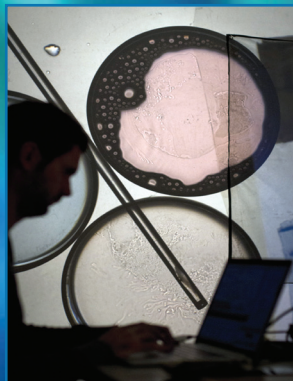


2013 REPORT

UTEN Portugal

University Technology Enterprise Network

Global Incubation and Acceleration of
Portuguese Technology-based Companies





In 2007 the University Technology Enterprise Network (UTEN) was launched in Portugal with the assistance of the IC² Institute at The University of Texas at Austin and sponsored by the Portuguese Science and Technology Foundation. The primary goal of this collaboration was to lead, facilitate, and accelerate the commercialization of science and technology innovations created by Portuguese researchers. In addition, the goal was to stimulate new international joint research and development ventures in science and technology as well as related economic activities in both Portugal and emerging markets worldwide. Since its inception, UTEN has continuously broken new ground by fostering entrepreneurial attitudes and the international business competitiveness of Portuguese science and technology innovations and by exploring new paradigms through the global commercialization of university-based technologies out of Portugal.

Based on a unique innovative concept combined with a vision to become a cooperative network incorporating universities, technology transfer offices, research laboratories, incubators, and professionals in Portugal in the context of technology commercialization, UTEN soon became a leading program bridging the gap between early stage innovations and the marketplace for the benefit of society. The tangible outcomes of the different activities undertaken by UTEN speak for themselves and have been reported in the media, but probably the most important outcome has been a new cohort of young, skilled technology managers in Portuguese technology transfer offices whose competences have already been internationally recognized.

Two years ago, the evaluations and recommendations contained in an assessment of UTEN by the Academy of Finland stressed the utmost relevance of the UTEN program to the economic future of Portugal. In part as a consequence of this assessment, work has been undertaken with early-stage Portuguese companies and young entrepreneurs, helping them with their plans to enter foreign markets, but this work has never been considered a priority of UTEN. Nevertheless, companies that are now in European and U.S. markets have clearly benefited from their prior involvement in UTEN, and many benefits have been observed. The challenge is now to further capitalize on developed networks and commercial successes by taking advantage of those skills, networking, and competences previously developed.

After a remarkable effort in investing in research (effectively turning money into knowledge), the time has come for Portugal to monetize that knowledge. Based on the consensus that innovation is one of the major drivers of the economies of modern societies, the second phase of UTEN, from 2013 to 2017, will target the creation of an international business hub in Austin, Texas for incubating and accelerating Portuguese technology ventures. These ventures will benefit from physical co-location space and feet-on-the-ground mentorship in Austin from an experienced team of business developers focusing on company expansion and growth.



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1. UTEN: New Visions

“ UTEN is a key element in nurturing the entrepreneurial spirit country-wide for the future. It requires a full commitment from the TTOs and their institutions and demands building relationships of mutual trust between them and the research community.”

Marco Bravo, IC² Institute Program Director

1.1 Introduction

In 2007, Portugal initiated strategic partnerships with leading institutions worldwide that have been promoted and supported by its Foundation for Science and Technology (FCT), in collaboration with the Portuguese Industrial Property Institute (INPI) and the Council of Rectors of Portuguese Universities (CRUP).

The University Technology Enterprise Network (UTEN) originated in March 2007 within the *UT Austin | Portugal Collaboratory for Emerging Technologies (CoLab)*, focused on collaborative research in advanced interactive digital media, advanced computing, and applied mathematics (www.utaustinportugal.org). UTEN's focus was to enable international commercialization of Portugal's S&T efforts, and was to coordinate across similar Portugal programs with Carnegie Mellon University and the Massachusetts Institute of Technology. Currently, UTEN involves all Portuguese university-based technology transfer offices plus other scientific institutions and science parks.

UTEN's focus continues to evolve against an unchanging mission: **to transfer Portugal's science and technology achievements from its laboratories to the global marketplace.**

UTEN Success Metrics, 2007 - 2012

UTEN was the smallest of several Portuguese-U.S. partnerships initiated in 2007 and to date, the program outcomes have been remarkable in providing a broad national impact through:

- Successfully networking all major research institutions throughout the Portuguese mainland and associated islands
- Developing a technology transfer office (TTO) infrastructure at all major nodes within the UTEN network
- Delivering more than 50 workshops hosting more than 1,500 participants providing broad training for in-country professionals and scientists
- Intensive infrastructure investment in 12 TTO's from leading universities, providing intensive assessment, development, and process improvement
- Deep training of more than 30 TTO professionals who have interned in the United States, receiving immersion training in best practices in technology commercialization
- Capturing more than 150 new Portuguese technologies in the form of inventions (nearly a 50% increase in disclosure rate)

- Catalyzing a large increase of more than 1,900% in provisional patent filings and an overall increase of nearly 20% in patents issued to Portuguese researchers (2007 to 2010)
- Supporting the launch of more than 100 new technology-based companies with international market and business strategies
- Driving an increase in academic spin-off rate of more than 132% compared to pre-UTEN, with these companies showing more than a 125% increase in revenue and 38% hiring growth
- Accelerating five Portuguese companies into the U.S. market through the US Connect pilot program with: in-person meetings with more than a dozen Fortune 500 companies; several business, services, and manufacturing deals; and U.S. subsidiaries for three companies.

These metrics demonstrate UTEN's success and underscore its critical role in connecting Portuguese innovation and scientific output with *tangible economic impact*, in terms of both GDP and employment. The IC² Institute views these outcomes as indicative of the success that can be expected to continue in terms of:

- Capturing leading scientific accomplishments as inventions
- Practicing effective technology transfer in support of out-licensing and spin-off activities
- Developing human capital to support entrepreneurial activities
- Preparing Portuguese companies for international market expansion.

Therefore, a more comprehensive strategy has been outlined for the coming five-year period, from January 2013 to December 2017, that will focus on establishing a global innovation hub, BIZ.pt, in Austin, Texas to assist Portuguese technology-based companies in succeeding in international markets.

Entrepreneurs: The New Focus

UTEN's initial purpose was to provide Portugal with a comprehensive strategy to see its investments in S&T yield fruit in terms of economic expansion and growth through the support and outreach of entrepreneurial enterprises. Having made tremendous progress toward these goals in the first five years, in terms of establishing and training a network of professional TTOs to enable a more entrepreneurial ecosystem, UTEN now turns its attention to the entrepreneur through:

- *Technology business incubation* to nurture start-up Portuguese companies

- *International business acceleration* to help companies expand to international markets including the United States, and to assist international companies when locating in Portugal
- *Business development* through a Global Start-up Program (US Connect), with strategic links to incubator activities.

In support of these goals, the UTEN Annual Conference and UTEN Annual Report will promote foundational networking and dissemination of UTEN results.

The UTEN program provides an essential segue from a decade of science infrastructure investment to the realization of new enterprises to support a thriving economic sector. In other words, UTEN's mission is to bring technologies from Portuguese laboratories to international markets and thus provide a return on the national investments in Portugal's university science and technology systems.

Such movement of S&T innovation to the market can be assisted through the efforts of an outside entity, but need to be grounded in the preparation and dedication of in-country professionals—stakeholders who will link aspiration to realization of these bold programmatic goals. UTEN programs will exercise critical thinking, creativity and personal risk management in the practice of science and commercialization.

UTEN will strengthen the understanding of leading research faculties in Portugal in the process and importance of commercialization as a natural extension of scientific pursuit. New emphasis will be placed on supporting emerging entrepreneurs (the new company executives and maturing CEO's) to lead new start-ups and SMEs toward national and international markets. Finally, evaluation and metrics will be applied to all programs on an annual basis to measure success, identify areas requiring improvement, and redesign initiatives to insure outcomes are realized.

These programs and processes are shown in Figure 1.1, placed within the continuum of science-to-market in terms of process and in relation to particular stakeholders that are critical for driving these ideas into products. Each program focuses on a different stage of the commercialization process and targets a different group of stakeholders. The global innovation hub, BIZ.pt, is a major initiative with multiple actions to simultaneously build capacity and operations through linked, but distinct, activities. BIZ.pt also reflects the movement of ideas: from S&T source, through commercialization vehicles, and into the market to improve the probability, frequency, and magnitude of

social impact and its associated commercial success. UTEN has been thoughtfully fitted to Portugal's needs so that it might accurately address the challenge to grow the nation's economy and in-country wealth through the international exploitation of its S&T investment, and more fully realize its remarkable potential on the immediate horizon.

1.2 Portugal's Rapid S&T Growth

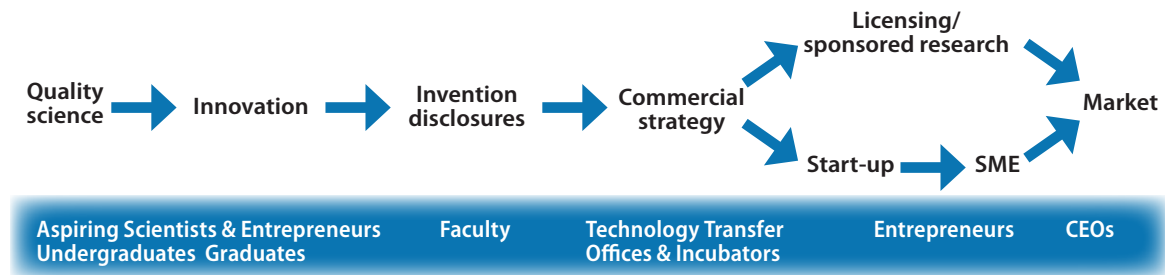
It is widely recognized that scientific progress is a source of economic development. Public resources invested under rigorous international assessment policies lead to new knowledge, advanced training of new human resources for society, and new ideas and processes—that increasingly result in innovation, modernization of institutions, improved quality of life, economic productivity, and wider employment. In pursuit of stable economic development, the nation of Portugal has made aggressive investments to deepen its scientific capacities. The results of these investments have been transformative and provide (more than hope) new opportunity in the face of manifest political and economic crises.

In recent years Portugal has become one of the fastest growing European countries in terms of science and technology (S&T) investments and results. Total expenditure on research and development (R&D) as a percentage of the Gross Domestic Product (GDP) has more than doubled from 2005 to 2010 (0.78% in 2005 to 1.64% in 2009 and provisionally 1.59% in 2010). In absolute numbers, private investment *within companies* accounted for 45% of the total expenditure (47% in 2009). In international comparison, Portugal was well placed in 2010, above Spain, Italy, and close to Norway.

As a direct result of these and other national investments in Portugal's S&T system, the nation recently met and surpassed the EU average number of researchers per thousand labor force. In 2008 it reached 7.2 per thousand labor force, while the latest data available indicate Portugal has 8.2 researchers (measured as full time equivalent, FTE) per thousand human capital, corresponding to an increase of about 115% from 2005 to 2010. This increase in research personnel has been matched with an increase in the number of researchers in the business sector, which increased by 158% from 2005 to 2010 (from 4,014 to 10,363 FTE). Eurostat's most recent data show that Portugal's achievements also reflect a remarkably high rate of women employed in science sectors: 45.6% in 2009.

Scientific output in Portugal has doubled since 2004, in terms of the number of internationally referenced

Figure 1.1: BIZ.pt 2013 - 2017 (flow of activities)



1. Soft landing pad (start-up incubation)

2. International business acceleration

3. Global start-up program

4. Observation and assessment

scientific publications. An analysis of the relative scientific competitiveness of OECD countries shows that Portugal, with about 626 scientific publications per million population in 2008, exceeds the EU-27 average ratio between output (publications) and input (public expenditures on R&D). This ratio indicates an internationally competitive science base, albeit the nation currently lacks the critical mass necessary for knowledge-integrated communities. This growth in Portugal's scientific production is based on about 12,000 PhD researchers working in academic R&D centers (measured as FTE), corresponding to an increase of 25% over the last two years and a doubling of the number of PhD researchers since 2000. This strong growth has shown clear results in terms of the international impact and visibility of the Portuguese scientific community.

In 2008 Portugal reached the target of 1,500 new PhDs per year. The percentage of new PhDs awarded to women is at a historic peak, recently surpassing 50%. Further, new PhDs in the fields of science and engineering currently represent 47% of the total, while this number was less than one third (31%) in 1991.

Portuguese patent applications to the European Patent Office (EPO) per million inhabitants have increased 300% from 1999 to 2009 and increased from 11.39 per million in 2005 to 14.34 in 2009. Similarly, the number of patents granted by the United States Patent and Trademark Office (USPTO) for Portuguese applicants has grown from 0.73 per million inhabitants in 1996 to 1.97 in 2005 (the latest available data on Eurostat).

As part of the overall strategy that has produced this growth, a unique set of international collaborations with leading institutions worldwide was successfully developed, based on thematic R&D networks and

integrating advanced training initiatives. Combined with a national increase in S&T investment devoted to S&T, scientific output metrics began to reflect positive change. Within this overall growth context, a hypothesis was framed for Portugal to develop a globally competitive and sustainable commercialization infrastructure, capable of harvesting these increases in scientific results through economic valorization.

The UTEN program began as an experiment to meet this need. There was no working model on which to frame the program's design to affect this broad primary goal. Initial pilot programs revealed that working directly with companies would be premature before establishing a broad base of technology transfer talent to provide an entrepreneurial ecosystem and support network. A coordinated training effort ensued, targeting Portugal's university TTOs and laboratories. These efforts are detailed in the following UTEN Reports, which are available on the UTEN web site:

- *Portugal's People, Knowledge, & Ideas: Competing in International Markets with the IC³ Institute*, 2008-2009 Annual Report
- *Advancing & Professionalizing Science & Technology Commercialization*, 2009-2010 Annual Report
- *Increasing Capacity for Portuguese Technology Transfer & Commercialization*, 2011 Report
- *Entrepreneurship & Technology Commercialization: Building Portugal's Future, 2007-2012: A Progress Report*.

The broad success of UTEN programs to form a professional TTO network now enables UTEN to shift its focus to the entrepreneur. Currently, UTEN involves all

Table 1.1 UTEN Technology Transfer Offices

Institution	Technology Transfer Offices	UTEN Focal Points
NOVA Univ. of Lisbon	Technology Transfer Office of FCT/UNL	Zulema Lopes Pereira Ana Sofia Esteves
Polytechnic Inst. of Porto	Knowledge and Technology Transfer Office	Carlos Ramos Rafael Pedrosa
Technical Univ. of Lisbon	SpinLogic, Católica Porto Knowledge & Technology Transfer Unit	Eduardo Luís Cardoso
Technical Univ. of Lisbon	OTIC UTL	Eduarda Camilo
	TT@IST, IST's Technology Transfer Office	Luís Caldas de Oliveira
Univ. of Algarve	CRIA, Division of Entrepreneurship & Technology Transfer	Hugo Barros Sofia Vairinho
Univ. of Aveiro	UATEC, University of Aveiro Technology Transfer Unit	José Paulo Rainho
Univ. of Beira Interior	ICI, Research Coordinator Institute GAPPI - Office for Promotion of R&D	Ana Paula Duarte Conceição Camisão Dina Pereira Pedro Serrão
Univ. of Coimbra	DITS, University of Coimbra Technology Transfer Unit	Jorge Figueira João Nuno Simões
Univ. of Évora	Projects & Information Office Science & Cooperation Services	Carlos Braumann Manuel Cancela d'Abreu
Univ. of Lisbon	UL INOVAR	Maria Teresa Salter Cid
Univ. of Madeira	OTIC-TeCMU Technology & Knowledge Transfer Office	Carlos Lencastre
	GAPI Madeira at Madeira Tecnopólo	Pedro Mota
Univ. of Minho	TecMinho	Marta Catarino Pedro Silva
Univ. of Porto	InescTec, Tecnologia e Ciência Laboratório Associado	José Mendonça
	UITT, Innovation and Technology Transfer Unit of INESC Porto	Alexandra Xavier
	UPIN, University of Porto Innovation	Maria Oliveira
Univ. of Trás-os-Montes e Alto Douro (UTAD)	GAPI-OTIC, Technology Transfer Office at UTAD	António Miguel Bacelar Carla Mascarenhas

university-based technology transfer offices plus other scientific institutions and science parks, as presented in Tables 1.1, 1.2, and 1.3.

1.3 Why The University of Texas at Austin?

By means of several metrics, Austin, Texas, is considered one of the most innovative cities in the world. It was ranked second in *Forbes'* list of "America's Most Innovative Cities in 2010," with about 2,900 patents registered by its residents (second-most per-capita of any metro area in the United States). With an annual ratio of 1.7 patents per 1,000 residents, Austin's culture of innovation is boosted by the presence of a significant number of technology companies (Dell, IBM, Freescale Semiconductor, etc.), and a constant flow of start-ups emerging from its rarified entrepreneurial ecosystem. Austin is home for a wide array of successful entrepreneurs and is praised for its creativity in hosting South-by-Southwest (SXSW), the largest annual start-up, film, media, and music festival in the world. In 2010, *Yahoo Finance* considered Austin as the third fastest growing city and *Kiplinger* ranked it as the "Best City for the Next Decade."

The University of Texas at Austin is a major research university: home to more than 52,000 students, 2,900 faculty, and 21,000 staff members. With more than 3,500 research projects, 90 research units, and annual research funding exceeding \$640 million, more than 400 patents have been awarded to the university since its inception. In FY 2010-2011, licensing deals generated more than \$25 million for the university. Annually ranked among the best U.S. public research universities, many of its colleges, schools and departments are considered among the finest in the nation. The *Times of London*, in a 2004 survey of colleges and universities around the world, ranked The University of Texas at Austin as number 15 worldwide. UT Austin is the flagship university of the University of Texas System, which includes nine universities and six health science centers. The University of Texas System conducts over \$1.5 billion in sponsored research annually.

An interdisciplinary research unit of The University of Texas at Austin, the IC² Institute¹ has advanced the theory and practice of entrepreneurial wealth creation

1 IC² stands for Innovation, Creativity and Capital.

Table 1.2 UTEN Entrepreneurial Support

Institution	UTEN Focal Points
AvePark, Science and Technology Park	Carlos Remísio
CEIM, Centro de Empresas e Inovação da Madeira BIC MADEIRA	Patrícia Dantas de Caires
INOVISA	Luís Mira da Silva
IPN – Instituto Pedro Nunes	Carlos Cerqueira José Ricardo Aguilar Paulo Santos
ISCTE - Lisbon University Institute Audax BGI VC	José Paulo Esperança Gonçalo Amorim
Madan Park	José Damião Alcino Pascoal
NOVA University of Lisbon NOVA University Entrepreneurship Office	Joana Mendonça
Parkurbis - Science and Technology Park of Covilhã	Pedro Farromba Daniela Marta
Sines Tecnopolo	Mónica Brito
Spinlogic, Católica Porto Incubator	Eduardo Luís Cardoso
Taguspark, S.A.	Amaro Teixeira
University of Aveiro	
UATEC, University of Aveiro Technology Transfer Unit	José Paulo Rainho
IEUA, University of Aveiro Business Incubator	Celso Guedes de Carvalho
UPTEC, Science and Technology Park of University of Porto	Clara Gonçalves

Table 1.3 UTEN Research Institutions

Institution	UTEN Focal Points
CEDOC - Chronic Diseases Research Center	Marta Carapuço Joaquim Teixeira
IGC - Instituto Gulbenkian de Ciência	Joaquim Teixeira
IMM - Instituto de Medicina Molecular	Maria do Carmo Fonseca Filipa Nunes
IN+ - Center of Innovation, Technology & Policy Research	Paulo Ferrão
ITQB - Instituto de Tecnologia Química e Biológica	Francisco Pereira do Valle

for more than thirty-five years, and has established itself as a leader in technology commercialization through research, education, and service. The Institute was founded on the premise that science and technology are resources for economic development, enterprise growth, and shared prosperity worldwide, and on the principle that entrepreneurship and technology transfer is the predominant source of wealth and jobs in market economies. Theories and hypotheses developed at the IC² Institute are tested in life scale through world-recognized programs such as:

- *The Austin Technology Incubator (ATI)*, one of the world's most prominent business incubators
- *The Master of Science in Technology Commercialization (MSTC) degree program*, now available at the McCombs School of Business
- *The Global Commercialization Group (GCG)*, a catalyst for emerging knowledge-based economies throughout the world

- *TechBA*, a technology business accelerator created by the United States-Mexico Foundation for Science (FUMEC), sponsored by the Mexican Ministry of Economy, and operated in partnership with the GCG.

1.4 UTEN: Building on Success

UTEN's considerable progress has been achieved in a relatively short time and with a modest budget. While positive results continue to manifest, external reviews confirm that UTEN's long term continuation might provide crucial differences toward a sustainable transformation in Portugal's economy.

Having trained a critical mass of skilled TTOs, UTEN now turns its efforts to assisting Portuguese *entrepreneurs'* efforts in commercialization activities and business development by means of a global innovation hub in Austin for *incubation* of university-based start-ups and *acceleration* of technology companies expanding



to international markets. Networks continue to play a key role in UTEN efforts, and the IC² Institute enables UTEN's relationships with:

- UT Health Science Center at San Antonio
- UT San Antonio (UTSA) Center for Innovation and Technology Entrepreneurship (CITE)
- UTSA Management of Technology program
- Texas Research Park
- InCell and TEKSA Incubators, San Antonio
- Inst. for Innovation & Entrepreneurship, UT Dallas
- UT Marine Science Institute, Port Aransas
- Texas A&M University
- University of Southern California

The IC² Institute also initiates cross-program events and activities to promote organic partnership development across the project lines of its international programs. UTEN's networking commitment continues

to encompass Portugal's international partnerships with the Fraunhofer Society (FhG), Carnegie Mellon University (CMU), the Massachusetts Institute of Technology (MIT), and Harvard Medical School (HMS). UTEN also continues to enrich sustainable, value-added partnerships and networks across The University of Texas at Austin. Similarly, UTEN's action lines and activities continue to strengthen the TTO network across UTEN partner institutions, which is integral to moving forward with new goals.

Continuous assessment for agile response

From its inception the UTEN program has methodically collected feedback from participants of all events and activities in order to provide agile response to changing and emerging training needs. This practice continues to provide flexibility as the program moves forward.

Successful hands-on training models continue to arise in the fields of technology transfer and commercialization, and many of these focus on the entrepreneur. Several of these models have already been incorporated into UTEN activities, such as the 3 Day Start-up event, and the ISTCE-MIT Venture Competition.

UTEN's international network brings seemingly infinite potential for new partners and innovative programs—and a wide array of potential events and activities are reviewed so that UTEN training programs continue to meet participants' needs.

A Portuguese innovation hub

Exercising these various strengths developed over the past five years provides stability for UTEN to shift its focus to a new goal: to develop an international business hub to help meet the needs of Portuguese businesses at every development stage.

1.5 BIZ.pt: A global innovation hub

The IC² Institute has spent 35 years creating and testing the practices and infrastructures surrounding technology commercialization and regional wealth creation. An entrepreneurial ecosystem that provides a professional and globally competitive infrastructure is critical to economic growth and sustainability over time. The Institute is developing three primary organizations that collectively comprise BIZ.pt:

- *A technology incubator*, to nurture emerging companies
- *A business accelerator*, to help companies approach international markets
- *A technology commercialization center*, to provide TTO services to smaller institutions.

These complementary organizations help build capacity for Portuguese technology companies at every stage of a company's life cycle, to promote technology development, investment, and job creation across a broad range of technologies. UTEN works closely with Business Angels, venture funding agents, and the recently created *Portugal Ventures* initiative that allows for the creation of “a new business landscape [in Portugal] with high export potential, globally competitive and well-positioned in the international value chains.”

UTEN's goals reinforce Portugal Ventures' strategic principle to invest in entrepreneurial projects with the potential to compete globally and to attract capital and international know-how. BIZ.pt provides a robust program to move Portuguese technologies into the U.S. and other global markets. Success metrics include:

- Formal and informal business networks
- Business contacts and negotiations
- Funds raised
- Number of companies involved
- Products and services commercialized in the U.S. or other international markets

- Job creation
- Partner agreements established.

Technology Business Incubation

In partnership with the IC² Institute's Austin Technology Incubator, BIZ.pt provides soft landing assistance, comprehensive incubation services, assistance with starting U.S. subsidiaries, and physical space for Portuguese start-ups to operate in the U.S. and other international markets. While Austin serves as the central doorway to the North American market, the Institute also networks other points of entry, such as incubators in Boston (MIT and Harvard), and Pittsburgh (Carnegie Mellon University). Complementary to this goal, UTEN promotes Portugal as an entry-point to the European market for American technology companies.

International Business Acceleration

BIZ.pt provides office space and dedicated business development professionals to assist acceleration into international markets for medium-size technology companies that display rapid growth. The business accelerator focuses on networking, training, and identifying funding resources in the United States, while it helps companies achieve tangible business milestones. Utilizing proven market assessment processes and launch plans helps to drive a hands-on business development effort that brings results.

- A private office is provided for each enterprise.
- Managers work with enterprises to identify potential partners or customers (in the U.S. or other global markets) and facilitate business engagement agreements.
- A graduate student intern is assigned to each company to assist with market research, business development investigations, and follow-up (under the supervision of a business development manager).
- Experienced faculty and business professionals provide training (one day a month or 3 days/quarter).
- Semi-annual program-wide networking events, such as technology expos, provide access to members of the local technology community, potential investors, and industry interests.
- University networking meetings are arranged on a continuing basis.

Global Start-up

Global Start-up began in 2011 as US Connect, a pilot program of the UTEN initiative. Its purpose is to assist

Portuguese entrepreneurial endeavors in different phases of development:

Early stage commercialization projects led by researchers or entrepreneurs that may lead to a new spinoff company. This market entry initiative targets early stage entrepreneurial projects with a promising technology in early development, which is often the case with entrepreneurially minded researchers. Portugal's international partnerships with American and European institutions is an active engine for producing such technologies. Examples within the UT Austin|Portugal program include GimmeDaBlues and LIFEisGAME—two CoLab digital media projects that have recently visited Austin to be coached by the UTEN team. BIZ.pt also works with Portugal's other international programs such as MIT, Carnegie Mellon University, Harvard Medical School, and Fraunhofer Gesellschaft.

For these types of endeavors led by Portuguese researchers, the IC² Institute prepares those entrepreneurs for global markets through proactive business development. The Institute works extensively with the most promising Portuguese entrepreneurs for eight to twelve months to have a successful market launch, not only in the U.S. but also in the other regions where IC² Institute is active. The Institute provides the following proactive international business development activities for selected technologies:

- Research into potential international business engagements for the technologies
- Planning a research-based strategic approach to develop new business
- Developing information on each technology's unique value proposition, specific benefits to prospective clients, and competitive advantages
- Working with the technology representatives to develop marketing materials
- Presenting technology information to those deemed appropriate as a result of initial calls
- Framing potential avenues for business engagements with appropriate parties
- Arranging meetings between technology representatives and interested parties
- Coaching technology representatives prior to meetings and throughout the business development activities of the program
- Providing feedback and guidance on business model development, marketing, pricing, and contract negotiations
- Facilitating business agreements between technology representatives and interested parties.

Early stage start-up ventures that are typically based on a technology that is within a development phase close to the market, such as the finalist projects of the major business plans competitions in Portugal. The IC² Institute partners with the local organizers of the most relevant business plan competitions in Portugal, including the ISCTE-MIT initiative, to provide business development services to finalist and winning projects that prove, through a thorough assessment, to be ready for internationalization.

Mature start-up ventures with sales records that desire to make the transition to global markets, primarily by closing business deals in the United States. This program builds on the experience of US Connect that produced excellent results for Portuguese start-ups such as Bioalvo, Feedzai, Technophage, Innovapotek, and Tecla Colorida, in terms of business development, incubation, and closure of deals. Particular focus is placed on Portuguese ventures that have demonstrated success in the domestic (Portuguese) market, but have yet to expand into global markets. It emphasizes Portuguese ventures with products, revenue, and the capacity to support travel and business development in the United States. Like all UTEN programs, US Connect leveraged live cases to provide training—in this case, training in market assessment, market messaging and outreach, and best practices in U.S. business development. The primary goal is to achieve business development results. Some of these ventures can later be admitted to physical incubation in Austin within BIZ.pt.

1.6 Governance Model

Funding and Sustainability

The main funding source of UTEN, since its inception, has been the Portuguese Foundation for Science and Technology, FCT, part of the Ministry of Education and Science, through its Secretary of State for Science. UTEN also works closely with the Council of Rectors of the Portuguese Universities towards full institutionalization of the UTEN organization over time. The long-term goal is for UTEN to become a self-sustained program, being supported by business partnerships and deals closed by Portuguese companies in international markets.

Integration with the National Plan of Innovation

UTEN's plan for the next five years is in line with the National Plan for Innovation in Portugal that was approved by the Portuguese Government in December 2011, with the aim to adopt a policy model for the promotion of innovation and entrepreneurship with four main objectives: (1) a more entrepreneurial society based on a creative and innovative culture, (2) larger

number of innovative companies with a strong drive to export, (3) involvement of Portugal in international knowledge, innovation and entrepreneurship networks, and (4) allocation of investment for the development of innovative firms with differentiation capacity. UTEN will address the following policies that are included in the Government's plan:

1. Incentivize qualified entrepreneurship focused on internationalization and with an emphasis on the involvement of young people;
2. Combat risk adversity by encouraging autonomy among university students and researchers;
3. Promote the investment in innovation activities toward the development of a favorable ecosystem for entrepreneurship in Portugal, including the promotion of foreign venture capital;
4. Develop actions involving different stakeholders that participate in the construction of a more entrepreneurial society, namely:
 - » Provide tools and capacities for recent PhD graduates to find employment in non-academic careers inside or outside the scientific system, namely within industry or developing their own business ventures;
 - » Foster innovation through the development of partnerships between the technology transfer offices that operate within the scientific system and companies, and the creation of networks for the economic valorization of scientific knowledge by bringing universities and companies together;
 - » Training support for branding protection through international patented and licensed technologies;
 - » Stimulate entrepreneurship to attract national talent as well as foreign entrepreneurs to base their ventures in Portugal.

Integration with the Academy of Finland's Assessment

In its recent *Independent Assessment of Portuguese Collaboration with U.S. Universities in Research and Education*, the Academy of Finland made positive remarks about the UTEN initiative with The University of Texas at Austin:

- “UTEN separates the UTAustin-PT from the other programmes,”
- “...the input-output ratio of UTA-PT...is better than that of the other two Programmes...”,
- “compared with other activities [within the international partnerships programme], UTEN rates highest when it comes to innovation ecosystem effects.”

The Academy of Finland recommended UTEN's enlargement across Portugal, and concluded “technology transfer and innovation activities have not been on the Portuguese agenda for very long... the changes required are considerable and the time used to implement the programmes has been short for the technology transfer area.” Nevertheless, “the UTEN initiative under UTA-Portugal has been successful in developing technologies for commercialization in international markets.”

The Academy of Finland also observed that “the governance and scaling-up efforts are seen as holding considerable potential for the future” and that “Long-term commitment and the process of building an environment where new ventures can thrive are a first step...” Collectively, these findings indicate that UTEN has been successful to date, but to ensure consistent results throughout Portugal, a long-term commitment is necessary. While most of the respondents to the study's survey “felt that access to global markets for companies has been impacted,” there is still a generalized inability to access venture capital and other sources of external funding. This will be a critical focus of BIZ.pt.

UTEN is attending to the recommendation to extend the scope beyond the United States and in particular to Portuguese-speaking countries, putting special emphasis on developing strong links with other European countries, Brazil, and Macau.

The report also states, “a more entrepreneurial and risk-taking mindset are ambitious long-term goals that can only be achieved after years of concerted efforts....” UTEN directly addresses the recommendations of “promoting economic growth through science-based innovation” and “enabling access to international markets for Portuguese companies” by the creation of the business incubator, the accelerator, and the business development hub in Austin, thereby augmenting the cases of successful Portuguese companies in international markets and the increase of venture capital available to those ventures.

Finally, Finland's assessment report concludes that “in terms of innovation and technology transfer, there has been a considerable boost and new professionalism that needs to be maintained and built on.” This underscores the importance of UTEN's success over the first five years, even while it calls for a new phase of UTEN activities to help place “entrepreneurship and technology commercialization in a more central role in the R&D&I policy by engaging industry in research to a significant degree,” thus bringing Portugal to the forefront in this area.



2. UTEN Conference 2013

“The Global Start-up program was a real surprise...in all other programs we learned a lot of theories and experiences from several types of people (from successful entrepreneurs to university teachers), but in Global Start-up program it was exactly the opposite: we went straight to the source...The team is great and the program awesome!”

Afonso Santos, CEO Tuizzi

2.1 2013 UTEN Conference

The 2013 UTEN Annual Conference, held in Porto, on October 28th, was designed to promote new relations with Latin America and to help increase awareness of the emerging patterns, related challenges, and opportunities associated with international technology transfer and commercialization of products from small and medium size enterprises, during a time of global financial constraint.

Day One

The 2013 UTEN Conference provided a forum to introduce the Portuguese technology transfer offices, incubators, FCT, and other chief stakeholders to the new global innovation hub in Austin for Portuguese technology-based companies. Known as BIZ.pt, the business hub aims to explore new conditions and emerging spaces for scientific, technological and industrial development, and international cooperation. A panel structure was adopted to facilitate knowledge transfer and interaction among the attendees.

During the opening session, leadership was represented by José Manuel Mendonça, UTEN Scientific Director, President of INESC Porto; José Marques dos Santos, Vice President of the Council of Rectors of the Portuguese Universities; and Mark Calhoun, Chairman of the Advisory Board, IC² Institute, The University of Texas at Austin, all introduced and welcomed guests.

Panel I

Moderated by João Claro from the University of Porto and director of the CMU|Portugal program, this session of the conference consisted of presentations focusing on technology commercialization in Latin America, and also provided the closest linkage to ALTEC's conference theme.

The first presentation was by Juan Pablo Ortega, Public Utility Company of Medellín (EPM), former CEO Ruta^N, a public/private partnership driving innovation structurally and relationally in Medellín, Colombia. He presently heads the innovation group within EPM, the public utility of Medellín. Mr. Ortega described the work of Ruta^N as a catalyst for innovation to develop the culture, the structure and renewal of the city, and catalyzing the renewal of regional tech innovation. He also referenced the value of his relationship with the IC² Institute over the past three years.

Carlos Ross, Director of the Center for Global Innovation and Entrepreneurship (CGIE), addressed the evolution of innovation culture within Mexico during his

presentation. CGIE is a non-profit, self-sustaining center founded by The University of Texas at Austin and located in Monterrey, Nuevo León, Mexico. It is a portal for the free flow of students, teachers, businesses, and knowledge between Texas and Mexico.

The activities of Mexico's Central government, primarily through CONACYT and the Ministry of Economy, were presented as well as their impact on innovation in the state of Nuevo Leon. The focus was on how Monterrey has transformed itself into a City of Knowledge, and how private and public institutions located together in PIIT, its science and technology park, create greater value by linking the activities of research labs, sponsored by CONACYT, to CGIE's joint Masters/Certificate degree program (<http://cgie.org.mx/ms/>), and to universities and private companies in order to develop and incubate new businesses.

A brisk roundtable discussion surrounding how the models provided by Colombia and Mexico could be applied more broadly was led by Elsie Echeverri-Carroll, Senior Research Scientist, IC² Institute, and by Maria Oliveira, University of Porto, UPIN.

Panel II

This panel was moderated by the vice-rector of the University of Porto, Carlos Gonçalves. Gregory Pogue from the IC² Institute made a presentation alongside Pedro Bizarro, co-founder of Feedzai, one of the leading companies involved in the initial US Connect pilot program, 2010-2011. Feedzai was subsequently admitted to the Austin Technology Incubator's Soft Landing Pad program, and the IC² Institute helped it identify its first two deals in the United States, and introduced it to key networks that led the company to secure venture funding in California, where it is now located. Dr. Pogue discussed the methodologies of organizing networks in Austin into what is termed the innovation reef, which serves to accelerate companies as they progress from isolation into a network ecosystem, and then propels and accelerates them toward funding.

An active round table discussion ensued with Anders Haugland, TTO manager from Bergen; and Tara Branstad, Carnegie Mellon University, addressing how best to promote the international commercialization of start-ups in global networks.

Panel III

The oil and gas industry provided a case study to illustrate both the opportunities and challenges associated with international commercialization. This industry sector has great interest for Latin America as a

UTEN CONFERENCE 2013:

*"Internationalization, Technology
Commercialization and Knowledge Exchange"*



José Manuel Mendonça, José Marques dos Santos, and Mark Calhoun in Day One's opening session.

very strong provider of oil and gas, for Portugal, which has a leading oil and gas company, and for the United States as the second largest provider of oil and gas in the world.

Presentations by Carlos Pina Teixeira, CEO of Eneida, and Manuel Parente, CEO of Abyssal, provided two examples of how Portuguese start-ups have identified needs within the oil and gas industry and have developed industry-specific product solutions. Carlos Costa Pina, a member of the Executive Committee on Galp Energia's Board of Directors, moderated the session. Discussions illustrated the value of innovation in the oil and gas industry to provide value to larger companies.

This was followed by discussions between experts in technology transfer and incubators, represented by Paulo Ferrao, Instituto Superior Tecnico, MIT|Poland; Paulo Santos, IPN Incubator, University of Coimbra; and Max Green, IC² Institute, The University of Texas at Austin, about how best to position new technologies in the oil and gas industry. A very lively discussion about this complex topic resulted.

Closing Remarks

The topics discussed during closing remarks focused on the value that trans-Portugal interactions fostered by UTEN have provided to the commercialization environment. Aurora Teixeira from the University of Porto presented an analysis that indicated technology

transfer offices in Portugal have demonstrated a net increase in income, a net increase in business deals, and a net increase in all important categories, during the period since UTEN changed its focus from supporting technology transfer activities, as it did in the first five years, to its current focus of concentrating on start-up company activities. This shows that UTEN, over the previous five years, helped to generate a self-sustainable, national ecosystem of technology transfer offices through a network model.

Marco Bravo, IC² Institute, The University of Texas at Austin, director of the program in Austin, concluded with a discussion of strategic goals for Biz.pt and how they relate to the build out of technology transfer offices and incubator networks throughout Portugal during the first five years of UTEN. The power of a functioning network, as revealed by Dr. Teixeira's research, to identify and commercialize companies will continue to create positive synergy between UTEN and Biz.pt moving forward.

José Mendonça, UTEN's Scientific Director, described his enthusiasm for the program and its potential. Pedro Carneiro of FCT, the sponsor of the program, finished with an enthusiastic discussion of the value UTEN has provided in the past and the excitement of moving UTEN from capacity building into economy building and sustaining activities.



Greg Pogue, Senior Research Scientist with the IC² Institute addresses the conference on Day Two.

Day Two: Global Start-up Initiative, Biz.pt Training

UTEN conducted a training session for nine start-up ventures at the UPTEC Incubator in Porto. The event was open only to select Portuguese start-ups engaged with the Global Start-up Initiative. The initiative focuses on supporting the participating companies through business development, incubation, and acceleration as they achieve significant commercialization goals.

The training focused on determining each company's unique value proposition, then moved to explore how this proposition fit into the industry value chain, and culminated with a customized definition of key milestones generated for each company to consider. Challenging exercises and feedback among peers were extremely useful as the Biz.pt team, consisting of Marco Bravo, Max Green and Gregory Pogue, pressed the companies to be specific, clear and quantitative about their value statements, value chain arguments and milestones. The milestone process was important to create alignment between the companies and the Biz.pt team that would be followed up through Skype, email and further conversations.

This intense time was balanced by social activities that offered important opportunities for relaxed casual interactions between the teams. The benefit was gaining a better understanding of the participants, their motivations, and company strategies.

The last activity was a site-visit to the home office of Abyssal, one of the Biz.pt companies. The Abyssal Operating System is a software product installed on Remotely Operated Vehicles allowing users to “see” operations in real time through the use of Augmented Reality Systems. While the Biz.pt training session took place, the Annual CoLab Conference continued which included a keynote from the digital media festival and Future Places initiative. Each academic area was provided an opportunity to speak about past and future programs in the major areas of interest:

- Digital media
- Advanced computing
- Mathematics
- Nanotechnology
- UTEN Biz.PT

A ceremony to launch the renewed UT Austin|Portugal Program was conducted to recognize the official start of the CoLab and UTEN programs. The ceremony took place at the Rectorate of the University of Porto and was attended by its Rector and the Vice President of the Foundation for Science & Technology (FCT), the program's sponsor. The ceremony closed with a feedback session that provided excellent comments that were full of enthusiasm for the future.



3. BLZ.pt (2013 - 2017)

“Zercatto had an outstanding experience while dealing with the IC² team, in the sense that they were clear about the goals, the opportunities and the challenges ahead of a U.S. market entrance, and this helped us realize that Zercatto was still not ready to take the most out of the program, but we were incredibly satisfied by the IC² team’s approach, and highly recommend it!”

Gaspar d’Orei, Co-founder & CEO Zercatto

3.1 BIZ.pt: A Global Innovation Hub

Bringing Portuguese Companies to the United States

The Portuguese global innovation hub for technology business incubation and acceleration in Austin, BIZ.pt, seeks to increase the success of technology ventures, nurture a strong entrepreneurial culture, and create a strong network of scientific and academic institutions in Portugal oriented towards fostering technology transfer and commercialization on an international scale.

The primary goal of BIZ.pt is to leverage the long-standing global commercialization experience of The University of Texas at Austin and other international partners in general, and specifically the intimate knowledge of Portuguese technology transfer and commercialization of the University's IC² Institute to create a Portuguese hub to incubate Portuguese university-based spin-offs and accelerate mature technology companies in international markets.

This is a program for practitioners, and its main objective is to promote the development of a globally competitive and sustainable technology commercialization infrastructure in Portugal, building on existing and new technology transfer institutions, incubators, networks of technology transfer managers and staff; and science and technology entrepreneurs in Portugal. A secondary objective is providing commercialization opportunities in the United States and other regions globally.

BIZ.pt fosters cross-border Portugal-U.S. businesses and covers a broad range of technologies including health, ICT, energy, and nanotechnology. The outcomes of this initiative are commercialization activities for Portugal as well as technology development, investment, and job creation. The hub's main objective is to nurture Portuguese early start-ups and mature technology companies to expand beyond the Portugal marketplace, with a special focus on the U.S. market, but also on European, Asian, and South American markets.

2013 cohort

The IC² Institute team contacted the main technology commercialization and incubation entities in Portugal, 13 in total across 8 different locations. Most of these entities are associated with universities:

- Guimarães/Braga: TecMinho and Avepark
- Porto: UPIN and UPTEC
- Aveiro: UATEC and IEUA
- Coimbra: GATS and IPN
- Cantanhede: Biocant

- Lisbon: ISCTE-IUL, Inovisa, and Start-up Lisboa
- Almada: Madan Park
- Faro: Cria.

Each entity was asked to identify, within its portfolio, the top spin-off companies that are interested in developing operations in international markets, particularly in the United States. Evaluation of the top finalist companies was conducted by the IC² Institute team in close collaboration with the host institutions. This selection process included background information, in-person interviews, and follow-up distance conversations. The IC² Institute team (<http://ic2.utexas.edu/>) will engage the Global Commercialization Group (<http://www.ic2.utexas.edu/global/>), the Austin Technology Incubator (<http://ati.utexas.edu/>), and other entities to assist the finalist companies with international business development, incubation, and acceleration.

From a pool of more than 30 companies, the IC² Institute team has invited six companies to join the program:

- Abyssal
- Omniflow
- Tuizzi
- Auditmark
- Celfinet
- Zercatto.

UTEN is also working with four other management teams to help them approach international market readiness: Ecofoot, Critical Materials, Active Aerogels, and BestSupplier. Profiles of these companies follow.

3.2 2013 BIZ.pt Companies



Abyssal

<http://www.abyssal.eu/>

Abyssal develops integrated Subsea Navigation Solutions for Remotely Operated Vehicles (ROVs). The company's software, Abyssal OS, was developed after years of working with ROV pilots, subsea contractors, and oil & gas companies. Abyssal OS features advanced 3D technology, augmented reality, and precise navigation. These features allow it to operate safely in the world's harshest environments. The company is headquartered in Matosinhos, Portugal, and is led by Manuel Parente and Rafael Simão.



Omniflow

<http://omniflow.pt/>

The technology of Omniflow's device makes use of an inverted wing shaped airfoil to direct the wind from any direction (omnidirectional) and promote a venturi effect that accelerates the wind in the direction of the central vertical axis turbine. The surface of the wing is covered by PV cells that maximize energy production. The ability to combine two power sources in such a small surface area makes Omniflow's product a novel contender in the renewable energy market. The company is headquartered in Porto, Portugal and is led by Pedro Ruão Cunha and his team composed of Pedro Vieira Castro, Mário Jorge Rodrigues, Filipe Marçal, Filipe Afonso, and Vera Ramos.



Tuizi

<https://www.tuizzi.com/>

Co-founded by Afonso Santos (CEO), Álvaro Ferreira (CFO), and Helder Fernandes (CTO), Tuizzi is a platform that offers the easiest way to manage outdoor advertising. The company's mission is to simplify the process of finding, planning, buying, and selling alternative, traditional, and digital out-of-home media. Through Tuizzi's online marketplace, media providers create enhanced media profiles for their properties. In turn, advertisers use the extensive and comprehensive database of media properties to find new ideas, plan, and build the perfect out-of-home campaign.



Auditmark

<http://www.auditmark.com/>

Auditmark has developed web application security and web traffic auditing products to help protect web applications and their users from web attacks. Both of these products focus on putting the first line of defense right on the client-side in order to efficiently mitigate web threats before they turn into real problems for website owners. Auditmark's products already have many users and are gaining more traction every day. The Global Start-up Team is currently working with Auditmark on a marketing strategy for the United States. The company is located in Porto, Portugal, and is led by Rui Ribeiro and Pedro Fortuna.



Celfinet

<http://www.celfinet.com/>

Celfinet, created in 2003, focuses on technical consultancy services and solutions for tele-communications companies. Its primary product, Vismon Intelligence, is a Multivendor Network Performance Manager based on BSS counters that is tailored to GSM/DCS, UMTS and LTE technologies. It statistically monitors information collected directly from the main network elements, and enables close inspection of the major QoS offenders, identifying network trouble spots and setting up and implementing correction measures. Celfinet is headquartered in Lisbon, Portugal and the business development efforts are being led by Luis Varela and Alexandre Victorino.



Zercatto

<http://trading.zercatto.com/>

Zercatto has developed a product that allows investors to follow the top traders in financial markets. Their product audits and publishes every trade made by top traders to verify their high performance and increase transparency in the market. The product is ready for use and the company is currently working to acquire active users. The company is led by Gaspar d'Orey, Gonçalo Moreira, and Pedro Torres. Zercatto is headquartered in Porto, Portugal.



Ecofoot

<http://www.ecofoot.pt/pt/>

Ecofoot has developed a silica particle that can bind with various dye types to produce a cleaner and more cost-effective dyeing solution. The textiles industry is one of the three most polluting and among the largest consumers of water in the world. Everyday millions of tons of water are contaminated with dyes, salts, heavy metals, and toxic substances. Ecofoot's primary product, H2COLOR Indigo, was developed to address the costs and ecological problems associated with Indigo dyeing. Ecofoot is currently engaged in an industry trial with the textile company Mundotextil. The Global Start-up Team

is working with Ecofoot to devise a commercialization plan and marketing materials for each of its products. The company is led by Jaime Rocha and is located in Guimarães, Portugal.



Critical Materials

<http://www.critical-materials.com/>

Critical Materials has developed solutions and products for critical applications of material systems and structures. The company's primary product, PRODDIA, is an innovative structural health monitoring and management system that is compatible with a wide array of sensors and structure types. Its product features real-time data acquisition and analysis tools that rival global leaders in structural health monitoring. In addition to its software, Critical Materials also offers hardware solutions. Critical Materials is currently working with the Global Start-up Team on market applications and strategies for its products. The company is headquartered in Guimarães, Portugal and is led by Gustavo R. Dias, Júlio C. Viana, Pedro Murtinho, and Rui Cordeiro. The company has been operating since 2009.



Active Aerogels

<http://www.activespacetech.com/aerogel/>

Active Space Technologies, a company that specializes in materials engineering and R&D solutions, has been developing aerogels since 2005. Aerogels are gels whose liquid phase is extracted under super critical conditions. The material features impressive performance attributes, including high porosity, low density, high thermal performance, and great acoustic insulation capabilities. Bruno Carvalho, CEO, and his team have created silica composite and silica monolith materials that have the ability to compete in the global market because of their wide range of operating temperatures, competitive prices, and remarkably low densities. Presently the team is working to develop marketing materials and determine a strategy for U.S. market application. The Active Aerogels team is from Coimbra, Portugal.



BestSupplier

<http://www.bestsupplier.eu/>

BestSupplier has developed a supplier evaluation and qualification online platform that minimizes supply chain risks, increases the knowledge of available suppliers, and promotes continuous improvement of inventory. BestSupplier has grown tremendously over the past few years. In the company's first year of operation, it had 6,600 suppliers and 50 certified companies. Now, in its fourth year, the company has 88,594 suppliers and 1,688 certified companies. The company is headquartered in Porto, Portugal and is led by João Petrucci, Paulo Bengala, Antonio Lima, and Carlos Fonseca.

3.3 Tuizzi Visits Austin, November 2013

In order to validate the market opportunity of Tuizzi's technology, the Global Start-up Team arranged meetings with industry experts and various representatives of Tuizzi's clientele and partner types. Afonso's visit began with a strategy session with the Global Start-up Team. During this time the team learned the more nuanced details of Tuizzi's product and business plan before making refinements to the pitch Afonso would present in the meetings that followed.

The team then ventured to GSD&M to meet with Kirya Francis and Amanda Rassasack. This meeting served to survey the perspective of large media agencies and to identify the ways that Tuizzi's platform might aid their operations. The same day, Kirya introduced Afonso to DELTAOOHMEDIA.com, one of the biggest media agencies in Miami, Florida.

Following this, Afonso met with Austin Technology Incubator Directors Isaac Barchas and Kyle Cox as well as Emily Roccheggiani, ATI associate and media expert. During this meeting, Afonso was able to refine his next steps for expanding his business into the American market. Afonso then met with Dr. Peterson, the IC² Institute's Director, to discuss the feedback he had received during his stay in America.

A second strategy session was held at ATI to gain feedback from media owners, with Jay Champion, Venture Partner at Access Venture Partners; Jason Cragg, Director of Outdoor Advertising at Gunnarson Advertising; and Tim Hayden, Mobile/Lifestyle Marketing Executive at TTH-Strategy, Board of Advisors at 44Doors, Board of Advisors at Together Mobile, and (Immediate Past Chair) Board of Directors of Meals on Wheels.

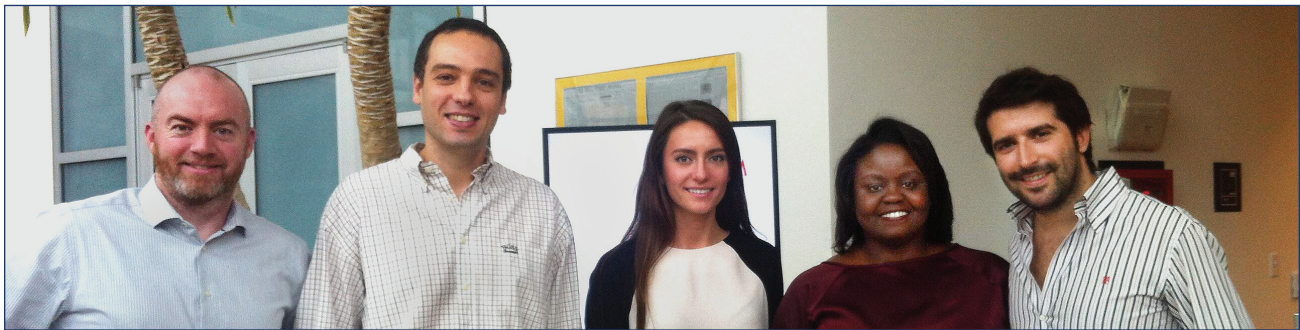
In order to gain a better understanding of the American advertising market as a whole, Afonso met with advertising experts Dr. Isabella Cunningham and Lisa Dobais at the School of Communications at The University of Texas at Austin.

This meeting was followed by a marketing strategy session with Dr. Arthur Markman. Afonso's visit ended with a meeting with Noah Davis and Chris Davis, creative partners at The Swizzle Collective Advertising Agency. This meeting was intended to validate advertising agencies' market need for Tuizzi's platform in the United States. This goal was achieved, and in addition, Chris and Noah agreed to help Tuizzi with creative and branding for free. All in all, feedback was positive, market need was confirmed, and the information received was incredibly valuable moving forward.

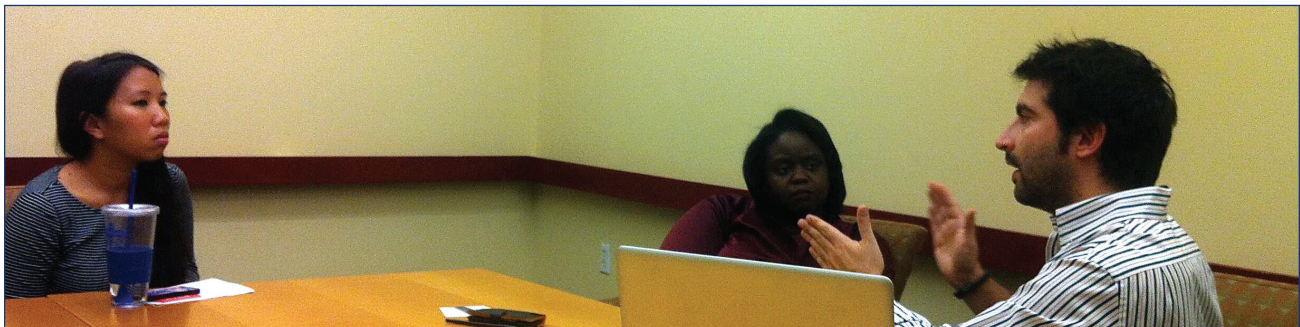
3.4 BIZ.pt Action Lines

Companies that are selected and accept participating in the BIZ.pt program receive assistance with:

- *Preparation and strategy:* the IC² Institute team works closely with start-ups to adapt their business model and sales pitch to the U.S. market. A strategic plan is defined with each company to detail its route (business development and/or incubation, and/or acceleration).
- *Business Development:* business development managers work with the selected companies to identify potential partners or customers (in the U.S. or other global markets) and facilitate business engagement agreements. This activity requires sporadic travel to the United States.



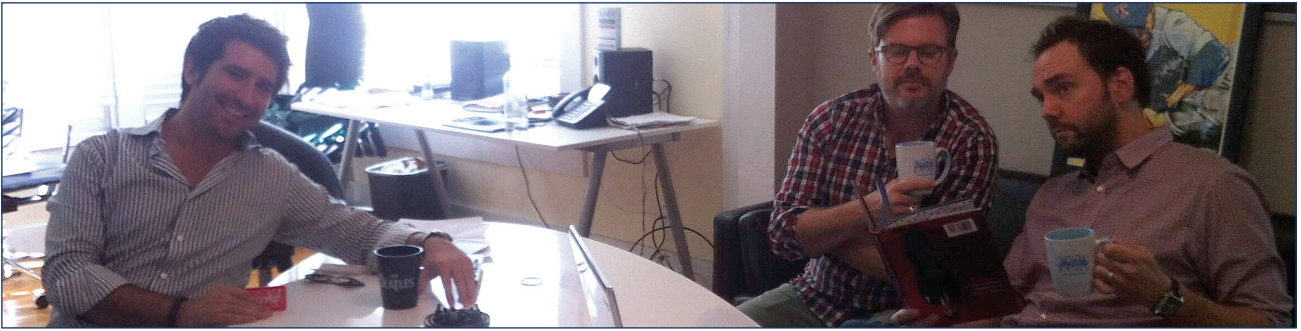
BIZ.pt strategy team members Max Green, Marco Bravo, and Francesca Lorenzin with QSD&M's Kirya Francis and Afonso Santos.



Amanda Rassasack and Kirya Francis with GSD&M Media Agency meet with Tuizzi's Afonso Santos.



Strategy session at ATI [From Left] Toni Miranda; Afonso Santos; Jay Champion, Access Venture Partners; Jason Cragg, Gunnarson Advertising; Tim Hayden, TTH-Strategy, 44Doors, Together Mobile, and Meals on Wheels.



Afonso Santos meets with Noah and Chris Davis, creative partners at The Swizzle Collective Advertising Agency.



Afonso Santos and Marco Bravo (right) meet with Lisa Dobias, Senior Lecturer at The University of Texas at Austin and previous media buyer with Dr. Isabella Cunningham, Chair of Advertising and Public Relations at The University of Texas at Austin.

- *Incubation and acceleration:* for the companies that qualify and demonstrate interest, BIZ.pt provides soft landing assistance, comprehensive incubation services, assistance with starting U.S. subsidiaries, and physical space for the Portuguese companies to operate in the U.S. When appropriate, the IC² Institute team also assists the Portuguese companies in applying to the Austin Technology Incubator (ATI). ATI has highly competitive entrance requirements and offers both a landing pad and full membership option. Other locations for business incubation and acceleration will also be considered on a case-by-case basis.

plan designs that drive a hands-on business development effort that will bring business results. This program targets medium-size technology companies that are experiencing rapid growth and are trying to increase revenues by expanding their business to the U.S. or other international markets.

In addition, the IC² Institute will promote Portugal as an entry point to the European market for U.S. and other international start-ups that express interest.

The major goals of BIZ.pt are to enhance commercialization activities for Portugal as well as technology development, investment, and job creation.

The IC² Institute team provides technology enterprise acceleration in international markets for selected mature technology enterprises looking to expand their business to the United States market or other global markets while in residence in offices in Austin, Texas. The BIZ.pt accelerator provides office space and dedicated business development professionals to assist these enterprises in accelerating their businesses in international markets.

Unlike other programs available today, the business accelerator does not only focus on networking, training, and identifying funding resources in the U.S., but also delivers tangible business results that are specific to each technology company it serves. It utilizes proven processes of market assessment and effective launch



4. Research: Survey of Technology Transfer Offices

“The UTEN network played a significant role in creating sharing and discussion spaces between the technology transfer officers of various universities. Not only did it contribute to the creation of a national technology transfer network, but also provided training to the officers, which led everyone to use the same vocabulary, to share good practices, and to get to know international mechanisms for some areas.”

(TTO Survey Interview, June 2013)

4.1 Surveys of TTOs: Methodology

In 2010, the first annual UTEN network survey of Technology Transfer Offices (TTOs) was conducted to develop a more comprehensive view of technology transfer in Portugal. Many of the questions were identical or similar to those on prior ProTon Europe, ASTP and other surveys (adjusted according to the suggestions of Portuguese TTOs). The second survey, implemented in 2011, repeated the same questions in order to update the information collected in the previous year and to enlarge the sample of respondent TTOs. Unlike the prior two years, in 2012 UTEN Portugal implemented the TTO survey with Maastricht University's MERIT, 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.

The present fourth wave of the UTEN Survey was launched in July 2013 but only finalized in October 2013 due to difficulties in obtaining the responses from the 18 TTOs contacted. In parallel, TTO directors were also interviewed face-to-face (between May and June 2013) in order to collect their personal testimony on the strength, weaknesses, opportunities, and threats faced by TTOs and data on the (formal and informal) links each TTO established with the other TTOs from the UTEN network, as well as other entities from the Science and Technology System.

Aurora Teixeira—Associate Professor with Habilitation (Agregação) at FEP (Universidade Porto) and researcher at CEF.UP, INESC-Porto, and OBEGEF—has led the research effort to administer and analyze these annual surveys. Research associates directly involved in this project have included:

- *James Jarrett*, Sr. Research Scientist, IC² Institute, The University of Texas at Austin, 2010, 2011, 2012
- *Ana Paula Amorim*, UTEN Portugal, 2010
- *Maria José Francisco*, UTEN Portugal, 2010
- *Maria Oliveira*, UTEN Portugal, 2011
- *Marlene Grande*, UTEN Portugal, 2011, 2012
- *Fátima Ramalho*, UTEN Portugal, 2012

All graphics in this chapter represent the computations of Aurora Teixeira and Marlene Grande using the primary research data gathered through the UTEN surveys and face-to-face interviews with TTO officers from 2007 to 2013.

4.2 Summary of research 2007 - 2012

Highlights of the four waves of the UTEN network survey of technology transfer offices include:

- The respondent TTOs are relatively young (8 years old on average) and small, although their size increased from 2007 to 2012.
- TTO teams present a high level of formal education and training but relatively low industry experience.
- Among TTO staff, common high level qualifications include engineering or natural sciences and management or business administration, whereas law and biomedical are relatively rare.
- A considerable amount of human resources (in FTE) is allocated to grant applications and fundraising activities, preventing the TTOs from concentrating their resources and attention mainly on core activities, namely intellectual property management and support services for entrepreneurship and spin-offs.
- From 2007 to 2012, the TTOs' average budget registered an average decline of 3.3% per year.
- The largest share of the budget (55%) is spent on human resources with expenditures related to patenting, which experienced a noticeable decrease over the last two years.
- There was an enormous concentration of revenue sources (70% of the total, approximately) on grants and the institution/university. Given the austerity measures that public institutions face (and will continue to face), this concentration puts a serious limitation on the future sustainability of TTOs.
- The average number (per TTO) of new patent applications (priority filings) increased from 2007 to 2009 but then, with the exception of provisional filings for patents, all other applications suffered a striking decrease.
- The number of patents granted to the institution through the corresponding TTO declined between 2007 and 2012.
- The relative weight of EPO and USPTO patents in active patents is very small, similarly to granted patents, and the number of active patents from the Portuguese patent office (including provisionals) decreased significantly from 2011 to 2012.
- The number of licenses, option agreements, and assignments executed by TTOs increased significantly, from 34 in 2007 to 101 in 2012, the

vast majority being executed with Portuguese partners.

- The share of licenses, option agreements, and assignments executed by TTOs with EU partners experienced a significant increase in 2012.
- License income received by institutions, through their TTOs, increased 30% between 2011 and 2012, surpassing 1 million euros in 2012.
- R&D agreements between TTOs institutions and companies, newly created spin-offs, and active spin-offs registered a marked increase between 2007 and 2011.
- In absolute number, by the end of 2011, the 18 TTOs from the UTEN network were responsible for executing 371 R&D agreements between their institution and companies, and creating 140 new spin-offs and 500 active spin-offs.

SWOT analysis based on the perceptions of technology transfer officers revealed the following:

- *Strengths*: human resources and strong networking activity.
- *Weaknesses*: uncertainty/instability of human resources, financial constraints, and knowledge valorization/commercialization neglect.
- *Opportunities*: changes in institutional frameworks and the prospect of establishing strong (national and international) networks.
- *Threats*: the economic and financial crisis.

Social network analysis of the linkages established between TTOs, and between TTOs and other S&T stakeholders found the following:

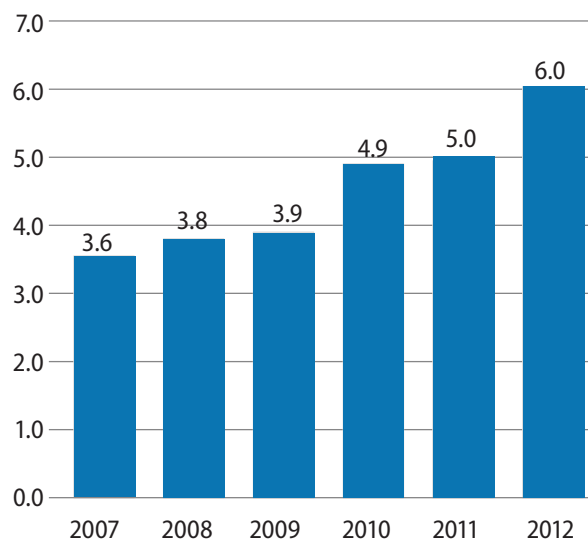
- Portuguese TTOs are embedded in a well-built national TTO network, which is mainly based on strong *informal* connections between them.
- The density of *informal* networks among TTOs is relatively high (55.3% of all possible connections), revealing strong (informal) connections between TTOs. The *formal* networks present lower density (32.2% of all possible connections), with GAPI and OTIC being the most central (with most connections).
- The density of networks established between TTOs and other technology transfer stakeholders, both *formal* and *informal*, is rather low (reaching, respectively 8.7% and 4.5% of all possible connections). It is interesting to note that foreign universities are squarely at the center of the formal network, being strong partners of Portuguese TTOs.

4.3 TTOs survey findings 2007-2012

Characteristics and organization of the TTOs

The respondent technology transfer offices are, in general, young (8 years old on average) and small, with an average number of 6 employees in full-time equivalents. Notwithstanding, between 2007 and 2012, the TTOs' average size increased (cf. Figure 4.1).

Figure 4.1: TTOs average number of employees (in full-time equivalents)



In the vast majority of cases (17 out of the 18), the technology transfer office (TTO) is an integral part of the institution/university and is responsible for some or all of the patenting, licensing, or other technology transfer activities of the University.

TTO technical/professional staff is relatively highly educated, with 74.8% of the total having an undergraduate degree, 36.3% studying for a masters or doctoral degree, and 21.4% and 6.4% having, respectively a masters or a doctoral degree. It is interesting to note that, in 2009, 85.5% of TTOs' technical/professional staff had attended a UTEN conference, workshop, or internship, and 98.3% had attended other training on technology transfer (other than UTEN). Despite their high levels of formal education and training, TTOs technical/professional staff members are relatively inexperienced in professional terms, with more than half not possessing any job experience in industry and 38.5% with (positive but) fewer than three years of job experience in private industry.

Most respondent TTOs have at least one of its staff with university qualifications in *engineering or natural sciences* (16 out of 18) or *management or business administration* (14

out of 18). In contrast, only 6 TTOs have staff with *law or biomedical qualifications* (cf. Figure 4.2).

All of the 18 responding TTOs indicated that they perform activities in the upstream process, such as *assessing the patentability of inventions; managing material transfer or confidentiality agreements; raising awareness/ disseminating information on intellectual property rights and entrepreneurship*; and also *providing services regarding the creation or support of start-up companies based on their institution's inventions*; a clear downstream activity of the technology transfer process (see Figure 4.3).

Furthermore, 17 out of the 18 TTOs confirm their participation in *negotiating and arranging licenses*. Activities such as *contributing to patent applications* (83% of total), *scouting for new intellectual property and new technology* (89%) and *providing training to faculty, researchers, or students* (89%) are also performed by the majority of the respondent TTOs.

Summing up, albeit no specialization pattern can be highlighted, the most frequent type of activities

Figure 4.2: Number of TTOs whose office staff has the listed university qualifications, 2012

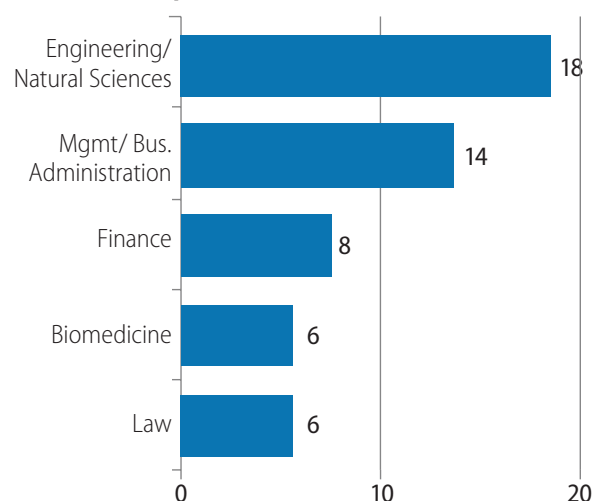
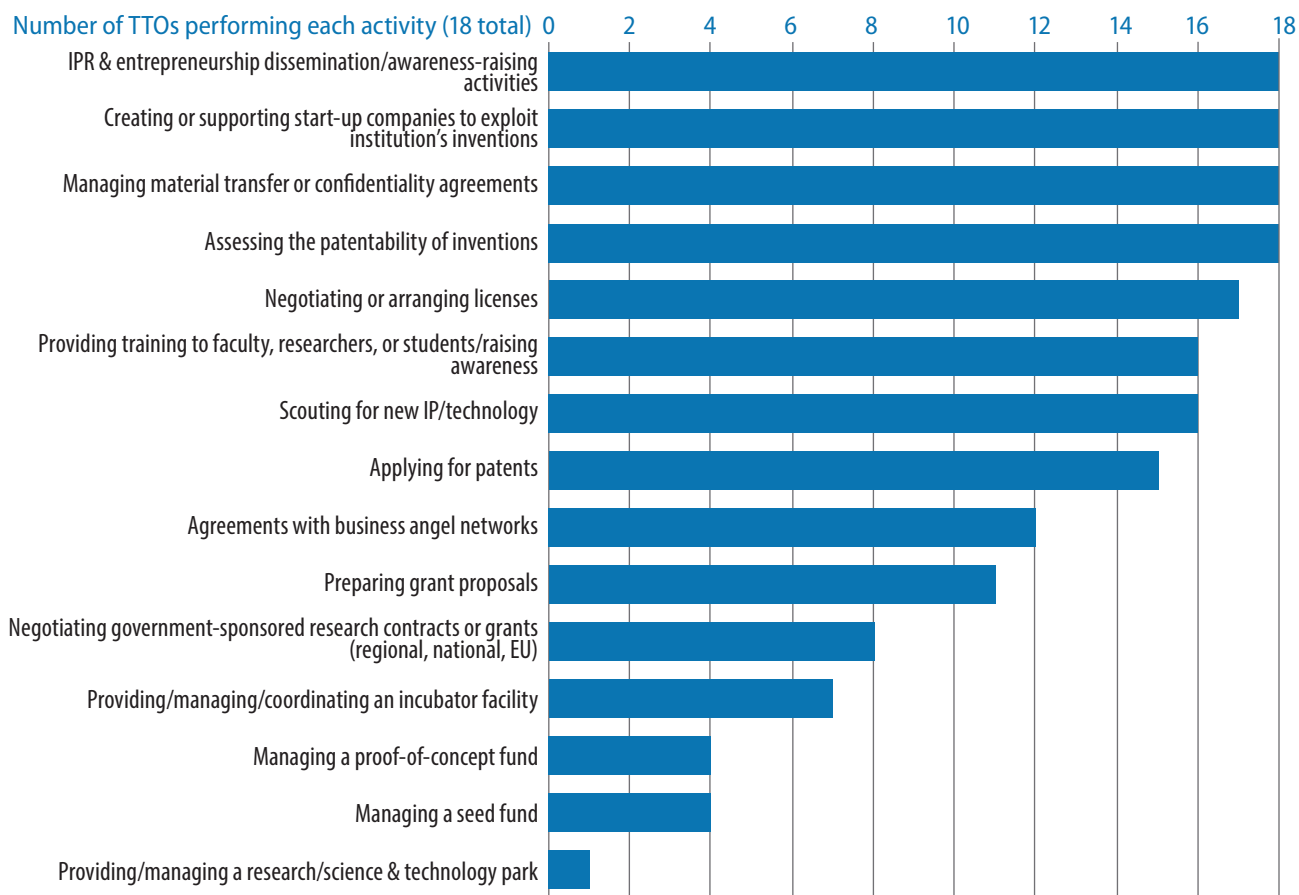


Figure 4.3: TTO Activities, 2012



performed by Portuguese TTOs is related to upstream phases of the TT process, most notably invention disclosures and priority filings.

In the last five year period (2008-2012), a considerable amount of human resources (in FTE) was allocated to grant applications and fundraising activities (cf. Figure 4.4). This obviously prevents TTOs from concentrating their resources and attention mainly on core activities, namely intellectual property management and support services for entrepreneurship and spin-offs. In the words of one of the technology transfer officers:

Almost all human resources of [...] are financed by the returns generated from the participation in international projects. We therefore run the risk of losing the focus on our main activity. (*Interview held in June 2013*)

Budget information

From 2007 to 2012, the TTOs' average budget decreased by 3.3% per year, reaching the highest average value in 2008 (almost half a million euros) and the lowest in 2009 (176 thousand euros). The largest share of the budget was spent on human resources (around 55% of the total expenditures). See Figure 4.5. Expenditures related to patenting experienced a noticeable decrease in the last two years of analysis.

Taking a revenue perspective of the TTOs' budgets, it is clear that TTOs are significantly dependent on grants, representing, between 2007 and 2011, almost 40% of TTOs' total revenues. In that same period, TTO institutions/universities contributed around one quarter of total revenues. The importance of external and internal technical services and fees, and particularly license and option agreements as sources of revenues, are relatively negligible, with the latter representing only 2.1% of the revenues for the period 2007-2012.

In 2012, there was a significant change in the composition of revenues, with TTOs' institutions representing the major source with 40% of total TTO revenues and grants, registering a marked decrease of almost 18 percentage points (see Figure 4.6). Given the financial harshness that Portuguese universities are facing and will continue to face in the near future, the lack of financial autonomy of TTOs is likely to constitute a serious constraint to TTO activities.

Intellectual property and commercialization

TTOs handle the bulk (over 80%) of all patent applications of their institutions. The intellectual property rights created at TTOs' institutions are in the vast majority of cases exclusively owned (11 out of 18) by the university. In 6 cases the intellectual property

Figure 4.4: Percentage of technical/professional employees (in full-time equivalents) allocated to the activities performed by TTO, 2008-2012

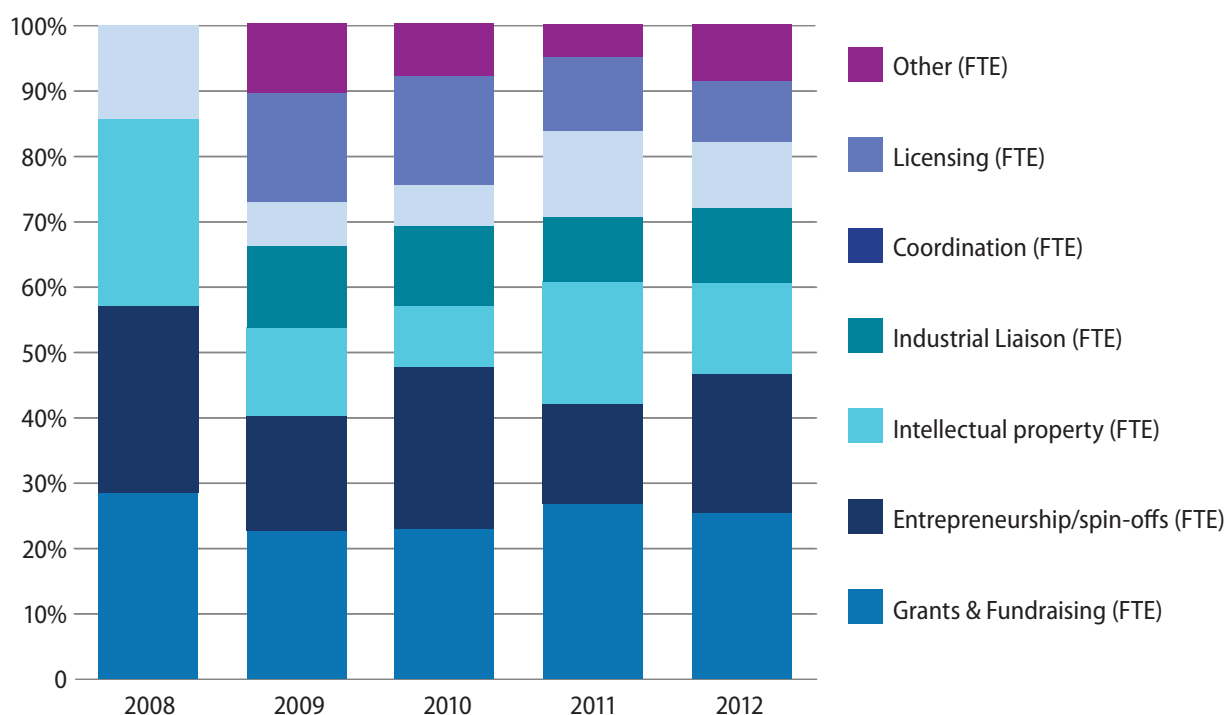


Figure 4.5: TTOs' average total expenditures (€) and distribution (%) by type of expenditure, 2007-2012

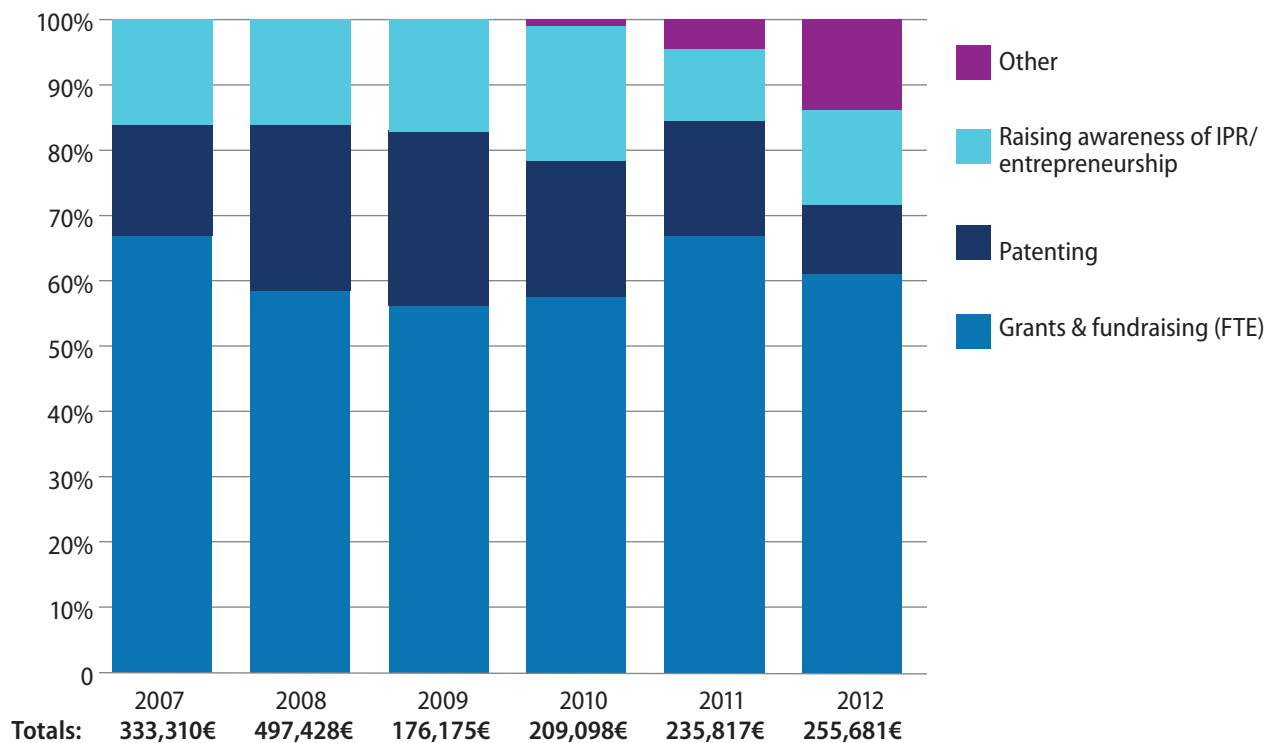
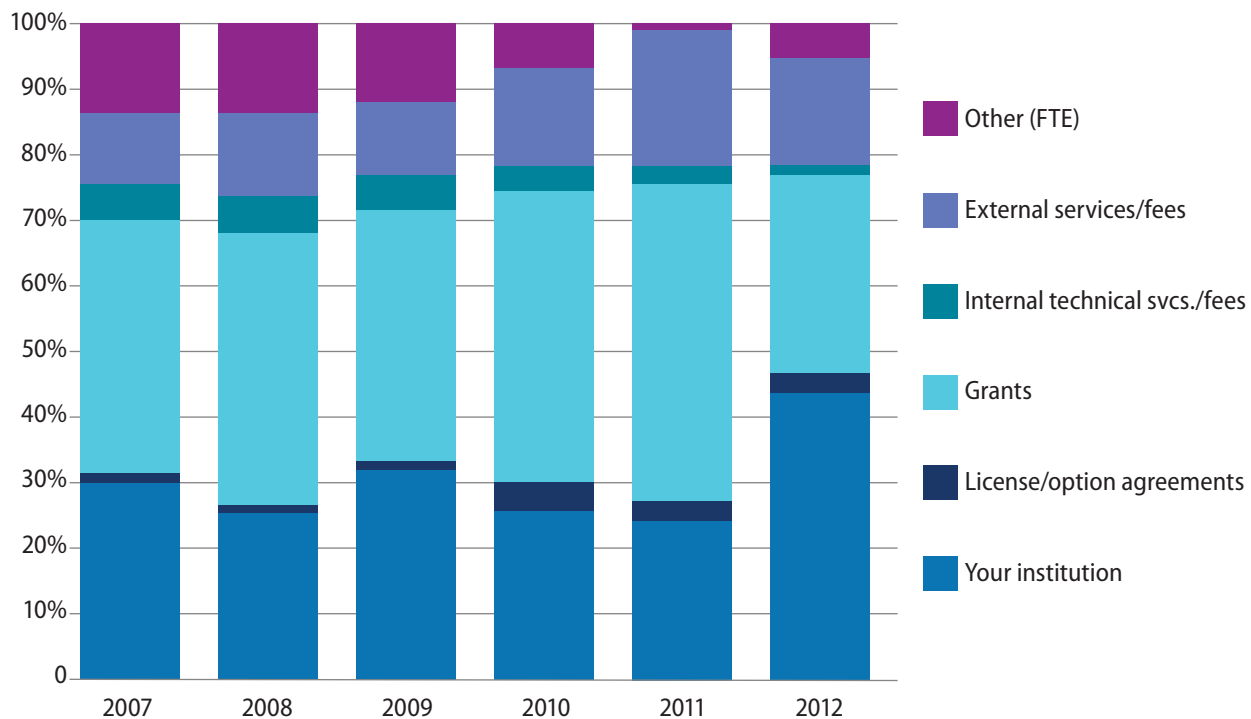


Figure 4.6: Distribution (%) of TTOs' average total revenues by source, 2007-2012



rights created at TTOs' institutions belong to both the university and the inventor.

The policy of distribution of royalties among stakeholders (e.g., the institution, the government, the inventors, others [schools, research consortiums]) is quite diversified among the TTOs. In 10 out of the 18 cases, the royalties from intellectual property at the institution is equally divided by the university and the inventor. In 7 cases, the largest part of the royalties go to the inventor (in 4 of these 7 cases, the inventor receives more than 80%). Only in one case does the institution receive the totality of the royalties.

Although from 2007 to 2011 there was an increase in the number of invention disclosures reported to the TTOs by the corresponding institutions—approximately 10 per TTOs in 2007 up to 17 in 2011—in the last year (2012) there was a substantial decrease in this average, reaching a similar figure to that of the beginning of the period (cf. Figure 4.7).

The average (per TTO) number of new patent applications (priority filings) increased from 2007 to 2009 (cf. Figure 4.8). After 2009, however, with the exception of the provisional filings for patents (which is a kind of “lower-cost first patent filing”), all other applications suffered a striking decrease (namely the Portuguese and PCT). Foreign patent applications, most notably at the European (EPO) and the United States (USPTO) patent offices remained insignificant.

Most of the respondent TTOs claimed that, in 2012, they had patent applications in *computers, communication equipment, and software* (73.3%) and *biomedicine* (66.7%), but the latter was the most frequent subject area for only one third of the TTOs (see Figure 4.9). This indicates that TTO patent applications are quite disperse among subject areas.

The number of patents granted to the institution through the corresponding TTO declined over the period of analysis (cf. Figure 4.10). In each year, over 80% of the patents were granted by the Portuguese Patent Office. In 2012, 6 patents were granted by the USPTO, 2 by the EPO and 1 by the Canadian patent office.

By the end of 2012, Portuguese TTOs possessed 1141 active patents. The relative percentage of EPO and USPTO active patents is very small, similarly to granted patents, respectively 6.6% and 5.3%. As it is clear in Figure 4.11, the number of active patents in the Portuguese patent office (which includes provisionals) decreased significantly.

The number of licenses, option agreements, and assignments executed by TTOs increased significantly over the period of analysis, from 34 in 2007 to 101 in 2012 (see Figure 4.12). Although the vast majority is executed with Portuguese partners, the number of executions with EU partners experienced a significant growth in the last year of analysis, representing in 2012 almost

Figure 4.7: Average number of invention disclosures, 2007-2012

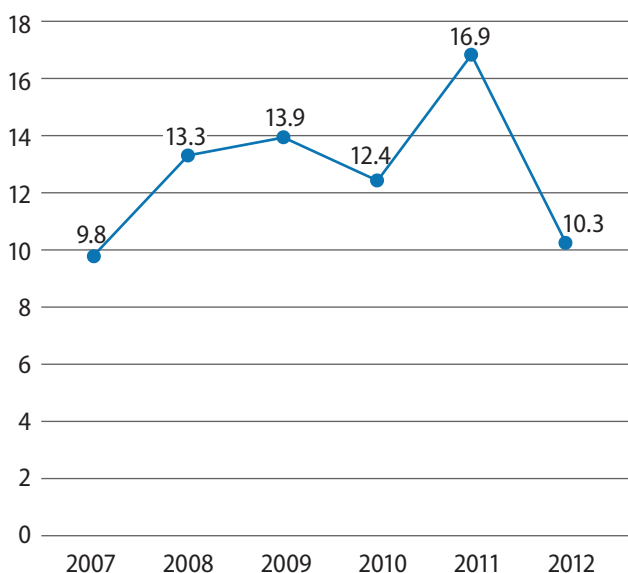


Figure 4.8: Average number of new patent applications, 2007-2012

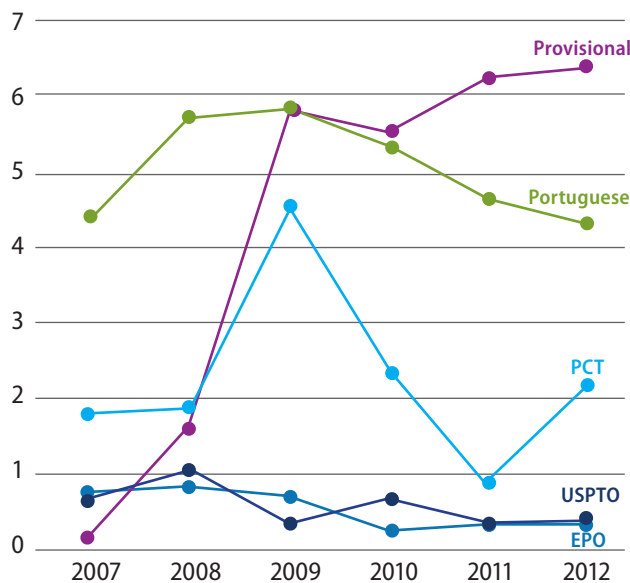
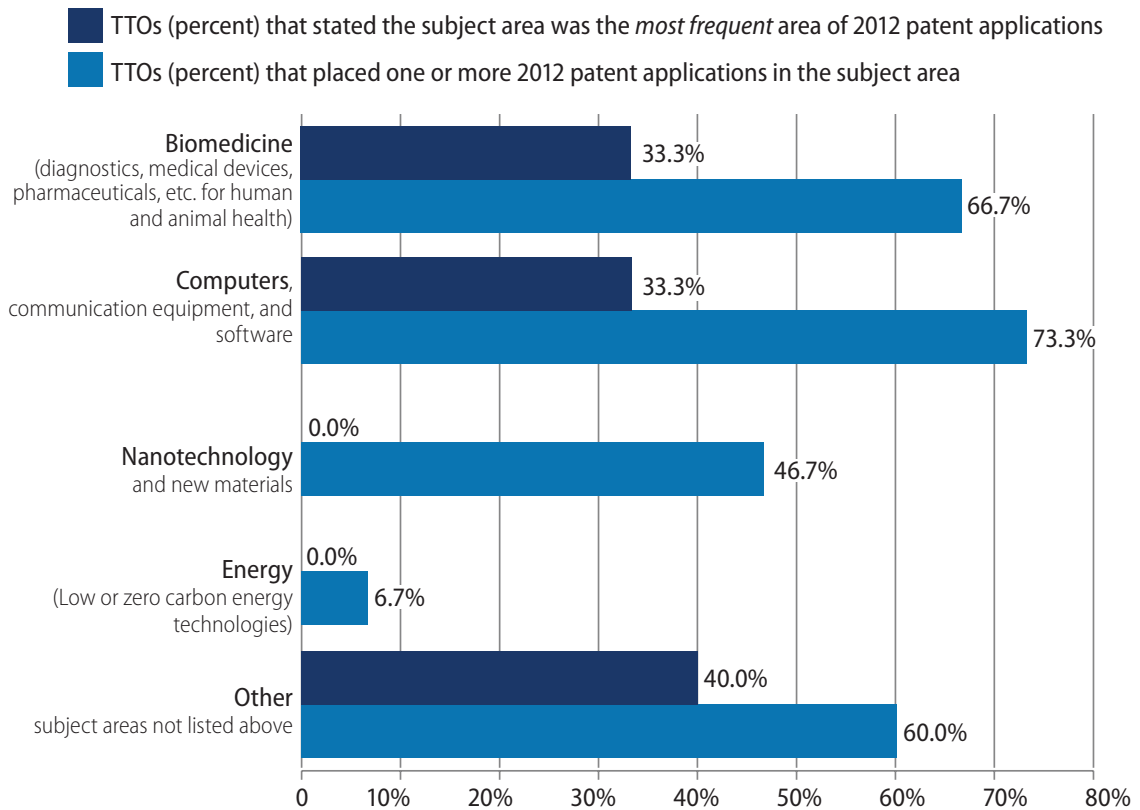


Figure 4.9: 2012 Patent applications by subject area (% TTOs)



Note: The total for reference is 15 TTOs as 3 did not have new patent applications in 2012. Also, the total of *most frequent* patent applications exceeds 100% because one TTO listed two topics as *most frequent*.

Figure 4.10: Patents granted to the institutions through the TTOs, 2007-2012

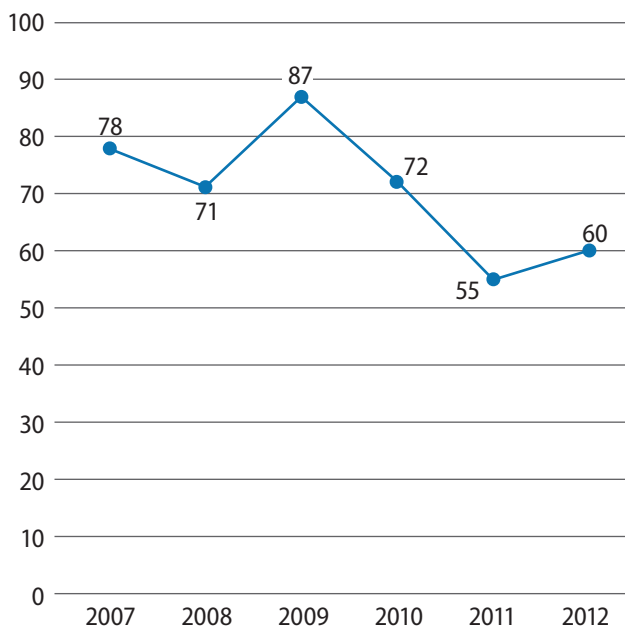


Figure 4.11: Active patents by the end of the year, 2007-2012

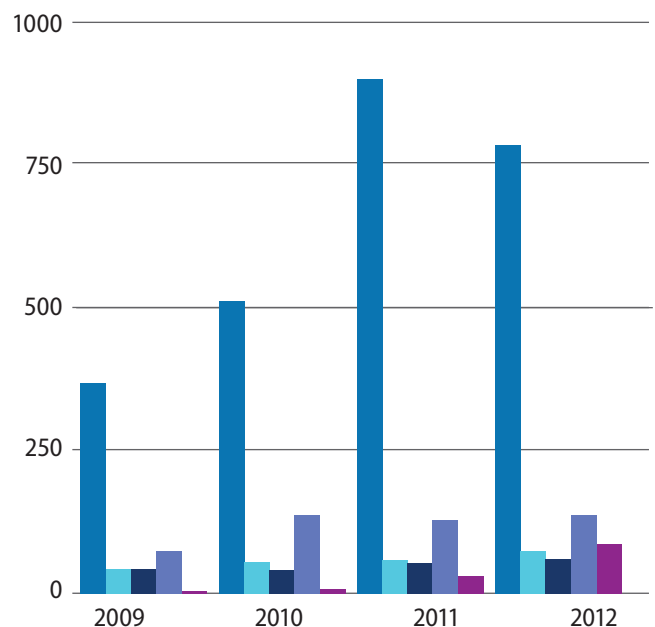
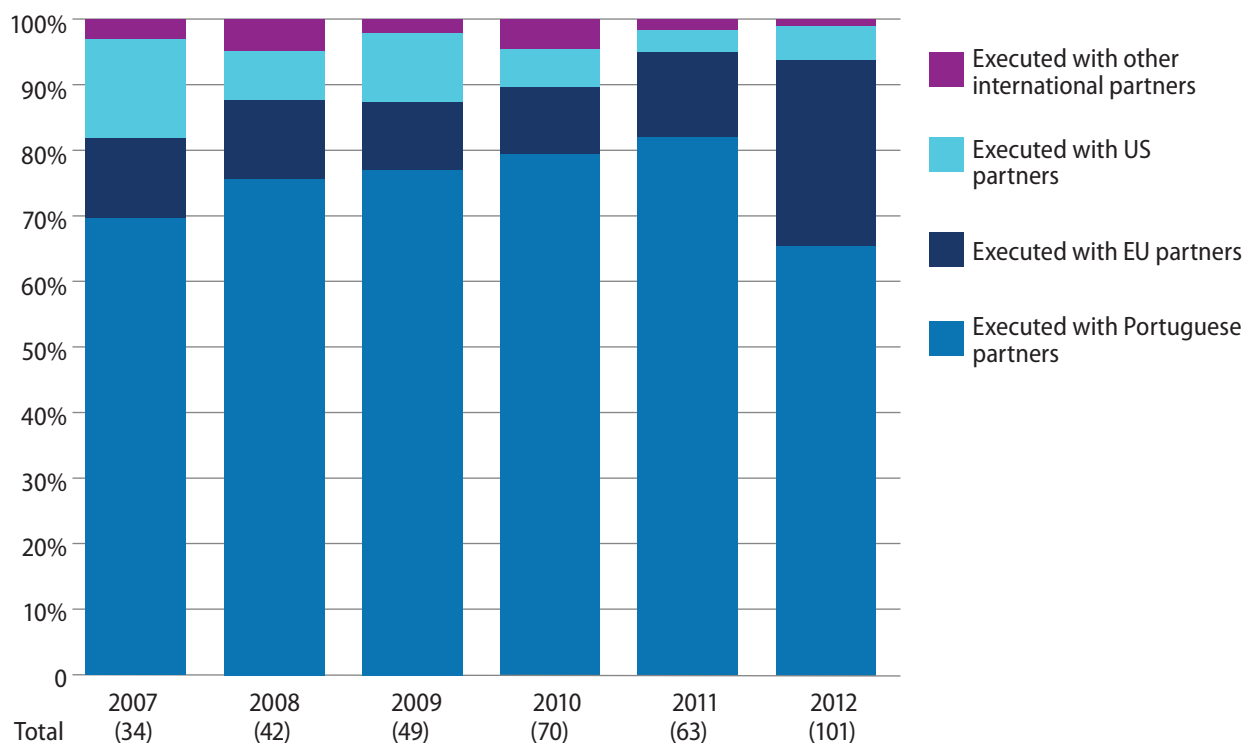


Figure 4.12: Licenses, option agreements, and assignments executed by TTOs, 2007-2012



one third of the total licenses, option agreements, and assignments executed by TTOs.

The vast majority of the licenses and option agreements executed were granted to companies (72% in 2011 and 96% in 2012). Of these, almost half were granted to *firms with fewer than 250 employees*. In 2012, *start-ups* represented less than 30% of total licenses and option agreements granted to companies, against 42.9% registered in 2011 (cf. Figure 4.13).

The total amount of license income (license issue fees, annual fees, option fees, plus milestone, termination, and cash-in payments) received by the institutions through their TTOs, from their intellectual property (including patents, software, material transfer agreements, confidentiality agreements) amounted in 2011 and 2012, respectively, to 933 and 1215 thousand euros, of which about 10% was from international licenses.

A quite high number of TTOs (13 out of 18) stated that at least one of their institutions' technology or knowledge licenses resulted in commercially profitable products or processes between 2010 and 2012. In 2007, each TTO executed, on average, 12 research and development (R&D) agreements between their institution and companies. This figure almost doubled by 2011, reaching 22 R&D agreements, although in 2012 there was a slight decline to 18. By the end of 2011, the 18 TTOs were

Figure 4.13: Licenses/option agreements executed by TTOs granted to companies, 2011-2012

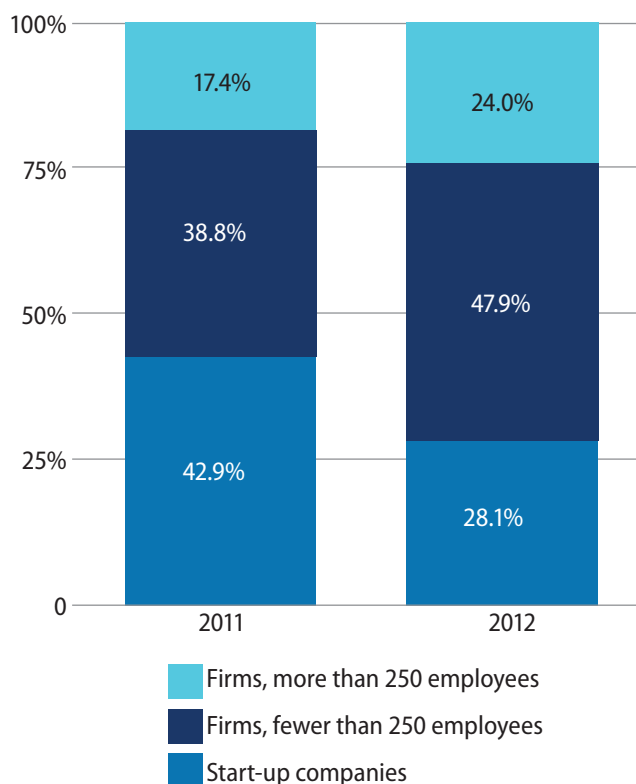
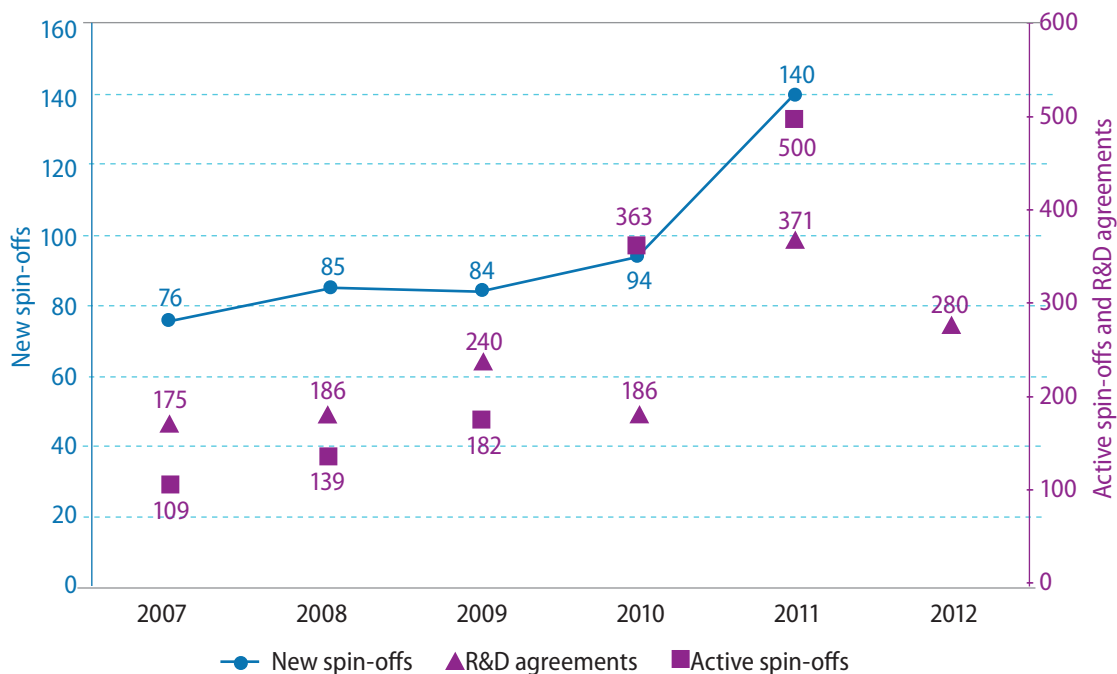


Figure 4.14: Number of R&D agreements and spin-offs (new and active), 2007-2012



responsible for executing 371 R&D agreements between their institution and companies (see Figure 4.14).

For the period 2007-2011, an average of 6 spin-offs were created each year per TTO, and by 2011 about 31 spin-offs were active. These averages hide enormous differences between TTOs, with two TTOs claiming a number of newly established and active spin-offs in the last two years, respectively 30 and 100 firms.

In their own words: A SWOT analysis

According to the technology transfer officers interviewed, the main strengths of these entities include (see Figure 4.15) *human resources* and *networking/relationships between the several stakeholders involved in the technology transfer process* (9 out of 17 interviewees pointed these two factors), and *well established procedures* (4 out of 17). The relevance of human capital is highlighted by one of the interviewees:

Our main strength is our dedicated and loyal team which has great competences, experience and capacity. (June 2013 Interview)

Regarding the networking issue, interviewees emphasized the synergies with other TTOs, good relationships with industry, researchers and deans, possessing a vast network of contacts, and reputation. The *healthy relationship and well-established procedures between TTOs and their institutions/universities* clearly

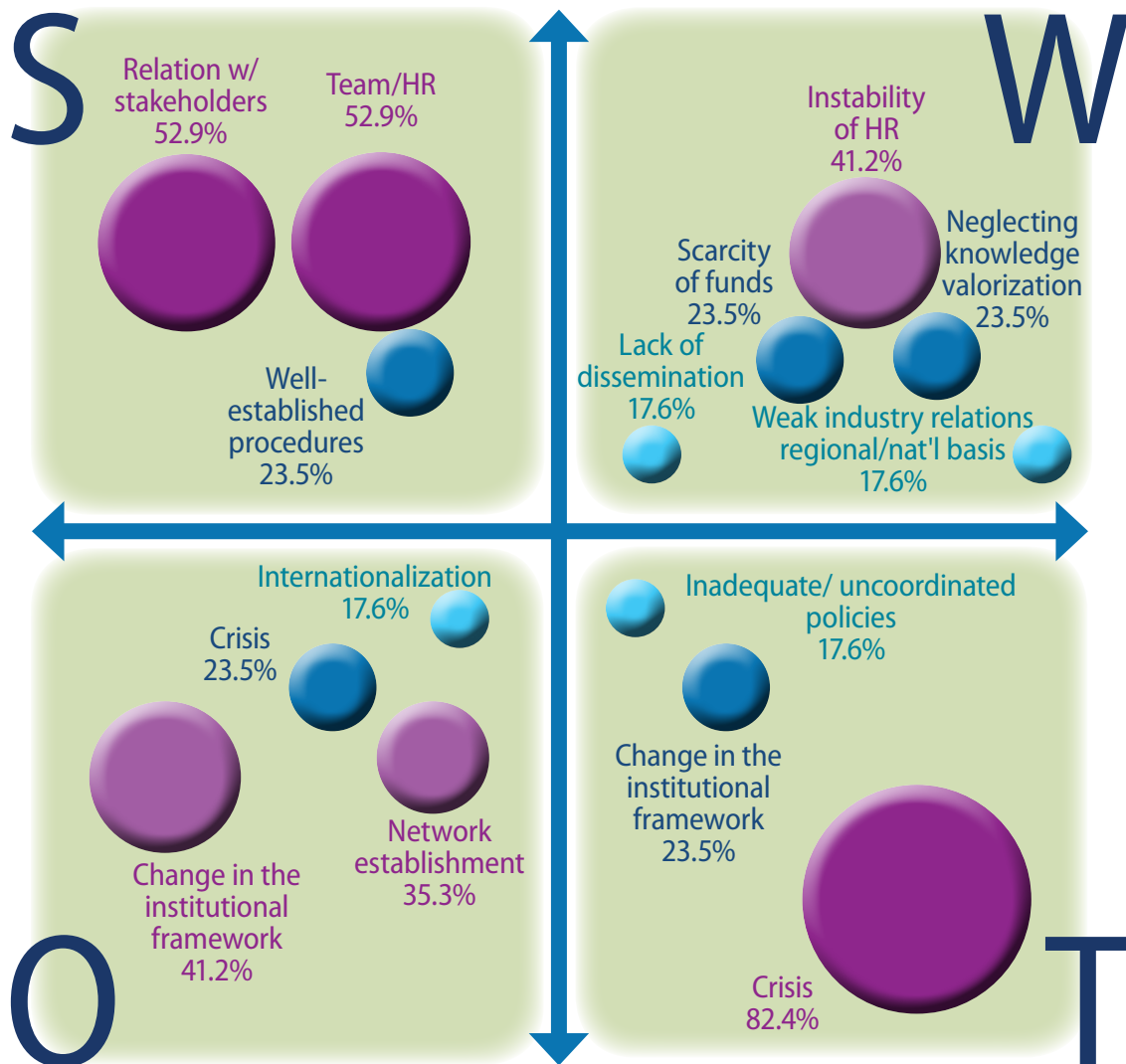
facilitate the bureaucratic dealings TTOs have to follow to undertake their activity.

Although only 4 interviewees (23.5%) explicitly pointed to *financial constraints* as a relevant weakness of TTOs, 41.2% of the TT officers mentioned the *instability of maintaining human resources*, linking such instability with binding financial restrictions. With human capital being the main pillar of a TTO, such a weakness stands as the most worrisome aspect. The financial limitations cause TTOs to apply and be involved in (inter)national research projects as a way to obtain funds to finance their activities. This, however, diverts attention away from the TTOs' main technology transfer activity, as stressed by one of the interviewees:

The participation in projects financed by the European Union has been our main financial source. Nonetheless, they require too much attention, leading us to neglect our core activities. (June 2013 Interview)

According to the interviewees, until now the advantages of knowledge valorization have been largely neglected by researchers. Thus, more awareness activities directed to researchers should be a major priority in order to overcome technology transfer deficiencies. In line with this, some of the interviewees mentioned that one of the weaknesses of TTOs is *poor dissemination of their activities*,

Figure 4.15: SWOT analysis: Perceptions of technology transfer officers, 2013



which remain largely unknown even on their own campus. *Weak industrial base and fragile relationships with industry* was also highlighted by 4 TTOs. This might be to a large extent due to the limited industry experience of TTO staff, preventing the office from relying on “natural brokers.”

In terms of opportunities, *change in the institutional framework* was mentioned by 41.2% of the TT officers. This requires an expected growing commitment of the university with technology transfer issues, an increasing valorization of innovation and entrepreneurship, and a rise in the investors’ interest in those areas. Such (expected) changes of institutional settings and mentality in the Portuguese population are considered a central step towards the development of technology transfer in Portugal. In the words of one TT officer:

Never before have we seen so many people committed to trying to create their own company, and excited about this area! (*June 2013 Interview*)

The topic of *establishing and strengthening networks* was indicated by 6 TTO officers as a promising opportunity, with identifying the prospects of a strong TTO network and expanding the health cluster being critical aspects. The *financial and economic crisis* was also addressed in the sense that it might obligate people (researchers/ students) to search for new opportunities for generating high added value. Finally, *internationalization* was named as a potential opportunity for the development of TTOs, as the participation in international research projects is likely to be a way of exporting knowledge, increasing foreign direct investment in Portugal, and creating a solid international network of TTOs, critical for enhancing their performance. Some TTOs have

already made some efforts to create and be engaged in networks and clusters in order to leverage their activity by exchanging experiences and practices with similar entities.

...created a nationwide project in 2011, the RedInovar, a network connecting firms and researchers associated with the agriculture, food and forestry sectors. (*June 2013 Interview*)

The *financial and economic crisis* and the consequent scarcity of financing were regarded as the most serious threat to the vast majority (82.4%) of TTO officers. The crisis was identified with budget cuts, and shortage in or lay-off of human resources, which ultimately undermine the survival prospects of the TTO. Three TTO officers mentioned their major threat as the *uncoordinated policies for technology transfer activities*, focusing mainly on policy makers' lack of knowledge regarding the TTOs' needs and the consequent not-so-adequate measures taken in this context. This aspect is corroborated by the global SWOT analysis of the Portuguese scientific system (FCT, 2013), which identified as a major weakness the *scarcity of evaluation activities* for policies and national programs, namely the limited use of collective debates with reduced stakeholder involvement in the policy designing process.

The great mission would be ending the dependency on the Ministry of Science and move to the Ministry of Economy, promoting the allocation of funds for the technology transfer area to universities, and thus preventing the extinction of such offices due to the lack of funding. (*June 2013 Interview*)

Uncertainty generated by the possibility of *changes in the institutional framework*, which can lead to new university priorities that may not include the existence of a TTO, was also stressed as an important threat.

Networks: A strength and an opportunity

Historically, and related to the commercialization of technology and knowledge, investments have been focused on tangible capital infrastructure projects, most notably the establishment of incubators and science parks. While in many regions/countries, such as Portugal, the existence of such tangible innovation assets is pointed to as a proof of investment in innovation, it has been discovered that in some cases an investment in the capacity building of human networks to engage in technology transfer and commercialization related activities can act as a stronger facilitator for transforming economies and producing a larger return on investment in innovation for a country (Gibson and Naquin, 2011). Therefore, networks play an essential

role, especially regarding intermediate organizations such as TTOs, since they embrace all the activities, resources, and competences of the value chain of the technology transfer process.

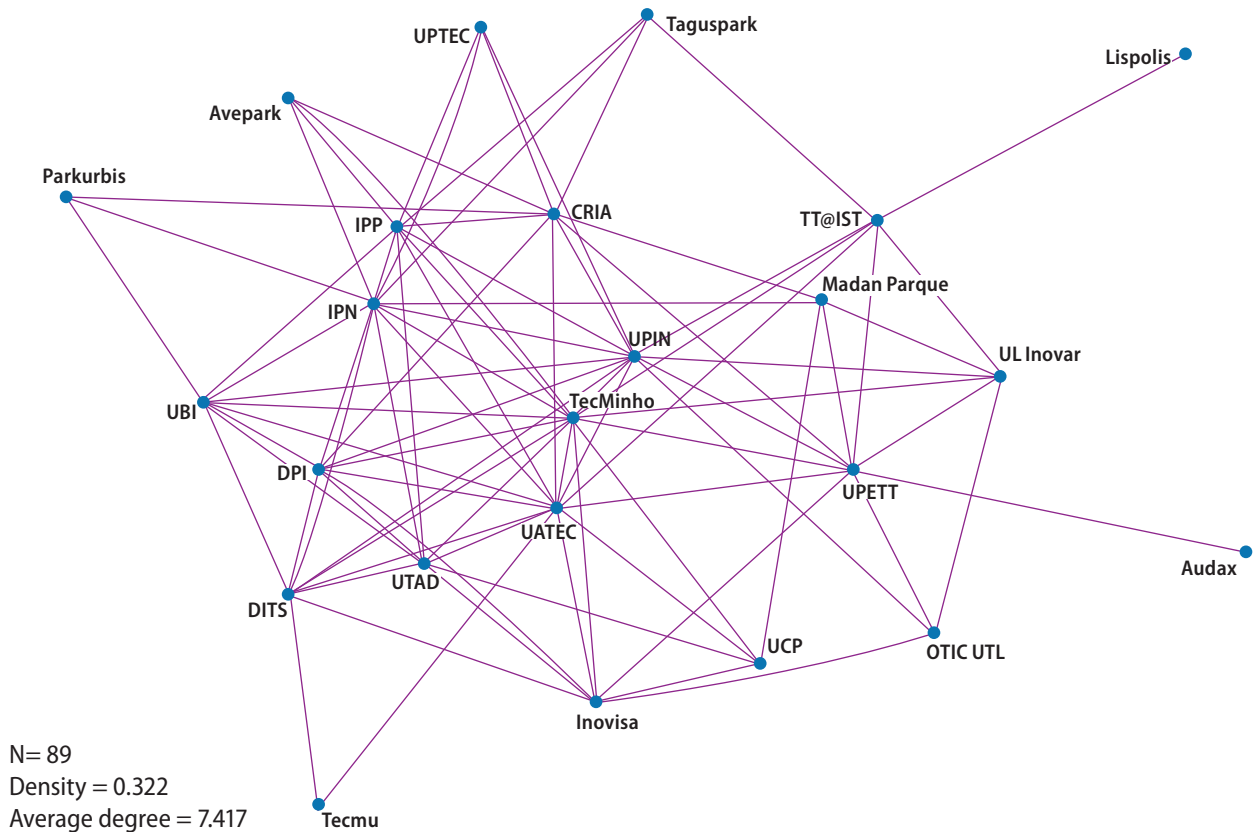
The aim of the TTO is to maximize the revenues of the commercialization of academic results by managing, as much as possible, a linear and unidirectional process (Matt and Schaeffer, 2012). Thus, the network, which is built largely based on cooperation, facilitates access to a variety of partners (Van Burg et al., 2008), setting the foundation for solid external relationships with, for instance, institutional investors, firms and consulting organizations (Nosella and Grimaldi, 2009).

Additionally, TTOs and TTO networks play a key role in assisting entrepreneurs, providing a range of services from hardware, such as shared offices and access to research labs, to software, such as access to knowledge and network pools for start-up companies. Such support gives the start-up companies a relatively secure environment and a head start over others (Bathula et al., 2011). As Cooper et al. (2012) revealed in their study, technology transfer support mechanisms strive to develop robust business and social networks to bring value to their resident companies in the form of intellectual and material resources.

In order to characterize the architecture of the network involving the Portuguese TTOs, technology transfer officers of 15 TTOs and the directors of 2 science and technology parks were asked to identify the relationships they maintained (over the past five years, 2008-2012), not only with other national TTOs or science parks, but also with other actors in their external environment, encompassing national and international stakeholders that participate directly or indirectly in the process of technology transfer. These relationships include both formal and informal links. Formal links include a given kind of official connection based on legal agreements and/or formal cooperation through contracts, while informal links are based on personal acquaintance communication processes and relations (Almodovar and Teixeira, 2012).

Social network analysis (SNA) tools were employed to more adequately describe and assess the architecture of the networks, thus making it possible to identify interaction patterns. Pajek, a professional computer software for network analysis and visualization, was used to perform these analyses. In Pajek, a network is defined in accordance with graph theory: a list of vertices or nodes and lists of arcs and edges, where each arc or edge can have a value (Nooy et al., 2005).

Figure 4.16: The architecture of formal networking between Portuguese TTOs, 2008-2012



Source: Based on face-to-face interviews with UTEN technology transfer officers between May/June 2013.

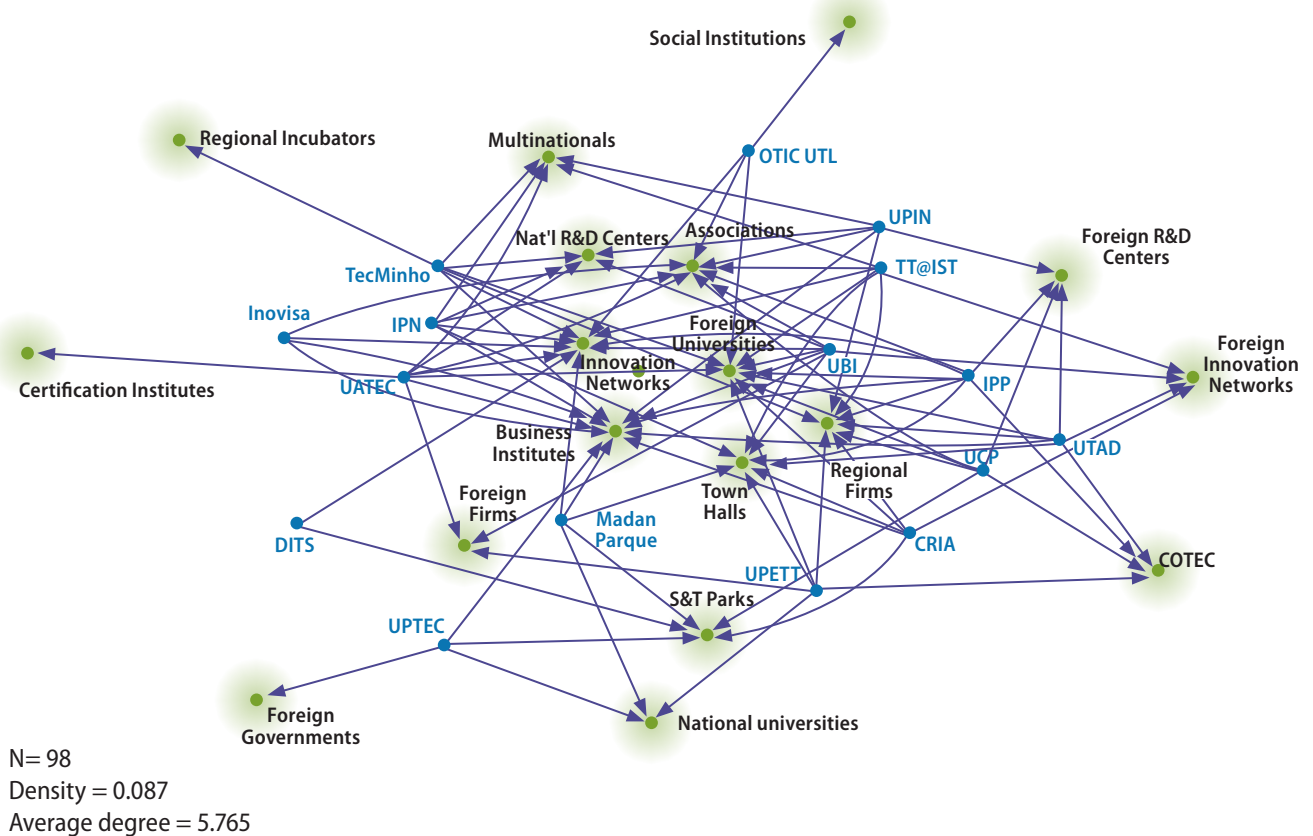
In order to have a clearer view of the TTOs' network architecture, the analysis of the networks was divided into two groups: 1) network interactions between TTOs; and 2) relations between TTOs and other stakeholders. Figure 4.16 illustrates the architecture of formal networking activities between TTOs, being an example of a sociogram, that is, a graphical representation of a group structure. The sociogram is among the most important instruments originated in sociometry, and is the basis for the visualization. It depicts the structure of ties within a group, showing which organization has more connections, as indicated by the number of lines or arcs directed from or to their vertices or their position in the graph.

In this particular case, this group/ network is composed of 24 organizations and 89 connections between them, having a density of 0.322 (see Figure 4.16). The density of a network is the percentage of all possible lines that are present in a network. Maximum density (=1) is found in a complete simple network, that is, a network in which all pairs of vertices are linked by an edge or by two arcs, one in each direction (Nooy et al., 2005). In this case, a density of 0.322 means that 32.2% of all possible connections are present. As the network density

varies drastically along networks with different sizes, it is advisable to use the average degree as a comparison term between networks. The degree of a vertex is equal to the number of vertices that are adjacent to this vertex, that is, the number of stakeholders/TTOs to which a TTO is connected. In this case, every TTO has on average 7.4 formal connections with other TTOs (cf. Figure 4.16). As depicted in Figure 4.16, the TTOs with more connections are located at the center of the network, while those with sporadic relations are placed on the periphery of the sociogram.

According to additional information on the vertices, it is possible to state that TTOs which enjoy centrality in the graph, that is, the ones with a larger number of formal relationships with other entities of the same type, are the ones embedded in a national network of technology transfer offices, namely GAPI and OTIC. Those networks were created in the beginning of the 2000s by the Portuguese government to implement several measures with the aim of bridging the policy gap between "innovation" and "research." The setup of the network of GAPI (IPR support offices) has played an important role in making scientists, particularly in universities, display their research outcomes for IPR filing. Furthermore, a

Figure 4.17: Architecture of the formal network between TTOs and other stakeholders, 2008-2012



Source: Based on face-to-face interviews with UTEN technology transfer officers between May/June 2013.

network of university technology transfer and licensing offices (OTICs) was also established in order to allow universities to transfer and license out the commercial outcomes of their research; the OTICs are seen as being complementary to the GAPIs, acting on a more downstream stage. Both initiatives have contributed to the creation of a national technology transfer network, which facilitated the contact between several TTOs.

By the mid-2000s the financial support to the GAPIs and OTICs was gradually discontinued; nonetheless the relationships and contacts remained and were even fostered by the training activities and workshops organized as part of the UTEN program. Therefore, it is understandable that TTOs which participated or still participate in upgraded versions of those networks (such as GAPI 2.0) have a more central position when it comes to relations among TTOs, as they are more familiar with other TTOs and the most recent TTOs are more likely to establish formal/contractual cooperation with the ones they already know.

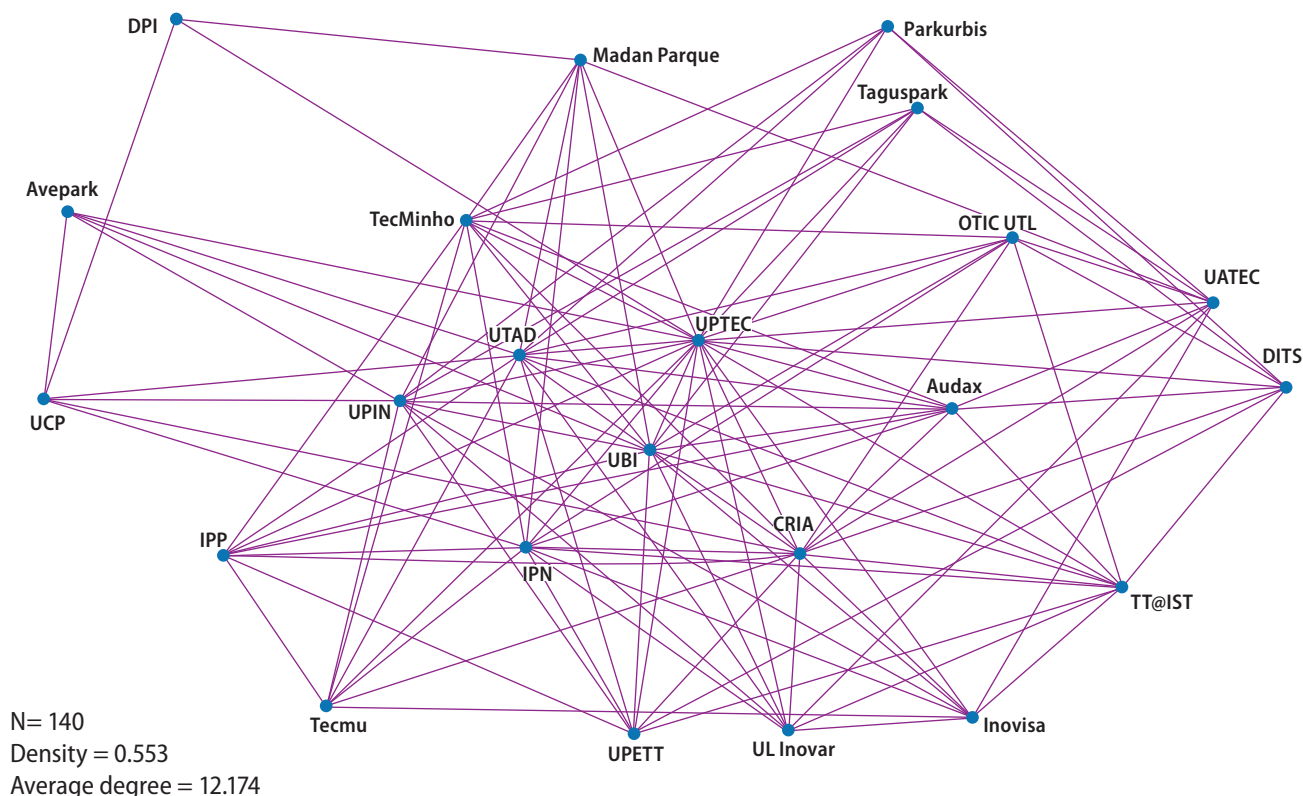
Figure 4.17 illustrates the structure of the formal links between TTOs and other technology transfer stakeholders. In Figure 4.17, directional arcs were used

instead of lines because the connections have a single direction, in contrast to the previous graph where a TTO could indicate a connection with a certain partner and be indicated by this same partner. This change also contributes to the lower density of the network (bidirectional arcs were not considered; instead, this study focused only on the connection from the TTO to the stakeholder and not vice versa).

Looking at the average degree of vertices, it is possible to observe a slight decrease in average connections when it comes to relations with external partners. The stakeholders that receive more arcs are located in the center of the sociogram, having more connections with the Portuguese TTOs. Of national partnering entities, TTOs focus formal relations mainly on *regional firms*, *town halls*, *innovation networks* (such as Portugal Ventures, Red Empreendia, Inov Cluster, Inov C) and *business institutes* (such as Institutos e Núcleos Empresariais, chambers of commerce and industry).

Interestingly, contrasting with the position of *national universities*, *foreign universities* lie squarely at the center of the network, being strong formal partners of Portuguese TTOs. Other international stakeholders, such as *foreign*

Figure 4.18: Architecture of the informal network among TTOs, 2008-2012



Source: Based on face-to-face interviews with UTEN technology transfer officers between May/June 2013.

governments, foreign R&D centers and foreign innovation networks, have a more peripheral location when it comes to formal connections.

As stated by Gibson and Naquin (2011), it is important for Portugal to build human networks to engage in technology transfer and commercialization which can act as a catalyst for leveraging the country's innovation system. Analyzing this graph, it is possible to state that the initiatives taken by the Portuguese TTOs in constructing a strong/dense national innovation network is an important first step, which hopefully will lead to, in a subsequent phase, an engagement in valuable international networks.

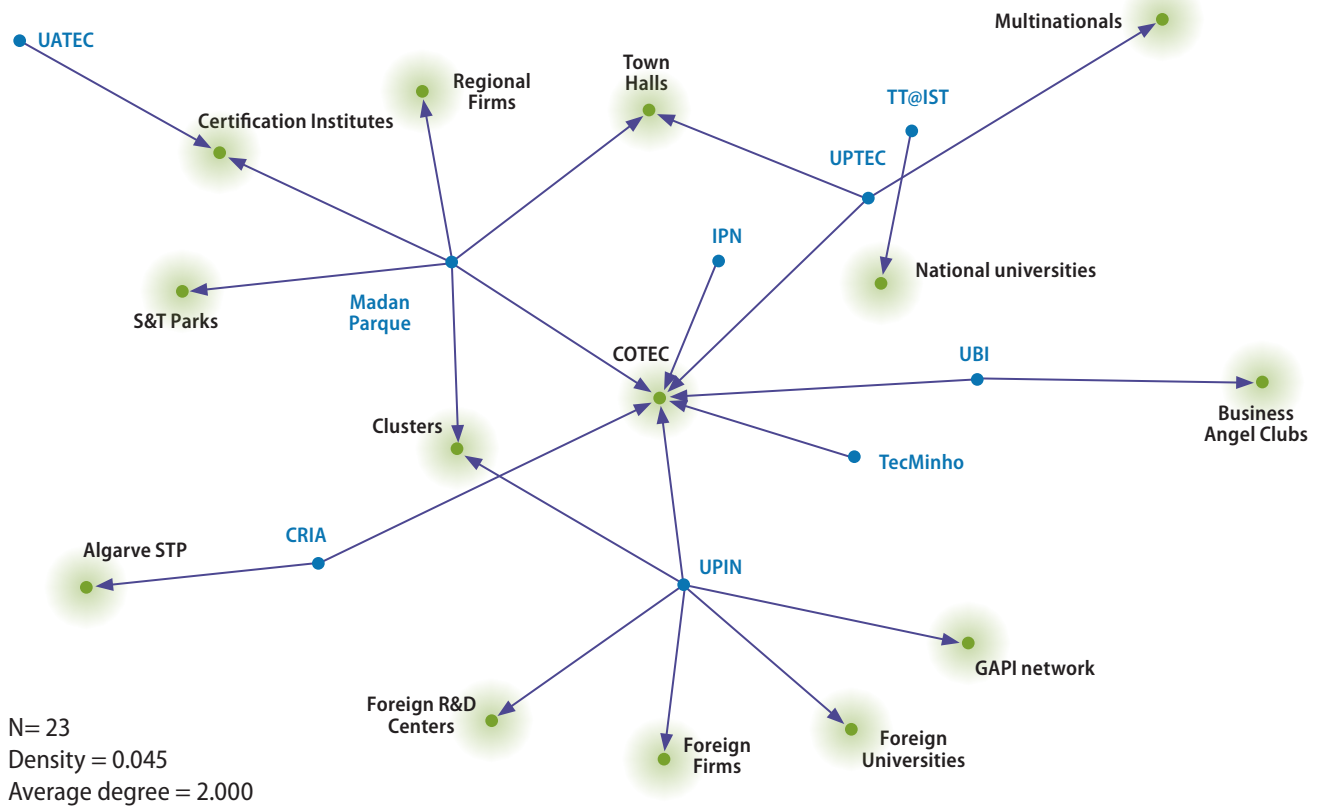
Figure 4.18 reports the casual links between TTOs regarding the informal relationships of the respondent TTOs. The total number of the vertices is 23 and the number of connections which relates them is 140. In contrast to the previous graphs, the density clearly increased because bidirectionality is enabled across intense unofficial relationships between TTOs. This aspect is also highlighted by the average degree of vertices, which is 12.174. The increased density and

the high average degree indicate that the informal network of TTOs is based on strong connections, so that almost every TTO has a central position, even the ones which were not interviewed, that is, those who could not indicate their relation network (for instance, DPI, Avepark, Tecmu and Audax).

Still in relation to the informal relationships of the respondent TTOs, Figure 4.19 includes the links between TTOs and other stakeholders. The total number of vertices is 23 and the number of connections which relates them is also 23. Similarly to the graph that describes the formal network of TTOs and other stakeholders, the density is slightly decreased (compared to Figures 4.16 and 4.18) by the fact that bi-directionality is not considered when it comes to "external" (non TTOs) stakeholders.

The average degree of vertices regarding informal links with other stakeholders shows a large decrease, indicating that each TTO has on average two connections with an external stakeholder. In this sense, besides having a small number of TTOs that maintain relations with other stakeholders, those relations are

Figure 4.19: Architecture of the informal network between TTOs and other stakeholders, 2008-2012



Source: Based on face-to-face interviews with UTEN technology transfer officers between May/June 2013.

clearly scarce. Therefore, it is possible to state that the informal network of TTOs focuses its attention on entities of the same type, while connections with other technology transfer stakeholders are based on formal relationships.

Furthermore, it is possible to observe that the only external stakeholder with a large number of informal relations with TTOs is *COTEC*. *COTEC* Portugal is a business innovation association that seeks to promote a culture of innovation as a critical source of company competitiveness, to foster the practice of innovation by all the agents of the National Innovation System, to influence the strategic orientation of both the National and European Innovation Systems, and to remove context barriers to innovation.

Focusing on the results illustrated in Figures 4.16 and 4.18 about the formal and informal networks among TTOs, it is possible to state that Portuguese TTOs are embedded in a strong network with entities of the same type. These findings indicate that not only have initiatives such as the creation of the GAPI and OTIC networks contributed to a strong TTO network, but also and essentially, as stated by the technology transfer

officers interviewed, the implementation of the UTEN network, with the specific goal to build a globally competitive and sustainable science and technology (S&T) transfer and innovation network managed by highly trained Portuguese professionals.

In addition to a variety of services offered by the UTEN program, initiatives such as training for 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 were pointed out as being essential, not just on the basis of knowledge absorption, but also in terms of the establishment of relations with colleagues from other TTOs or similar technology transfer institutions.

The UTEN network played a significant role in creating sharing and discussion spaces between the technology transfer officers of various universities. Not only did it contribute to the creation of a national technology transfer network, but also provided training to the officers, which led everyone to use the same vocabulary, to share good practices, and to get to know international mechanisms for some areas. (*June 2013 Interview*)



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