Puerto Rico
Science, Technology
& Research Trust

Technology Transfer Initiative

Benchmarking Tech Transfer Summary

November 2015

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Introduction

The Puerto Rico Science, Technology and Research Trust (Trust) Technology Transfer initiative is aimed at designing, creating and implementing an agile and effective structure to foster the commercialization of locally developed scientific inventions and discoveries.

Through this initiative the Trust seeks to establish a Technology Transfer Office (TTO) that serves as an umbrella entity to move innovations from academia to the private sector. The goal of this Technology Transfer initiative is the creation of new products and companies, expansion of employment, and fueling economic activity in Puerto Rico.

Benchmarking academic institutions and their technology transfer performance and opportunities requires a detailed understanding of three areas:

- research & development performance,
- technology transfer metrics, and
- the use of best practices

This benchmarking document presents technology transfer metrics and the use of best practices. Research & development benchmarking is presented separately.

1. Academic Institutions

Research and development expenditures are reported annually by each institution to the U.S. National Science Foundation and reported by the NSF National Center for Science and Engineering Statistics in an annual Higher Education Research and Development Survey. Only those individual campuses reporting to NSF are included. The latest data available is FY2013 (July 2013 - June 2014). Summary tables are presented that aggregate information for:

- University of Puerto Rico System (UPR) campuses
  - Mayagüez, Medical Sciences, and Rio Piedras
- Ana G. Méndez University System (SUAGM) campuses
  - Metropolitana, Turabo, and del Este
- Ponce Health Science University (PHSU)
- University Central del Caribe (UCC)

1.1. R&D Expenditures for Higher Education Institutions in Puerto Rico

Research and development at institutions of higher education provide researchers with the

funds necessary to pursue new knowledge, address specific or broad issues, and make that new knowledge and those solutions available to their scientific colleagues, the private sector, and the public.

To facilitate this transfer of knowledge, publication in academic journals and presentation at academic conference are encouraged and key to making the results widely available. As the result of the U.S. Bayh-Dole Act (Pub.L. 96-517, 1980) universities and their researchers have been incentivized to also transfer the results of federally funded research to the private sector through a technology transfer process that involves the protection (e.g., patenting) and licensing of intellectual property. As a result, technology transfer offices were established in universities and a new profession emerged that links science to business, with the goals of developing new products and processes and benefitting the public at large.

Five-Year Trends

Puerto Rico's universities compete with all U.S. universities for federal funds to support research programs. In 2013, Puerto Rico's universities spent[1] $140 million on research and development, a 23% increase over a five-year period. Expenditures from the one-time American Recovery and Reinvestment Act of 2009 (ARRA) have decreased through 2013.

The public University of Puerto Rico System (UPR) consistently achieved the highest ranking, producing about 75% of all R&D expenditures at Puerto Rico's universities. In addition, its expenditures increased from $97.9 million in 2009 to $105 million in 2013, a 7% increase. The most rapid increases in R&D expenditures were from the Ana G. Méndez University System (SUAGM), from $1.7 million to $16.3 million, and the Ponce Health Sciences University (PHSU), from $7.1 million to $12.3 million, while Universidad Central del Caribe (UCC) showed a slight decline.

[1] R&D data is measured by "expenditures", i.e., the funds actually spent on research.

2. Technology Transfer Metrics

The protection of intellectual property (IP) is fundamental in attracting private sector businesses, entrepreneurs and investors. Businesses (licensees) desire a competitive advantage through a license that transfers rights to exploit the IP. Without IP protection, discoveries and inventions may be publicly available through publication in journals, presentations at conferences, or other methods of public disclosure.

The goal of a technology transfer office is to work closely with researchers to facilitate timely disclosure of potential inventions. There are three keys to an effective relationship:

- Educate researchers about how to recognize a research discovery and when to disclose the findings to the technology transfer office.
- Synchronize the filing of IP protection/patents so as not to impede the researchers ability to publish.
- Build confidence in the researchers the technology transfer process will be robust, unbiased, and timely.

Benchmarking technology transfer metrics of Puerto Rico's higher education institutions can clarify past efforts, but most importantly build an effective approach to a future Technology Transfer Office (TTO). While the UPR System has a history of IP protection through its Office of Intellectual Property and Commercialization, its licensing (transfer) efforts have produced few licenses and not been the main focus of activity to date. At this time the UPR, SUAGM, PHSU, and UCC all have individuals serving in roles that can facilitate technology transfer.

With the universities' R&D profiles, how should a TTO be structured and resourced?

A rational business approach is to benchmark peer higher education institutions with a similar R&D profile and use standard technology transfer metrics as future benchmarks.

The Association of University Technology Managers (AUTM) is a non-profit association of 3,200 individual members who work in academic, research, government, legal and commercial settings. AUTM promotes and supports technology transfer through education, advocacy, networking and communication. Each year, AUTM conducts its *Licensing Activity Survey* to quantify tech transfer and for more than two decades, has been the leader in collecting, synthesizing, and disseminating academic technology transfer data. AUTM's 2013 data[2] is used to complete this benchmarking section.

The collection of data continues to evolve with the profession. Early numerical measures included the number of patents filed, license agreements executed and new companies formed. Later numerical measures included revenues from license fees, royalties and cash from equity investments paid to the academic institutions and the numbers of products successfully

[2] AUTM Licensing Activity Survey FY2013 http://www.autm.net/FY_2013_Licensing_Activity_Survey/15156.htm

introduced to the market. Non-numerical results have also been collected, such as the university's ability to retain entrepreneurial faculty, attract outstanding graduate students, contribute to the institutional reputation for innovation, augment its research program through interaction with the private sector and enhance its reputation for providing highly trained students to the workforce.

The following sections include:

- Peer university selection
- R&D expenditure comparisons
- Technology transfer staffing
- Disclosures, licensing, and license income
- Legal fees and patenting
- Patent protection and patents issued
- Start-ups

2.1. Peer Selection

A review of the 2013 AUTM Licensing Survey for the U.S. and Canada was completed and included metrics and statistics for 196 technology transfer offices at universities and research institutes. From this the peer sample was limited to:

- Public or private institutions of higher education
- Institutions with medical schools
- A group with average R&D expenditure comparable to Puerto Rico's $140.6 million

In the peer group there are 15 universities, 10 in the U.S. and 5 in Canada with an average R&D expenditure of $141.4 million, each with an operational technology transfer office (TTO).

Of note is the average year the TTO was established (1989) which reflects the 1980 Bayh-Dole Act in the U.S. and the development of industry-liaison offices in Canada to facilitate technology transfer and industry engagements.

Peer Selection Comparison 2013

Institution	State/ Province	Medical School	Year TTO Started	Country	Total R&D Expenditures
Univ. of Saskatchewan	SK	Yes	1990	Canada	$169,940,758
Tufts Univ.	MA	Yes	1978	USA	$163,454,769
Georgetown Univ.	DC	Yes	1993	USA	$158,889,918
West Virginia Univ.	WV	Yes	1999	USA	$151,751,731
Oklahoma State Univ.	OK	Yes	1995	USA	$144,120,753
Medical College of Wisconsin Research Foundation	WI	Yes	1984	USA	$143,807,297
Univ. of Manitoba	MB	Yes	1983	Canada	$143,759,552
Dalhousie Univ.	NS	Yes	1990	Canada	$142,839,369
Temple Univ.	PA	Yes	1989	USA	$136,605,865
Tulane Univ.	LA	Yes	1985	USA	$135,375,143
Univ. of Arkansas for Medical Sciences	AR	Yes	1994	USA	$135,000,000
Univ. de Sherbrooke	QC	Yes	1986	Canada	$129,730,364
Memorial Univ. of Newfoundland	NL	Yes	1987	Canada	$127,980,608
Univ. of Central Florida	FL	Yes	1985	USA	$126,700,000
Drexel Univ.	PA	Yes	1995	USA	$111,043,330
Average			1989		$141,399,964

Definitions

Total Research Expenditures: TOTAL RESEARCH EXPENDITURES include expenditures (not new awards) made by the institution in the survey year in support of its research activities that are funded by all sources including the federal government, local government, industry, foundations, voluntary health organizations (i.e., AHA, ACS, etc.), and other nonprofit organizations. Indirect costs should be included.

2.2. R&D Expenditures

In comparing peer R&D expenditure sources between federal sources and industry sources, there are important similarities and differences:

- Federal sources: 61% for peer group compared to 66% for Puerto Rico
- Industry sources: 8% for peer group compared to 2% for Puerto Rico

This difference in industry engagement presents an opportunity for Puerto Rico's institutions to engage the private sector. An initial step may be to review faculty incentives for undertaking sponsored projects and balancing with teaching loads. Past evidence shows there is disconnect between research tax credits and university engagement.[3]

[3] Georgia Tech-Puerto Rico Innovation Institute for a Technology-Inspired Economy, Phase II Pre-Proposal (2013). Puerto Rico Science, Technology and Research Trust document.

Peer R&D Expenditure Source Comparison 2013

Institution	Total R&D Expenditures	Federal R&D Expenditures	Industry R&D Expenditures
Univ. of Saskatchewan	$169,940,758	$82,253,613	$7,273,619
Tufts Univ.	$163,454,769	$124,973,856	$9,393,514
Georgetown Univ.	$158,889,918	$117,395,509	$5,918,636
West Virginia Univ.	$151,751,731	$90,832,387	$13,229,297
Oklahoma State Univ.	$144,120,753	$44,508,332	$11,349,773
Medical College of Wisconsin Research Foundation	$143,807,297	$115,822,263	$7,648,218
Univ. of Manitoba	$143,759,552	$74,657,414	$8,027,349
Dalhousie Univ.	$142,839,369	$85,990,466	$26,637,803
Temple Univ.	$136,605,865	$92,144,866	$6,014,719
Tulane Univ.	$135,375,143	$110,935,226	$16,056,874
Univ. of Arkansas for Medical Sciences	$135,000,000	NA	NA
Univ. de Sherbrooke	$129,730,364	$57,375,196	$8,642,366
Memorial Univ. of Newfoundland	$127,980,608	$42,164,231	$23,024,614
Univ. of Central Florida	$126,700,000	$76,500,000	$6,600,000
Drexel Univ.	$111,043,330	$88,549,795	$4,605,199
Average	$141,399,964	$86,007,368	$11,030,142

Definitions

Federal R&D Expenditures: RESEARCH EXPENDITURES: FEDERAL GOVT. SOURCES include expenditures made in the survey year by the institution in support of its research activities that are funded by the federal government. Expenditures by state and local governments should be excluded.

Industry R&D Expenditures: INDUSTRIAL SOURCES include expenditures made in the survey year by the institution in support of its research activities that are funded by for-profit corporations, but not expenditures supported by other sources such as foundations and other nonprofit organizations.

2.3. TTO Staffing

Peer TTOs are mature organizations and integral units of the university. Licensing university IP is one important function, if not the most important. Overall in 2013, the U.S. and Canadian TTOs reported:

- $64.2 billion in R&D
- 2,363 FTE staff of which 1,118 are licensing and 1,245 are other

The resulting ratio is $27.1 million of R&D expenditure/FTE, and the ratio of licensing staff to other staff is about 1:1. These trends have been consistent since the mid 1990s with variations shown in type of institution (e.g., medical schools, size, approach). Among the peer group with an average R&D expenditure ($141.4 million) and an average of 6 FTE, the averages show:

- Total TTO Staffing: $23.6 million R&D expenditure/FTE

- Licensing FTEs: $35.3 million R&D expenditure/FTE
- Other FTEs: $70.7 million R&D expenditure/FTE

The peer group shows more licensing staff, which may be explained by the approach taken by smaller TTOs, where those licensing staff also perform "other" duties.

Peer TTO Staffing Comparison 2013

Institution	Licensing FTEs	Other FTEs
Univ. of Saskatchewan	10	3.8
Tufts Univ.	6	1
Georgetown Univ.	5	4
West Virginia Univ.	0	1
Oklahoma State Univ.	5	2
Medical College of Wisconsin Research Foundation	3	0
Univ. of Manitoba	5	2
Dalhousie Univ.	7	3
Temple Univ.	3	1
Tulane Univ.	2	2
Univ. of Arkansas for Medical Sciences	1	3.5
Univ. de Sherbrooke	NA	NA
Memorial Univ. of Newfoundland	3	1
Univ. of Central Florida	5	6
Drexel Univ.	5	3
Average	4	2

Definitions

Licensing FTEs: Person(s) employed in the TECHNOLOGY TRANSFER OFFICE whose duties are specifically involved with the licensing *and* patenting processes in either full or fractional FTE allocation. Licensing examples include licensee solicitation, technology valuation, marketing of technology, license agreement drafting and negotiation, and start-up activity efforts.

Other FTEs: Person(s) employed in the TECHNOLOGY TRANSFER OFFICE in either full or fractional FTEs whose duties and responsibilities are to provide professional, administrative, or staff support of TECHNOLOGY TRANSFER ACTIVITIES that are not otherwise included in LICENSING FTEs. Such duties might include management, compliance reporting, license maintenance, negotiation of research agreements, contract management, accounting, MTA activity, and general office activity. General secretarial/administrative assistance to the TECHNOLOGY TRANSFER OFFICE may also be included in this category.

2.4. Disclosures, Licensing, and License Income

While peer group technology transfer metrics are readily available and consistent, Puerto Rico's technology transfer metrics are not publicly available. UPR provides some basic information

about patenting, but it is not up-to-date. The Benchmarking Best Practices (survey and on-site visit, June 2015) will collect metrics for those institutions participating and provide a foundation for future peer comparisons. Peer averages include:

- 59 disclosures,
- 9 agreements (licenses and options), and
- a gross license income of $3.5 million

Peer average comparisons show:

- 1 disclosure/$2.4M in total R&D expenditure
- 9.8 disclosures/FTE, with 14.75 disclosures/Licensing FTE
- 6.5 disclosures/agreement
- $59,149 in gross license income/disclosure
- $387,755 in gross license income/agreement

It is important to note that the "disclosure to agreement" and "gross license income" comparisons are not directly related but show an annual total.

Peer Disclosure, Agreement and Income Comparisons 2013

Institution	Invention Disclosures Received	Licenses Issued	Options Issued	Gross License Income
Univ. of Saskatchewan	42	13	2	$10,035,969
Tufts Univ.	94	5	6	$5,696,395
Georgetown Univ.	62	1	2	$8,576,039
West Virginia Univ.	31	2	1	$159,430
Oklahoma State Univ.	50	10	2	$2,203,775
Medical College of Wisconsin Research Foundation	42	2	1	$241,547
Univ. of Manitoba	48	6	0	$2,027,238
Dalhousie Univ.	44	3	3	$232,111
Temple Univ.	60	4	1	$11,506,822
Tulane Univ.	57	7	2	$3,836,253
Univ. of Arkansas for Medical Sciences	33	4	2	$1,137,124
Univ. de Sherbrooke	27	9	0	$5,701,880
Memorial Univ. of Newfoundland	19	4	1	$89,632
Univ. of Central Florida	124	11	6	$797,883
Drexel Univ.	148	10	14	$104,879
Average	59	6	3	$3,489,798

Definitions

Invention Disclosures: INVENTION DISCLOSURES include the number of disclosures, no matter how comprehensive, that are made in the year requested and are counted by the institution.

Licenses and Options: Count the number of LICENSE or OPTION AGREEMENTS that were executed in the year indicated for all technologies. Each agreement, exclusive or non-exclusive, should be counted separately. Licenses to software or biological material end-users of $1,000 or more may be counted per license, or as 1 license or 1/each for each major software or biological material product (at manager's discretion) if the total number of end-user licenses would unreasonably skew the institution's data. Licenses for technology protected under U.S. plant patents (US PP) or plant variety protection certificates (U.S. PVPC) may be counted in a similar manner to software or biological material products as described above, at manager's discretion. Material Transfer Agreements are not to be counted as Licenses/Options in this survey.

Gross License Income: LICENSE INCOME RECEIVED includes: license issue fees, payments under options, annual minimums, running royalties, termination payments, the amount of equity received when cashed-in, and software and biological material end-user license fees equal to $1,000 or more, but not research funding, patent expense reimbursement, a valuation of equity not cashed-in, software and biological material end-user license fees less than $1,000, or trademark licensing royalties from university insignia. LICENSE INCOME also does not include income received in support of the cost to make and transfer materials under Material Transfer Agreements.

2.5. Legal Fees and Patenting

Legal fees and patenting are indicators of the level of investment the university makes toward protecting its IP and the legal fees reimbursed as a result of successful licensing. As with other technology transfer metrics, these are not available for Puerto Rico institutions but will be included in the June 2015 Benchmarking Best Practices survey.

Peer average comparisons show:

- $15,177 in legal fees/disclosure
- 0.89 patent applications/disclosure
- $16,895 in legal fees/patent application
- $313,980 in legal fees reimbursed/$895,455 in legal fees = 35% reimbursement ratio, not directly correlated to the reporting year's fees, but an annual total.

Peer Legal Fees and Patenting Comparisons 2013

Institution	Invention Disclosures Received	Legal Fees	Legal Fees Reimbursed	Total Patent Applications
Univ. of Saskatchewan	42	$628,659	$138,891	25
Tufts Univ.	94	$3,440,801	$1,732,545	127
Georgetown Univ.	62	$1,409,718	$191,311	76
West Virginia Univ.	31	$207,652	0	20
Oklahoma State Univ.	50	$450,482	$270,058	32
Medical College of Wisconsin Research Foundation	42	$329,012	$196,721	27
Univ. of Manitoba	48	$715,305	$22,121	37
Dalhousie Univ.	44	$378,554	$231,628	23
Temple Univ.	60	$651,825	$140,656	47
Tulane Univ.	57	$1,268,381	$600,668	48
Univ. of Arkansas for Medical Sciences	33	$650,923	$456,110	28
Univ. de Sherbrooke	27	$232,197	$219,215	0
Memorial Univ. of Newfoundland	19	$117,512	$11,542	8
Univ. of Central Florida	124	$1,650,000	$176,555	197
Drexel Univ.	148	$1,300,800	$321,673	104
Average	59	$895,455	$313,980	53

Definitions

Legal Fees: LEGAL FEES EXPENDITURES include the amount spent by an institution in external legal fees for patents and/or copyrights. These costs include patent and copyright prosecution, maintenance, and interference costs, as well as minor litigation expenses that are included in everyday office expenditures (an example of a minor litigation expense might be the cost of an initial letter to a potential infringer written by counsel). Excluded from these fees is significant litigation expense, e.g., any individual litigation expense that exceeds 5% of total LEGAL FEES EXPENDITURES. They also do not include direct payment of patenting costs by licensees.

Legal Fees Reimbursed: LEGAL FEES REIMBURSEMENTS include the amount reimbursed by licensees to the institution for LEGAL FEES EXPENDITURES (see definition for LEGAL FEES EXPENDITURES). LEGAL FEES REIMBURSEMENTS paid via lump sum payments of costs incurred in prior years when a new license is signed AND regular reimbursements of new costs incurred after the license is signed. Do not include amounts deducted from LICENSE INCOME prior to internal distribution because LEGAL FEES EXPENDITURES have not been previously reimbursed (e.g., technologies licensed non-exclusively.)

Total Patent Applications: TOTAL PATENT APPLICATIONS include (1) the first filing of the patentable subject matter (NEW PATENT APPLICATIONS, U.S. or Foreign), and (2) U.S. patent continuations, divisionals, or reissues, but typically does not include CIP

2.6. Patent Protection and Patents Issued

Benchmarking patent protection and patents issued are good indicators of the TTO's patent strategy to utilize the U.S. provisional, U.S. non-provisional (utility), foreign (e.g., PCT), and the ratio of patent applications to patents issued. Patents issued may reflect a patent-granting agencies trends as well as the quality of the patent application.

Peer average comparisons show, of new patent applications:

- About 70% are for U.S. provisional patents
- About 20% are for U.S. utility patents
- About 10% are for foreign patents (e.g., PCTs)

There is a 46% ratio of U.S. utility patent applications to U.S. patents issued, not directly related but an annual total that reflects filings from 3+ years prior.

Peer Patent Protection and Patents Issued Comparisons 2013

Institution	Total Patent Applications	New Patent Applications	US Utility Patent Applications	Foreign Patent Applications	Provisional Patent Applications	Issued US Patents
Univ. of Saskatchewan	25	22	3	2	17	7
Tufts Univ.	127	59	0	0	59	30
Georgetown Univ.	76	40	1	0	39	18
West Virginia Univ.	20	20	15	0	5	5
Oklahoma State Univ.	32	15	1	0	14	12
Medical College of Wisconsin Research Foundation	27	11	0	0	11	8
Univ. of Manitoba	37	30	3	11	16	9
Dalhousie Univ.	23	50	7	27	16	3
Temple Univ.	47	19	0	0	19	9
Tulane Univ.	48	42	3	0	39	4
Univ. of Arkansas for Medical Sciences	28	29	6	3	20	0
Univ. de Sherbrooke	0	0	0	0	0	0
Memorial Univ. of Newfoundland	8	14	4	6	4	1
Univ. of Central Florida	197	96	20	0	76	71
Drexel Univ.	104	95	26	8	61	23
Average	53	36	6	4	26	13

Definitions

New Patent Applications: NEW PATENT APPLICATIONS FILED are the first filing of the patentable subject matter. NEW PATENT APPLICATIONS FILED do not include continuations, divisionals, or reissues, and typically does not include CIPs. A U.S. PROVISIONAL APPLICATION filed in the survey year will be counted as new unless it is a refilling of an expiring U.S. PROVISIONAL APPLICATION. If a U.S. PROVISIONAL APPLICATION is converted in the same survey year to a U.S. UTILITY APPLICATION, then that corresponding U.S. UTILITY APPLICATION filed in the survey year should not be counted as new.

US Utility and Provisional Applications: TOTAL U.S. PATENT APPLICATIONS FILED includes any filing made in the U.S. during the survey year, including provisional applications, provisional applications that are converted to regular applications, new filings, CIPs, continuations, divisionals, reissues, and plant patents. Applications for certificates of plant protection should also be included. TOTAL U.S. PATENT APPLICATIONS FILED should also include PCT applications where the PCT application is the first non-provisional filing where the U.S. is designated. If a U.S. utility application is filed by entering the national phase of a PCT application in the U.S., that should also be included in TOTAL U.S. PATENT APPLICATIONS FILED. However, a PCT application that does not designate the U.S. (e.g., because it follows a previous U.S. utility application or is filed at the same time as a U.S. utility application) would not be included.

2.7. Start-ups

Beginning in the mid 1990s, start-up companies have become increasingly important to technology transfer office functions and the relationship to local economic development efforts. University IP tends to be very early stage and requires further development to attract interest from larger established companies. As private equity investment in technology became more common, opportunities to invest early and seek substantial returns also became more common. Universities responded by changing policies and practices to accommodate start-ups.

Start-ups are new companies established to develop and commercialize university IP under a license. These start-ups are positioned to raise private funds for early stage development of the IP. Typically, start-ups proceed from an option agreement to a license when university policy and practices guidelines are met. These may include a business plan, identified management (e.g., other than the university employee founder), approved conflict management plan, and a level of committed funding.

Peer average comparisons show:

- $70.7 million in R&D expenditure/start-up formed (licensed)
- 3% ratio of start-ups/total disclosures, not directly related to disclosures from the same period, but an annual total
- 33% of licenses were for start-ups, directly related to the license agreements executed during the period