its component is created partly by own funds of the enterprises, academic institutions, organizations and higher education institutions and individuals, and partly from the budget, the property rights for these components are distributed on the basis of technology transfer agreement.

Article 16. "State-owned enterprises that produce or procure technology or components in order to determine their possible use in Ukraine need to register these."

The Ministry of Education and Science is in charge of the state register for TT.[24]
Article 19 governs the mandatory components of a TT agreement. Article 20 stipulates that the IPRs will be transferred in accordance with the Civil Code of Ukraine.

The Technology Transfer Law defines 'know-how' as information obtained through experience and tests, which (a) is not in the public domain or easily accessible on the date of conclusion of a TT agreement, (b) is essential (that is, important and useful for the manufacture of products and/or the provision of

[24] On approval of the registration technology and components created or purchased for the budget, created or acquired by state-owned enterprises, http://zakon4.rada.gov.ua/laws/show/472-2013-%D0%BF/paran9#n9 (last accessed April 24, 2017).

services), and (c) is defined (that is, described with the sufficient details making it possible to check if such technology meets the non-public-domain and essentiality criteria).

3. Law on Innovation Activity[25]

Article 1 defines

- Innovative enterprise (innovation center, technopark, technopolis, innovative business incubator, and so on)—a company (association) that develops, produces, and sells innovative products and/or services, the volume of which in monetary terms exceed 70 percent of its of total production and/or services;

- Innovation infrastructure—a set of businesses, organizations, institutions, and associations, of any form of ownership, providing services in support of innovation activity (financial, consulting, marketing, information and communication, legal, educational, and so on).

Article 14 pertains to the main characteristics of an innovative product. It defines what an innovative product is and lists the mandatory requirements for an innovative product to be regarded as such. One of the requirements is that the product is the realization (implementation) of an object of IP for which the manufacturer of a product has state security documents (patents, certificates) or has obtained them from the owners of these objects of IP, licenses, or assignments. The used object of IP should be determining for this product.

4. Law on Protection of Rights to Inventions and Utility Models[26]

Patent is a protective document that is issued in Ukraine to confirm priority, authorship, and ownership of an invention, utility model, or industrial design. Contrary to the legislation of many countries, in Ukraine the objects that can be protected as inventions or utility models are the same: (a) products (devices, substances, microorganism strains, plants or cultures of animal cells, and so on) or (b) processes (methods) or (c) the novel use of a known product or process.[27]

Since 2003, there has been a noticeable trend in the rapid increase of applications in utility models because after a short-term patent (six years) expires, patents on improvements based on research experiments could be applied for.

[25] http://zakon4.rada.gov.ua/laws/show/40-15 (last accessed April 24, 2017).
[26] http://zakon4.rada.gov.ua/laws/show/3687-12 (last accessed April 24, 2017)
[27] Ukraine IP Factsheet, Office for harmonization in the internal market, https://euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/observatory/documents/News/Ukraine-guide_en.pdf. The major differences between inventions and utility models are their patentability requirements, registration procedures and timescales, and terms of protection. Industrial designs cover shapes, pictures, coloring, or any combination that define the appearance of an industrial product and are designed to meet aesthetic and ergonomic demands and comply with the patentability requirements. However, there is no industrial design protection for architecture objects (apart from small architectural structures), industrial, hydrotechnical, and other fixed constructions, printed production, and objects of an unstable form of liquid or gaseous, free-flowing, and similar substances (last accessed April 24, 2017).

5. Law on Science Parks

'Science park' is a legal entity created on the initiative of higher education institutions and/or research institutions by combining the contributions of the founders for the organization, coordination, control, process development, and project management of the science park. Its partners can be the entities that must enter into an appropriate agreement. The regulative framework uses different terms: science parks, industrial parks, and technological parks.

6. Law on Priority Directions of Innovative Activities[28]

Defines the strategic priorities for the innovation policy between 2011 and 2021. Largely unimplemented, the law requires further development in the form of a comprehensive strategy and a clear road map for reform. Though the legislation envisaged the adoption of one-year action plans with measurable targets, none of these have been developed to date.

7. Law on Higher Education[29]

Article 69. Intellectual Property Rights

Article 70.

> 3. A higher education institution in the manner prescribed by law and in accordance with the statute has the right to:
>
> 1. ownership of intellectual property created by own funds or funds of state or local budgets (except in cases specified by law);
>
> 10. participate in the formation of the share capital and innovative structures formed with the participation of higher educational establishments of small enterprises, developing and introducing innovative products, through the inclusion of intangible assets (property rights for intellectual property rights);
>
> 11. establish educational institutions and research institutions;
>
> 12. establish enterprises for conducting innovative and / or production activities;
>
> 14. by making intangible assets (property rights for intellectual property rights) to participate in the authorized capital of innovative structures of various types (scientific, technological parks, business incubators, etc.).

8. Law on Copyright and Related Rights[30]

Copyright protection includes verbal or written, published or unpublished works of science, literature, or art, regardless of their purpose or value. Copyright protection also includes computer programs and databases. The protection covers only the work itself and does not cover any ideas, methods, and so on,

[28] http://zakon4.rada.gov.ua/laws/show/3715-17 (last accessed April 24, 2017).
[29] http://zakon3.rada.gov.ua/laws/show/1556-18/page5 (last accessed April 24, 2017).
[30] http://zakon4.rada.gov.ua/laws/show/3792-12 (last accessed April 24, 2017).

which contributed to it, even if they are described, explained, and so on in the work. Relevant material is protected from the moment of creation and does not need to be registered. However, upon the owner's request, the copyright itself and assignment or license copyright agreements can be registered with the Copyright Office. The registration procedure does not require an examination of the substance of the copyright material. Registration may take about two months. Property rights arising out of the copyright are protected for the lifetime of the author plus 70 years after his/her death. Nonpecuniary rights are protected indefinitely.[31]

9. Law on Protection of Rights to Trademarks for Goods and Services32

Trademark matters are governed by the Law on the Protection of Rights to Trademarks for Goods and Services adopted in 1993 and last amended in 2015. Trademark rights cover signs, which distinguish goods and services of one person/entity from another. A trademark must be registered with the SIPS. The process of obtaining a registration certificate under the ordinary registration procedures may take one to two years. However, an official accelerated registration procedure is available. It allows for the registration of trademarks within three to nine months, at an additional cost. It is also possible to obtain recognition of a 'well-known' trademark in Ukraine and a special procedure exists to obtain this status. A well-known trademark has much broader protection than an ordinary trademark: it gives protection for all goods and services even though it is recognized as well-known only for a limited list of goods and/or services. The registration of license and assignment agreements for trademarks is not obligatory. However, it is possible to register such agreements and changes in title within the respective state register. Protection for a trademark is granted for 10 years with the possibility of further indefinite extensions in 10-year periods, provided renewal fees are paid.

10. Other Relevant Laws

- Law on Protection of Rights to Industrial Designs[33]
- Law on Protection of Rights to Topographies of Integrated Circuits[34]
- Law on State Control over International Transfers of Military and Dual-use [35]
- Law on Protection of Plant Varieties[36]
- Law on Protection from Unfair Competition[37]
- Law on the Scientific and Technical Expertise [38]

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[31]Yegorov et al., Lex Mundi, Guide to doing business, Ukraine.
[32] http://zakon4.rada.gov.ua/laws/show/3689-12 (last accessed April 24, 2017).
[33] http://zakon4.rada.gov.ua/laws/show/3688-12 (last accessed April 24, 2017).
[34] http://zakon4.rada.gov.ua/laws/show/621/97-%D0%B2%D1%80 (last accessed April 24, 2017).
[35] http://zakon4.rada.gov.ua/laws/show/549-15 (last accessed April 24, 2017).
[36] http://zakon4.rada.gov.ua/laws/show/3116-12 http://zakon4.rada.gov.ua/laws/show/3116-12 (last accessed April 24, 2017).
[37] http://zakon4.rada.gov.ua/laws/show/236/96-%D0%B2%D1%80 (last accessed April 24, 2017).
[38] http://zakon4.rada.gov.ua/laws/show/51/95-%D0%B2%D1%80 http://zakon4.rada.gov.ua/laws/show/51/95-%D0%B2%D1%80 (last accessed April 24, 2017).

- Law on Scientific and Scientific-Technical activity[39]

- Law on Special Regime for Innovation Activity in Technological Parks[40]

- Law on Priority Directions of Science and Technology[41]

11. Ministerial Acts

- Cabinet of Ministers of Ukraine of 17.09.2003. Number 1474 "On approval of state registration of innovation projects and the State Register of innovation";

- Cabinet of Ministers of Ukraine of 26.11.2003 p. Number 1839 "On approval of determining the competitive innovation enterprises of strategic importance to the economy and security, will be financed from the state budget."

- Ministry of Education and Science of Ukraine AOR July 2013 № 1052 "On approval of the application form on the review of the innovation project, the form of innovative design and arrangements for public examination of innovative projects"

- Ministry of Education and Science of Ukraine 12 December 2013 № 1764 "On approval of a model structure of the business plan of the innovative project"

- Ministry of Education and Science of Ukraine of 21 December 2015 № 1325 "On Amendments to the Ministry of Education and Science of Ukraine AOR July 2013 № 1052"

Ministerial Acts pertinent to science and technology parks

- Law of Ukraine " On special regime for innovation activity of technological parks » № 991-XIV of 15.07.1999r

- CMU Resolution "On normative legal acts to ensure implementation of the Law of Ukraine" On special regime for innovation activity in technological parks »] Number 2311 from 17.12.1999r

- Cabinet of Ministers of Ukraine of 29 November 2006 r. Number 1657 " Some problems of organization of technological parks";

- Cabinet of Ministers of Ukraine of 21 March 2007 r. Number 517 "On approval of the monitoring and supervising the implementation of projects of technological parks";

- Cabinet of Ministers of Ukraine on February 2, 2011 r. Number 118 "On approval of the transfer amounts corporate income tax accounts for special technology park, its participants and joint ventures, the use of these funds and control over their spending"

[39] http://zakon4.rada.gov.ua/laws/show/1977-12 (last accessed April 24, 2017).
[40] http://zakon4.rada.gov.ua/laws/show/991-14 http://zakon4.rada.gov.ua/laws/show/991-14 (last accessed April 24, 2017).
[41] http://zakon4.rada.gov.ua/laws/show/2623-14 http://zakon4.rada.gov.ua/laws/show/2623-14 (last accessed April 24, 2017).

- Strategy for Sustainable Development of Ukraine 2020

Adopted in January 2015, it includes developing a favorable business environment for SMEs among its priorities, together with attracting investment, facilitating trade and improving the efficiency of the labor market.[42]

Relevant International Law

According to the 'Law on International Treaties', all international agreements to which Ukraine is a party constitute integral parts of its domestic legislation. Accordingly, the provisions of the international conventions and treaties to which Ukraine is a party form part of Ukraine's legislative regime on IP.

- WTO TRIPS: In 2008, Ukraine became a member of the WTO, as a result of which it is now a party to the TRIPS Agreement.

Ukraine has ratified all the major international treaties in the IP field that are pertinent in the context of international TT:

- Paris Convention for the Protection of Industrial Property
- PCT
- International Convention for the Protection of New Varieties of Plants
- Hague Agreement Concerning the International Registration of Industrial Designs
- Nice Agreement Concerning the International Classification of Goods and Services for the purposes of the Registration of Marks
- Madrid Agreement Concerning the International Registration of Marks
- Berne Convention for the Protection of Literary and Artistic works

Relevant EU Law

1. Association Agreement between the EU and Ukraine (2014)

In accordance with this Agreement,[43] Ukraine must ensure an adequate level of effective protection and enforcement of IPRs. There has been considerable progress in recent years, in particular in IP legislation, but Ukraine is expected to improve its legislation even further in a number of areas, including geographical indications, designs, trademarks, data protection for pharmaceuticals, enforcement measures (including at its borders), and the liability of internet service providers. [44]

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[42] http://www.etf.europa.eu/webatt.nsf/0/E5B597CD15164A86C125800A00334F97/$file/SME%20Policy%20Index%20Eastern%20Partners% 202016_EN.pdf (last accessed April 24, 2017).
[43] http://trade.ec.europa.eu/doclib/docs/2016/november/tradoc_155103.pdf (last accessed April 24, 2017).
[44] Ukraine IP Country Factsheet, Office for Harmonization in the Internal Market, https://euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/observatory/documents/News/Ukraine-guide_en.pdf (last accessed April 24, 2017).

Article 159 deals specifically with issues of TT and intellectual property rights:

> 1. The Parties agree to exchange views and information on their domestic and international practices and policies affecting transfer of technology. This shall in particular include measures to facilitate information flows, business partnerships, and licensing and subcontracting deals on a voluntary basis. Particular attention shall be paid to the conditions necessary to create an adequate enabling environment for technology transfer in the host countries, including issues such as the relevant legal framework and development of human capital.
>
> 2. The Parties shall ensure that the legitimate interests of the intellectual property right holders are protected.

The following articles of the agreements are pertinent to TT in the biotech and pharmaceutical sector: Article 219 (Patents and public health); Article 220 (Supplementary protection certificate); Article 221 (Protection of biotechnological inventions); and Article 222 (Protection of data submitted to obtain an authorization to put a medicinal product on the market).

2. Directive 98/44/EC of the European Parliament and of the Council of July 6, 1998, on the legal protection of biotechnological inventions

In 1998, the EU harmonized the patent law in member countries relating to biotechnological inventions. This clarifies which inventions are patentable or not on ethical grounds, giving the legal certainty to organizations in the sector that is required to attract the considerable investment that is needed for innovation.

Relevant articles: Article 3(1), Article 5(2), Article 8, and Article 9.[45]

3. Directive 98/71/EC of the European Parliament and of the Council of October 13, 1998, on the legal protection of designs

4. Directive (EU) 2016/943 on the protection of undisclosed know-how and business information (trade secrets) against their unlawful acquisition, use, and disclosure[46]

This legal act standardized the existing national laws on the protection against the misappropriation of trade secrets.

5. Council Regulation (EC) No. 40/94 of December 20, 1993, on the community trade mark

6. Directive 89/104/EEC of the Council of December 21, 1988, to approximate the laws of the member states relating to trade marks

7. Horizon 2020

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[45] Directive 98/44/EC of the European Parliament and of the Council of July 6, 1998, on the legal protection of biotechnological inventions, OJ L 213, 30.7.1998, p. 13–21, available at http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=Directive&an_doc=1998&nu_doc=44 (last accessed April 24, 2017).

[46] https://ec.europa.eu/growth/industry/intellectual-property/trade-secrets_en (last accessed April 24, 2017).

In March 2015, Ukraine joined Horizon 2020, the EU's research and innovation funding program. This agreement opens up a wide range of new opportunities to Ukrainian research institutions, universities, and businesses across the research and innovation value chain, from fundamental research to close-to-market activities. To reap the benefits of Ukraine's participation in this program and to enhance the country's innovation ecosystem, the government needs to (a) review the current institutional and strategic framework; (b) mobilize resources for its implementation, including leveraging private sector support; and (c) create mechanisms for multistakeholder coordination at the policy level and TT cooperation between SMEs and research centers at the operational level.[47]

[47] Academic Patenting: How universities and public research organizations are using their intellectual property to boost research and spur innovative start-ups, Mario Cervantes http://www.wipo.int/sme/en/documents/academic_patenting.html (last accessed 04/24/2017).

Appendix II. Comparative Review of Government Policies and Institutional Practices

The emergence of disruptive technologies and the changing global landscape of science and innovation have given rise to novel approaches to transfer and commercialization of the result of publicly funded research. This appendix gives an overview of various IP and TT public policy and legal initiatives, both at the institution and government levels. The strategies and policies reviewed include IP ownership of publicly funded technologies, PRO procedures targeting research personnel and faculty, academic spin-offs, intermediaries, and bridging organizations (TTOs, TTAs, for-profit models, Internet-based models, and free agency), and researchers' incentives for knowledge and invention disclosure.

IP Ownership of Publicly Funded Technologies

Countries might adopt different policies with respect to the ownership of IP obtained through publicly funded research. Most EU countries have removed the so-called 'professor's privilege', where researchers enjoy full rights over the IP they created, and have moved toward a system of institutional IP ownership, where the PRO retains the right to the IP created through publicly funded research.

In the 'professor's privilege' systems, researchers manage their inventions, by establishing firms or performing consultancy in return for royalties and compensation. This may result in lower costs for the institutions in commercializing the invention. However, that system relies on professors having the necessary funds to protect their results and the time and skills to transfer them. In most cases, researchers do not have the resources or interest to successfully commercialize their own research.

For this reason, since the early 2000s, most EU countries have moved toward a system of institutional ownership of IP for publicly funded technologies. The EU countries operate various systems of institutional ownership (see table 2.1), which differ in the content of IPRs granted to the PROs and the type of compensation of researchers (van Eecke et al. 2009).

Table 2.1 Institutional Ownership Systems in Europe

Preemption Rights Systems (Austria, Finland, Germany, Hungary, Lithuania, and Poland)	Automatic Ownership Systems (Latvia, France, United Kingdom, Estonia and Ireland)
Researcher is the first owner of the invention. PROs have the right to 'claim' the invention within a specified period. If the invention is not claimed within the specified period, then the right to the invention reverts to the inventor (employee). Employer must pay some form of remuneration to the employee-inventor as compensation for transferring the right to patent the invention to the employer.	The PRO is the first owner of the IPR. No reversion rights to the employee-inventor. The employee-inventor might be entitled to compensation for transferring the invention. Belgium: hybrid system—the rights to an invention automatically vest in the research institution. However, these rights may revert to the inventor if the research is not commercialized within a reasonable time and without legitimate reason (minimum 3 years from the date of notification) (Van Eecke et al. 2009).

The current exceptions to a system of institutional ownership are Sweden where professors' privilege is well established and Italy where it has fluctuated with different parliaments (see table 2.2).

Table 2.2. Professors' Privilege Systems in Europe				
Country	**Scope**	**Compensation**	**Patent Protection**	**Derogation**
Italy	The privilege applies to all employees of a PRO and potentially all consultants and third parties involved in the research. The privilege does not extend to copyright, and other than for inventions, IP ownership is as agreed between the parties.	PROs are entitled to a portion of the profits deriving from the exploitation of the invention.	The researcher must patent the invention.	If the researcher does not industrially exploit the invention within 5 years, the PRO is entitled to a royalty-free, nonexclusive right to exploit the invention, and if the research is wholly or partly privately financed, then the PRO owns the invention.
Sweden	Act 345 on the Right to Employees' Inventions 1949 states that academics at universities, technical colleges, and other academic institutions shall not be considered as employees under the act, and thus the ownership of the patent rights is vested in them.	PROs are not entitled to any profits.	The researcher has no duty to patent the invention.	No equivalent provisions under Swedish law.

The shift to the institution ownership system was largely motivated by the experience that the United States had with the 1980 U.S. Bayh-Dole Act.[48] The act removed the U.S. government's claims to university-based innovation, conferring U.S. universities the rights to inventions that were federally funded. The new system facilitated the transfer of government-funded research from American universities to the private sector by enabling the universities to retain the rights to government-funded research and license these inventions on a nonexclusive or exclusive basis to external entities (for major provisions of the act, see box 2.1).

Since the Bayh-Dole Act was enacted, almost every U.S. research university set up a central TTO, although some, such as the University of California, have offices at different campuses. The TTOs are charged with evaluating inventions, filing patent applications on behalf of the university, and licensing patents. They are largely staffed by professionals, with backgrounds in science, law, marketing, and business development. Most U.S. TTO operations conform to a 'patent agency' model of operation where the focus is on selling patentable inventions to industrial adopters.

This model of innovation for government-based funding has been widely adopted in other industrialized countries worldwide with similar enabling legislations. It is credited not only with expanding TT from universities to industry, but also enabling cross-sector R&D collaborations (UNECE 2011). However, a successful institutional IP ownership system can take a long time to build a successful IP portfolio and require significant investments in building TTO structure and recruiting and retaining highly professional staff.

[48] P.L. 96-517, Patent and Trademark Act Amendments of 1980.

Box 2.1. Major Provisions of the Bayh-Dole Act

- Nonprofits, including universities, and small businesses may elect to retain title to innovations developed under federally funded research programs.
- Universities are encouraged to collaborate with businesses, to promote the utilization of inventions arising from federal funding.
- Universities are expected to file patents on inventions they elect to own.
- Universities are expected to give licensing preference to small businesses.
- The government retains a nonexclusive license to practice the patent throughout the world.
- The government retains march-in rights.

The ownership provisions of the act are as follows:

- The university must decide on taking title to the invention within two years after disclosing the invention to a federal agency.
- If the research results must be published, claiming title will take at least 60 days before the end of the statutory period. Federal agencies may claim title if the university does not.
- The university must file a patent application within one year or before the end of any statutory period in which valid patent protection can be obtained in the United States.
- Universities may not assign their ownership of inventions to third parties, except to patent management organizations.

Source: AUTM, www.autm.net.

PRO Procedures Targeting Research Personnel and Faculty

PROs can develop their own IP regulations and practices (bylaws) to encourage the process of disclosure, evaluation, protection, and transfer of IP. For instance, some institutions grant preferential treatment (through standard licenses) to researchers that decide to license the technologies they developed while working at the institution (See box 2.2).[49] Other institutions grant researchers the right to establish new ventures, take leave of absence, or grant them a tenure clock stoppage to pursue commercialization of the technologies they have developed. Some institutions require a commercial track record to obtain academic tenure (for example, Oklahoma State University).

PROs also face the issue of potential IP ownership by individuals who are not employed on research contracts by the organization, for example, graduate students and visiting scholars involved in research. If these situations are not covered by clear and transparent institutional IP policy, then ambiguity of ownership and conflicts can arise.

Most PROs make some provision for this situation in their IP policy by considering the employment relationship between the inventor and the degree to which the invention could have taken place without 'significant' use of PRO resources. For example, the University of Missouri allows students to claim ownership of an invention, provided they are not university employees and have not used more university resources than those generally available to other students.[50]

[49] Author's own calculations, based on the Global Innovation Index 2013 and 2016, at https://www.globalinnovationindex.org/analysis-economy. Where 1 is the highest ranking and 128 is the lowest ranking.
[50] Author's own calculations, based on the Global Innovation Index 2013 and 2016, at https://www.globalinnovationindex.org/analysis-economy. Where 1 is the highest ranking and 128 is the lowest ranking.

Box 2.2. The University of North Carolina (UNC) Express Licensing Agreement

This standard licensing agreement to establish spin-offs is used by the UNC to provide a collaborative environment in which entrepreneurial faculty and the university can work together and avoid conflict and lengthy negotiations.

Key provisions:

1.0 percent royalty on products requiring the Food and Drug Administration's approval, based upon human clinical trials

2.0 percent royalty on all other products

Cash payout equal to 0.75 percent of the amount paid to the UNC upon a merger, stock sale, asset sale, or initial public offering (IPO)

Provisions that encourage broad commercialization of the licensed technology, including making products available for humanitarian purposes in developing countries

No up-front fees

Month delay on obligation to begin repayment of patent costs

The use of the agreement is possible under the following circumstances:

UNC faculty member, student, or staff member is a founder of the company.

All IPRs are owned solely by the UNC.

The detailed business plan is reviewed and approved by the UNC.

Source: Kauffmann Foundation. 2010. "Facilitating the Commercialization of University Innovation: The Carolina Express License Agreement." Ewing Marion Kauffman Foundation Research Paper.

Establishment and Financing of ACADEMIC Spin-Offs

Different types of IP ownership systems can result in different types of spin-off structures. In countries with an institutional IP ownership system, academic spin-offs are typically set up to obtain a license for the publicly funded technology. In countries that have professors' privilege, academic spin-offs are set up without licensing and are often termed academic 'start-ups' (OECD 2008). However, the terms are used loosely and often interchangeably in different countries.

On a national level, there has been a rise in schemes that target certain stages of the spin-off process such as PoC, pre-seed, and seed funding, as well as funding for advisory and technical services. Norway is one of many countries that has developed financing mechanisms to help establish spin-offs (box 2.3).

Box 2.3. Norway's FORNY2020

This program has been streamlined to two funding schemes: basic funding and PoC funding. Basic funding targets Norwegian TTOs. Public investment in the PoC activity helps reduce technological and commercial risks so that investors are more likely support the project. Projects applying for funding must originate from publicly funded R&D institutions. PoC funding from FORNY2020 requires that the projects aim to develop products, processes, or services that are new to the international market. The scheme is technology neutral. Applicants can include TTOs receiving basic funding, other bodies focusing on commercialization and representing publicly funded R&D institutions, and microenterprises originating from publicly funded R&D institutions.

Source: OECD. 2014.OECD Reviews of Innovation Policy: Industry and Technology Policies in Korea, OECD, 2014.

Similarly, many developing countries deliberately encourage researcher mobility to engage in spin-offs. For instance, in Brazil, researchers are allowed to work in other institutions through undertaking joint projects and can request special leave if they decide to form a spin-off (Correa and Lara 2016). Another option is the ability to take a sabbatical, as is allowed in Malaysia (OECD 2015).

While the number of academic spin-offs globally is likely to continue to increase, they probably remain a small subpopulation of new entrepreneurial firms. There are several reasons for this: (a) spin-offs tend to come from a small number of top research institutions that have the research strength to create the technology needed to sustain a new venture and there is probably an upper limit on the number of spin-offs that even top institutions can initiate, given the conflicting demands placed on their faculty and staff, and (b) not all academic disciplines are equally able to generate new firms. Many other forms of TT and commercialization compete with spin-offs, for example, the licensing of commercially relevant technologies to industry has the advantage of being less resource and time intensive for PROs and HEIs and of carrying lower risks (Callan 2001).

Intermediaries and Bridging Organizations

TT Offices

The TTO's functions might vary across countries and even across PROs within the same country. In general terms, however, the TTO acts as an intermediary between the supplier of IP (the PRO) and entities that could help the commercialization of such IP (box 2.4).

Box 2.4. The Case of Israeli Yeda

Yeda is a TTO of the Israel's Weizmann Institute (PRO). It is in charge of identifying, licensing, and protecting of all the Weizmann Institute's IP. Inventors have to cooperate with the TTO and disclose relevant knowledge.

If Yeda does not submit a patent, inventors can try to commercialize their invention on their own but still have to repay part of any profits to Yeda.

If Yeda decides to patent an invention, it will oversee the patent application process and, after the patent is granted, focus on licensing contracts, often with Israeli firms.

Revenue is distributed as follows: 40 percent to the scientists and 60 percent to the institute (minus a commission for the TTO).

Yeda has filed or participated in filing 1,400 patent families, has signed many licensing agreements, and has established around 50 spin-off companies. It owns 660 live patent families. The total annual royalty-generating sales in 2010 amounted to US$15 billion. The Weizmann budget is approximately US$300 million. A third comes from the Israeli government for basic funding, while the rest comes from international donations, international and national competitive funding, and revenues from their endowment. Yeda also organizes money flows for precompetitive research from industry to the institute. A large industrial park next to the institute hosts a number of successful firms.

Israeli TTOs have clear missions and top staff. Yeda representatives work closely with researchers and have more than 1,000 industry contacts a year.

Source: OECD. 2013. *Science, Technology and Industry Outlook 2012*, OECD, 2013.

Many governments and PROs have experimented with new bridging and intermediation structures (see box 2.5 for a description of the Swedish Innovation Offices Program). Most of these initiatives focus on replacing or building upon TTO structures and services, including, but not limited to, TTAs, Internet-based models, for-profit models, or approaches to vesting some rights in inventors while maintaining university ownership (for example, the free agency model).

Box 2.5. Swedish Innovation Offices Program

Due to the Swedish 'professor's privilege' system, PROs have relatively weak infrastructures for commercializing their R&D. The 2008 Research and Innovation Bill introduced 'innovation offices' (innovationskontor) that seek to facilitate the commercial utilization of research results from universities. Their purpose is to support researchers and university management by providing innovation advice for the establishment of spin-offs, business

development, verification, and management of intellectual assets. Initially, eight innovation offices for 11 Swedish universities were founded. The 2012 Research and Innovation Bill increased the allocation of funding to innovation offices to establish four additional offices to cover all universities.

Source: OECD. 2013.*OECD Reviews of Innovation Policy: Sweden 2012*.

TTAs (Hub-and-Spoke Models)

Often, midrange PROs have limited ability to generate income to cover expenses of running a TTO, and thus it might be more efficient to share services through TTAs. This might lower operational costs, through economies of scale, and provide access to high commercialization expertise.

For instance, after the shift from an inventor to an institutional ownership system in 2002, each federal state in Germany established with ministerial resources at least one regional patent agency (RPA). Another example is the U.S. Innovation Transfer Network (ITN), established in 2006 with government support. It serves as a TTO for 13 smaller colleges, each of which is represented on the board.

In recent years, many developing countries have created TTAs that bring together several universities or act as off-campus TTOs in addition to the universities' TTOs. The objective of these TTAs has been to reach sufficient critical mass to operate more efficient and higher-quality specialist services (see box 2.6).

Box 2.6. TTAs in Chile and Kazakhstan

OTRI Chile was created in 2005 as a TTA through a partnership of five universities and two business associations. At that time, the participating universities did not have their own TTOs, and OTRI Chile was envisaged as an institution that would be able to provide professional services and establish linkages with national and international technology markets. Despite making some progress in the first years of its operation, OTRI Chile was downsized as it began to face financial and operational challenges, and eventually it closed. Its main challenges were the lack of projects that could reach the commercialization stage and difficulties of coordination among participating universities.

Since then, the Government of Chile, through its national innovation agency, Corfo, has focused on supporting the development of TTOs at individual universities. Corfo runs a program for the establishment of 'hubs of TT', that is, associations of university TTOs focusing on specific priority sectors. Corfo provides grants to cover up to 80 percent of the hubs' costs over a five-year period, with a limit of around US$7.3 million per hub. These hubs are independent, decentralized entities whose shareholders are a group of at least six PROs and/or HEIs. The hubs coexist with the individual TTOs of participating universities but focus on the international commercialization of publicly funded technologies in three priority sectors (agriculture, health, and industrial production and energy).

In Kazakhstan, in addition to the TTOs that were created within individual universities and public research institutes, in 2013 a nationwide Technology Commercialization Center (TCC) was established as an off-campus TTO, to complement the activity of university TTOs. It acts as an overarching institution, providing funding and support to the best projects that it selects from any of the country's universities or research institutes. The TCC is in charge of connecting the Kazakh academia with the international technology market. The TCC is under the auspices of the Kazakh Ministry of Education and Science.

Source: OECD. 2016. *Boosting Kazakhstan's National Intellectual Property System for Innovation*.

For-Profit Models

Some PROs have established for-profit companies that operate in the commercialization of invention. For instance, University Oxford Innovation Ltd (formally Isis Innovation) is an independent company owned 100 percent by University of Oxford, ranked 16th in the PCT applications in 2011. In Israel, the majority of TTOs are for-profit companies.

Internet-Based Platforms

Existing internal TTO structures are complemented by Internet-based platforms that offer easy access to knowledge and information to both TTO professionals and researchers. Among a very large number of examples, the University of British Columbia has developed an online platform called Flintbox to market its technologies. Another example is the Kauffman Foundation Innovation Network's online platform 'iBridge network'. Universities in the iBridge Network are able to post information about their (predominantly non-patentable) technologies directly on the site, which provides an alternative pathway to research tools, materials, and nonexclusive licensed technologies that should accelerate university innovation and lower transaction costs.[51]

Free Agency Model

The free agency model tries to resolve the potential antagonism that might occur between researchers and TTO operations. Often, researchers view TTOs as revenue maximizers that are reluctant to explore alternative commercialization methods. Under this model, the researchers choose between their university TTO or an agent elsewhere. The free agency introduces a strong element of competition to the university TTO, while giving academic researchers the freedom to choose the arrangement that they believe to be the most adequate for the commercialization of their innovation.

Researchers' Incentives for Knowledge and Invention Disclosure

A plethora of factors influence knowledge and invention disclosure by researchers: not realizing the commercial potential of their inventions, perceived costs of interacting with the TTO, and institutional environments and norms. Designing a suitable public policy for incentives to encourage researchers to disclose their knowledge and inventions is a difficult endeavor.

Monetary Mechanisms and Incentives

Monetary incentives may include a fixed or nonlinear rate of revenues generated from the exploitation of IP and other technological activities or a lump-sum payment. Other incentives to encourage researchers include awards, recognition in curricula, equity participation in spin-offs, additional research funds for department, and salary upgrades.

Nonmonetary Mechanisms and Incentives

Nonmonetary instruments can be as important for knowledge and invention disclosure as monetary incentives. Empirical evidence suggests that frameworks that include participation in innovation activities in their career advancement metrics have a stronger effect than policies that offer financial rewards for a researcher if the invention is commercialized.

In addition, research collaboration increases the probability of sharing knowledge, skills, and techniques as it is increasingly complex and in most cases an individual will not possess all the knowledge required to achieve a particular research objective. Public policies that aim to enhance research collaboration come in different forms, for example, funding and research agencies, promotion of interdisciplinary research and infrastructure provision, university governance and organization, and mobility between institutions.

[51] Description of the iBridge network, https://www.ibridgenetwork.org, (last accessed April 24, 2017).

PRO guidelines for researchers on how to comply with rules on data access and sharing may help facilitate knowledge and data disclosure.

Researchers and students often lack awareness of IPRs. IP awareness can be raised through organizing IP-related events and producing materials to disseminate IP-related information. This might act as an incentive for disclosure.[52]

Researchers are sometimes not willing to disclose their inventions because it may delay their publications or be time intensive to interact with TTO personnel in follow-up commercialization activities. Researchers may also find it difficult to assess the commercial profitability of their inventions, and thus, TTOs and similar intermediary organizations are instrumental in addressing this challenge.

[52] See the IP modules developed by the European Patent Academy run by the EPO at https://www.epo.org/about-us/office/academy.html (last accessed April 24, 2017).

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