

Knowledge Transfer Offices in Portuguese Universities: Institutional Change and Construction of New Actor-Networks

Hugo Pinto (hpinto@ualg.pt)

Centre for Social Studies, University of Coimbra and Research Centre for Organizational and Spatial Dynamics, University of Algarve

Tiago Santos Pereira (tsp@ces.uc.pt)

Centre for Social Studies, University of Coimbra

Draft Paper

Please do not cite or quote without the author's permission

Abstract:

Knowledge transfer has become a central activity in the university. In the overlapping areas of science and business, the translation of interests and creation of shared objectives is crucial. The article explores three case studies of intermediation actors in Portugal. Using an approach inspired in the Actor-Network Theory and the literature of institutional change the analysis indicate the significant diversity of behaviour regarding knowledge transfer even in a small country like Portugal. A blind replication of best-practices may be inadequate due to the scientific areas of expertise, regional economic structure and institutional architectures.

Key-words:

University, Knowledge Transfer, Knowledge Transfer Offices, Institutional Change, Actor-Network-Theory

Copyright of the paper resides with the authors. Submission of a paper grants permission to the **8th Triple Helix** International Scientific and Organizing Committees to include it in the conference material and to place it on relevant websites. The Scientific Committee may invite papers accepted for the conference to be considered for publication in Special Issues of selected journals.

1. Introduction

The Triple Helix (TH) underlines the complexity of innovation and the interaction and overlay from academy, industry and government actors. Recently, Etzkowitz and Ranga (2010) expanded the notion of Triple Helix system, underlining the components, linkages and functions that exist within such system. The stabilized idea of institutional spheres of TH literature is refreshed by the notion that functions can be understood as spaces. The current article focusing the knowledge transfer offices (KTOs), hybrid organizations that synthesize ideas and elements from academia, industry and government. The study of these offices is encompassed in the analysis of the innovation space, particularly the technology transfer institutions and the policies to promote the formation and activity of the technology transfer institutions.

The paper is structured as follows. A first section explores the state-of-art regarding the studies of knowledge transfer. A second section regards the contributions of Actor-Network Theory and institutional change literature to the case studies. Thirdly, a short introduction to Portuguese recent evolution in innovation and knowledge transfer and the presentation of three intermediation actors in Algarve, Aveiro and Coimbra, is done. Finally, some implications and contributions for KT effectiveness and KTO organization and work processes are presented.

2. State of Art: The Governance of Knowledge Transfer Activities and the Institutional Architectures

The TH (Etzkowitz and Leydesdorff, 1997) introduces the new role of the university within the knowledge economy as an entrepreneurial organization (Etzkowitz et al, 2000). A new stream of activities linked with knowledge transfer (KT) point directly to the promotion of territorial development (Rodrigues, 2008; Gunasekara, 2006). All these changes in the university's role have multiple variations with deep institutional roots and depend considerably from the type of state and the public science system (Whitley, 2007).

Universities have assisted to great changes in their roles. Uyarra (2010) presents an historical evolution of the five key types of universities in the innovation systems: knowledge factories, relational universities, entrepreneurial universities, systemic universities and engaged universities (summary table in Annex 1). The vision proposed by Uyarra stresses the complexification of the university's activities and the pivotal role in territorial development. Currently, KT assumes a central importance to university. A broad notion of KT includes both the science commercialization and other activities related with the civic role of university. As a central topic for policy, KT gained relevance with the introduction in the 80's of the Bayh-Dole Act in the US. Berman (2008) stressed the usefulness of this act as a process of institutionalization of a number of practices underlining the importance of transfer activities, in particular, the economic benefits resulting from publicly funded research patents, creating incentives and changing practices and routines. In Europe, the recognition of a European paradox, the better performance in scientific research than in innovation, brought KT to the centre of policy debate in the mid-nineties.

Universities and firms interact in a huge diversity of ways. D'Este and Patel (2007) have showed that KT occurs through multiple channels and are not limited to the classical formal mechanism of industrial property rights (IPR) licensing, collaborative projects or spin-off creation. In fact, these authors found econometric evidence on the impact of informality. KT happens in an interface area where the worlds of science, industry and government overlap. Different types of bodies have emerged, acting as intermediaries. Howells (2006) debates the diversity of intermediaries within an innovation system. Intermediaries have a systemic value in policy terms. Even if the understanding of the true impact of intermediaries is difficult given their indirect (and intermediate) effect in the value chains it is evident that they improve not only the connectedness between the components of the system but are usually the animators of other relevant actors engaged in innovation.

The KTOs are one of these new intermediaries that can be seen as boundary organizations, mediators internalizing the contingent nature of the scientific reality in their everyday practice, creating border objects for the collaboration between different worlds (Guston, 1999). Siegel et al (2003) accept that KTO are boundary spanning actors but they conclude that the characteristics of the KTO staff restrict the office's approach to KT activities. Personnel with careers linked with Law tend to focus in the protection and licensing of IPR and staff with industrial experience prefers spinning-out as the

favourite KT mechanism. The KTOs have become central actors in the governance of KT. Debackere and Veugelers (2005) discuss the organizational structures of the KTOs for their success, exemplifying with a in-depth case study in Belgium. The national environment, the institutional architecture, the history of the university and the specific construction of each KTO are factors that impact in the approach of each office. Several factors are critical for the governance of KT but these authors argue that an adequate incentive structure for academy members, the professionalization of the KTO staff and the high autonomy of decision in the KTO are absolutely crucial.

Geuna and Muscio (2008) argue that a high diversity of answers exist in the governance of knowledge transfer in the universities. This variety is evident in Europe, and it is justified by different science and technology structures that conducted to specific patterns in the historical construction of university-enterprise relations. The authors underline the diversity of KTO organizational models in Europe but the similar goal, usually bridging university and industry and not only marketing the university research. Knowledge transfer is a third main university activity and the majority of proposals of policies are oriented to its professionalization. Bonaccorsi and Daraio (2009) characterized and classified the universities in the European system using cluster analysis. The structural distinctions are mainly associated with differences in strategic orientation of universities related with the research or teaching focus. In most European countries there are no discernible differences across universities along these dimensions. Those countries in which universities are more differentiated according to research or teaching dimensions have implemented policies for differentiation through a variety of policy instruments. The universities in these countries are internationally highly ranked what suggests a structural linkage between the poor performance of European universities in research-based rankings and the lack of differentiation.

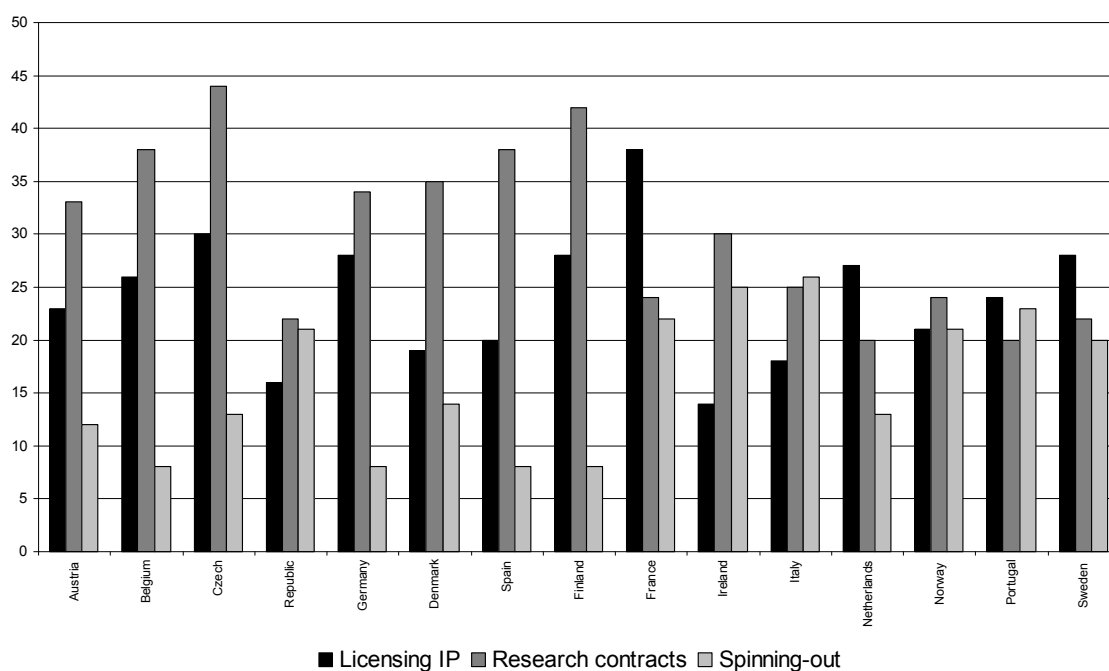


Fig. 1: European Diversity of KTO, Allocation of Time by type of Formal Mechanism (%)

Source: Personal Elaboration with data from CEMI (2008)

Rasmussen et al (2006) have found different approaches to promote the commercialization of science comparing four cases in universities in Finland, Ireland, Norway and Sweden. Even countries that have somewhat similar institutional configurations, the UK and the US, linked with a liberal/market oriented type of variety of capitalism show substantial diversity in KT relations (Decter et al, 2007). Different countries present different trajectories in their KT processes and different kinds of capabilities. The diversity of KT can be easily accessed by the different time allocation to knowledge

transfer mechanisms (CEMI, 2008). As illustrated in figure 1 there is relevant national contrasts even if we only focus the three main formal mechanisms.

For Geuna and Muscio (2008), even in the intra-national scale, regional disparities that are anchored in economic specialization and research market potential create a problem of adaptation of good practices; an adequate KT tool in a specific university cannot be replicated in a simplistic manner.

3. Research Focus and Methodology

The article focuses on three Portuguese universities: Algarve, Aveiro and Coimbra. The choice of these universities is justified by its central role in terms of regional development. The three universities are outside of the two most relevant metropolitan areas in Portugal (Lisbon and Porto) and had a significant impact in the qualification of the human resources and local dynamics. However the cases are different in terms of critical mass, history and linkages with industry which has created specific configurations. Personal interviews to the KTO coordinator (or indicated KT officer) and the collection of secondary information facilitated the systematization and comparison of the mission, motives and moment for the creation, organizational structure and crucial results of the three KTOs.

The analysis, framed under the Actor-Network Theory (ANT), tries to understand KT by tracing the associations that each KTO has done to succeed. ANT has been developed in the field of Science and Technology Studies (some examples are Callon, 1989; Callon, 1998; Callon, 1999; Latour, 1986; Latour, 1987; Latour, 2005), and while its understanding as a theory is often criticized, in this article ANT is used as a research tool to open up the box of KT. At the core of ANT is the concept of translation, how the actors constantly engage in a process to translate their languages, their problems, their identities and their interests into others.

In a different disciplinary tradition, these notions have affinities with institutional analysis by bringing attention to the process of change through temporary stabilizations and facilitating the analysis of the process of institutional change itself. Streeck and Thelen (2009) debate that the institutional analyses are too often anchored in a dubious notion of stability that abstracts from change and time variant elements. One example is the varieties of capitalism approach (Hall and Soskice, 2001; Amable, 2005). Even when the possibility of change exists it is considered as an exogenous reality that is going to originate a new equilibrium. Berman (2008) analyzes the institutional change that resulted in the Bayh-Dole Act and the right of the universities to retain title of the government-funded inventions. Berman believes that institutional theories sometimes do not avoid the problem of rigid structuralism. Understanding institutions also as solutions for social problems facilitates the analyses of how actors develop, work and cooperate, how policies are created and implemented and how change occurs. In this way such an institutional approach resembles the mediation and translation process that is central to ANT (*ibidem*: 839).

4. Institutional Change and the Construction of Actor-Networks in Portuguese KT

4.1. Recent Evolution in KT Context in Portugal

Portuguese universities have been increasingly facing the international dynamics requiring an enlarged role of the universities. In 2007 the legal framework around Portuguese Higher Education Institutions (HEIs) has changed with the Law No. 62/2007 of 10th September (known as RJIES). This law establishes the regulations for HEIs; their constitution, functions and organization, functioning and competence of its organs and furthermore, the authority and supervision of the public state over them, as part of its autonomy. The new roles of HEIs are clearly defined, including the right and duty to participate individually or through their units, in activities to connection with the society, in particular for dissemination and knowledge transfer, as well as economic utilization of scientific knowledge. While these dynamics have been progressing throughout the last decade, this legislation required a large effort of adaption of the universities to the new legal context, creating new internal structures and reorganizing the functions within the university, new actors and institutions for the governance system and an increased interest in opening to society. This was followed by changes in the academic career structures, including the recognition of the contribution of lecturers and researchers towards KT activities.

The changes were strongly felt with the emergence of new incentives and schemes to engage researchers and firms in these activities, the design of new legal instruments, with the simplification of IPR codes and the creation of reference guides to spinning-out processes, or the emergence of new actors such as the KTOs. KT has been making increasingly, part of the concerns of policymakers, who fostered in Portugal, particularly since 2000, an increase of government programmes for this theme. These activities were stimulated in particular with the creation of new intermediation actors within the scientific system (universities and polytechnics) and the technology system (S&T parks and industrial associations), a network of units of industrial property rights promotion (UIPP/GAPI) and offices for technology transfer and innovation (OTIC).

4.2. Three Case Studies of Intermediation Actors in Portugal

Intermediation in the Algarve

The University of Algarve (UAlg) is a young public HEI located in the Algarve, region well known internationally by its tourism specialization. It was created in 1979 and as currently around ten thousand students. UAlg is located in four campuses (three in Faro and one in Portimao). The main research areas are Marine Sciences, Arts and Culture, Tourism and Regional Development and Agro-food Engineering.

The Algarve's Regional Innovation Centre (CRIA), is a initiative of 2003, mainly a regional policy-push project benefiting from European funds financing. This interface entity was established within the UAlg to promote relations between universities and enterprises, support the establishment of new firms, the use of IPR and to develop, outside the university, technological agglomeration areas in the region. The genesis of CRIA is INOVAAlgarve, a project under the European Programme of Innovative Actions that defined as essential the creation of an interface actor to promote relations between science and business. CRIA was born from the idea of creating this unit. The current rector Joao Guerreiro (at that time, between 2003 and 2005, the Pro-rector and President of the regional authority CCDR Algarve) formalized the existence of CRIA in partnership with this organization, the National Association of Young Entrepreneurs (ANJE) and the Business Association of the Algarve Region (NERA). CRIA's activities continued with the UIPP/GAPI and OTIC financing.

The success of the CRIA's intervention has been recognized with regional and national participations in various networks and in strategic studies and innovation plans. The lack of density in terms of innovation actors in this region gave to this KTO a broader role than a simple transfer office. It assumes a central place in the connectedness of the innovation system. At the European level, the distinctions from the European Commission and the ERIK Network in 2007 and, more recently, approval for multiple projects in programs of European cooperation in innovation and knowledge transfer as the INTERREG Programme, which includes the leadership of the project KIMERAA - Knowledge transfer to Improve Marine Economy in Regions from the Atlantic Area, between 2010 and 2012, are relevant aspects to underline. The university absorbed the entity for its functional structure in 2010 turning it into a division – the Division of Entrepreneurship and Knowledge Transfer.

CRIA's efforts in bridging science to business have been made in four different ways: i) the implementation of initiatives that seek to increase levels of entrepreneurship, ii) the support for knowledge-based entrepreneurs, iii) supporting businesses seeking to establish networks with the university and, finally, iv) support researchers who have entrepreneurial dynamics and look solutions to enhance their knowledge by transferring it to companies. The CRIA focus and its main results were connected to the areas of spinning-off, where this KTO collected a relevant expertise, especially in the marine sector, and was able to create a diversity of border objects to stimulate the creation of advanced firms (figure 2).

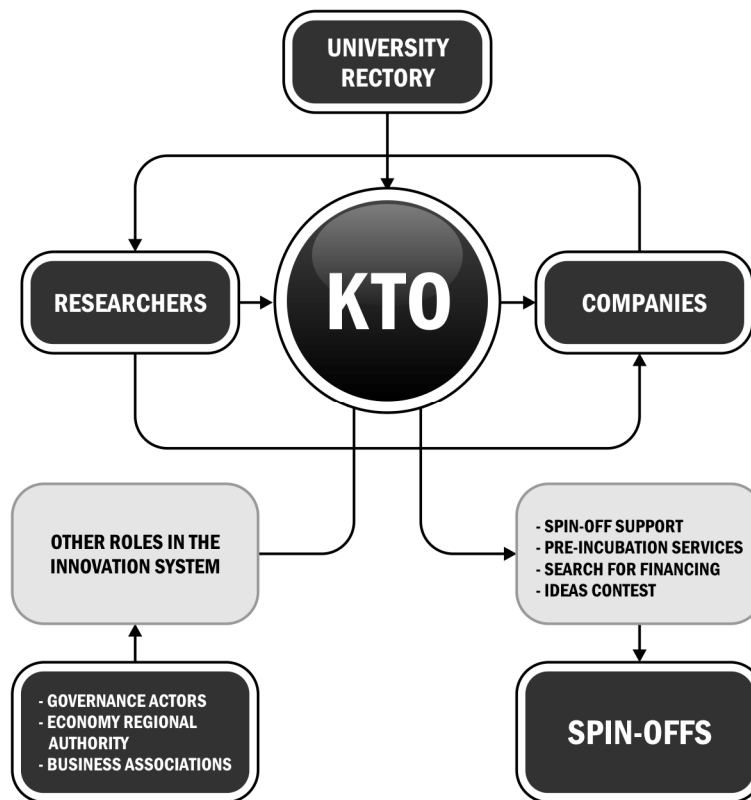


Fig. 2: The Focus of CRIA
Source: Personal Elaboration

The collaborative projects and IPR valorisation is at an incipient stage. The positive aspects of CRIA, in the vision of the interviewee are linked with the flexibility and informality that have stimulated different sorts of networks. The central aspect to improve is the characteristics of the staff and their excessive occupation in other faculty responsibilities. Finally, the work processes are not standardized and the results are roughly evaluated (table 1).

Positive Aspects	Aspects to Improve
"The high degree of informality, which generates flexibility, contacts and structuring activities." "An external team created for the purpose (...)" "The experience and networks of contacts of the coordinator coming from the business and his practice in associations (...)" "Participation in International and European networks and initiatives in KT to benchmarking processes (...)"	"(...) the lack of performance evaluation may have affected the recent team's performance (...)" "Lack of technological skills of staff and of vocation for the brokering of some team members." "(...) a deficient work processes motivates the frustration of some specific stakeholders (...)" "A disproportionate allocation of employees to other duties extra-KTO (...)"

Table 1: Self-analysis of CRIA functioning

Intermediation in Aveiro

The University of Aveiro (UA) is a public HEI located in the city of Aveiro. Built in 1973, quickly became a benchmark in terms of university research in the fields of Information Technology, Electronics, Materials, Physics, Mathematics and Communication. The university is also known for its international programs for student mobility. Currently with around twelve thousand students, UA is located almost entirely on Campus Santiago, Aveiro, where the various departments and independent sections, such as the library, laboratories and major services are.

The UATEC - Unit of Technology Transfer is the mediator of KT at UA. The unit, focusing the acquisition, administration, negotiation, assessment and evaluation of technologies, the IPR protection and commercialization, has a peculiar characteristic of a relative intensive demand-side effort that stimulates the linkages in university-industry relations. The creation of UATEC was initially idea of a manager of a technology transfer from an UA associated laboratory that presented the idea to the rector in the year 2005. The UATEC begins with the launching of the OTIC Program. The unit initially began with a small, number of staff and was gradually increasing. It is constituted by the Director of the unit and (now) four senior technicians. It is directly under the Rector, or by delegation to a vice-rector, supervision. The UATEC is not considered a division even if formally is. It is part of the rector and provides services to the entire university, all departments and all research units. For its director, this has serious implications in the work processes. When talking about UATEC is not about a division or a department but the interests of the university.

There are three large areas of action. One is the technology-based entrepreneurship. When a new firm is created the process moves to another entity in the University, Grupunave that supports the incubation process and the consolidation of the firm. Another major area of concern is innovation. Innovation is, for UATEC, a big "hat" that goes from providing services to contract R&D, collaborative projects and research that promote new product and process at the firm-level. To connect the university with market, UATEC uses a system of six / seven pivots that detect the most relevant opportunities inside each specific research areas (figure 3). UATEC wants to create around ten pivotal researchers for the main university's areas in the near future. A third area of concern is the question of UA's intellectual property. IPR is where the support to UIPP/GAPIs is inserted.

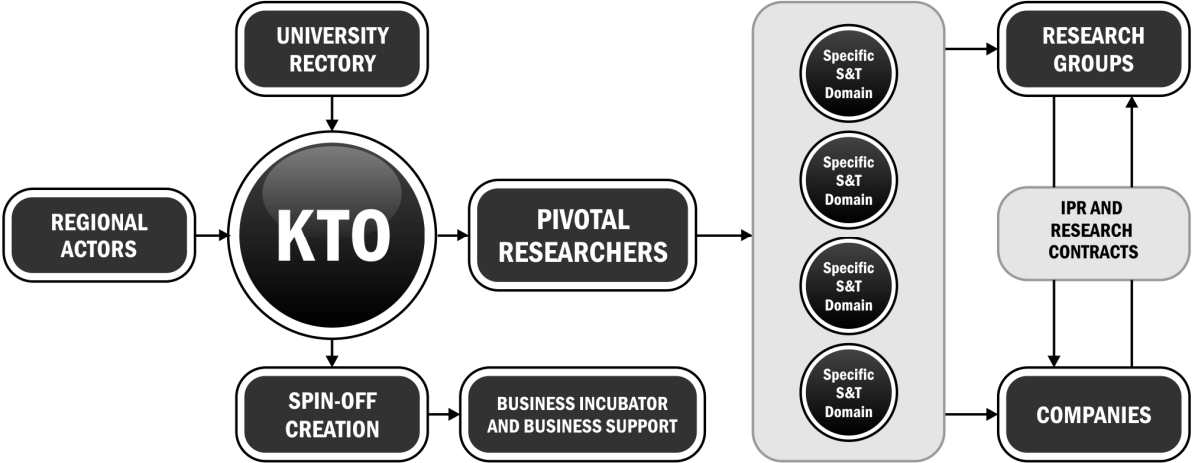


Fig. 3: The Focus of UATEC
Source: Personal Elaboration

UATEC is well connected with professional associations, sectoral associations, and even the CCCR Centro. It is relevant to refer that UA is located in a very interesting triangle that links this university with the University of Coimbra (also in the Centro region) and the University of Porto (UP), the main university in the North region, and the biggest of Portugal in terms of students and very relevant in research capabilities. Two of the intermediary organizations of UP, the knowledge transfer office, University of Porto Innovation (UPIN) and INESC Porto (Institute for Systems and Computer Engineering of Porto) are often referred as practices to benchmark at national level. This triangle creates a significant critical mass and facilitates the conception of common strategies and collaborative work focusing some specific scientific domains or economic clusters. Recent examples are linked with biosciences, human health and creative industries. The director of UATEC considered is unit as one of the best performers and qualified KTOs in the country. In terms of limitations it was referred the restrictions in the specific work processes, in terms of standardization and evaluation (table 2).

Positive Aspects	Aspects to Improve
<p>"Thus, without false modesty, I think we are one of the KTOs in the country that at least knows what are doing."</p>	<p>"Often policies are too show-off with no real meaning." "Critical is the question of size. When in UATEC you have four people working in a specific topic in a US KTO you may have forty. While we produce thirty patents a year, they produce thirty a month." "Internally there is a point we have to improve, the systemization of all internal processes from patenting, entrepreneurship, industrial property, contracts with companies. Skip the amateurism to professionalism." "We need to measure and then we will be able to manage (...) then be improved." "The issue of pivots is essential. But it is something that depends not only on UATEC, but on the Rectory, research units, departments, and so on. It's something fundamental that needs to be enhanced, because in reality it will allow us to have our "tentacles" in the various research units." "Regionally, we are currently doing the construction of a science and innovation park which is fundamental to obtain the support of businesses, associations and local authorities."</p>

Table 2: Self-analysis of UATEC functioning

Intermediation in Coimbra

The University of Coimbra (UC) is the oldest and most traditional Portuguese university, having received its first statutes in 1309. During the seven centuries of existence, UC is linked with the dissemination of Portuguese culture in the world and knowledge production. UC is consistently ranked among the best universities in Portuguese in several scientific areas both in education and in research. UC has currently about 22,000 students and is spread by all Coimbra's with different poles, faculties and services contributing crucially for the city dynamics.

The case of Coimbra was explored by Marques et al (2006) using a TH framework to understand the growing relevance of innovation in UC and its attention with the collaborative efforts with industry and governance actors. Instituto Pedro Nunes (IPN), the focus of our case study was underlined in this opportunity as a crucial structure in the TH system. IPN was created in 1991, a pioneer initiative in Portugal at the time as a non-profit private organization to promote a culture of innovation, quality, competence and entrepreneurship. IPN was stimulated initially by the UC Rector, who found of central relevance the creation of an interface institution between academia and business. It exists in the current facilities since 1995 and with a new building since 2008.

The institute develops three main groups of activities (figure 4): applied research through its own laboratories in various domains; training activities in technical areas and in areas that interest the incubated companies; and, incubation of technology-based companies. There are laboratory units in different areas such as testing of materials, geotechnical engineering, systems, corrosion and pharmaceutical industries. The model of management is the same for all laboratories, a laboratory director, a PhD holder from UC, commonly a Professor from the Faculty of Science and Technology. In parallel, exists the figure of an operational director, responsible for daily management of the laboratory, usually a researcher from the staff structure of IPN. The incubator unit, which has been praised internationally, is now autonomous. In Portugal there is no other university-based incubation project with an impact comparable to IPN. It generated a number of success cases, more than one hundred companies with a survival rate of eighty percent. The IPN has also a unit called IPN VCI (Valorisation of Knowledge and Innovation) which intends to help KT and the protection of intangible assets. IPN is providing some services outside these main areas, for example, technology assessment in industry, support to R&D project applications to firms, and the management of UC's IPR.

The institute has two different branches of work processes. First is a stage where the researcher has an idea and wants to protect it and prevent things from falling into the public domain. The second level relates to a support closer to the market. The work relates with the incubator, to legally constitute the firm, the elaboration of the business plan, the structuring of financial data that will sustain the strength

of that project. This project is then submitted to a panel of approval from the incubator and if accepted, the idea will then have a placement in IPN for no more than three years.

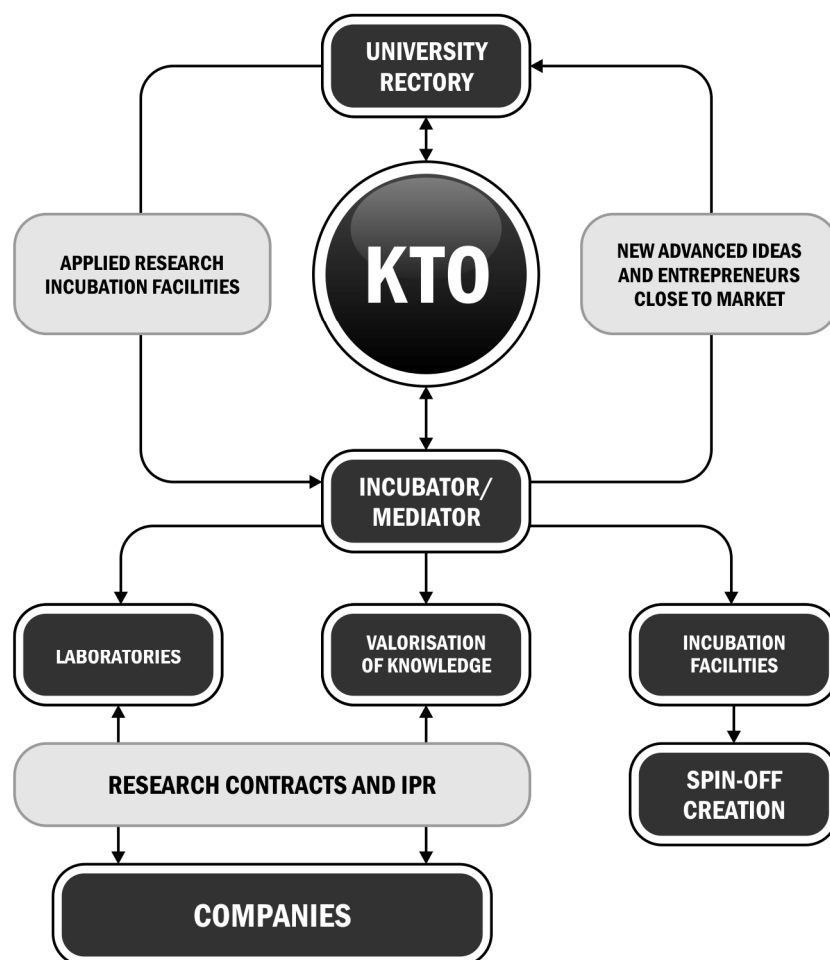


Fig. 4: The Focus of IPN
Source: Personal Elaboration

The IPN has about forty people. The area with more personnel is the laboratories. The VCI has a multi-disciplinary staff from Economics and Management, Law and Pharmacy. IPN has no direct public funding for its operation, the criterion is to survive with the income internally generated. It is also dependent on the national programmes that have existed for stimulating this kind of activities such as the UIPP/GAPI network. The status of member of IPN depends on that a specific organization or an individual person pays for an investment unit. The IPN has in its statutes that the majority of the units must be owned by the UC, which always will have the right to appoint the chairman and vice chairman of the board.

The collaboration with a more recently created KTO in the university is, in the vision, of the interviewee, the best. IPN was already working in this area and the KTO, since its beginning looked for cooperation. IPN and the KTO established informal and personal ties, friendship in some cases, creating a very strong team at the regional level. They cooperate daily in managing university projects. The majority of the governance actors, like the regional authority (CCDR Centro) or the municipality of Coimbra are very confident in the work of IPN.

Interview data permits to structure a self-analysis of the positive aspects and aspects to improve in IPN (table 3). The most positive aspects underlined were the broad area of intervention of the organization and the record of technology-based firms that emerged with the support of the institute.

The limitations are linked with the excessive work load on other (more irrelevant) functions and the continuous need to upgrade the quality of the staff in KT.

Positive Aspects	Aspects to Improve
<p>“The multiplicity of valences IPN offers and its follow-up. For a technology company there are very few Institutions that can offer design, collaboration and assistance, in the different areas of the accounting, banking relationships, registration of intellectual property.”</p> <p>“(…) the history of undeniable successes that started here, not started anywhere else.”</p> <p>“(…) the close link with the university and industry, and all the synergies that might arise.”</p> <p>“(…) the independence that this institution has.”</p>	<p>“The need to liberate some people from certain kinds of functions.”</p> <p>“(…) try to enrich a little more the teams to provide a higher quality support for the community.”</p>

Table 3: Self-analysis of IPN functioning

5. Contributions and Implications

Knowledge transfer assumes today a crucial role in the life of a university. It is not only implemented with the expectations of gather additional financial resources but it is crucial to embed the university in the territory and to create linkages between the university and the economic needs of the region expressed by the demands of R&D in the firms. The Portuguese reality had major modifications in a recent past, with the legal framework of universities changing dramatically its governance and the requirements in opening to society. KT was explicitly one of the activities underlined as crucial to engage with communities in a way to produce a higher share of scientific knowledge with capacity to be rapidly explored economically. Several KTOs emerged in Portugal in all universities and in the majority of other HEIs, research units and technologic centres.

The article explored the cases of three intermediation actors, IPN in Coimbra, CRIA in the Algarve and UATEC in Aveiro. The results underline the considerable heterogeneity of approaches to answer the new challenges that universities in Portugal face. Despite the specific features of each KTO, these organisms commonly evidenced the crucial impact for the KT Actor-Network creation, assuming themselves as translation enablers in a relevant proportion of the processes in their regional intervention area. An evident limitation of the study is the difficulty to compare the cases. As one of the interviewees has stated:

“We are talking about one university that is the most recent in Portugal, and another that is the oldest in the country. What similarities can we find here? Very few. Each of the offices that exist in these various universities, taking into account their reality, had to intervene in very different ways. But I think that their actions and activities have been adapting successfully to their contexts.”

Regarding effectiveness, the interviews pointed out some important implications. It is relevant to the KTO to improve mutual understanding between universities and firms and create stable channels and communication routines. The work processes should have a certain degree of (internal) standardization guaranteeing that different researchers have the same support taking into attention that excessive bureaucratization may turn out to be negative (but this impact depends heavily on the institutional context). It is central to provide staff the right competencies in terms of management skills and scientific-technological backgrounds. The relevance of other types of expertise for the KT staff is huge, networking and promotion of cooperation skills are not typically valued as central elements but for KT are absolutely vital. The staff in the Portuguese intermediation organizations is too often spending high proportions of time in secondary activities of dubious added value. KT activity has to be very well thought out, must be thoroughly examined and above all it must be managed as firm. Nevertheless profit in KT is an objective but cannot be the ultimate goal. A culture of evaluation of results is essential to facilitate planning and management of the activities. Each university should have a commitment with the KTO avoiding the excessive dependence on short-term projects and financing. It is crucial to improve the skills of all researchers in this area. It is especially important to avoid

mistakes, mainly in terms of fatal disclosures, the training in the detection of promising technologies, and even the introduction of the university curriculum chairs in the sciences and KT. In most courses people may be called to work in KT in the future, those who have jobs will be called to go abroad. The proof of concept for KT is fundamental, but a necessity that is not being taken in the correct direction. Policy-makers designed some funds but more connected with the company creation.

To these limitations, it is important to underline the merit of a recent Portuguese initiative, the University Technology Enterprise Programme (UTEN). UTEN is a network of professional KTOs focused on the commercialization and internationalization of Portuguese S&T, managed by University of Texas at Austin. It is a collaboration that intends to benchmark US KT best-practices, adapt and apply these tools in the Portuguese framework. The member organizations include universities, polytechnic institutes, associated R&D labs, university-linked incubators and science parks that participate in workshops and conferences, international internships, on-the-job training and observation and assessment. It is a project that has allowed several moments of networking between national institutions and people in KT, some of them that did not know each other, with members from the UIPP/GAPI network and other people who had no contact with the network. This network has increased internal UTEN collaborations and contacts. The international experience and learning was also relevant but, as commented in all the interviews (the three organizations participate in UTEN), the program has several limitations and the major one is the capacity to replicate the methodologies and ideas coming from US universities in the Portuguese reality with a diversity of economic, scientific and institutional contexts. Even comparing the three cases, as done in this article, it was possible to illustrate different approaches to KT and the impossibility to replicate the exact same models in each one of the KTOs. The direct transference of the ideas of Austin, Carnegie Mellon or Cambridge may not suit as well for the regional realities as the ones that are already being implemented by the KTOs in their specific contexts.

Acknowledgements

Hugo Pinto gratefully acknowledges the financial support from the *Fundação para a Ciência e a Tecnologia* (grant ref. SFRH/BD/35887/2007). This author is thankful to the *Instituto de Estudos Sociais Avanzados del Consejo Superior de Investigaciones Científicas* in Cordoba for receiving him as a visiting scholar during the course of this research. The authors acknowledge the availability of João Guerreiro (Rector of the University of Algarve), João Paulo Rainho (Director of UATEC) and José Ricardo Aguilar (IPR Legal Adviser at IPN) for extensive interviews and in the supply of secondary information. The support of Helder Rodrigues (University of Algarve) in designing the figures presented is gratefully acknowledged.

References

- Amable, B (2005) *Les cinq capitalismes: Diversité des systèmes économiques et sociaux dans la mondialisation*. Paris: Seuil.
- Berman E P (2008) Why Did Universities Start Patenting? Institution-Building and the Road to the Bayh-Dole Act, *Social Studies of Science*, 38, 835-871.
- Bonaccorsi A and Daraio C (2009) Characterizing the European university system: a preliminary classification using census microdata, *Science and Public Policy*, 36, 763-775.
- Callon M (1998). *The Laws of the Markets*, Oxford: Blackwell.
- Callon M (1999). Some Elements of a Sociology of Translation, in Biagioli, Mario (eds.) (1999) *The Science Studies Reader*, New York and London: Routledge, 67-83.
- Callon M (ed.) (1989). *La science et ses réseaux: Genèse et circulation des faits scientifiques*, Paris: La Découverte.
- Castaldi C and Dosi G (2003) *The Grip of History and the Scope for Novelty: Some Results and Open Questions on Path Dependence in Economic Processes*, LEM Papers Series 2003/02, Laboratory of Economics and Management (LEM), Sant'Anna School of Advanced Studies, Pisa, Italy.

- CEMI (2008) The CEMI Survey of University Technology Transfer Offices, Report prepared by Conti A and Gaule P, Collège du Management de la Technologie, Chaire en Economie et Management de l'Innovation de École Polytechnique Fédérale de Lausanne.
- Debackere K and Veugelers R (2005) The role of academic technology transfer organizations in improving industry science links, *Research Policy*, 34, 321-342.
- Decter M, Bennet D and Leseure M (2007) University to business technology transfer – UK and USA comparisons, *Technovation*, 27, 145-155
- D'Este P and Patel P (2007) University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry?, *Research Policy*, 36, 1295-1313.
- Etzkowitz H and Leydesdorff L (eds) (1997) *Universities and the Global Knowledge Economy – A Triple Helix of University-Industry-Government Relations*, London: Continuum.
- Etzkowitz H and Ranga M (2010) A Triple Helix System for the Knowledge-based Regional Development: From “Spheres” to “Spaces”, 8th Triple Helix Conference.
- Etzkowitz H., Webster A, Gebhardt C, Regina, B, and Terra, C (2000) The future of the university and the university of the future: Evolution of ivory tower to entrepreneurial paradigm, *Research Policy*, 29, 313-30.
- Geuna A and Muscio A (2008) The Governance of University knowledge transfer, SEWPS, paper no. 173, SPRU Electronic Working Paper Series, University of Sussex.
- Gibbons M, Limoges C, Nowotny H, Schwartzman S, Scott P, and Trow M (1994). *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, London: Sage.
- Gunasekara C (2006) Reframing the Role of Universities in the Development of Regional Innovation Systems, *The Journal of Technology Transfer*, 31, 101-113.
- Guston D H (1999) Stabilizing the Boundary Between US Politics and Science: The Role of the Office of Technology Transfer as a Boundary Organization, *Social Studies of Science*, 29, 87-111.
- Hall P A and Soskice D (2009|2001) “An Introduction to Varieties of Capitalism”, in Hancké, B (ed.) (2009) *Debating the Varieties of Capitalism – A Reader*. Oxford: Oxford University Press
- Howells J (2006) Intermediation and the role of intermediaries in innovation, *Research Policy*, 35, 715-728.
- Latour B (1987). *Science In Action: How to Follow Scientists and Engineers Through Society*, Cambridge Mass, USA: Harvard University Press.
- Latour B (2005). *Reassembling the Social: An Introduction to Actor-Network-Theory*, New York: Oxford University Press.
- Latour B (1986). *Visualization and Cognition: Thinking with Eyes and Hands*, *Knowledge and Society*, 6, 1-40.
- Marques J, Caraça J and Diz H (2006) How can university-industry-government interactions change the innovation scenario in Portugal? – the case of the University of Coimbra, *Technovation*, 26, 534-542.
- Rasmussen E, Moen O and Gulbrandsen M (2006) Initiatives to promote the commercialization of university knowledge, *Technovation*, 26, 518-533.
- Rodrigues C (2008) *Universities and regional development: a new perspective on the second academic revolution*, Doctoral Thesis, Universidade de Aveiro.
- Siegel D, Waldman D and Link A (2003) Assessing the impact of organizational practices on the relative productivity of university technology transfer offices: an exploratory study, *Research Policy*, 32, 27-48.
- Streeck W and Thelen K (2009|2005) “Institutional Change in Advanced Political Economies” in Hancké, B (ed.) *Debating the Varieties of Capitalism – A Reader*, Oxford, Oxford University Press.

Uyarra E (2010) Conceptualizing the Regional Roles of Universities, Implications and Contradictions, European Planning Studies, Volume 18, 1227–1246.

Whitley R (2007) Constructing universities as strategic actors: Limitations and varieties, Communication in “The University in the market” Symposium, Stockholm, 1-3 November.

Other Relevant Documents Analysed

Programa de Candidatura a Reitor da Universidade do Algarve, Estratégia para Uma Universidade Comprometida, Criativa e Empreendedora, João Guerreiro, Janeiro 2006 [Program Application for Rector of the University of Algarve, A Strategy for a Concerned, Creative and Entrepreneurial University, Joao Guerreiro, January 2006]

Programa de Acção, Candidatura a Reitor da Universidade do Algarve, João Guerreiro, Outubro de 2009 [Action Programme, Rector of the University of Algarve, Joao Guerreiro, October 2009]

Candidatura a Reitor da Universidade de Aveiro, Programa de Acção 2010 – 2014, Manuel António Cotão de Assunção, Janeiro 2010 [Application for Rector of the University of Aveiro, Action Programme 2010 - 2014, Manuel Antonio Cotão de Assunção, January 2010]

Universidade de Coimbra, UC em Números, Outubro de 2009 [University of Coimbra, UC in Numbers, October 2009]

RJIES - Regime jurídico das instituições de ensino superior, Lei n.º 62/2007, Diário da República, 1.ª série — N.º 174 — 10 de Setembro de 2007 available online at http://www.ig.mctes.pt/docs/LEI_62.pdf

Visited Online Sites

University of Coimbra: www.uc.pt

University of Aveiro: www.ua.pt

University of the Algarve: www.ualg.pt

IPN: www.ipn.pt

UATEC: www.ua.pt/uatec/

CRIA: www.cria.pt

UTEN: <http://utenportugal.org/>

Annex 1

Roles, determinants and engagement modes of universities

Model	Knowledge 'factory'	Relational university	Entrepreneurial university	Systemic university	Engaged university
Main Role of universities	Producer of scientific knowledge	Exchange of knowledge	Active commercialisation role	Boundary-spanning role	Developmental role
Main Unit of analysis	Innovation outputs	Linkages	Intermediaries (ILOs/TTOs)	Systems/networks	Spaces of governance
Main partners /beneficiaries	High-tech firms located in proximity to universities	Large manufacturing firms	Large manufacturing firms Spin-off firms	Regional clusters Regional SMEs	Regional stakeholders
Directionality of engagement	Unidirectional (implicit)	Bi-directional (implicit)	Bi-directional (explicit)	Triple-helix (university, industry and government)	Responsive
Dominant methodology	Industrial surveys Citation count Production function analysis	Industrial surveys Case studies	Surveys of university TT managers	National and regional innovation surveys Case studies	Case studies
Key factors influencing impact	Research intensity/inputs Geographical proximity Industry sector	Structural factors (Size of firm, age, sector, R&D intensity); Innovation strategy	Organisational structures/forms Managerial practices Faculty behaviour/incentives	Regional system configuration Regional policy Institutional capacity of universities	No. and synergies between universities University leadership Joined up policies/incentives
Policy implications	Co-location of firms and universities. Increased funding for research	Some links should be promoted vis-à-vis others	Intermediaries and organisational arrangements/incentives are needed to ensure links	Institutional arrangements are important to ensure linkages	Joining up of universities missions and other policies at different levels

Source: Uyarra (2010)