3. Observation, Assessment, and Reporting

"Academic Spin Offs (ASOs) economic performance (sales per individual in FTE) is highly dependent on internationalization dynamics – on average, firms that export and implement a foreign subsidiary outperform their domestic based counterparts."

Aurora Teixeira, Professor
Faculty of Economics, U.Porto
Associate Researcher
CEF.UP, INESC Porto & OBEGEF

3.1 2012 Survey of Portuguese TTOs

In 2012 the third annual UTEN network survey of technology transfer offices was conducted to develop a more comprehensive view of technology transfer in Portugal. A short summary of key findings follows.

- The primary functions of TTO employees continue to be: grants and fund-raising (27%), intellectual property (18%), and entrepreneurship/spin-outs (14%) with smaller amounts of time devoted to coordination, licensing, and industrial liaison;
- On average, approximately half of the revenues received by TTOs are from grants, with another 20% from external fees and services; only one-fourth of TTO revenues are provided by their institution.
- Compared to last year, there was a substantial increase (42%) in the number of invention disclosures reported by the TTOs.
- There are no clear trends with patent applications, while there has been an upward or stable trend over time for the three main types of patents granted.
- Licenses, option agreements, and assignments in 2011 matched the strong number in 2010, and the trend over time continues to be positive.
- Total license income increased once again in 2011, by about 6% over the prior year.
- Research and development agreements were 38% higher in 2011 than in 2010.
- TTOs reported a large number of new companies established: 141 in 2011 compared to 95 in 2010.

Introduction

Twenty offices were contacted, and responses were received from 18 TTOs as of late October. TTO directors were promised that only aggregate results would be released and that no responses from individual TTOs would be disseminated. Unlike the prior two years, this year UTEN Portugal implemented the survey with MERIT of Maastricht University, under the European Commission's Recommendation on Knowledge Transfer and supported by the European Council's Resolution on Knowledge Transfer. UTEN and MERIT surveys were merged to decrease the response burden on Portuguese TTOs and to overcome the lack of international comparable data. TTOs were contacted initially in late September 2012, and responses were tabulated in October 2012. A second survey was sent to a larger group of Portuguese institutions including polytechnic institutes, associated labs and private research centers, to access their technology transfer results for the year of 2011. The responses received are included in the results provided to MERIT integrating the sample for the technology transfer study commissioned by the European Commission.

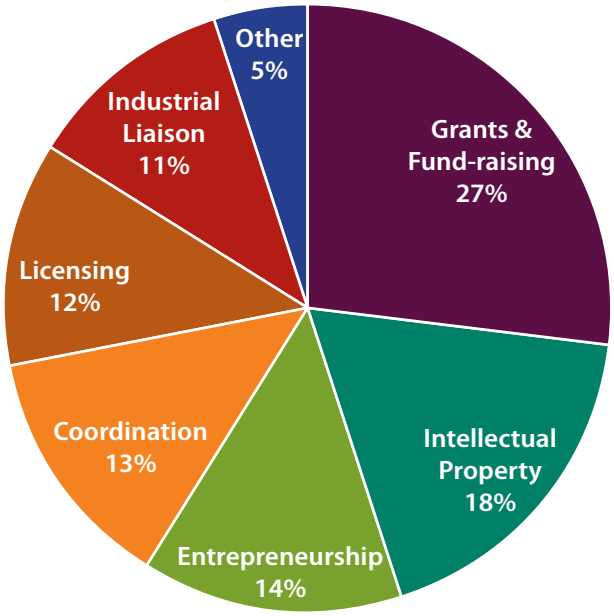
Organization and Budget

Basic organizational structure: Most TTO respondents are an integral part of their institutions. Two TTOs are external organizations that provide technology transfer services to multiple institutions. Besides performing services for their universities, four TTOs serve government or non-profit research institutes, two serve incubators or a research institute, and two serve research parks.

Maturity of TTOs: Many of the TTOs are recently established with only two TTOs having been established for at least a decade. Others are more recent with one started in 2010 and another in 2012.

Employee duties: The number of full-time technical/professional employees ranges from 1 to 14 per office. Twelve of the 18 TTOs have five or fewer technical/professional employees. The offices that responded have a total of 81 technical/professional employees work in the offices of the TTOs that responded. Across the different TTOs, on average employees allocate their time to several key functions (figure 3.1).

Figure 3.1 Primary functions of TTO staff



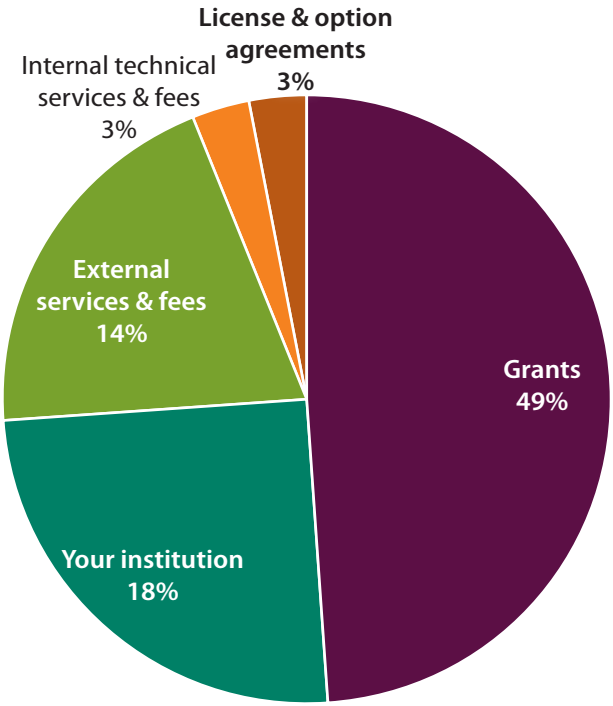
Employees' backgrounds: More than half of the TTOs have employees with university qualifications in Management/Business Administration and Engineering/Natural Sciences. About one-fourth of the TTOs have employees with a background in Law. About one-fifth of the TTOs have employees with qualifications in Finance, and three TTOs (one-sixth) have staff with biomedical backgrounds.

Budget expenditures: Expenditures vary considerably across the TTOs. At least four TTOs spent more than €200,000 and four others spent more than €100,000. The aggregate amount for all TTOs could not be calculated in 2011 as there were an insufficient number of responses. Of the TTOs providing expenditure information, approximately 70% was devoted to human resources, with nearly 20% allocated to patenting and the remaining funds spent on entrepreneurship.

Sources of revenues: As shown previously in figure 3.1, grants and fund-raising are an important task for TTOs.

Only one TTO in 2011 received all of its revenue from its home university. TTOs are in fact quite dependent on grants to perform their functions as nearly half of their revenues, on average, come from grants. In 2011, ten of the TTOs secured at least half of their revenue from grants, with three TTOs above 70%. Two other TTOs were entirely funded from external fees and services. On average in 2011, the TTOs received their revenues from sources as shown in figure 3.2. Compared to the prior year, TTOs increasingly relied on external fees and services and grants, and received a smaller proportion from their home institution.

Figure 3.2 Sources of revenues (2011)



Services Provided: Despite the diversity among TTOs in their budget expenditures and revenue sources, there is considerable similarity in what services are being provided. All TTOs:

- Create or support start-up companies based on their institution's inventions
- Raise awareness/disseminate information on intellectual property rights and entrepreneurship

At least three-quarters of TTOs:

- Assess the patentability of inventions
- Manage material transfer or confidentiality agreements
- Apply for patents
- Negotiate or arrange licenses
- Scout for new intellectual property and new technology
- Prepare grant proposals

More than half of TTOs:

- Provide training to faculty, researchers, or students
- Negotiate government-sponsored research contracts/grants
- Coordinate with business angel networks

In contrast, about one-third manage or coordinate an incubator facility and one in five manages a research/science and technology park. Other services noted by TTOs included providing consultancy services, drafting non-disclosure agreements, business idea competitions, searching research and developing competencies, and industrial liaison.

Intellectual Property and Commercialization

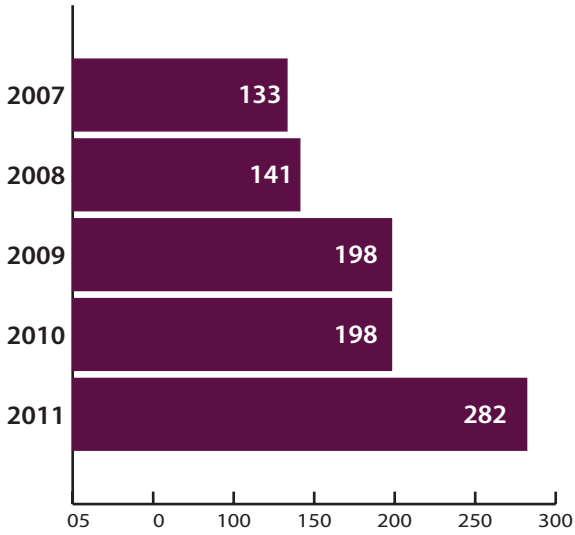
Scope of patenting: In 2011, all but three of the 16 TTOs responding to this question performed at least 90% of the patent applications through their offices. One reported handling less than half of the applications, and two others do not undertake any patent applications.

Ownership of IP rights: The universities own IP rights in nearly all cases. In three, inventors own some rights depending on contract negotiations, and in one university IP rights are owned by the schools.

Royalties: Seventeen TTOs provided information about royalties, and 15 reported that royalties are split between their institutions and the inventors in varying proportions. In eight of the institutions, royalties are split 50%-50%. In another seven institutions, the inventors receive 55% or more, including two institutions that provide 80% to inventors. One university alters the allocation depending on the total amount of royalties received—for smaller amounts the inventor receives a higher percentage, while for larger amounts the university receives more and the organizational unit receives some proportion. Compared to last year, inventors now are receiving a larger share at a number of institutions.

Invention disclosures: Compared to last year, there was a substantial increase (42%) in the number of invention disclosures reported by the TTOs. As shown in figure 3.3, invention disclosures in 2011 reached 282.

Figure 3.3 Invention Disclosures ('07-'11)



Patent Applications (Priority Filings): The trend is less clear on patent applications as shown below. In one category (provisional), the trend is clearly upward, while in the other four categories there are no clear trends. In 2011, there was one application in Spain and another in India.

Filings	2007	2008	2009	2010	2011
Provisional	4	23	66	80	100
Portuguese	71	88	76	78	69
PCT	29	30	74	43	17
EPO	12	13	12	4	6
USPTO	11	17	5	11	7

Patent Applications by Subject Area: More than half of the TTOs applied for some type of a biomedical (diagnostic, devices, pharmaceutical etc.) patent in 2011. Six of the TTOs applied for a patent related to computers or communication equipment, while four applied in the area of nanotechnology/new materials, and two in low or zero carbon energy technologies. Other areas in which TTOs applied for patents were agricultural sciences, life sciences, mechanics & electromechanics, and the food industry.

Patents Granted: The trends has been upward or stable over time for the three categories. In 2011, two TTOs reported receiving Canadian patents.

Active Patents: Compared to 2010, there were increases in the number of EPO patents (6%) and USPTO patents (26%) in 2011. PCT active patents declined by 5%. Because of changes in the data collection methodologies, the increase in the number of active Portuguese patents could not be determined precisely. The increase was a minimum of 56% and possibly as high as 85%. TTOs reported having active patents in Canada, France, Russia, Norway, Brazil, Japan, China, Australia, and South Africa.

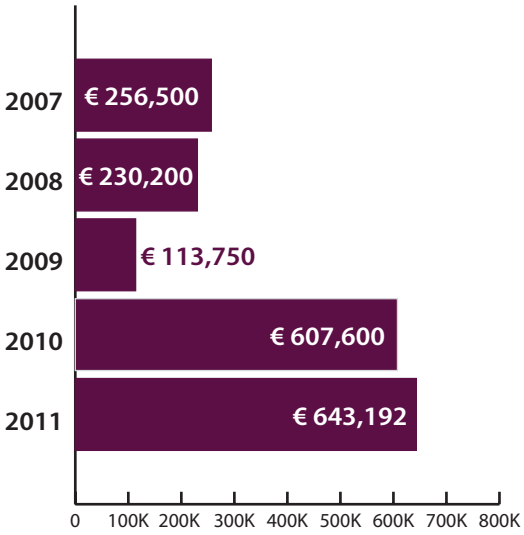
Licenses, Option Agreements, and Assignments: As in prior years, the large majority of the licenses, agreements, and assignments have been executed with Portuguese partners as shown below. The total in 2011 nearly matched the very strong number in 2010, and the trend over the past five years continues to be positive.

Partners	2007	2008	2009	2010	2011
Portuguese	24	32	38	56	52
EU	4	5	5	7	8
USA	5	3	5	4	2
Other Int'l	1	2	1	1	1
Total	34	42	49	68	63

About an equal number of licenses and options were granted to start-up companies and firms with fewer than 250 employees. The remaining licenses and options, about 20%, were granted to companies with more than 250 employees.

License Income: The total amount of license income increased once again in 2011, following the dramatic increase in 2010. Seven of the TTOs reported license income, with three TTOs reporting license income of at least €100,000 in 2011. Therefore the aggregate amount of nearly €650,000 is not due to a single transaction or single TTO. Three TTOs reported international license income.

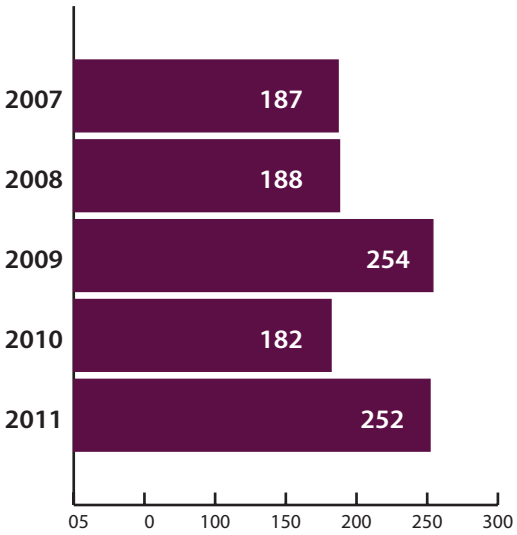
Figure 3.4. Aggregate License Income ('07-'11)



Commercially Profitable Products: Eleven TTOs indicated that their institution's licensed technology or knowledge had resulted in commercially profitable products or processes in the past three years.

Research and Development Agreements: TTOs reported a dramatic increase in the number of executed agreements in 2011, up 38% from the prior year. The number in 2011 essentially matches the strong performance in 2009 and considerably surpasses the levels in 2007 and 2008 as shown below.

Figure 3.5. R&D Agreements ('07-'11)



Institutional Research Resources: For the first time in this series of surveys, TTOs were asked questions about their institution's research resources. The total number of research personnel (researchers, technicians, and

administrative support personnel) at 14 institutions in 2011 was 22,377. Six TTOs reported more than 1,000 researchers each. The aggregate research budgets at nine institutions were €112,908,866, with two institutions accounting for three-quarters of the total. Privately funded research at institutions varied considerably. One TTO said 35% of total research expenditures came from private companies, a second TTO said that figure was 24% at their institution, and a third TTO reported 19%. One TTO each reported 12%, 11%, 10%, and 9%, while three TTOs reported 5%. Other TTOs did not provide a response.

Spin-off & Start-Up Companies: Data from the TTOs show that a large number of new companies are being established. In 2011, TTOs reported 141 new companies were established, while nine companies from prior years ceased operations. A more detailed enumeration and analysis of spin-off and start-up companies follows.

3.2 Performance of Portuguese Academic Spin-offs: Main Determinants[1]

The context

University Spin-Offs (USOs) [1] or Academic Spin-Offs (ASOs) [2] are firms whose products or services are based on scientific/technical knowledge generated within a university setting [3; 4], where the founding members may (or may not) include the academic inventor.In the European context, in general, and in the Portuguese, in particular, the promotion of the establishment of ASOs revealed to be a daunting and complex task [5; 6], especially because research institutions showed limited capacity for transferring scientific and technological knowledge to industry [7; 8]. Among the reasons for this incapacity are the cultural differences between the university and private sectors which, in part, reflect the lack of an entrepreneurial spirit within university environment [5], and the poor industry–university relations that characterize some EU countries, most notably Portugal, exacerbating the lack of university entrepreneurial orientation [9; 10].

To address such handicaps and difficulties for ASOs, in March 2007 the Portuguese Science and Technology Foundation (FCT), with the IC² Institute from The University of Texas at Austin, launched the University Technology Enterprise Network (UTEN). The project represented a significant investment in innovation by the Portuguese government with a specific goal of building a globally competitive and sustainable science and technology (S&T) transfer and innovation network managed by highly trained Portuguese professionals. UTEN's Portuguese member organizations include universities, polytechnic institutes, associated R&D labs, university-linked incubators and science parks. On the whole, excluding official governmental entities (i.e., FCT and IPIN), UTEN includes 29 organizations: 17 university Technology Transfer Offices (TTOs), one TTO from a polytechnic institute, two associated R&D labs,[2] four university-linked incubators, and five science parks.[3] UTEN undertook, and still undertakes, its goals at an upstream phase of the technology transfer process by *training Portuguese technology transfer managers and staff* through value-added workshops and internships in select and diverse centers of expertise for 'on-the-job' international competence building and enhanced network development. UTEN also, at a more downstream phase *actively supports and mentors select, globally competitive Portuguese business ventures.*

Thus, one might argue that, at least in part, over this five year period (2007-2011), Portuguese ASOs associated to UTEN members might have benefited *directly*, through personal participation in UTEN events (e.g., conference, workshops, business meetings), and/or *indirectly*, through higher quality level of services provided by TTOs, Science Park staff, and Incubators staff who attended UTEN international events including internships. Given that a five-year period elapsed since UTEN's genesis, it is now critical to assess what effective (or potential) value has been realized by Portuguese ASOs associated to UTEN's members—either in terms of economic value or internationalization performance, and which were their main drivers.

Methodology

This study has undertaken an empirical analysis to assess the relevance of the determinants of the performance of Portuguese ASOs associated to UTEN members. For this assessment, we constructed and implemented a direct email survey to all 309 ASOs associated to UTEN's members analyzing, in a quantitative and qualitative manner, how ASOs' innovation, international, and economic performance evolved from 2008 onwards, and which were their main drivers.

Existing literature on ASOs' performance refer three main groups of determinants: 1) those related to the entrepreneur or the team of founders (size, education and industry experience of the founding team) [11-14]; aspects concerning the firm/business (source of creation; innovation; internationalization; market strategies; demographic traits) [14-18]; and contextual factors (S&T support and obstacle mechanisms; university characteristics; regional factors) [14; 16; 19]. In a simplified away, the general econometric specification used stands as follows:

$$Performance_i = \hat{\beta}_0 + Entrepreneurs + Business + Context + e_i$$

Where i is the subscript for each ASO and e_i is the sample error term and where:

1 *Performance of Portuguese Academic Spin-offs: Main Determinants* is the work of Aurora A. C. Teixeira with the research assistance of Marlene Grande. Previous related studies appear in the 2009-2010 UTEN annual report, *Technology transfer and commercialization activities in Portugal: A quantitative overview,* p. 52-55 and *Portuguese Academic Spin-offs and the Role of Science and Technology Transfer Organizations,* p. 55-61*;* and the 2011 UTEN annual report, *Characters and Trends of Academic Spin Offs (ASOs) associated to UTEN partners, p.74.*

2 INESC Porto and IMM

3 The membership of UTEN evolved since its genesis. This composition is the one that was in stake in October 2012.