

# **TTOs and Successful University Spin-offs: A Co-Evolutionary Perspective**

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## **Abstract**

In recent decades, the debate around the interacting role played by university, industry and government in supporting innovation dynamics has gained substantial importance in literature. To understand the specific contribution of university in promoting innovation through technology transfer, more theoretical and empirical research is required. This paper addresses this need by examining the role played by TTOs in a co-evolutionary perspective and through the analysis of one Italian and two Spanish case studies. Findings show that technology transfer processes able to generate successful USOs are result of effective multi-level co-evolutionary adaptations within university and between university, industry and government.

**Keywords:** Co-evolution, Knowledge and Technology Transfer, International Comparison

## **Introduction**

In a knowledge-based society, university is a critical development actor generating the most important raw material for regional socio-economic growth and competitiveness (Etzkowitz and Leydesdorff, 2000). University plays a strategic role in enhancing entrepreneurial activities based on innovation by exploiting and diffusing scientific knowledge mainly through the formation of research-based firms led by scientists, the so-called University Spin-Offs (USOs) (Chiesa and Piccaluga, 2000).

Over the past two decades, the debate around the interacting role played by university, industry and government in supporting innovation dynamics has gained substantial importance in literature, following the impact of the Bayh Dole Act (1980) on the research mission of university. In this vein, the Triple Helix of innovation (e.g., Etzkowitz and Leydesdorff, 2000) refers to university, industry and government as relatively equal, independent and interacting institutional spheres whose increasing linkages facilitates technology transfer from university to industry. Over the years, the original model has been enriched with the sustainability concept through the addition of a fourth and a fifth helix (Carayannis and Campbell, 2010), and the development of a “Sustainability-twin Helix model”, that balances development and sustainability (Etzkowitz and Zhou, 2017).

Beyond the issue of the number of the helices, the contribution of the Triple Helix to the analysis of innovation processes lies in the holistic perspective of the mutual relationships between the spheres, as well as their evolutionary dynamics over time. Moreover, the systemic dimension of triple helix interactions constitute the *ratio* of the model. However, there are calls to investigate deeper the level of sphere-specific actors and the way interaction dynamics are influenced within each sphere (Etzkowitz and Ranga, 2015), adopting a multi-level analysis (Rasmussen *et al.*, 2014).

Based on such assumptions, the purpose of this study is to increase our understanding of the specific contribution of the single university-sphere in promoting innovation through knowledge and technology transfer processes. This issue can be properly addressed by adopting the co-evolutionary approach to the analysis of the interactions – and their variation over time – that takes place at different levels within universities. In this view, technology transfer processes able to generate successful USOs are result of effective multi-level co-evolutionary adaptations.

In particular, the study has focused on the following research questions (RQ):

RQ(1): Why and how does the co-evolutionary approach explain the innovation dynamics in the university-sphere, and how TTOs contribute to these dynamics?

RQ(2): What are the main determinants able to promote effective technology transfer process from university to industry?

RQ(3): Do these determinants change in relation to the different temporal phases of this process and to different local contexts?

In order to reach its aim, this paper analyses the knowledge transfer processes activated by TTOs in Italy and in Spain through USO support programs, such as the business plan competitions, aimed at promoting the creation of successful USOs.

The paper is structured as follows. First, a description of TTO and USO is provided. Then an interpretative framework to the analysis of the role played by TTOs in promoting technology transfer according to the co-evolutionary perspective is presented. Then, this framework is tested through the investigation of three case studies, and findings are gathered. Finally, discussion, conclusions and suggestions for future studies are presented.

### **TTOs as overall infrastructures and USOs**

Technology transfer can be variously interpreted according to different definitions and perspectives present in literature. A shared definition is that provided by AUTM (2003), which generally states that «technology transfer is the formal transfer of new discoveries and innovations resulting from scientific research conducted at universities and non-profit research institutions to the commercial sector for public benefit».

Most of universities around the world have constituted specific organizational units, the TTOs, devoted to favour the technology transfer activities from university to industry. To this end, TTOs can be accompanied by other interface structures such as incubators and accelerators, science and technology parks, and university-enterprise foundations. Also, universities can outsource some technology transfer activities to external partners (e.g., private companies, Chambers of Commerce, other public agencies) or jointly coordinate these activities together with them. As a matter of fact, there is no unique model for managing the technology transfer processes (Debackere and Veugelers, 2005; Conti *et al.*, 2011). In this paper, with TTO, we intend the overall technology transfer infrastructure, including all the internal centralised/decentralised units and the external networked organizations, which harmoniously act as a whole entity.

USOs are one of the most challenging form of technology transfer whose business models are directly related to the R&D activities performed inside university departments.

In their formation and development phase, USOs usually benefit from services provided by TTOs through supporting schemes or programs (Aguirre *et al.*, 2006). In this regard, USO support programs are powerful and effective tools to: *i*) spreading of the entrepreneurial culture within the university; *ii*) educating people who are interested in starting a new venture; and *iii*) encouraging the creation of USOs. As such, these supporting programs can be considered as education-oriented market mechanisms positioned at the crossroad between entrepreneurial exploration and exploitation processes. Indeed, through appropriate educational programs faculty members and other research staff are facilitated into framing their business solution and seeking market opportunity; moreover, these programs provide further competencies for evaluating and exploiting the identified technological opportunities through business plan competitions, mentoring activities, informal meetings. Viable spin-off projects are usually rewarded by TTOs through further services such as legal support to establish the business and to protect the IP, marketing activities for business and professional networking, space and services inside incubation structures; initial financial support. Consistently with the research objectives, in this paper successful USOs are considered as the result of technology transfer processes resulting from effective multi-level co-evolutionary adaptations within university.

### **Interpreting innovation processes in a co-evolutionary perspective**

Innovation is widely considered to be a multidimensional phenomenon that emphasizes the role played by university together with industry and government. In this vein, the Triple Helix of innovation assumes that knowledge-based development is generated by the synergic interactions between university, industry and government that while getting closer overlap by taking the role of the other in some regards – i.e. university acting as entrepreneurial agents, industry sharing knowledge, government taking the role of venture capitalist (Etzkowitz and Leydesdorff, 2000). Moreover, it's worth nothing that most such interactions take place at regional level where specific issues determine gaps in the innovation environment that can be solved through forms of collaborations among the three helices. This implies that innovation is indeed a highly localised phenomenon, influenced by place-specific factors (Boschma and Martin, 2010).

In order to grasp the innovation dynamics, the co-evolutionary perspective has been introduced into the triple helix theoretical and empirical research offering a *neo-evolutionary perspective* to this field of studies (e.g., Leydesdorff, 2000). In particular, the co-evolutionary lens allow to holistically consider the interaction dynamics and mutual functionality that take place simultaneously between the three helices reshaping their institutional arrangements over time and generating innovation. Each helix, while experiencing ongoing transformations internally under environmental pressure, interacts with the others over time on the basis of some sub-dynamics which allow various degree of mutual adjustment between them (Etzkowitz and Leydesdorff, 2000). Moreover, by interacting each other, the helices determine knowledge-based development conditions by generating new networks and organizations among the helices such as hybrid organizations (e.g., TTOs, public-private science parks and incubators, venture capital firms and foundations, or research institutes that are involved both in R&D and in its use) (Etzkowitz and Leydesdorff, 2000). In this regard, it is acknowledged that the new layers of networking imply adaptation mechanisms within and among the helices.

The co-evolution concept – whose roots trace back to Darwin's biological assumptions – has been widely used in economic literature and business economics and management studies to explain the dynamics of the organization-environment relationship (e.g., Ahlstrom and Bruton, 2010; Nelson, 2006; Breslin, 2011; Hodgson, 2013; Abatecola,

2014; Paniccia and Leoni, 2017; Paniccia *et al.*, 2017). Furthermore, the concept of co-evolution is used in the emerging field of research of the evolutionary economic geography (EEG) literature to better understand the processes and mechanisms that over time determine the dynamics of regional development (e.g., Boschma and Martin, 2010).

The co-evolutionary perspective allows to jointly consider the interdependencies and dynamics of interactions at different levels (micro, meso, and macro) in their disjointed valence as well as in their mutual relations. In fact, co-evolution is multilevel. This means that it takes place not only within organizations, but also between them, their territories and the whole society (Breslin, 2011; Paniccia and Leoni, 2017). All the actors involved are called to adapt to each other effectively, thus to search for solutions to common problems (Lewontin, 1989). In this perspective, the relationship between the organization and the environment is interpreted through the mechanisms of organizational adaptation, or as a joint result of the dynamics of the relationship between the organization's strategic intentionality and environmental pressures (Baum and Singh, 1994). The central aspect is that none of these two forces (organization and environment) is able, by itself, to define organizational adaptation, but both are necessary.

### **Multiple levels co-evolution within university: the role of TTOs**

In accordance with the above and for the purposes of this work, the proposed framework interprets technology transfer as the result of virtuous co-evolution adaptations at multiple levels within university. In doing so, the main determinants able to promote effective technology transfer through the creation of successful USOs are determined and explained.

Evidences from the literature allow identifying different levels within university able to contribute to the development of technology transfer (e.g., O'Shea *et al.*, 2007; Rasmussen *et al.*, 2014; Fini *et al.* 2017). Departments where academic research is carried out through the involvement of different actors (e.g., professors, researchers, doctoral and graduate students, administrative personnel), can be referred to as the micro-level of analysis. Hybrid organizations acting as intermediaries between university and industry in order to enhance the academic research results are the meso-level of analysis. TTO and its services provided through USO support programs are included at this level. University governance responsible for the policies that foster technology transfer corresponds to the macro-level of analysis.

In this approach, two aspects are particularly relevant. *Firstly*, TTO (meso level) becomes key agent for connecting departments (micro level) with university governance (macro level) and the rest of the society (Etzkowitz and Leydesdorff, 2000; Huyghe *et al.*; 2016). In fact, the creation of a TTO signals that the university considers technology transfer as a part of its mission (Fini *et al.*, 2017), and, on the other hand, TTO facilitates the development of entrepreneurial competencies at micro level by interacting with other organizations (O'Shea *et al.*, 2007; Rasmussen *et al.*, 2014). *Secondly*, the systemic set-up of departments and TTO is a basic condition for consolidating/renewing skills and competencies (Kast and Rosenzweig, 1973) and therefore to mutually adapt effectively.

In their evolution, departments, TTO and academic governance co-evolve as they are interdependent with mutual influences, and each one support the others (O'Shea *et al.*, 2007; Rasmussen *et al.*, 2014; Fini *et al.*, 2017). This interdependence and mutual functionality requires adaptation. It develops according to an evolutionary circular relationship of *dialectical nature* (Benson, 1977; Hrebiniak and Joyce, 1985): TTO generates dependence (through the dynamics linked to the commercialization of university research and evaluation of universities' third mission activities) and departments tend towards autonomy because of the lack of entrepreneurial culture and

competences to develop business idea (O'Shea *et al.*, 2007; Rasmussen *et al.*, 2014; Huyghe *et al.*, 2016).

In turn, TTO and departments co-evolve with the larger system of society and economy; one and the other are therefore, called to renew themselves by adapting according to environmental developments. Thus, co-evolutionary perspective allows to grasp the existence of a university entrepreneurial inclination as the organizational result of interactive dynamics taking place within and across micro (departments), meso (TTO and hybrid organizations) and macro (university governance) levels.

From all of the above, it is possible to derive three main determinants capable of promoting virtuous co-evolutionary adaptations. They are: *i) systemic approach* (Kast and Rosenzweig, 1973; Etzkowitz and Leydesdorff, 2000; Boschma and Martin, 2010), understood as the ability to organize and administer departments, TTO, university governance and the relationships between them in an integrated way as a basic condition to foster “competitive interdisciplinarity” and strengthen entrepreneurial competencies able to generate positive externalities; *ii) entrepreneurial spirit and social responsibility*, understood as the university ability to increasingly assume entrepreneurial tasks advancing development through the commercialization of inventions and the creation of successful USOs (Etzkowitz and Zhou, 2017; Scafarto, 2017), offering a wider contribution to society devoting attention to emerging values (Siegel and Wright, 2015; Panizza *et al.*, 2017); *iii) market orientation* (Rasmussen *et al.*, 2014) understood as the ability to develop market-related knowledge capable of transforming scientific findings into high-quality products and services.

In conclusion, within university there is a relationship of mutual functionality between departments, TTO and university governance. This relationship is variable over time, necessarily co-evolutionary and sometimes contradictory (i.e., dialectic). This suggests that to ensure the creation of successful USOs, effective, ongoing, and co-evolutionary adaptations between multiple actors at different levels are needed.

## **Methodology**

In line with the proposed interpretive framework and in order to reach the research aims, this study relies *on case study analysis* following a qualitative approach and a multiple-case perspective (Stake, 1995; Yin, 2017). This method is particularly appropriate for studying organizations according to a co-evolutionary approach as it analyses the organization-environment relationship in its real context, from a holistic perspective, and in compliance with time limits (e.g., Ahlstrom and Bruton, 2010; Breslin 2011; Hodgson, 2013).

The unit of analysis is the USO support program, namely the business plan competition. To this end, the Italian “PNI – National Innovation Award” (PNI) and the Spanish “Iniciativa Campus Emprendedor” (ICE) and “Yuzz” programs are analysed. In Italy, the PNI is one of the most popular business plan competition organized within the National Innovation Award (PNI) by the Italian Association of University Incubators and Local Business Plan Competitions (i.e., PNICube, <http://www.pnicube.it/>). The purpose of this initiative is promoting local sustainable development through the creation of USOs. In Spain, despite the fact that all universities possess an own TTO and other hybrid structures, to best of our knowledge, it seems that USO support programs, such as the business plan competitions, are mainly promoted inside each single university. Notwithstanding, there are few programs fostering academic entrepreneurship between universities at regional and national levels on an ongoing basis, such as the ICE and Yuzz programs. The research focused on Italy and Spain because of their similarities in relation to the cultural context, the industrial structure and the innovation environment.

This paper follows a qualitative approach and is based on the analysis of the following secondary data (Yin, 2017): *i*) PNICube's data from 2010 to 2017; *ii*) Netval's data from 2003 to 2018 (Netval is the Italian Network of TTOs of Universities and Public Research Organizations); *iii*) Netval's annual surveys from 2003 to 2018; *iv*) CYD's data from 2009 to 2016 (CYD is a Spanish Foundation aimed at promoting Spanish universities contribution's to socio-economic development). Moreover, these data have been triangulated with information collected from other sources (i.e., direct examination, key informants interviews, associations' website, publications in economic and political newspapers, scientific articles).

Data analysis has been focused on the research of those determinants of effective co-evolutionary adaptations emerged in the theoretical framework.

## Findings and discussion

### *“National Innovation Award” (PNI) – Italy*

The PNI was established in 2003 on the initiative of University with the Ministry for Productive Activities. It takes place at regional and national levels through: *i*), the so-called “Regional Start Cup Competitions” (Start Cup), opened to research groups that belong to universities and public research organizations that promote the initiative locally; *ii*) the national level competition (the PNI) among all the regional winners. At both levels, contestants compete for monetary and non-monetary awards allocated to innovative business ideas in relation to 4 specific sectors as well as to their content in terms of social innovation and equal opportunity. The 2017 edition of PNI involved 17 Start Cups organized by 46 universities, public research organizations, associated incubators, regional and national institutions, firms. At regional level, it generated 1,074 business idea (Tab. 1), related to the Cleantech and Energy sector for 32% (17% in 2015), Life Sciences for 32% (stable), Industrial and ICT for 19% and 17% (both declining).

The first aspect that emerges from the analysis is the *systemic nature* of the PNI model, based on the interactions between key-innovation actors, and the beneficial effects over time of ongoing cooperative interactions between them. In fact, the first edition of PNI involved 5 Start Cup compared to the 17 in 2017, and a total of 190 USOs has been generated from all the PNI finalists since 2003. Regarding TTOs, their contribution in facilitating knowledge transfer is evident during all the main phases of the initiative (Tab. 1). *Firstly*, TTOs contribute to search for, identify and stimulate potential entrepreneurs to present innovative business ideas. To this end, the following aspects are considered: originality of ideas and their technological/knowledge content, feasibility and market potential, proponent teams' composition and capabilities. The total number of business idea submitted to the Start Cups has exceeded 1,000 units since 2013 (from 538 in 2010). *Secondly*, TTOs take part in support and mentoring activities aimed at giving qualified assistance to Start Cup's contestants' in writing eligible business plans. In this respect, from 2010 to 2017, data shows that 46% of business ideas has been turned into business plans. *Thirdly*, TTOs provide technical support to start USOs, favour the creation of interdisciplinary teams, and promote their interaction with other local actors (e.g., public institutions, banks, investors, other research organizations that can provide complementary technologies). Referring to local contexts, Start Cups held at central Italy for the years 2014-2016 highlight a 4% of business ideas turned into successful USOs (1% if north Italy Start Cups are considered) (Tab. 2).

Thus, findings show that during all the main phases of the PNI, TTOs interact with scientists, research groups, students, local communities, and all the actors of the territory on an on-going basis, over time in a strong *circular interdependent relationship*. This

shows how virtuous co-evolutionary processes take place between departments, TTOs, universities and their territories. However, this circular interdependent relationship could be characterized by *contradictions* and *discontinuity* that can – if not properly managed – adversely affect this relationship. It's worth nothing that some critical issues emerge in relation to the start of USOs such as bureaucratic procedures that slow down the process, lack of entrepreneurial competencies within departments, TTOs' difficulty in creating network of relationships. In this vein, there is a need for a greater involvement of all stakeholders in coordinating resources and activities, which would certainly support effective interactions among all actors, favouring socio-economic development at regional and national levels.

*Table 1 – The PNI phases*

	Regional Start Cup Competitions	Business Idea (Regional Star Cup)	Business Plan (Regional Star Cup)	PNI finalists	USOs
2010	14	538	361	59	19
2011	17	756	361	69	17
2012	16	850	368	64	25
2013	15	1,278	528	55	14
2014	15	1,219	503	58	16
2015	18	1,193	570	63	13
2016	16	1,171	511	65	7
2017	17	1,074	540		
<b>Total</b>		<b>8,079</b>	<b>3,742</b>	<b>433</b>	<b>111</b>

*Source: Our elaboration of data from PNICube and Netval survey*

*Table 2 – The PNI phases on regional base (2014 – 2016)*

Regional Start Cup Competitions	Business Idea (Regional Star Cup)	Business Plan (Regional Star Cup)	PNI finalists	USOs
North Italy	2,077	992	136	31
Central Italy	311	174	51	11
South Italy and Islands	1,197	418	97	0
<b>Total</b>	<b>3,583</b>	<b>1,584</b>	<b>284</b>	

*Source: Our elaboration of data from PNICube and Netval survey*

#### *“Iniciativa Campus Emprendedor” (ICE) – Spain*

The ICE initiative is a business plan competition which encompasses a regional level of participation, including the 9 universities (Burgos, León, Salamanca, Valladolid, Pontificia de Salamanca, IE Universidad, Europea Miguel de Cervantes, Católica de Ávila e Isabel I de Castilla y el Consejo Superior de Investigaciones Científicas). It takes place under a common technology transfer framework (i.e., the T-Cue) which has been set by the Regional Government as part of the local R&D and Innovation Strategy 2013-2017, now part of the Smart Specialization Strategy 2014-2020. All the universities take part to a joint university foundation (FUESCYL), and The Banco Santander plays a role by patronizing the competition, even though it is not the main proponent. Applicants from all the participating universities can join the program by choosing to compete in one of the two categories: business idea, and business plan. A double selection is due for the applicants to the business idea category with the first at a single university level, and the second at regional level. In the case of the business plan category, the selected applicants directly access the final regional competition, where experts from industry and academy select and evaluate the innovation and the sustainability of the entrepreneurial projects. The prizes consist of training support from experts and a university certificate, for the entrepreneurial projects, four financial rewards are also provided (for a total amount of 35,000 euros). As to the evolution of the ICE program results, during the last eight

editions (2009-2016) a total of 313 business ideas and 261 business plans have been submitted, with an average yearly value of 39 and 32 respectively (Tab. 3).

*Table 3 – ICE program – N° of business ideas and business plans submitted*

<b>Applications</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>Total</b>
Business ideas	31	24	44	49	47	26	46	46	313
Business plans	26	24	38	35	41	35	29	33	261
<b>Total</b>	<b>57</b>	<b>48</b>	<b>82</b>	<b>84</b>	<b>88</b>	<b>61</b>	<b>75</b>	<b>79</b>	<b>574</b>

*Source: CYD (2016)*

During the period 2009-2016, about 19 successful USOs have been formed after the participation to the ICE program. According to CYD, most of them operate in the agribusiness and natural resources industries (47%), about one third (32%) in the macro-sector of health, social assistance, demographic changes and well-being, while the remaining quota (20%) belongs to that of ICT, energy and sustainability.

Comparing these results with those of the PNI, the absolute value of USOs created in almost a decade is almost 6 times greater for Italy (111 vs 19). However, if we divide this values by the number of participating universities for each country program, we obtain that during the respective time span an average number of 2.4 USOs have come from the ICE program in Spain (19 USOs / 9 universities), while the PNI has produced 2.5 academic spinoffs (111 / 43 universities/incubators affiliated). These results are not much dissimilar, with a slightly better situation for the Italian case.

#### *YUZZ – Spain*

The YUZZ program is a case of an USO support programme that, differently from the Italian PNI, has been designed, promoted and supported by an important business player. This is Banco Santander, one of the world most responsible company investing in education initiatives. Indeed, Banco Santander manages over 1,200 partnerships with universities and other institutions around the globe.

YUZZ was launched in 2009 with two centres, one in Barcelona and the other in Madrid, as a technological incubator for big ideas. Since then, it has grown exponentially and, under the direction of CISE (Santander International Entrepreneurship Centre), sponsored by Banco Santander through Santander Universities, it has opened 48 centres around Spain, with over 1,000 entries each year, and about 750 business plans elaborated. As a result of CISE's work, coordinated with universities all over the country and other stakeholders from the private sectors (i.e., EY Fondacion Espana, Indra, Netberry, Secot), YUZZ provides about 5 months of free training and support to people aged 18-31 to develop their own projects in acceleration/incubation centres around Spain. Yearly, there are financial prizes (80,000 euros in 2016) for the first three best entrepreneurial projects, besides the opportunity to travel to the Silicon Valley, as well as gaining access to renowned acceleration programmes such as FinTech and Ernst&Young Women Entrepreneurs. Starting from last fall 2017, the YUZZ program has evolved into Explorer and has been extended to other Latin-American countries and China. Over almost 10 years, around 500 high-technology ventures have been created through the programs, several of them founded by academic entrepreneurs and students (an overall figure of about 10.6% of the total of the participants). Also, a global online platform bridging together university entrepreneurs has been launched with under the brand Santander X. The Banco Santander, through the CISE and its network of partners, is an active actor from the industry-sphere in igniting the technology transfer process from universities to the market. In doing so, the company helps the Spanish university TTOs to stimulate



entrepreneurship both among research staff and university students, and thus plays a leading role in the ecosystem of the Spanish triple helix.

### **Discussion and conclusions**

Findings show that USO support programs are influenced by place-specific factors and conditions that determine the proactive role played in promoting these competitions by different key-innovator actors. However, regardless of their origins, evidence confirm that through these programs, TTOs play a very important role in disseminating entrepreneurial culture within university by: *i*) encouraging the generation of business idea within departments; *ii*) providing assistance to develop and execute eligible business plans; *iii*) promoting competitive team interdisciplinarity and the generation of successful USOs. Furthermore, evidence highlights that TTOs facilitate knowledge transfer, encourage academic entrepreneurship, and interact on an ongoing basis within university and with local and national innovator-actors.

Moreover, the results are consistent with the proposed theoretical framework and confirm that successful USOs are result of continuous, efficacious and mutual adaptations at multiple levels within university, favoured by three main determinants: systemic approach (Kast and Rosenzweig, 1973; Etzkowitz and Leydesdorff, 2000; Boschma and Martin, 2010); entrepreneurial spirit (Etzkowitz and Zhou, 2017; Scafarto, 2017) and social responsibility (Siegel and Wright, 2015; Paniccia *et al.*, 2017); market orientation (Rasmussen *et al.*, 2014). Lastly, the results highlight that university does not act in isolation, but interacts with industry and government in supporting innovation dynamics at regional and national levels. As such, the importance of the same determinants for effective, ongoing interactions between university, industry, and government emerges.

In conclusion, this study investigates the role played by university in promoting innovation through knowledge and technology transfer processes by adopting the co-evolutionary approach.

The main limit of this study is linked to data availability mainly in relation to the Spanish cases. However, this is a first step of the research that stimulates further investigations. Moreover, this study addresses knowledge transfer activated through USO support programs and, as such, future investigations may be extended to other technology transfer mechanisms.

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