The behaviour of the Technology Transfer Center

Applied to Polytechnic Institutes in the Alentejo Region

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Abstract

We live in an era of strong social and technological changes but, above all, in an atmosphere surrounded by uncertainty. This type of changes happen through the interactions of the triple helix model. This model studies the connections of the knowledge transfer of production, technological innovation and economic development achieved with the cooperation between the higher education, the government and the industry (Ranga, 2010). The higher education institutions have a structural role in the economic, cultural, political and social dynamics in the region where they are located (Saúde.C, Borralho.C, Féria.I & Lopes S; 2013).

This research is based on the identification and characterization of three technological transfer centers (TTC) and their behaviour in the Alentejo region. This region is geographically capable of covering the characterization of regional, socioeconomic, educational and business issues. This dissertation focuses on polytechnic institutes as institutions with a strong impact in the region, namely IP Beja, IP Portalegre and IP Setúbal.

The IPs empowered their facilities through technological transfer centers interacting directly into the region. The behaviour of each center is dependent on the region in which it is inserted. Their function is to contribute to the creation of companies, evaluation of R&D projects, searching of financing loans, partner engagement projects, optimization on local resources and recognition of higher education polytechnic Intuitions.

Keywords: Regional development, Polytechnic Institutes; Technological Transfer Centers

1. Introduction

The transfer of knowledge has become a global trend with local impact. International political organizations such as the Organization for Economic Co-operation and Development (OECD) and the European Union have discussed the need to create knowledge networks among education, political and business actors. The higher education institution is a knowledge transfer actor, an essential resource for the development of regions (OECD, 2005). In Portugal, for the last two decades, due to a greater knowledge on the territorial dispersion and regional development impact, several political and educational entities have demonstrated an increasing effort in assuring region sustainability with innovation and entrepreneurship measures, such as, the creation of technological transfer centers in polytechnics institutes (MCTES, 2016).

Consequently, the scientific community has developed innumerous studies that quantify and develop indicators to measure the performance of higher education institutions in the regional development (Saúde.S, Borralho. C, Féria.I & Lopes. S, 2014). As a result, some questions

may arise: assuming that all polytechnic institutes were created with the same mission, will the technological transfer center (TTC), be equal among regions (interior and coastal)? Which is the competitive advantage of having a TTC? Which are the core strategies of each TTC?

The conclusions of this work will contribute to the scientific community by highlighting the Alentejo region, as well as the similarities versus the differences between TTC located in coastal and interior regions. Studying the behaviour impact of TTC in regional development; leading to improvements of each TTC studied; conducting the institute polytechnic in a way of attracting new partners and fixation of specialized human capital in the region.

2. Literature Review

2.1. Triple Helix Model

The triple helix model is not fixed, it differs from the interactions of society environment between the government, industrial and higher education spheres. Its type of configuration depends on the distribution of the power between the spheres.

The model covers two types of perspectives: the (neo) institutional and the (neo) evolutionary. First, the (neo) institutional perspective, which is the identification of commercialization of the knowledge variables that promote the academic and research practises. The variables are a series of factors assessed individually in the model configuration, such as, the stakeholders, the drivers, the possible impacts, benefits, the regional development, and the municipal policies (Etzkowitz, 2000). It can be described in three main configurations:

- The ***static configuration*** is the model that concentrates all the decision power in the governmental sphere. That sphere leads to the interactions between education and industry (Etzkowitz e Leydesdorff, 2000);
- The ***laissez-faire configuration*** is the model that defines the industry as the main force when negotiating with the market opportunities (Etzkowitz e Leydesdorff, 2000);
- The ***balanced configuration*** is the model whose intersections are balanced between them. The decisions are unanimous and applied equally (Etzkowitz e Leydesdorff, 2000).

Second, the (neo) evolutionary perspective, which is inspired by the theory of social systems. It enables the communication between the three spheres through interactions, organizations and society systems. This type of theory argues that new partnerships can be created by balancing the expectations and agreements of the spheres and building communication channels, such as science "know-how" and business experiences that will conduct to new public and private knowledge transfer processes (Etzkowitz and Leydesdorff, 2000).

2.2. Higher education- Knowledge transfer in society

The conceptualization of knowledge transfer is permanent and spontaneous, passive and not previously planned in organizations (Simões, J., & Duarte, C., 2013). The knowledge transfer can be defined in two distinct approaches: the transmission and the absorption of knowledge. According to Davenport and Prusak (1998, 101-102) the access of knowledge is important but it is not enough to ensure that knowledge is correctly understood. Moreover, there must be mechanisms that facilitate this absorption. The goal of knowledge transfer is to improve an organization using and exploring that knowledge. Another goal is to know which are their limitations and then optimize and increase their value. In order to do an effective transfer of knowledge it obligatorily leads to a behavioural change, such as in a product development or in a good society practice.

The higher education is recognized as a center of educational excellence, research and socioeconomic development in the region where it is inserted (Yusuf, 2008; Wittrock, 1993). It is currently guided by three missions, namely (1) teach; (2) research and (3) social interaction.

2.3 Regional development in Portugal

The regional development can be measured by the *regional development index* It

is the representation of the results obtained from the performance of variables applied across all the regions in Portugal. These variables are, competitiveness index, cohesion index and environmental quality index (INE, 2014). Through the regional development index it is possible to observe socioeconomic constraints between coastal and interior regions. The regions with the greatest regional development are located on the coast and have always been more improved in political and industrial issues when comparing with the interior regions for their territorial features. Portugal with the European Commission and under the five Structural and Investment European funds (nearly 25 million euros invested), have been adopting principles focused on promoting the economic, social and territorial development policies between 2014 and 2020. These governance principles are aligned with the intelligent, sustainable and inclusive growth, regulated in the Europe 2020 strategy. These policies in intelligent specialization have included initiatives both at national and regional level, they are supported by a Portuguese investigation and innovation strategy, which identifies the larger strategic applications in areas of scientific, technologic, economic specialization, defining the comparative and competitive advantages in their regions. The alignment of these strategies motivated the application of Portugal 2020 investments in research, technological development and innovation. The implementation of Portugal 2020 is divided in four domains: Competition and Internationalization; Social Inclusion and Employment; Human Capital; Sustainability and Resources Usage Efficiency.

2.4 *Smart Specialisation in Alentejo*

In 2012, a regional development strategy was conceived to “The Research and Innovation Strategies for Smart Specialization,” under the Portugal 2020 operational program. This strategy is comprised during the period of 2014/2020, aiming to empower the Alentejo region. The territorial competitiveness also includes economic valorisation of low-density areas, in order to enhance its vast territory, its resources and specificities. This strategy has been established according to community funds and is structured according to strategic planning in three designs: "Smart Growth" - economic attractiveness (based on knowledge and innovation); "Sustainable Growth" - valorisation of cultural and heritage identity; "Inclusive Growth" - social responsibility (CCDRA, 2014). According to EREI Alentejo, the following five Areas of Specialization were identified:

I. **Alimentation and Forests:** value the dimension and climatic conditions, by promoting the articulation among agriculture and agroindustry, envisioning the integration in the value chain and increasing the control in it, in the perceived value by the regional food items through the articulation with the culture and tourism, as well as, exploring market and technological opportunities for the emergency of companies, which are intensive in knowledge relating to the precision agriculture domains, introducing advanced production systems, with strong electronical components, sensors and ICT, as well as, production management control,

II. **Environmental, Natural, and Mineral Resources Economy:** value the environmental, geological and natural diversity in Alentejo, potentializing the innovative and structurally diverse economic activities growth among the extractive industries and creating design activities, as well as new construction materials, production technologies and sustainable exploration.

III. **Patrimony, Cultural and Creative Industries and Tourism Services:** value the patrimony (natural and cultural, as main wealth and distinctive trace), by articulating with creative and cultural industries which contribute to the region development.

IV. **Critical Technologies, Smart Energy and Mobility:** value the network and computer security management technologies, particularly in areas such as energy and mobility. Having in consideration the Alentejo characteristics and the consolidated economy in terms of combustibles, it is important to value the renewable energies (solar and biomass), and conventional energy, having the

possibility of elevating the specialized development in support technologies and production of energy using renewable sources.

V. **Technologies and specialized services of Social Economy:** directs scientific and entrepreneurial competences towards the creation of new technological solutions and new business model, which promote a better service offer through an innovative form, integrating inclusive educational activities, urban regeneration, microcredit, tourism, health and active aging, as well as, support to entrepreneurship and innovation at the workplace.

2.5 Characterization of three case-studies in Polytechnic Institutes

The polytechnic institutes were characterized according with the identification of their areas of investigation in R&D and enumeration of the infrastructures that allow the support to knowledge transfer. The context of the data was withdrawn from the most recent strategic plan developed by each institute:

- **IP Beja**

Table 1- R&D Areas of IP Beja

Education and Adult Training
Agriculture and Food Technology
Water and Environment
Sustainable Energy
Technologies of Knowledge and Multimedia Creativity
Tourism and Heritage (natural and cultural)
Health and Quality of Life

The infrastructures that allow the support to knowledge transfer:

- Knowledge Transfer Center (CTCo)

- **IP Portalegre**

Table 2-R&D Areas of IP Portalegre

Bioenergy and Sustainable Materials
Computing, Design and Marketing
Social Sciences, Humanities and Health

The infrastructures that allow the support to knowledge transfer:

- Interdisciplinary Coordination Research and innovation (C3i);
- Entrepreneurship and jobs officer (GEE);
- Bioenergy and Business Incubator of Portalegre (BioBIP).

- **IP Setúbal**

Table 3-R&D Areas of IP Setúbal

Tourism
Medium and High Sectors High Technology and Intensive Knowledge Services
Blue Economy.
Territory and Environment
Energy Efficiency and Renewable Energies
Sustainable Urban Mobility
Active Aging and Quality of Life

The infrastructures that allow the support to knowledge transfer:

- I&D & Services;
- IPStartUp;
- IN2SET.

3. Proposed Methodology

This dissertation consists in the studying of the behavior of the knowledge transfer centers in the Alentejo region. The following institutes were analysed: IP Beja, o IP Portalegre and IP Setúbal. For that, an investigation methodology is proposed, which includes the following steps.

3.1 Step 1: Exploratory interview analysis

Representation of the qualitative data was obtained through an exploratory interview, allowing the identification of several characteristics and their relevance for the topic studied in the dissertation. Six exploratory interviews were conducted, two for each institute, to the coordinators responsible for the technologic transfer center. For the three case studies, the exploratory interview was structured according with this line of thought:

1. Introduction of the interviewed
2. Framing to the topic of the dissertation
3. Framing of the Polytechnic Institutes
4. Approach to the subject: (i) technologic transfer centers; (ii) regional development;

(iii) third mission and interaction of the polytechnics in the society

5. Strategies and plans in course in the technologic transfer centers.
6. Acknowledgment of the polytechnic institutes
7. Limitations of the polytechnic institutes
8. Challenges and future perspectives
9. Visit to the Center and/or incubator

3.2 Step 2: Data analysis

Representation of the data was achieved through the strategic plan defined by each institute, allowing the identification of several indicators, such as the number of planned activities, the number of funded projects and metrics relevant for this dissertation.

Later, the main indicators were analyzed in order to study the behavior of the technologic transfer center.

The indicators were developed according with the project "Culture of the Performance" with the main purpose of identifying performance indicators in the polytechnic institutes concerning the applied investigation activities and its impact in the regions. From the innumerous indicators presented, the ones selected were the indicators which are best applied to the evaluation of the TTC, according with the information collected from the exploratory interviews about the form and utilization of those centers, the indicators concern the economic, social and political impact (Figure 1).

3.3. Step 3: Results

In this step, several analyses were performed from the results obtained in the visited to the research field and from strategic line of specialization by each institute.

Centro de Transferência Tecnológica (2016)				
Indicadores	Tipos de Transferência	IP Beja	IP Portalegre	IP Setúbal
Impactos Económicos	Projetos em colaboração	Forte	Forte	Igual
	Participação em redes	Igual	Igual	Forte
	Infraestruturas em equipamentos/materiais	Forte	Forte	Igual
	Número de empresas criadas	12	18	5
	Sobrevivência de empresas criadas	_____	_____	_____
	Número de empregos criados (startups)	>20	>30	>10
	Formas de empreendedorismo de estudantes	Forte	Forte	Forte
Impactos Sociais	Melhorias de qualidades sociais/qualificação/especialização	_____	_____	_____
	Alteração de práticas ou hábitos	Pouco	Forte	Igual
	Satisfação dos beneficiários/utentes/ clientes/stakeholders	Forte	Forte	Forte
	Envolvimento de estudantes (atividades relacionadas com o funcionamento do centro)	Pouco	Pouco	Pouco
	Consultoria e prestação de serviços com empresas	Igual	Forte	Forte
Impactos Políticos	Participação ou melhorias em questões públicas	_____	_____	_____

Figure 1-Performance indicators in TTC

4. Results and Discussion

4.1. The fields of Expertise in each Polytechnic Institute

It is presented a matrix of relation (Figure 2) that aggregates the three institutes according to domains of specialization, allowing the visualization of the strategic line of specialization by each institute. From this matrix it is possible to note that: IP Beja presents a differentiating value proposal in areas oriented towards domains of Food, Forest and Heritage; IP Portalegre in the area of specialization of Bioenergy and Sustainable Materials and IP Setúbal in areas oriented towards domains of Heritage; Intelligent Mobility and Specialized Services of Social Economy. These areas of specialization should be the predominant areas of expertise that will allow each IP to gain recognition and competitive advantage.

Domínios de especialização EREI Alentejo 2020 / Institutos Politécnicos	Alimentação e Floresta	Economia dos Recursos Minerais, Naturais e Ambientais	Património, Indústrias Culturais e Criativas e Serviços do Turismo	Tecnologias Críticas, Energia e Mobilidade Inteligente	Tecnologias e Serviços Especializados da Economia Social
IP Beja	◎		◎		
IP Portalegre		◎		◎	
IP Setúbal			◎	◎	◎

Figure 2- Cumulative relation Matrix

4.2. The behaviour of Technological Transfer Center in IP Beja

Figure 3- TTC in IP Beja

IP Beja has been investing on the creation of infrastructures and conditions to improve its provision of services and R&D. The value proposition of the center is the training of companies in the region, that is, it serves as an incubator for young companies created by IP Beja students and other companies from outside the region, related to areas of specialization where the institute wants to be distinguished, such as: agriculture, farming, agribusiness and tourism. At the moment, the center is not specialized to domains of the region.

4.3. The behaviour of Technological Transfer Center in IP Portalegre

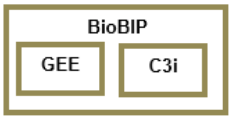

Figure 4- TTC in IP Portalegre

IP Portalegre has re-created its image as an institution, redefined its communication strategy and created three distinct departments, which are: C3i - responsible for service delivery, R&D and knowledge transfer, GEE- responsible for entrepreneurship practices by students and in the region; and BioBIP, which is a technology-based incubator specialized in bioenergy and biomass. The value proposition is the distribution and organization of the center into specialization domains. However, with one year of activity, it still has not shown expressive results.

4.4. The behaviour of Technological Transfer Center in IP Setúbal

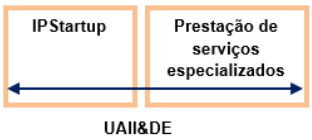

Figure 5- TTC in IP Setúbal

IP Setúbal organized its knowledge transfer processes, consolidated the formation and creation of business ideas through the Poliempreende contest and set up a UAII&DE unit (*Unidade de Apoio à Inovação, I&D e Empreendedorismo*) that is responsible for the management of this center. The value proposition is the consolidation and dissemination of the knowledge transfer generated by the institute. UAII&DE enables the institute with flexibility of lecturers' management in an effective way, since it detects opportunity and consolidates partnerships between them, in addition to having another function, which is to stimulate entrepreneurship within the institute. This type of strategy is different from the other ones because specialized technicians are the head of this center, while in the other two cases this responsibility lies with institution's own teachers. The center has sought to include domains of specialization.

4.5 Technological Transfer Center belonging to coastal (Setúbal) VS interior regions in Alentejo

There is clearly a divergence between the center located in the coastal region and the two others in the interior of the country. The coastal region allows a greater volume of services provided, larger number of established partnerships and has a consolidated company's niche in the region. The center focuses on the process articulation, in terms of business opportunities, new investigation studies and ideas monitorization. There is a necessity from the institute in specializing, however, its priority is to systemize and organize its knowledge

transference allowing its dissemination and access.

The interior region invests in specialized infrastructures and conditions in order to strike an inexistent market crested by the territorial dispersion. These centers allow the institutes to specialize in areas with high growth potential in the region besides of making them “boosters” in the creation of companies.

5. Conclusions

In the last decades there has been a higher knowledge about territorial dispersion and of the regional development impact in Portugal. Several entities have shown a greater effort in securing innovation and entrepreneurship measures to help the sustainability of the regions.

Consequently, the scientific community has developed innumerous studies that allow to quantify and develop indicators that measure the institute’s performance in the higher education concerning the region development where they are present. This dissertation offers a contribution to the knowledge transfer among institutions and evaluates the behavior of the centers in its regions.

From the results obtained, the following analyses were conducted, coming to the conclusion:

- The technological transfer centers were originated from political incentives and strategies for the polytechnic Higher Education. The studied institutes inaugurated its centers in the same year (2015). The behavior of each center is dependent from the region where it is inserted.

- The Beja Polytechnic Institute could present advantage in areas oriented to the domains of Alimentation, Forests and Patrimony;

- The Portalegre Polytechnic Institute could present competitive advantage in areas oriented for the domains of Bioenergy and Sustainable Materials;

- The Setubal Polytechnic Institute could present competitive advantage in areas oriented for the domains of Heritage; Intelligent Mobility and Specialized Services of Social Economy;

-The behavior of TTC in Beja Polytechnic Institute depends on the local needs perceived by the institute and it manages the center depending on the possible alternatives and in the resolution of those needs, for example: training, consultancy to local projects, workshops, renting spaces for events, intensive courses, among other alternatives.

Figure 6- TTC behaviour in IP Beja

- The behavior of TTC in Portalegre Polytechnic Institute is an autonomous organic structure, organized in three cores that include different types of knowledge transfer with the objective of making it self-sustainable. Exemplifying in a model:

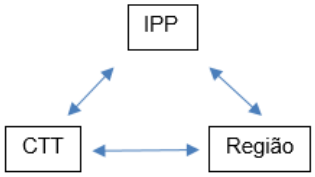

Figure 7- TTC behaviour in IP Portalegre

- The behavior of TTC in Setúbal Polytechnic Institute is an intermediary organic unit with the objective of interacting with the institute in terms of resources management, creation of companies, research of projects and funding programs and complementarily interact with the region in the accompaniment of the needs in the region, monitor and update the number of partnerships and local activities, among other initiatives for the regional development. Exemplifying in a model:

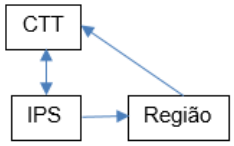

Figure 8- TTC behaviour in IP Setúbal

- The TTC distributed in coastal and interior regions of the country differ in their composition. In the case of the interior centers the investment is more focused in the conditions and infrastructures previously nonexistent in the region in order to promote R&D and entrepreneurship.

Before 2010, the third mission in the polytechnic institutes was achieved without the need to invest in innovation and entrepreneurship domains, those areas existed but were not a priority. Nowadays it is possible to observe results from the investment made in infrastructures and R&D. In the coastal region center case, there were already conditions and infrastructures, which led the R&D projects and services provision. The amount of industries with headquarters in the regional coast is comparatively superior to the ones in the interior, so there is a higher demand in the region and the institute counteracts with a variety of offers supported to the local needs. The center itself has contributed as an intermediary among the polytechnic institute and the industries/region in the processes systemization, management of available resources and divulgation of results from projects and successful cases,

- Given the inexistence of indicators that prove the impact of technologic transfer centers in the regional development, this evaluation can only be measured in the medium/long term (3 to 5 years).

- The contest Poliempreende has been gaining recognition throughout the years and leading the students in the polytechnic education to have an active action in the creation of ideas. However, this type of contest does not have a basis of collective information that allows to make a global evaluation of the contest in a transversal way to all institutes.

- The centers studied described several common difficulties. namely: limitation in human resources working full time in the center, leading to conflicts in the management and capacity of the center; the specialization domains are not defined or stipulated, there is not dissemination available of knowledge transfer to the public of their projects in R&D, partnerships established and projects funded, which makes difficult the recognition and marketing destined for the technologic transfer centers;

- The Beja Polytechnic Institute needs to create conditions (supports and grants) to stimulate professors and technicians to actively collaborate in knowledge transfer processes (consultancy, R&D, partnerships, among others). In the case of Portalegre Polytechnic Institute that incentive goes through the "channeling of expenses" from the funds obtained in investigation projects. In the Setúbal Polytechnic Institute, support was created and incentive grants were given to stimulate the professors.

Possible solutions to give response to the difficulties previously mentioned:

- Inclusion of the students in the technologic transfer centers, from conferences organization and management of workshops and entrepreneurship events;

- Approach in the entrepreneurship subjects on the local problems where business models can be created with the respective feedback from the incubated companies in the centers;

- Create a grant that, in case of inexistence of human resources, like in Beja Polytechnic Institute, allows that a student to solve conflict resolution responsibilities, for a period of time. This grant can be given in several formats, as cost reduction in the study fee, food allowance, recommendation letters, among other;

- Suggest to the Poliempreende contest, focused in the IT area, where the students can develop an interface and database that will allow the contest a good control and information crossing of every idea, prizes and save it in historic.

- Suggest the Beja and Portalegre polytechnic institutes that have not been investing in the contest Poliempreende, to reformulate their entrepreneurship strategy and incentive the students to participate having in mind the monitorization of projects and the accompaniment of expectation of the students.

This dissertation concludes that the technologic transfer centers have been stimulating the polytechnic institutes to find direct forms of interacting in the region. The centers could contributing for the creation of companies, evaluation of R&D projects candidatures, funding methods alternatives, optimize resources and organize them in knowledge transfer. Above all that the centers could increase the institutes acknowledgement

through results divulgation, through projects and initiatives conducted in the polytechnic institutes in international and national context.

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