



DISCUSSION NOTE: HIGHER EDUCATION INTELLECTUAL PROPERTY AND TECHNOLOGY TRANSFER

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This discussion note supports questions in the [USAID Higher Education Learning Agenda](#), specifically, question 6: "*How can higher education systems and higher education institutions (HEIs) play a more active role in developing and strengthening national and regional innovation ecosystems?*"; and question 7: "*How can HEIs collaborate most effectively with the private sector to enhance the relevance and quality of teaching and learning, and research and innovation?*" To further explore these topics, and more USAID HEI collaborations, please visit [EducationLinks](#), or to contribute to or learn more about the USAID Higher Education Learning Agenda, please contact us at helearning@usaid.gov.

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INTRODUCTION

Have you ever sipped on Gatorade, hit a golf ball, or used Allegra to cure your pesky allergies?¹ Each of these products was developed through the research and innovation of higher education institutions (HEIs). HEIs are a global source of research that expands knowledge and produces discoveries that improve everything from medicine to national security. To share these discoveries or create products that enter the market, HEI faculty, inventors, and researchers must receive the support they need to advance technology transfer and protect their intellectual property (IP) from its initial development to its eventual launch into industry.

The purpose of this Discussion Note is to provide applicable and relevant information about HEIs and their connection to IP and technology transfer. It also gives a broad overview of the context in which these two methods of research and design work within HEIs and a brief significance of their history. This Note recognizes that many USAID Missions and Operating Units are exploring strategies to support HEIs in strengthening their research and innovation ecosystems, developing and protecting their IP, and collaborating effectively with the private sector through technology transfer. As a critical function of the higher education system, demonstrated in the [USAID Higher Education Program Framework](#), strengthening higher education research and innovation capacity enhances opportunities for local innovation.

WHAT IS IP AND TECHNOLOGY TRANSFER?

IP includes products of human intellect that are unique, new and innovative, have value in the marketplace, and are the creation of a single person or a team². IP can be an idea, an invention, a patented work, an expression, or literary creation. For HEIs, this refers to products created by faculty, staff, and student researchers through grants or awards³. Disseminating IP is known as technology transfer. A further list of relevant key terms is in Table I on the next page.



The maize on the left was stored in a conventional bag and protected with pesticides, while the maize on the right was stored in a pesticide-free Purdue Improved Crop Storage (PICS) bag. Photo Credit: Theodora Kachingwe

¹ Marcus, J., 2020. *Think universities are making lots of money from inventions? Think again.* [online] The Washington Post. <https://www.washingtonpost.com/local/education/think-universities-are-making-lots-of-money-from-inventions-think-again/2020/01/16/3989e448-362f-11ea-bb7b-265f4554af6d_story.html>

² Van Dusen, Virgil. "Intellectual Property and Higher Education: Challenges." *Administrative Issues Journal*, vol. 3, no. 2, 3 Oct. 2013, dc.swosu.edu/aij/vol3/iss2/3/?utm_source=dc.swosu.edu%2Faij%2Fvol3%2Fiss2%2F3&utm_medium=PDF&utm_campaign=PDFCoverPages.

³ AAUP. (2013). *Intellectual Property and Copyright*. <https://www.aaup.org/get-involved/issue-campaigns/intellectual-property-risk>.

TABLE 1: TECHNOLOGY TRANSFER AND INTELLECTUAL PROPERTY RELEVANT KEYWORDS	
COPYRIGHT	Protects any original work of authorship against copying and reproduction. ⁴
INTELLECTUAL PROPERTY (IP)	Through research scholarship and education, university faculty, staff, and students create patentable inventions or copyright-able works that merit legal protection and have financial, scientific, and scholarly value. ⁵
MARCH-IN RIGHTS	Rights granted to the federal government. These allow the government to grant patent licenses to other parties or to take licenses for themselves if they helped fund the patent owner's research and development (R&D). ⁶
PATENT	A government grant of exclusive rights in the invention for a limited period, in exchange for which the inventor must disclose the invention to the public. ⁷
TECHNOLOGY TRANSFER	Refers to the cycle of responsible licensing of university technology to third parties and the formation of new companies for the benefit of society. ⁸
TECHNOLOGY TRANSFER OFFICE (TTO)	An office/unit at a higher education institution, within an academic research program, or at a research institute established to handle the IP and licensing rights for faculty and student inventors. ⁹
TITLE	Conveys information to the user of patent documents and gives a first impression of the main content of the invention. ¹⁰
TRADEMARK	Intangible rights that allow institutions to define and protect aspects of their identities as they engage in the market. ¹¹

⁴ "What is copyright. US Copyright Office. <https://www.copyright.gov/what-is-copyright/>

⁵ Rooksby, J. (n.d.). Copyright in Higher Education: A Review of Modern Scholarship. *Duquesne Law Review*, 54.

⁶ West Group. 2002. "The Government's Patent Policy: The Bayh-Dole Act and 'Authorization and Consent' | Morrison & Foerster." [Wwww.mofo.com](http://www.mofo.com). October 6, 2002. <https://www.mofo.com/resources/news/the-governments-patent-policy-the-bayh-dole-act-and-authorization-and-consent.html>.

⁷ "Intellectual Property Policy» Academics | Boston University." 2017. Bu.edu. 2017. <https://www.bu.edu/academics/policies/intellectual-property-policy/>.

⁸ Hockaday, T. and Piccaluga, A. (2021). University Technology Transfer in Innovation Management. *Oxford Research Encyclopedia of Business and Management*.

⁹ Varma, Brinda K. 2014. "Intellectual Property Rights and the Technology Transfer Process." *Treatise on Process Metallurgy*, 1249–89. <https://doi.org/10.1016/b978-0-08-096988-6.00039-0>.

¹⁰ United States Patent and Trademark Office. n.d. "A-Z Definitions of Intellectual Property Terminology- Glossary." [Wwww.uspto.gov](http://www.uspto.gov). <https://www.uspto.gov/learning-and-resources/glossary>.

¹¹ Ibid.

Technology transfer describes the complete cycle of bringing knowledge and technologies to society through publication, commercialization, or in the form of start-ups¹². From the drawing board to the laboratory bench, both federal and higher education researchers, scientists, innovators, and engineers are constantly producing novel technologies. The term "inventor" signifies the individual(s) who invents, creates, authors, and innovates with respect to inventions¹³. These fundamental discoveries move to the market for development into products and services that benefit society. Mobaideen- et al. 2012, in Figure I, present a simplified flowchart of the complete technology transfer process at HEIs from the primary research stage to the final agreement of ownership.

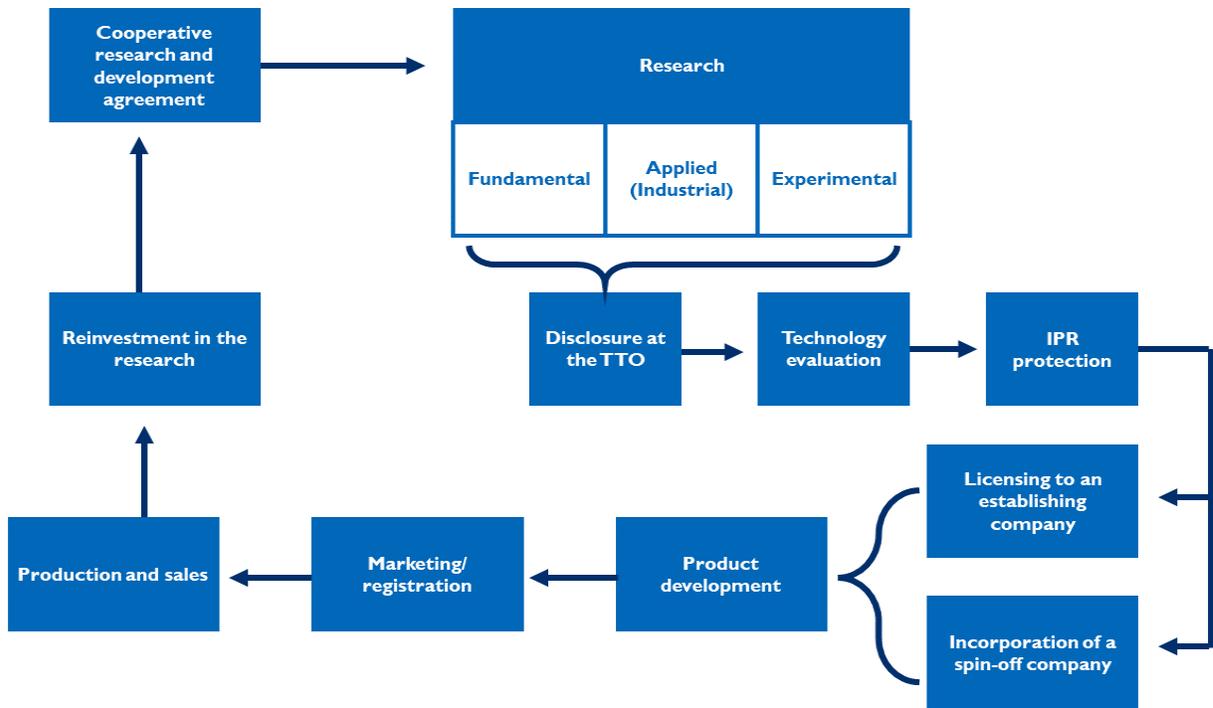


Figure I: Flowchart of the simplified process of technology transfer at universities, adapted from by Mobaideen- et al. 2012, "The Relationship between the Perceptions of Academic Staff in Mutha University of Technology Transfer and Mutha's University Organizational Readiness for Change," *European Journal of Business and Management*.

Successful cases of technology transfer from higher education research to market include the Honeycrisp Apple, developed by a professor at the Minnesota Agricultural Experiment Station at the University of Minnesota¹⁴. Introduced to the public in 1991, it has become famous both nationally and internationally due to its sweet-tart flavor. Another example is the online access code format used to prevent spam called CAPTCHA (Completely Automated Public Turing) and reCAPTCHA, invented at

¹² United States Patent and Trademark Office (n.d.). *A-Z definitions of intellectual property terminology- Glossary*. www.uspto.gov/learning-and-resources/glossary.

¹³ Ibid.

¹⁴ Scribd. 2022. *Technology Transfer Stories: 25 Innovations That Changed the World, 2006*. <https://www.scribd.com/document/2409113/Technology-Transfer-Stories-25-Innovations-That-Changed-The-World-2006>.

Carnegie Mellon University by Luis Von Ahn, who also invented the language application DuoLingo. Vohn handed over CAPTCHA and reCAPTCHA, to Yahoo¹⁵.

Another impactful technology transfer story is that of the portable neonatal incubator Incuven, used to treat infants born preterm. Created by engineer Claudio Bruno Castellano Levano and his team at the Pontifical Catholic University of Peru (PUCP)¹⁶, ongoing support for this research from PUCP has been crucial, as there is minimal government support for research in Peru. The patents held by PUCP on this research “serve as a bridge between university-funded research and commercialization” and allows for research costs to be recouped and new funding to be acquired¹⁷. Patents are the stepping stones for Incuven’s 20-year R&D journey. While Levano receives credit for the invention, the university owns most patents.

Each year, government agencies offer HEIs financial support to conduct scientific research¹⁸. This on-going investment extends human knowledge and helps educate future science and technology leaders, and new innovations from higher education research shape the foundation for new products that come to the market. The knowledge economy, technological innovation, and the scientific research is crucial for a sizable portion of the nation’s productivity growth^{19,20}.

Additionally, by moving technology to industry, HEIs can develop and commercialize their academic research for the public’s benefit in exchange for income (e.g., a royalty/fee stream). Universities often use that income to fund new research. For instance, according to a 2020 survey conducted by the Association of University Technology Managers (AUTM) on the licensing activities of academic institutions, professionals associated with universities and other academic institutions created more than 900 new products, added 5,900 new jobs, and contributed to a total research expenditure of \$83.1 billion to the U.S. economy. This was an increase of 7.6 percent from 2019, and a 22.8 percent increase in the past five years²¹.

Although the AUTM focuses on U.S. and Canadian HEIs, hospitals, and research institutions, there are also international, independent government research surveys conducted in high-income countries, such as the United Kingdom and Denmark. The World Intellectual Property Organization (WIPO) previously conducted these surveys in China, India, Japan, the Philippines, the Republic of Korea, Singapore, and

¹⁵ Business Insider. 2022. *The CEO who invented an online tool you see every day gave his tech to Yahoo for free — and he doesn't regret it.* <https://www.businessinsider.com/duolingo-ceo-invented-captcha-gave-to-yahoo-for-free-2018-6>.

¹⁶ Medium. 2022. *#Innovate4Health: Peruvian “Bubble” Gives High-risk Newborns a Fighting Chance.* <https://medium.com/innovate4health/innovate4health-peruvian-bubble-gives-high-risk-newborns-a-fighting-chance-801e8a16022e>

¹⁷ Ibid.

¹⁸ Van Dusen, Virgil. 2013. “Intellectual Property and Higher Education: Challenges and Conflicts.” *Administrative Issues Journal Education Practice and Research.* <https://aj.scholasticahq.com/article/529>.

¹⁹ “Technology Transfer Licensing Survey | AUTM.” 2021. Autm.net. 2021. <https://autm.net/surveys-and-tools/surveys/licensing-survey/2020-licensing-survey>.

²⁰ Mobaideen-, Dr Hisham, Sattam Allahawiah, Otham Hisham, Eng Imad, and Imad Halasah. 2012. “The Relationship between the Perceptions of Academic Staff in Mutah University of Technology Transfer and Mutah’s University Organizational Readiness for Change.” *European Journal of Business and Management*, January. https://www.academia.edu/66442223/The_Relationship_between_the_Perceptions_of_Academic_Staff_in_Mutah_University_of_Technology_Transfer_and_Mutahs_University_Organizational_Readiness_for_Change.

²¹ “About Technology Transfer & the Bayh-Dole Act | AUTM.” 2021. Autm.net. 2021. <https://autm.net/about-tech-transfer>.

Thailand, however, there were no follow-up surveys since 2007²². This data collection is useful in understanding how government funding can support stable technology transfer ecosystems. Other countries approached the AUTM to begin surveys and collect data, but similar data for low and middle-income countries does not exist.

Globally, these new products and processes are based on basic and applied HEI-conducted research, which can be indirectly connected to the results, products, and processes. Rather, these inventions and other innovations evolve from the beginning stages of research performed at HEIs. The overall development not only includes discovering innovative ideas, but also requires further development, partnership, capital, manufacturing capability, and marketing²³. HEIs and other stakeholders use technology transfer to shift scientific findings to the private sector for further development and commercialization. Students and faculty are critical players in translating research discoveries into modern technologies. This includes, but is not limited to, patents, copyrights, trademarks and service marks, tangible research property, and rights in data and other proprietary information²⁴. Because research can result in the creation of knowledge that may have commercial application, HEIs commonly move toward using a technology transfer department or Technology Transfer Offices within the institution to manage the complexities and specific skills associated with the licensing. The most successful higher education-industry interactions are based on the education and training of students, faculty who have the knowledge and skills to meet industry needs, or on partnerships between faculty members and private companies.

LEARNING FROM IP IN THE UNITED STATES

In the United States, the Bayh-Dole Act, formally known as the Patent and Trademark Act Amendments²⁵ is a federal law passed in 1980 that permits universities, non-profit research institutions, and small businesses to own, patent, and commercialize inventions created under federally funded research programs²⁶.

This ruling generated a uniform patent policy among federal agencies that fund research and innovation. Additionally, Congress recognized a need for consistent technology transfer mechanisms and a standardized set of rules to enable the process to work²⁷. This prompted HEIs to become active participants in transferring technology from research labs to industry. It allows institutions to keep titles and actively license technologies and typically allows the government to access work sponsored under

²² “Technology Transfer, Intellectual Property and Effective University-Industry Partnerships.” www.wipo.int, 2007, www.wipo.int/publications/en/details.jsp?id=167.

²³ Hockaday, T. and Piccaluga, A. (2021). University Technology Transfer in Innovation Management. *Oxford Research Encyclopedia of Business and Management*.

²⁴ “Intellectual Property Policy» Academics | Boston University.” 2017. Bu.edu. 2017. <https://www.bu.edu/academics/policies/intellectual-property-policy/>.

²⁵ West Group. 2002. “The Government’s Patent Policy: The Bayh-Dole Act and ‘Authorization and Consent’ | Morrison & Foerster.” www.mofo.com. October 6, 2002. <https://www.mofo.com/resources/news/the-governments-patent-policy-the-bayh-dole-act-and-authorization-and-consent.html>.

²⁶ “Global Dimensions of Intellectual Property Rights in Science and Technology” at NAP.edu. 1993. [Nap.nationalacademies.org](http://nap.nationalacademies.org). National Academies Press. <https://nap.nationalacademies.org/read/2054/chapter/3>.

²⁷ Phan, P. and Siegel, D., 2006. The Effectiveness of University Technology Transfer. *Foundations and Trends® in Entrepreneurship*, 2(2), pp.77-144.

federal grants. If proven successful, and the invention goes through the patent and production processes, the inventor retains the right to an agreed-upon percentage. The remainder of the revenue must go back to the HEIs directly for research and innovation²⁸.

Non-profit research institutions, which can include HEIs, can patent and retain the title to products invented from research funded by the federal government. Even though new knowledge may be considered IP and may be patentable, not all IP is valuable to a university. In this case, U.S. universities can use these patents for altruistic reasons with non-market objectives. For example, one well-documented case involves Yale University, which patented Stavudine, a medicine used in antiretroviral combination therapy useful in treating AIDS²⁹. Yale exclusively licensed the patent to Bristol-Myers-Squibb, which manufactured the medicine and agreed to substantially lower the price for governments and non-profit institutions in Sub-Saharan Africa, thus enhancing access to this critical therapeutic resource for underserved communities³⁰.

Legally, an HEI has the responsibility to disclose each invention to the federal funding agency within two months once the inventor has released it to the HEI³¹. The inventor must decide whether to retain the title to the invention or not, and within one year after seeking the title, file a patent application³². In general, HEIs must offer to license the rights to inventions to the commercial industry for further improvement, specifically focusing on small businesses. If unsuccessful, the federal government can retain the right to take control of the innovation³³.

The government could acquire the invention for other purposes, for example, if the invention involves health or safety concerns, or is restricted research³⁴. Upon receipt of funding, the federal sponsor or pass-through sponsor will share the process for handling classified information. Restrictions on personnel, information sharing (controlled unclassified information (CUI)), or access to campus facilities for national security purposes is also restricted research³⁵. Under law, this provision is known as the government's "march-in" rights³⁶. The federal government also receives a preferential, permanent license to the innovation.

HEIs who have distinct fundamental and applied research departments often have entities to manage patents, IP, advising, coordinating, and realizing start-up business ideas and companies. This is considered

²⁸ Ibid.

²⁹ Van Dusen, V. (2013). Intellectual Property and Higher Education: Challenges and Conflicts. *Administrative Issues Journal Education Practice and Research*. doi:10.5929/2013.3.2.10.

³⁰ Ibid.

³¹ Martinez, C. (2018). *From academic inventing to university patenting*. www.wipo.int. Madrid, Spain: WIPO.

³² West Group. 2002. "The Government's Patent Policy: The Bayh-Dole Act and 'Authorization and Consent' | Morrison & Foerster." <https://www.mofo.com/resources/news/>. October 6, 2002.

³³ Phan, P. and Siegel, D., 2006. The Effectiveness of University Technology Transfer. *Foundations and Trends® in Entrepreneurship*, 2(2), pp.77-144.

³⁴ "Classified or Restricted Research." n.d. UW Research. Accessed June 5, 2022. <https://www.washington.edu/research/myresearch-lifecycle/plan-and-propose/sponsor-requirements/classified-or-restricted-research/>.

³⁵ Ibid.

³⁶ United States Patent and Trademark Office. n.d. "A-Z Definitions of Intellectual Property Terminology- Glossary." <https://www.uspto.gov/learning-and-resources/glossary>.

necessary, as most HEIs need patent attorneys to deal with patent applications, which can be quite expensive. Given the intricacies, institutional regulations, funding requirements, and expert legal knowledge, most inventors – at HEIs or elsewhere – are unable or unwilling to undertake this process on their own.

Advancing IP from idea to actualized patent relies on the expertise, resources, and dedication of both parties – the researcher and the HEI – to perform their respective responsibilities. The researcher must provide technical expertise and impart knowledge of the concept, its origination, and evolution to create a patent declaration, which is used for a patent application. The HEI then provides the infrastructure for managing the IP, the resources and expertise to assist in filing the necessary paperwork, and the organizational reputation and resources to negotiate or defend agreements with other parties. This could include everything from filing the initial application, providing in-depth patent research, assuring required accounting procedures, overseeing legal and regulatory operations, providing highly specialized legal advice, and negotiating with other interested stakeholders. As both sides conduct specific tasks, a cooperative relationship is critical when bringing ideas to life.

IP WORLDWIDE

Countries around the globe vary in the extent to which they protect IP and how they enforce different regulations. Additionally, domestic laws protect IP rights in each country. Industrial property offices, courts, and well-trained academics all contribute to the successful operation of the IP system. Two main bodies assist in not only enforcing, but in monitoring and harmonizing IP rights.

- The United States Government’s Office of the United States Trade Representative (USTR) observes and monitors IP rights around the world and uses this information to combat IP theft. This includes assessing each country and giving them a rating according to their enforcement of IP rights and laws. USTR then compiles a Special 301 Report for an annual review of the global state of IP rights. Countries with significant offenses go on a “Priority Watch List”³⁷.
- WIPO is a specialized agency within the United Nations system that works to standardize IP laws around the world. Today WIPO works to:
 - Make uniform national IP legislation and procedures,
 - Offer insight into international applications for industrial property rights,
 - Provide IP information,
 - Provide legal and technical assistance to developing and other countries, and
 - Expedite resolutions of private IP disputes³⁸.

According to WIPO, and as shown in Table 2, a moderate number of countries analyzed have formally addressed the question of IP ownership through national legislation³⁹. The recent attention surrounding university patenting increased awareness of global policy trends and an eagerness among governments to strengthen the impact of public research. In some countries, decreasing federal spending on R&D is at stake. Most high-income countries examined have legislation requiring inventor participation in royalties and revenues derived from exploitation of technology. Other policy incentives spreading across

³⁷ “Intellectual Property.” n.d. United States Trade Representative. <https://ustr.gov/issue-areas/intellectual-property>.

³⁸ WIPO. 2019. “WIPO - World Intellectual Property Organization.” Wipo.int. 2019. <https://www.wipo.int/portal/en/index.html>.

³⁹ www.wipo.int. “Technology Transfer, Intellectual Property and Effective University-Industry Partnerships,” 2007. <https://www.wipo.int/publications/en/details.jsp?id=167>.

countries are the public support for technology transfer offices (TTO) and formation of technology transfer managers, funding mechanisms to finance start-up formation, and the creation of science and technology parks⁴⁰.

In terms of firm creation, there has been significant policy divergence across countries. Specifically, policies regarding the right to equal participation and leave allowances for firm creation are partially covered or absent. Fast-growing middle-income economies, such as Brazil, China, India, and South Africa have already implemented specific legislation or are in the process of introducing laws.

In 2002, China was among the first countries to adopt a policy framework, and in 2010, South Africa implemented the Intellectual Property Rights from Publicly Financed R&D Act, defining “a number of obligations ranging from disclosure, IP management and inventor incentives, to the creation of TTOs and policies regarding entrepreneurship”⁴¹. In addition, a considerable number of countries in Asia, Latin America, and the Caribbean—Brazil, Mexico, and more recently Colombia, Costa Rica, and Peru—have also considered such legislation. Several countries started to implement policy guidelines and support technology transfer infrastructure. For instance, Nigeria and Ghana have not enacted specific legislation but are establishing TTOs in all HEIs. Other countries like Algeria, Egypt, Morocco, and Tunisia are working on drafts for similar legislation⁴².

As low- and middle-income countries continue to improve and regulate their IP systems, it is important to note that IP rights do not only expedite the transfer or export of technology from one country to another. They also enhance R&D and innovative activity within their country, as well as spur innovation and development across all countries. Through their design to connect, inspire, and remove secrecy from ideas between inventors, IP rights seek to support the overall innovation ecosystem so that innovative ideas can assist in the creation and facilitation of other inventions and spur development.

Annex I presents a table of the regional and global WIPO offices. This also includes links to country websites, TTOs, patent offices and more information on updated IP laws.

⁴⁰ WIPO. 2019. “WIPO - World Intellectual Property Organization.” Wipo.int. 2019. <https://www.wipo.int/portal/en/index.html>.

⁴¹ www.wipo.int. “Technology Transfer, Intellectual Property and Effective University-Industry Partnerships,” 2007. <https://www.wipo.int/publications/en/details.jsp?id=167>.

⁴² “Intellectual Property Rights around the Globe.” n.d. https://saylordotorg.github.io/text_international-business/s17-02-intellectual-property-rights-a.html.

TABLE 2: TECHNOLOGY TRANSFER FRAMEWORKS AND LEGISLATION IN SELECTED LOW AND MIDDLE INCOME ECONOMIES⁴³

	LAW/POLICY/DECREE ENTITLING OWNERSHIP & INVENTOR RIGHTS	INNOVATION AND RELATED POLICIES	INVENTOR COMPENSATION	MANDATORY TTO CREATION
Brazil	<p>Ownership: 1996 Patent Law (Law 9279)</p> <p>Investors: 1998 Law on Industrial Property (Art. 93): Maximum of one third of the value of the invention.</p>	<p>2004: Innovation Law (Law no. 10.973). Incentives for R&D, collaboration, and technology transfer.</p>	<p>YES</p> <p>5 to 33 percent of royalties or licensing income</p>	<p>YES</p> <p>At each institution or shared among institutions</p>
Russian Federation	<p>Ownership: 1998 Decree and 2003 Revision of the Patent Law</p>	<p>2007-2012: R&D in priority fields of science and technology development in Russian Federation</p> <p>2002: Technology Transfer Network</p>	<p>NO</p>	<p>NO</p> <p>Not mandatory but encouraged</p>
India	<p>Ownership: 2000</p> <p>Government ruling</p> <p>Inventors and clarification of ownership rules: Utilization of Public Funded Intellectual Property Bill 2008 (under approval)</p>		<p>YES</p> <p>At least 30 percent of licensing income</p>	<p>NO</p> <p>Not mandatory but encouraged</p>

⁴³ www.wipo.int, "Technology Transfer, Intellectual Property and Effective University-Industry Partnerships," 2007. <https://www.wipo.int/publications/en/details.jsp?id=167>.

TABLE 2: TECHNOLOGY TRANSFER FRAMEWORKS AND LEGISLATION IN SELECTED LOW AND MIDDLE INCOME ECONOMIES⁴³

	LAW/POLICY/DECREE ENTITLING OWNERSHIP & INVENTOR RIGHTS	INNOVATION AND RELATED POLICIES	INVENTOR COMPENSATION	MANDATORY TTO CREATION
China	Ownership: 2002 Measures for Intellectual Property Made under Government Funding (entitling patenting) Inventors: S&T Findings Conversion Law	1998: the S&T Advancement Law and the S&T Findings Conversion Law 2002: Opinion on Exerting the Role of Universities in S&T Innovation	YES Varies according to type of transfer	NO Not mandatory but encouraged
South Africa	Ownership: Patent Law	National Research and Development Strategy (R&D Strategy)	YES At least 20 percent of licensing income	YES Mandatory
Argentina	Ownership: 1995 Law of Patents of Invention and Utility Models (Joint ownership by the university and the centralized agency CONICET)	1995: Law on National Higher Education 2002: National Program for the support and fortification of university linking with industry	YES Up to 50 percent (patent law)	NO
Chile	Ownership: 1991 Industrial Property Law	National Innovation Plan	NO	NO National TTO

TABLE 2: TECHNOLOGY TRANSFER FRAMEWORKS AND LEGISLATION IN SELECTED LOW AND MIDDLE INCOME ECONOMIES⁴³

	LAW/POLICY/DECREE ENTITLING OWNERSHIP & INVENTOR RIGHTS	INNOVATION AND RELATED POLICIES	INVENTOR COMPENSATION	MANDATORY TTO CREATION
Malaysia	<p>Ownership and inventors:</p> <p>2009 Intellectual Property Commercialization Policy for Research & Development Projects Funded by the Government of Malaysia</p>	<p>Second National Plan for Science and Technology Policy 2002-2020</p>	<p>YES</p> <p>Varying shares according to value of revenue</p>	<p>YES</p> <p>For public sector R&D institutions</p>
Mexico	<p>Ownership: 1991 Industrial Property Law</p> <p>Inventors: Federal Law of Labor and Innovation Law of 2010</p>	<p>2002 Science and Technology Law</p> <p>2010 Innovation Law: Inventor compensation and TTOs</p>	<p>YES</p> <p>Up to 70 percent of income</p>	<p>YES</p> <p>Not mandatory but encouraged</p>
Nigeria	<p>Ownership: 2004 Scheme of Service for Nigeria's Federal Research Institutes, Colleges of Agriculture and Allied Institutions</p>	<p>Guidelines on Development of Intellectual Property Policy for Universities and R&D Institutions</p>	<p>NO</p> <p>(Recommended but left to institution)</p>	<p>YES</p>
Philippines	<p>Ownership and inventors: 2009 Technology Transfer Bill</p>	<p>1997: Magna Carta of Scientists, Engineers, Researchers, and other S&T Personnel in the government (for researchers at PROS) and 2002: The National Science and Technology Plan</p>	<p>Only available for governmental institutions 60 percent (PRO) - 40 percent (inventor)</p>	<p>No National TTO (1997)</p>

WHY IS IP AND TECHNOLOGY TRANSFER IMPORTANT FOR HIGHER EDUCATION INNOVATION?

IP and technology transfer are increasingly important to HEIs around the world. This is due to their potential for contributing to each HEI's own goals toward contributing to the social good and advancing the state of knowledge, the possibility of generating income through innovative inventions, and the awareness that these matters may raise questions of actual or perceived conflict of interest. Additionally, IP and technology transfer may contribute significantly to the HEI's sustainability and is a core function of the higher education system in any context, although not every HEI contributes to this function. For these reasons, most colleges and universities have written policies that govern requirements and procedures related to IP and technology transfer. Individual IP and technology transfer arrangements are key; however, it is the overall engagement in the process that truly accelerates an HEI's role as source and catalyst in the economic innovation ecosystem⁴⁴. If done with intention and realization of the roles of, and benefits to, all parties, using IP to catalyze the transformation of new discoveries or the creation of new private sector engagements can naturally fit within, and even enhance, a HEI's mission.

HEIs view the importance of IP and technology transfer in three distinct functions: 1) Transactional, 2) Disclosure, and 3) Financial⁴⁵.

- **Transactional:** IP and technology transfer allow for the exchange of intangibles and facilitate transfer of complementary knowledge. This also leads to the production of new products, services, companies, and jobs, and can make use of knowledge for the general good. These transfers occur through publications, student training and education, graduate employment, conferences, consultations, and collaboration, as well as obtaining rights to inventions and discoveries that qualify for patent protection and then licensing them to private enterprises.
- **Disclosure:** Information allows for the dissemination of knowledge for the public good and encourages HEIs to stimulate a creative and entrepreneurial campus culture, while also receiving recognition. New inventions and IP, as well as new products and services, entrepreneurship, and ventures can fulfill an HEI's mission. Such ventures can help HEIs attract new investors and increase in national ranks.
- **Financial:** HEIs use information technology and technology transfer for monetary gain, where money received from innovative ideas is invested back into the HEIs. This is valuable for the HEI and inventors through licensing/fee sharing agreements, which typically are set percentages for the inventor(s), the HEI department/college, and the HEI overall. It is also important for the purchase of new equipment and spawning of new businesses.

⁴⁴ Marcus, J. 2020. "Think Universities Are Making Lots of Money from Inventions? Think Again." *Washington Post*, 2020. https://www.washingtonpost.com/local/education/think-universities-are-making-lots-of-money-from-inventions-think-again/2020/01/16/3989e448-362f-11ea-bb7b-265f4554af6d_story.html.

⁴⁵ Cahoon, Richard. n.d. "Importance of Intellectual Property (IP) for Universities & the WIPO EIE Project." Accessed June 12, 2022. https://www.wipo.int/edocs/mdocs/aspac/en/wipo_ip_osa_17/wipo_ip_osa_17_t3.pdf.

USAID PROGRAMMING EXAMPLE

PHILIPPINES: SCIENCE, TECHNOLOGY, RESEARCH, AND INNOVATION FOR DEVELOPMENT (STRIDE)

The Science, Technology, Research, and Innovation for Development (STRIDE) Program is a United States Agency for International Development (USAID) Philippines initiative started in 2013 that strengthens the country's science, technology, and innovation (STI) capacity as a driver for inclusive economic growth⁴⁶.

STRIDE highlights the critical role HEIs have in fostering talent and generating knowledge and is significant to the country's innovation ecosystem. It has increased interest among top universities to create mechanisms that engage industry on different fronts, including: 1) Improvement of higher education capacity for innovation, 2) Improved links between industry, government, and academy for innovation, 3) Improved government capacity for innovation, and 4) Improved policy and regulatory environment.

To improve higher education capacity in innovation, STRIDE administers mentorship trainings that assist HEIs in institutionalizing industry engagement mechanisms. These programs provide Philippine universities and colleges assistance in their innovation activities and create post-doctoral training centers for faculty and researchers. One example is collaborative research and innovation through the establishment of the Knowledge and Technology Transfer Offices (KTTO). The establishment of these offices and continued support enhances the growth of industry-engagement mechanisms. STRIDE develops these mechanisms by building a pool of local mentors from the pioneering universities that first adopted KTTOs and mechanisms to build "mentors' guides" and conduct train-the-trainer activities.

Other programs within STRIDE work to empower TTOs by providing financial support and other resources that heighten their initiatives and activities, as well as supporting individuals in establishing TTOs in HEIs. Partners collaborate to complete a series of trainings that aim to build HEIs' capacity to administer these initiatives. Additionally, allocating money to assist the trainees in implementation of their own TTOs is a priority and signals the government's commitment to seeking knowledge and technology transfer opportunities for HEIs in partnership with STRIDE programs. By working together and aligning interventions, it can create a wider impact for technology transfer capacities at HEIs⁴⁷.

In Mindanao State University-Iligan Institute of Technology (MSU-IIT), a new KTTO building was built on campus and encompasses various venues for innovation-related talks, conference rooms, staff offices,



Photo Credit: USAID STRIDE Program Jake Licayan PhD Scholar. (2016).

⁴⁶ RTI International. 2015. "Innovation for Development (STRIDE) Annual Report." USAID. https://pdf.usaid.gov/pdf_docs/PA00KTW9.pdf.

⁴⁷ www.usaid.gov. (2021). *Building University-Industry Learning and Development Through Innovation and Technology (BUILD-IT) | Documents | Vietnam | U.S. Agency for International Development*. <https://www.usaid.gov/vietnam/documents/fact-sheet-building-university-industry-learning-and-development-through-innovation>.

and a display room for R&D outputs and technologies. MSU-IIT is working to ensure research goes beyond publication and outputs leading to patents and commercialization. In 2015, they sent the head of their IP office to the STRIDE KTTO training program, and as one of the first ten pioneer KTTO trainers, she led the university in implementing the lessons learned during the training. Administration at the HEI recognized that a flourishing research pipeline was necessary to ensure a secure supply of products and technologies that the KTTO can provide to businesses and the community. After four years of challenging work from the university's leadership, MSU-IIT now has a new home for its KTTO⁴⁸.

CONCLUSION

HEIs and research institutions have a significant role in socio-economic development. Both scientific and innovation development are fundamental for economic, technological, social mobility, and economic growth. HEIs are a key area in which scientific development and innovation occurs, and the IP system is the fundamental mechanism enabling them and society to capture the value of innovation⁴⁹.

An IP system is one way to support HEIs to commercialize knowledge and enable them to acquire additional resources through partnerships with the private sector and other entities that can fund new research, which can attract the best researchers, faculty, and students. Partnerships with private companies and other organizations can ensure that academic research products have a broader impact, including competitiveness in an industry, creation of new companies, or in tackling a variety of highly complex, multi-disciplinary, socio-economic issues like health, food security, and climate change. Therefore, institutions in low- and middle-income countries engage in the commercialization of their research outcomes and ensure relevance of their research to make an impact in society.

As described, this process is complex and requires additional aid and capacity-building support for the people, structures, and skill sets needed to promote knowledge transfer in ways that benefit all parties. There are examples of this, however, each institution, country, and technical sector has its own specific needs and stakeholders. However, approaches that promote and encourage IP benefits and technology transfer, and emphasize how academic research and shared IP provide economic, environmental, and social benefits for society will continue to shape development and drive innovation into the future.

⁴⁸ Ibid.

⁴⁹ RTI International. 2015. "Innovation for Development (STRIDE) Annual Report." USAID. https://pdf.usaid.gov/pdf_docs/PA00KTW9.pdf.

ANNEX 1

DIRECTORY OF INTERNATIONAL PROPERTY OFFICES			
OFFICE	ACRONYM	CONTACT DETAILS	URL
African Intellectual Property Organization	OAPI	Regional Office	http://www.oapi.int/
African Regional Intellectual Property Organization	ARIPO	Regional Office	http://www.aripo.org/
Arab States Broadcasting Union	ASBU	Regional Office	http://www.asbu.net/
Benelux Organization for Intellectual Property	BOIP	Regional Office	http://www.boip.int/
Eurasian Patent Organization	EAPO	Regional Office	http://www.eapo.org/
European Patent Organization	EPO	Regional Office	http://www.epo.org/
European Union Intellectual Property Office	EUIPO	Regional Office	https://euipo.europa.eu/ohimportal/en/home
International Union for the Protection of New Varieties of Plants	UPOV	Regional Office	http://www.upov.int/
Interstate Council on the Protection of Industrial Property	ICPIP	Regional Office	
Patent Office of the Cooperation Council for the Arab States of the Gulf	GCC Patent Office	Regional Office	
	National IP Offices	All country offices	https://www.wipo.int/directory/en/urls.jsp