

A Comprehensive Analysis of Portuguese National and Regional Policy Instruments for Technology Transfer Offices*

Helena Rosário Da Costa
National Innovation Agency
Lisbon, Portugal
helena.costa@ani.pt

Katiuska Cruz
National Innovation Agency
Porto, Portugal
katiuska.cruz@ani.pt

ABSTRACT / POVZETEK

In the rapidly evolving landscape of global technological advancement, the process of transferring technological insights from academic settings to industrial and commercial areas – known as Technology Transfer (TT) – is paramount. This research examines the national and regional mechanisms that Portugal employs in the TT domain, with a specific focus on instruments targeting academic Technology Transfer Offices (TTOs). Particularly, the research assesses the implemented policy instruments, emphasizing their respective significance and operational dynamics for the benefit of TTOs. This paper offers a comprehensive understanding of Portugal's ambition and strategy for translating academic knowledge into tangible industrial benefits. The findings illuminate not only Portugal's strategic trajectory in TT but also offer critical insights for policymakers, academia, and industry stakeholders, exploring and highlighting the instrumental role of TTOs in bridging the gap between innovation and commercialization.

KEYWORDS / KLJUČNE BESEDE

Technology Transfer; Science, Technology and Innovation Policy; Higher Education Institutions; Technology Transfer Offices

1 Introduction

*A Comprehensive Analysis of Portuguese National and Regional Policy Instruments for Technology Transfer Offices

†Author Footnote to be captured as Author Note

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

Information Society 2023, 9–13 October 2023, Ljubljana, Slovenia

Historically, Higher Education Institutions (HEIs) have continually evolved in response to changing governmental visions and dominant socioeconomic influences[1]. A notable shift post-1990 was the intersection of education and research, highlighting the importance of knowledge dissemination and technological progress [1]–[3].

In today's landscape, HEIs are increasingly driven by applied research, positioning them at the forefront of technological innovations with marketable potential[4]. The modern role of HEIs integrates their primary educational and research missions into a holistic “third mission,” which envelops technology transfer, entrepreneurship, and industry partnerships [5]–[9]. At the heart of this value creation are technological breakthroughs, which are secured through Intellectual Property Rights (IPR), positioning Technology Transfer Offices (TTOs) as central figures[10], [11].

TTOs serve as pivotal conduits, connecting academia to industry. They meticulously review academic discoveries, guiding researchers toward identifying and presenting market-ready innovations. In defining their roles, responsibilities in patent decision-making, commercial potential assessment, and active marketing of inventions. Simultaneously, TTOs have a role in bridging information voids between industry and academia, particularly in valuing inventions [12], [13].

TTO efficacy hinges on available resources[13]–[15]. These resources, as highlighted vary across institutions and their effectiveness. Resources can be grouped into financial, infrastructural, human, and organizational capacities. Notably, seasoned TTOs often excel over their newer peers due to the extensive learning curve involved in mastering technology transfer[16].

To bolster this, HEIs have broadened their financial funds, focusing on translational research and the emergence of academic spin-offs [17]. Current discourse places emphasis on two mechanisms: Proof-of-Concept (PoC) programs [18], [19] and University Seed Funds (USFs) [14], [20].

Portugal's trajectory in R&D investment has historically been uneven, swayed by socio-political dynamics and economic downturns [21]. These fluctuations sometimes led to inconsistent support for TTOs, causing variances in their efficacy. While some Portuguese HEIs have blossomed into innovation hubs with proficient TTOs, others, especially those distant from urban centers, grapple with forming industry ties and securing steady funds. Contemporary barriers, such as challenges in promoting interdisciplinary research amidst bureaucratic limitations, funding, and capacity building further exacerbate these historical differences.

The crux of this paper is an examination of public funding's role in the evolution and sustenance of TTOs in Portugal, spotlighting government backing. Specifically, we delve into public financial structures that have engendered “gap funding” models [17], focusing on Portuguese HEIs deeply reliant on state support.

2 The Role of National and Regional Policy Instruments in Portugal's TTO Landscape

2.1 Direct Financial Support: A Catalytic Support for the Establishment of Portuguese TTOs

One of the pivotal strategies within the “third mission” of HEIs in Portugal has been the establishment of TTOs, which serve to sustain the interactions between HEIs, the industry, and the wider society.

In 2001, the Intellectual Property Support Offices (GAPI), spearheaded by the National Institute of Industrial Property (INPI), was introduced. They were co-funded by public schemes such as the Operational Programme for the Economy and the Incentive Program for the Modernisation of the Economy. These GAPIs aimed to guide researchers and academics regarding patentable knowledge.

By 2006, the Innovation Agency (ADI) launched the Technology and Knowledge Transfer Offices (OTICs), designed to streamline the transfer of knowledge and technology to businesses. Over time, the roles of GAPIs and OTICs began to intertwine, leading to their eventual integration into the unified TTOs (Table 1).

More recently, between 2016 and 2022, public funding (Regional Operational Programmes of Portugal 2020) was provided for the establishment of three additional TTOs in the Lisbon Region. These include a center at the NOVA University of Lisbon focusing on Social Innovation, aiming to be the first national infrastructure promoting a university-business-organization interface for innovative R&D projects addressing diverse social issues. At the University of Lisbon, the TTC@ULisboa acts as a facilitator for technology transfer and entrepreneurship, offering a strategically located space for young entrepreneurial students, researchers, and businesses. Lastly, the ISCTE - University Institute of Lisbon established a new TTO, leveraging its existing R&D structure, advanced training, and innovation, creating a hub for new ideas focusing on society and the challenges of digital transformation.

Table 1: Portuguese Higher Education Institutions with Technology Transfer Offices

Higher Education Institution	Type Funded Operation
Instituto Superior Técnico	GAPI
University of the Azores	GAPI
University of the Algarve	GAPI & OTIC
University of Coimbra	GAPI & OTIC
University of Évora	GAPI & OTIC
University of Beira Interior	GAPI & OTIC
University of Trás-os-Montes and Alto Douro	GAPI & OTIC
University of Porto	GAPI & OTIC
University of Minho	GAPI & OTIC
Polytechnic Institute of Setúbal	OTIC
Polytechnic Institute of Tomar	OTIC
Polytechnic Institute of Porto	OTIC
Polytechnic Institute of Leiria	OTIC
Polytechnic Institute of Beja	OTIC
Polytechnic Institute of Castelo Branco	OTIC
Polytechnic Institute of Portalegre	GAPI & OTIC
Polytechnic Institute of Viana do Castelo	OTIC
Technical University of Lisbon	OTIC
Portuguese Catholic University – School of Biotechnology	OTIC
New University of Lisbon	OTIC & Regional Operational Programs of Portugal 2020
Lusíada University of Vila Nova de Famalicão	OTIC
University of Aveiro	GAPI & OTIC
University of Lisbon	GAPI & OTIC & Regional Operational

University of Madeira	Programs of Portugal 2020 OTIC
ISCTE - University Institute of Lisbon	GAPI & Regional Operational Programs of Portugal 2020

Source: List of Approved QREN and Portugal 2020 Operations

2.2 Capacity Building: Shaping TTOs Ecosystem

2.2.1 University Technology Enterprise Network (UTEN)

In response to the fragmented interactions between Portuguese HEIs and industry, the Portuguese Foundation for Science and Technology (FCT) collaborated with the IC2 Institute of the University of Texas at Austin to establish the University Technology Enterprise Network (UTEN) in March 2007[22].

UTEN's primary objective was to develop a network proficient in transferring and commercializing science and technology. This network encompassed public Portuguese HEIs, an affiliated private institution, related TTOs, research centers, and occasionally, technological parks[23].

UTEN offered specialized training by internationally renowned experts, emphasizing the commercialization of Portuguese academic innovation[23]. From 2007-2010, UTEN facilitated international internships for technology transfer officers[22], [24]–[26].

2.2.2 TTO Network

Research indicates that academic TTOs evolve through experimentation, failure, and the mutual exchange of experiences [27], [28]. Yet, barriers persist in sharing best practices among TTOs. Initiated in 2018, the TTO Network represents National Innovation Agency's (ANI), previously ADI, commitment to fostering innovation, technology transfer, and knowledge commercialization within HEIs. In 2022, ANI commenced a two-year initiative to enhance TTO Network capacities.

In addressing the challenges Portuguese TTOs faced in capitalizing on their IP assets, an initiative was set in motion: the implementation of specialized training. The purpose behind this specialized training was twofold: it was structured to empower TTOs with the tools for effective collaboration, technology scouting

methodologies, precise market analysis, industry trend discernment, and the evaluation of technologies with high commercial potential. Moreover, the collaboration with international experts provided these TTOs with the strategic insight required to effectively manage their respective HEI's IP portfolios.

For each HEI was developed a comprehensive IP Portfolio, which integrates patents, trademarks, copyrights, and trade secrets, stands as a testament to an HEI's intellectual competence.

As part of this initiative, in the first semester of 2023 were introduced open innovation challenges. Rooted in the ethos of managing knowledge assets through open innovation [29], [30], these challenges encouraged companies to present real-world challenges they faced, incentivizing TTOs to respond with innovative technology solutions drawn from their IP portfolios.

2.3 Funding instruments for technology transfer: How TTOs support their activities?

The Portuguese government's support, although invaluable, primarily targets the creation and capacity-building of TTOs without explicitly supporting the daily operations of TT activities such PoCs and USFs. The primary onus, therefore, falls on TTOs themselves. These operations, characterized by collaborations with companies, demand for innovative solutions, and training initiatives, are not merely cost-intensive but also necessitate continuous financial inflow [14], [17], [18], [19], [20]. To address this, and in line with their “third mission”, Portuguese TTOs often resort to regional Operational Programmes, emphasizing the critical role such programs play in bridging the financial and operational gaps (Table 2).

Table 2: Overview of Funding Mechanisms for TT Activities Across Portuguese HEIs

Higher Education Institution	Funded Operation	Total Eligible Expenditure (in euros)	Operational Program	Type of Mechanism
Algarve University	TT 2.0	552 155,8	Algarve Regional Operational Program	PoC
Aveiro University	CAMPUS TEC	286733	Center Regional Operational Program	PoC and USFs

Católica University	3Boost	999960,89	Operational Programme for Competitiveness and Internationalization	PoC
Coimbra University	INOVC 2020	1627614,39	Center Regional Operational Program	PoC
Coimbra University	InovC+	3393755,86	Center Regional Operational Program	PoC
Polytechnic Institute of Leira	Knowledge Circle	477810,74	Operational Programme for Competitiveness and Internationalization	PoC
Trás os Montes and Alto Douro University	INOV@UT AD	754145,62	North Regional Operational Program	PoC and USFs
Trás os Montes and Alto Douro University	Lab2Business	506902,74	North Regional Operational Program	PoC
Trás os Montes and Alto Douro University	UI-Transfer	824056,95	Operational Programme for Competitiveness and Internationalization	PoC

Source: List of Approved Operations for Portugal 2020 as of June 30, 2023

3 Discussion and Conclusion

The introduction of the GAPI in 2001 marked a significant turning point in Portugal's commitment to fostering TT. With the formation of GAPIs and later the OTICs, the institutional structure for technology transfer was solidified. The involvement in UTEN activities expanded, and the focus shifted from just patenting to a more comprehensive TT ecosystem, encompassing patenting, licensing, start-ups, and industry collaborations.

Portugal's strategic approach to TTOs, seen through initiatives like TTO Network, is praiseworthy concerning the extensive learning curve involved in mastering tech transfer activities[16].

Out of the 26 HEIs that were funded to create the TTO, only 8 displayed consistent activity in TT funded by the Operational Programmes between 2016 and 2022. It's evident that more established and well-resourced institutions dominate TT activities, aligning with the observations from the literature. The appearance of Coimbra University twice could be attributed to multiple funding sources or different TTO initiatives undertaken at different periods. Such overlapping engagements aren't uncommon, especially in more established HEI.

The significant funding allocated by Operational Programmes for USFs and PoCs activities underscores their indispensable role. However, the persisting challenges, primarily the “funding gap” and the operational complexities, indicate the need for continuous adaptation and a synergistic approach involving policymakers, academia, and industry stakeholders to continue improving the funding programs.

This paper provides an insightful analysis of Portugal's approach to TT. When analyzing Portugal's historical and contemporary policy instruments, we uncover the commitment to building an ecosystem that fosters innovation, addresses funding challenges, and bridges the gap between academia and industry. The initiatives – from the establishment of TTOs, and capacity-building networks, to funding mechanisms – demonstrate a holistic strategy.

As Portugal continues its journey in the global TT landscape, the insights from this analysis can inform similar ecosystems globally, emphasizing the universality of the challenges and the importance of a coordinated approach to surmount them.

ACKNOWLEDGMENTS / ZAHVALA

The authors would like to acknowledge the National Innovation Agency for their unwavering support throughout this research.

REFERENCES

- [1] B. Readings, “The university in ruins,” p. 238, 1996, Accessed: Aug. 15, 2023. [Online]. Available: <https://www.hup.harvard.edu/catalog.php?isbn=9780674929531>
- [2] S. Rothblatt and J. Pelikan, “The Idea of the University, a Reexamination,” *Academe*, vol. 79, no. 1, p. 56, 1993, doi: 10.2307/40250443.
- [3] H. Etzkowitz and L. Leydesdorff, “The dynamics of innovation: from National Systems and ‘Mode 2’ to a Triple Helix of university–industry–government relations,” *Res Policy*, vol. 29, no. 2, pp. 109–123, Feb. 2000, doi: 10.1016/S0048-7333(99)00055-4.
- [4] H. Etzkowitz, A. Webster, C. Gebhardt, and B. R. C. Terra, “The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm,” *Res*

- Policy*, vol. 29, no. 2, pp. 313–330, Feb. 2000, doi: 10.1016/S0048-7333(99)00069-4.
- [5] L. Compagnucci and F. Spigarelli, “The Third Mission of the university: A systematic literature review on potentials and constraints,” *Technol Forecast Soc Change*, vol. 161, p. 120284, Dec. 2020, doi: 10.1016/J.TECHFORE.2020.120284.
- [6] A. Rubens, F. Spigarelli, A. Cavicchi, and C. Rinaldi, “Universities’ third mission and the entrepreneurial university and the challenges they bring to higher education institutions,” *Journal of Enterprising Communities*, vol. 11, no. 3, pp. 354–372, 2017, doi: 10.1108/JEC-01-2017-0006/FULL/PDF.
- [7] G. Trencher, M. Yarime, K. B. McCormick, C. N. H. Doll, and S. B. Kraines, “Beyond the third mission: Exploring the emerging university function of co-creation for sustainability,” *Sci Public Policy*, vol. 41, no. 2, pp. 151–179, Apr. 2014, doi: 10.1093/SCIPOL/SCT044.
- [8] P. Laredo, “Revisiting the third mission of universities: Toward a renewed categorization of university activities?,” *Higher Education Policy*, vol. 20, no. 4, pp. 441–456, Dec. 2007, doi: 10.1057/PALGRAVE.HEP.8300169/METRICS.
- [9] R. Baptista and J. Mendonça, “Proximity to knowledge sources and the location of knowledge-based start-ups,” *Annals of Regional Science*, vol. 45, no. 1, pp. 5–29, Aug. 2010, doi: 10.1007/S00168-009-0289-4/METRICS.
- [10] C. Fitzgerald and J. A. Cunningham, “Inside the university technology transfer office: mission statement analysis,” *Journal of Technology Transfer*, vol. 41, no. 5, pp. 1235–1246, Oct. 2016, doi: 10.1007/S10961-015-9419-6.
- [11] J. Bercovitz and M. Feldmann, “Entrepreneurial Universities and Technology Transfer: A Conceptual Framework for Understanding Knowledge-Based Economic Development,” *The Journal of Technology Transfer 2005 31:1*, vol. 31, no. 1, pp. 175–188, Nov. 2005, doi: 10.1007/S10961-005-5029-Z.
- [12] I. Macho-Stadler, D. Pérez-Castrillo, and R. Veugelers, “Licensing of university inventions: The role of a technology transfer office,” *Int J Ind Organ*, vol. 25, no. 3, pp. 483–510, Jun. 2007, doi: 10.1016/J.IJINDORG.2006.06.001.
- [13] D. S. Siegel, R. Veugelers, and M. Wright, “Technology transfer offices and commercialization of university intellectual property: Performance and policy implications,” *Oxf Rev Econ Policy*, vol. 23, no. 4, pp. 640–660, Dec. 2007, doi: 10.1093/OXREP/GRM036.
- [14] F. Munari, M. Sobrero, and L. Toschi, “The university as a venture capitalist? Gap funding instruments for technology transfer,” *Technol Forecast Soc Change*, vol. 127, pp. 70–84, Feb. 2018, doi: 10.1016/J.TECHFORE.2017.07.024.
- [15] J. Darcy, H. Kraemer-Eis, D. Guellec, and O. Debande, “Financing Technology Transfer,” *SSRN Electronic Journal*, Dec. 2009, doi: 10.2139/SSRN.1846344.
- [16] G. D. Markman, P. H. Phan, D. B. Balkin, and P. T. Gianiodis, “Entrepreneurship and university-based technology transfer,” *J Bus Ventur*, vol. 20, no. 2, pp. 241–263, Mar. 2005, doi: 10.1016/J.JBUSVENT.2003.12.003.
- [17] M. Benner and U. Sandström, “Institutionalizing the triple helix: research funding and norms in the academic system,” *Res Policy*, vol. 29, no. 2, pp. 291–301, Feb. 2000, doi: 10.1016/S0048-7333(99)00067-0.
- [18] J. Lerner, “Boulevard of Broken Dreams,” *Boulevard of Broken Dreams*, Dec. 2009, doi: 10.1515/9781400831630/HTML.
- [19] S. R. Bradley, C. S. Hayter, and A. N. Link, “Proof of Concept Centers in the United States: An exploratory look,” *Journal of Technology Transfer*, vol. 38, no. 4, pp. 349–381, Aug. 2013, doi: 10.1007/S10961-013-9309-8/TABLES/2.
- [20] A. Croce, L. Grilli, and S. Murtinu, “Venture capital enters academia: An analysis of university-managed funds,” *Journal of Technology Transfer*, vol. 39, no. 5, pp. 688–715, Oct. 2014, doi: 10.1007/S10961-013-9317-8/TABLES/14.
- [21] M. Heitor, H. Horta, and J. Mendonça, “Developing human capital and research capacity: Science policies promoting brain gain,” *Technol Forecast Soc Change*, vol. 82, no. 1, pp. 6–22, Feb. 2014, doi: 10.1016/J.TECHFORE.2013.07.008.
- [22] D. V. Gibson and M. Bravo, “UTEN Annual Report 2007,” Oct. 2007, Accessed: Aug. 16, 2023. [Online]. Available: <https://repositories.lib.utexas.edu/handle/2152/19881>
- [23] D. V. Gibson and H. Naquin, “Investing in innovation to enable global competitiveness: The case of Portugal,” *Technol Forecast Soc Change*, vol. 78, no. 8, pp. 1299–1309, Oct. 2011, doi: 10.1016/J.TECHFORE.2011.04.004.
- [24] D. V. Gibson and M. Bravo, “UTEN Annual Report 2008–2009,” 2009, Accessed: Aug. 16, 2023. [Online]. Available: <https://repositories.lib.utexas.edu/handle/2152/19880>
- [25] D. V. Gibson and M. Bravo, “UTEN Annual Report 2009–2010,” 2010, Accessed: Aug. 16, 2023. [Online]. Available: <https://repositories.lib.utexas.edu/handle/2152/19879>
- [26] M. Bravo and D. V. Gibson, “UTEN Annual Report 2011,” 2011, Accessed: Aug. 16, 2023. [Online]. Available: <https://repositories.lib.utexas.edu/handle/2152/19878>
- [27] D. M. Weckowska, “Learning in university technology transfer offices: transactions-focused and relations-focused approaches to commercialization of academic research,” *Technovation*, vol. 41–42, pp. 62–74, Jul. 2015, doi: 10.1016/J.TECHNOVATION.2014.11.003.
- [28] C. De Beer, G. Secundo, G. Passiante, and C. S. L. Schutte, “A mechanism for sharing best practices between university technology transfer offices,” *Knowledge Management Research and Practice*, vol. 15, no. 4, pp. 523–532, Nov. 2017, doi: 10.1057/S41275-017-0077-3.
- [29] A. T. Alexander and D. P. Martin, “Intermediaries for open innovation: A competence-based comparison of knowledge transfer offices practices,” *Technol Forecast Soc Change*, vol. 80, no. 1, pp. 38–49, Jan. 2013, doi: 10.1016/J.TECHFORE.2012.07.013.
- [30] J. B. P. Bejarano, J. W. Z. Sossa, C. Ocampo-López, and M. Ramírez-Carmona, “Open innovation: A technology transfer alternative from universities. A systematic literature review,” *Journal of Open Innovation: Technology, Market, and Complexity*, vol. 9, no. 3, p. 100090, Sep. 2023, doi: 10.1016/J.JOITMC.2023.100090.