

Illinois Innovation Index

Innovation news and metrics for metropolitan Chicago and the state of Illinois



2013 Quarter 4

Dynamism in Illinois:
Tracking technology development
at universities and research
institutions from inception to
commercialization

The Index is brought to you by the Chicagoland Chamber of Commerce, Chicago Metropolitan Agency for Planning, Illinois Science & Technology Coalition, and World Business Chicago in partnership with the Illinois Innovation Network.

TECHNOLOGY TRANSFER

Definition

Technology transfer is the process of transferring scientific findings from one organization to another for the purpose of further development and commercialization. The process typically includes:

- Identifying new technologies;
- Protecting technologies through patents and copyrights; and
- Forming development and commercialization strategies such as marketing and licensing to existing private sector companies or creating new start-up companies based on the technology.¹

¹ Source: Association of University Technology Managers

Overview

An innovation ecosystem's ability to assemble, coordinate, and support the necessary components for technology transfer—R&D funding, infrastructure, and capital—has a direct bearing on the success of universities in the development and commercialization of promising research. Since the process for bringing new technologies to market can take more than a decade, progress requires a sustained commitment on the part of many stakeholders. To promote an environment that supports innovation and entrepreneurship at universities, it is crucial to understand the interrelated steps in the university-supported technology transfer process.

Over the past decade, Illinois has made significant gains in bringing technologies developed at universities to market. This quarterly edition of the Innovation Index report examines the path that technology takes from inception to commercialization, sheds light on the challenges of technology transfer at academic institutions, and provides insights from new research on university start-ups.

Key findings

- From 2008 to 2012, the total number of patents obtained by Illinois universities grew by 47 percent compared with the 2003–2007 period, outpacing the national average growth rate of 16.5 percent.

- The quality of Illinois' university patents, a key indicator of commercialization prospects, has consistently been above average, but growth in licensing these technologies has lagged behind the country as a whole.

- From 2006 to 2013, 163 start-ups were spun out of Illinois' universities, with approximately 71 percent focused on biomedical applications, software, or information technology (IT).

- Of those 163 start-ups, 118 are still active. Of those, nearly three-quarters are still based in Illinois.

The technology transfer process

Funding from sources such as industry and the federal government enables faculty at academic institutions to pursue and develop innovative research. (For more information on R&D funding, see previous Index issues on [R&D expenditures at Illinois universities](#) and [industry funding for academic R&D](#).) To achieve commercialization of this research, a nascent technology must pass through three “gates”—invention disclosures, patenting, and licensing. Each of these gates serves to eliminate less commercially viable products, so the technologies that reach the licensing phase typically have direct applicability to businesses and industry. The length of time this process can take varies, but it is not uncommon for it to be several years.

The technology transfer process

Invention disclosure

Researchers submit an invention disclosure form or provisional patent application to their university’s technology transfer office (TTO) to document their technology and enable university officials to determine whether to pursue a patent.

Patenting

The institution’s TTO files an application with the U.S. Patent and Trademark Office to obtain intellectual property rights for a new technology.

Licensing

TTOs license commercially viable technologies to established companies or start-ups, depending on the investment and infrastructure needed.



² Since tech transfer is a multi-year endeavor, comparing five-year periods controls for the effects of volatility in output from year to year.

³ For this analysis, the ISTC identified 96 universities and medical colleges that have responded to AUTM's Licensing Survey every year over the period FY2003–2012. The survey included responses from the University of Illinois, the University of Chicago, and Northwestern University.

To observe changes in tech transfer activity over the past decade, the Innovation Index examined data for two five-year periods: 2003–2007 and 2008–2012.² The analysis found that Illinois' performance was uneven across the three stages of tech transfer. According to an ISTC analysis of data from the Association of University Technology Managers (AUTM),³ invention disclosures at Illinois universities rose 15.7 percent over these two time periods, slightly below the national average of 19.8 percent. However, the growth in invention disclosures signifies that more Illinois university researchers are actively pursuing commercialization. Meanwhile, growth in Illinois' university patent activity over these two time periods was nearly triple the U.S. average. The outstanding growth in patenting suggests that Illinois universities have increasingly made technology transfer a priority, despite relatively slow growth at the licensing phase, which requires expensive investments in marketing and outreach to industry.

Growth in technology transfer in Illinois¹ and the United States, 2003–2007 vs. 2008–2012, percentage change

	2003–2007	2008–2012	Total, 2003–2012	Percentage change
Invention disclosures	57,596	69,007	126,603	19.8%
	2,775	3,212	5,987	15.7%
Patents issued	11,895	13,859	25,754	16.5%
	519	763	1,282	47.0%
Licenses	14,307	15,495	29,802	8.3%
	515	536	1,051	4.1%

¹In this dataset, the University of Illinois, the University of Chicago, and Northwestern University account for almost all academic technology transfer output in the state.

²Excluding Illinois.

Source: Association of University Technology Managers (AUTM), ISTC

⁴ Ocean Tomo, LLC is a recognized leader of insight and analysis on tech transfer, patents, and intellectual property.

⁵ An OTR™ score higher than 100 indicates above-average quality (higher expected maintenance rate), while an OTR™ score lower than 100 indicates below-average quality (lower expected maintenance rate). Read more on the Ocean Tomo Ratings™ system and how OTR™ scores are derived and adjusted on page 11.

New data released for the first time by Ocean Tomo, LLC,⁴ a Chicago-based merchant IP bank, for the Index reveals that the 748 patents issued to Illinois universities from 2010 to 2013 have consistently demonstrated high commercial viability, placing on average in the top 20 percent of more than four million patents in the United States. (For more Ocean Tomo data, read the latest issue of ISTC’s Catalyst newsletter.) This quality is determined by the Ocean Tomo Ratings™ (OTR™) system,⁵ which uses a baseline of 100 to assess the likelihood that the patent has a level of commercial applicability that makes it a likely candidate for licensing or commercialization.

The top eight technology areas of university patenting in Illinois account for more than two-thirds of the state’s university patents, showing a steady increase from 65 percent

Patent quality¹ of top 8 technology areas of Illinois universities² by number of patents, percent, 2010–2013

United States Patent Classification (USPC)	USPC name	Average OTR™ score				Number of patents, 2010–2013
		2010	2011	2012	2013 ³	
435	Chemistry: molecular biology and microbiology	104.0	113.8	113.0	114.9	136
514	Drug, bio	109.2	105.9	99.4	117.9	105
424	Drug, bio	117.5	93.5	104.8	121.4	70
530	Chemistry: natural resins or derivatives; peptides or proteins; lignins or reaction products thereof	123.4	110.6	116.7	110.4	65
536	Organic compounds	108.6	120.6	108.3	113.6	54
257	Active solid ⁴	105.3	130.5	116.6	123.5	43
436	Chemistry: analytical and immunological testing	100.7	128.9	123.6	112.6	37
438	Semiconductor device manufacturing: process	126.0	140.1	120.7	127.9	36

¹ Refer to methodology in body text footnote 5.

² Figures include patents from Argonne National Laboratory.

³ 2013 figure as of October/November.

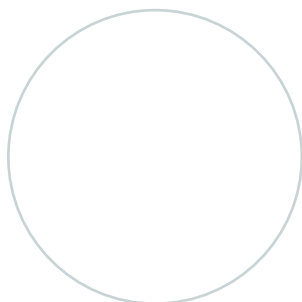
⁴ This class provides for active solid-state electronic devices (electronic devices or components that are made up primarily of solid materials, usually semiconductors).

Source: Ocean Tomo, LLC

of all patents in 2010 to 72 percent of patents in 2013. The average OTR™ of these patents ranges from 93 to over 140 (compared with an average OTR™ of 100). These numbers indicate increasing concentration in biomedical and semiconductor innovation as well as the success of Illinois' universities at conducting and identifying research with high commercial viability.

Once a technology has made it to the licensing gate, its commercialization prospects often hinge on the institution's tech transfer office (TTO), which must identify potential licensees or develop an alternative licensing strategy such as creating a start-up to license the technology. The TTO works with faculty to determine the best industry path for their inventions. For example, a TTO can help connect a researcher developing agricultural technologies to a mature company with the requisite resources to develop new products for market. Alternatively, a researcher may start a company with the sole purpose of developing a commercial application for the new technology. Innovations in IT or software that might attract early-stage funding from a venture capital firm or angel investor may be especially suited for the start-up route. However, even if faculty or researchers prefer to develop a technology through a start-up rather than license it to an external partner, they must first license the technology from the university where it was developed.

As the ISTC analysis demonstrated, despite the above-average performance in patenting, Illinois universities have struggled in licensing technology for commercialization. Whereas national licensing grew by 8 percent in 2008–2012 compared with 2003–2007, Illinois saw half that rate, with 4 percent growth in executed licenses. The industries where Illinois' patents are concentrated might partially explain this licensing shortfall: approximately half of Illinois university patents are in chemistry, molecular biology, and biopharmaceuticals, but large and midsize businesses in these industries are clustered on the coasts—particularly Boston, New York, New Jersey, and California. A greater focus on marketing and more outreach to industry partners and companies in other parts of the country could increase licensing in these areas.



Technology transfer offices: A vital component in tech commercialization

At universities across Illinois, faculty are conducting research and developing technologies that benefit a range of industries. Technology transfer offices (TTOs) play the critical role of evaluating and protecting this intellectual property and identifying partners to pursue commercialization through licensing or further development. Although the size of TTOs varies by institution, they share a common goal of working with faculty to bring promising technologies to market.

When researchers have developed a promising technology, the TTO helps with the invention disclosure process to document the technology and determine whether to pursue a patent. The TTO also manages the patent application process, which can take several years and cost between \$15,000 and \$30,000. Once a technology is patented, the TTO markets the patent

to potential industry partners and manages all facets of the licensing process, including the negotiation of intellectual property terms.

TTOs are also responsible for fostering innovation and entrepreneurship on campus. They work closely with their institution's research parks, technology incubators, and entrepreneurship programs to support mentorship of faculty and students. TTOs also promote their institution's latest research to industry through presentations at events and forums.

For more on how TTOs are driving innovation in Illinois, read [“TTOs: A vital link between academic institutions and industry”](#) by Lesley Millar, director of the University of Illinois' Office of Technology Management.

Start-up creation, development, and retention

Start-ups offer an avenue for the commercialization of promising early-stage technologies by attracting external, private funding for further development. Therefore, the number of businesses created to take new technologies to market is one indication of the health of a state's innovation ecosystem. In 2013, ISTC undertook its second annual survey of TTOs in Illinois⁶ to gather information on university tech-transfer start-ups, including their total number, status, location, and industry. The goal of the survey was to track and better understand what happens as technologies move outside the university and the effectiveness of the local innovation ecosystem at retaining and supporting technology development. The outcomes represent a comprehensive collection of data on Illinois' university-related start-ups from 2006 to 2013.

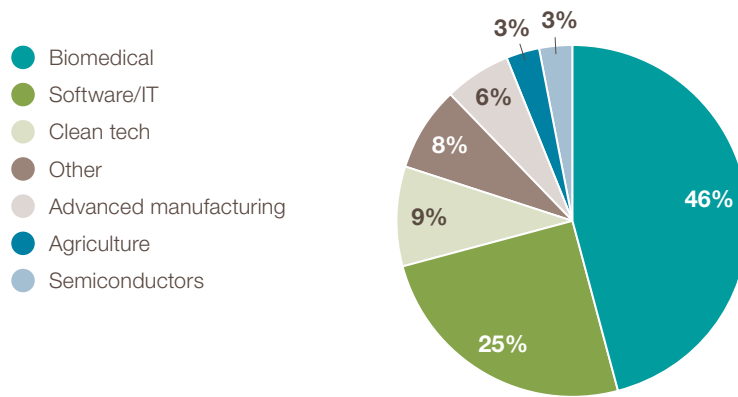
⁶ In Illinois, eight universities have TTOs: Northwestern University, University of Illinois at Chicago, University of Illinois at Urbana-Champaign, University of Chicago, Loyola University Chicago, Illinois Institute of Technology, Northern Illinois University, and Southern Illinois University.



⁷ Of the 163 start-ups founded from 2006 to 2013, 118 are still active.

According to the survey, at least 163 start-ups were spun out of Illinois' universities from 2006 to 2013 through university TTOs.⁷ Approximately 71 percent of these businesses were based on licensed technology with biomedical applications (biopharmaceuticals and medical devices), software, or IT. The total number of start-ups has increased over the past four years: Illinois universities produced an average of 23 start-ups a year from 2010 to 2013, up from 18 a year from 2006 to 2009.

Active Illinois technology transfer start-ups founded FY2006–FY2013,
by industry, percent

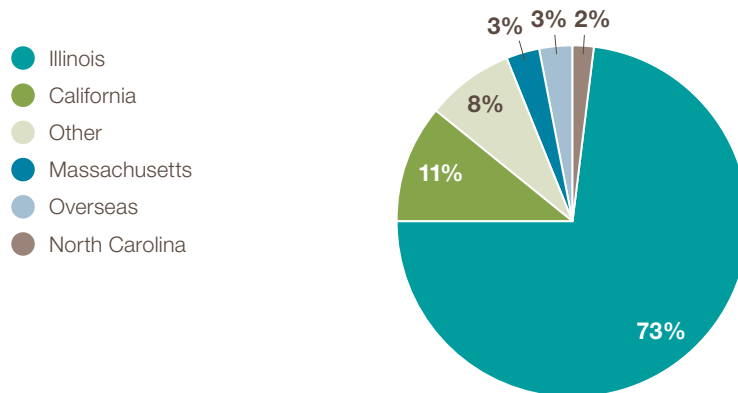


Source: ISTC Tech Transfer Survey, 2013

ISTC’s survey results suggest that Illinois has been successful at retaining the bulk of its start-ups. Of the 118 start-ups created in Illinois from 2006 to 2013 that are still active, 86—or approximately 73 percent—have pursued further technology development and commercialization of their technology within the state. The majority congregate close to the university from which they have licensed technology; Champaign and Evanston have the highest concentrations of technology start-ups. Resources in these localities, such as the University Research Park in Champaign, the Illinois Science + Technology Park (ISTP) in Skokie, and the Technology Innovation Center in Evanston, play an important role in helping to incubate and retain homegrown start-ups.

These retention rates suggest that Illinois has been effective in assembling the necessary components, including funding, infrastructure, and mentorship networks, to support start-ups as they grow and mature. The majority of start-ups that have left the state are commercializing biomedical technologies; of the 31 start-ups that have located or relocated out of state since their founding, 15 are biomedical start-ups. A number of these companies, such as Wittycell S.A.S. and Proteostasis Therapeutics, have also been among the most successful, indicating the importance of retaining and harnessing the biomedical innovation emerging from Illinois’ universities. More research could help identify the reasons for this and what more can be done to retain this pool of innovation and talent.

Active Illinois technology transfer start-ups founded FY2006–FY2013,¹
by current location, percent



¹N = 117; the location of one start-up has yet to be determined.

Source: ISTC Tech Transfer Survey, 2013

Looking forward

In the quest to strengthen research dynamism in Illinois, a number of state, regional, and citywide programs supporting technology commercialization have made progress. For example, Governor Quinn's Illinois Innovation Council recently piloted the Council's Corporate/Startup Challenge to connect early-stage businesses looking for mentorship, customers, and investment with five established corporations (Allstate, Molex, Motorola Mobility, John Deere, and Walgreens). And the City of Chicago is hosting its first venture capital summit this summer. Universities are also actively creating infrastructure and programs to promote tech transfer. For example, "proof-of-concept" funds such as the \$10 million Chancellor's Innovation Fund at the University of Illinois at Chicago and the Saluki Fund at Southern Illinois University enable these institutions to test the market viability of technologies before intellectual property leaves the lab. Place-based proof-of-concept centers, like EnterpriseWorks at the University of Illinois at Urbana-Champaign; the Health, Technology, and Innovation Center at the University of Illinois at Chicago; and the Chicago Innovation Exchange at the University of Chicago, also bring scientific and business resources and expertise together to support tech transfer.

To read more on the importance of this infrastructure, see "TTOs: A vital link between academic institutions and industry" by Lesley Millar, director of the University of Illinois' Office of Technology Management. ■

The Index partners would like to acknowledge and thank the Chicago Metropolitan Agency for Planning (CMAP) for their hard work and dedication to the Innovation Index.

More on the Ocean Tomo Ratings™ system and the OTR™ score

The table on page 6 was generated using the Ocean Tomo Ratings™ (OTR™) system. This employs a regression model to calculate a raw probability score for a patent. Raw scores represent the simple probability that a patent will be maintained for the full statutory term. For convenience, these raw scores are mathematically adjusted to provide a normalized mean or nominal expected score of 100. The adjusted score, dubbed the OTR™ score, is akin to an intelligence quotient (IQ) used to score human intelligence. Thus, a score of 100 on the OTR™ scale generally corresponds to an expected normal or median quality (average expected maintenance rate). An OTR™ score higher than 100 indicates above-average quality (higher expected maintenance rate), while an OTR™ score lower than 100 indicates below-average quality (lower expected maintenance rate). Of course, as with IQ, the OTR™ score provides only part of the equation for determining patent quality/value. Thus, a high OTR™ score does not guarantee high quality/value and vice versa. It only establishes a statistical correlation based on the body of available data.

To create the table, Ocean Tomo selected granted patents over the four years for selected educational institutions and grouped them by USPCs with the highest number of patents per year.

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