Identifying Successful Knowledge Exchange Practices between Academia & Industry in University-city Regions: The case of Thessaloniki Greece

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Abstract:
This paper aspires to contribute to the dialogue on the modes of cooperation and success factors of the knowledge exchange between research and entrepreneurial communities at local level. We present the results of a survey aiming at the identification of successful knowledge exchange practices between academia and enterprises in the wider Thessaloniki area. The results of the survey, combined with the examination of the context within those cases take place, aim to identify relevant best innovation policy practices at local and regional level. The survey constitutes a core activity of the INNOPOLIS project, an Interreg 4C project focusing on the investigation of existing knowledge endowments in university-city regions, the advancement of innovation, and by implication economic development.

Keywords
Knowledge exchange, knowledge transfer, innovation policy, entrepreneurship, intellectual property

1. Introduction

Universities are an important source of new knowledge creation and dissemination, which is a fundamental element for the promotion of regional development. The transfer of technologies from universities to enterprises is considered to boost competitiveness, stimulate economic growth and increase prosperity [1]. Whereas the benefits of knowledge exchange between universities and enterprises have been documented in various cases, there is still a long way to go considering the identification of the best-suited policy framework for the enhancement of this process, on national and regional levels.

In recent years, a number of contributions have been developed considering the models that describe the process of university to industry knowledge transfer [2], as well as the relative importance of the different channels for its diffusion [3], [4]. In the literature, the transfer of technology has been met as a linear sequence of steps [5], but also, in the framework of informal interpersonal networks and established relationships that promote knowledge sharing and learning [6].

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Regarding the potential paths through which knowledge is being transferred; these include publications, network formation, recruiting cooperation in R&D, joint ventures, contract-based research, and consulting. Next to these, people's mobility by visiting conferences and workshops is considered to create social networks and generate knowledge spillovers. A lot of attention has also been drawn in the intellectual property rights (IPR), in the form of patenting, co-patenting, licenses, and academic R&D valorization. The proliferation of patent-related empirical studies cannot be attributed to its importance as a knowledge transfer mechanism, since it has been proved to represent only a fragment of the total effort [7], but mainly to methodological convenience due to the availability of quantitative data [8]. Finally, a popular mechanism for the introduction of a new technology into the market, especially in industries like biotechnology or ICT, is through the formation of spin-offs. The relative importance of the above mentioned knowledge diffusion channels has been assessed in many empirical studies with, sometimes, contrasting results.

Having identified the possible ways of knowledge transmission, a number of policies have been developed with the aim to stimulate interaction between academia and enterprises and to foster knowledge exchange partnerships. Policies studied include the setting of institutional frameworks favoring technology cooperation and the formation of intermediating organizations, i.e. organizations which seek commercial applications for university research, the development of business incubators as managing facilities in support of new technology-based business [9], the development of technology platforms and virtual innovation environments [10], the establishment of international networks etc. So far, many of these policies have failed to provide a sustainable model for the regional fueling of university produced knowledge and to address the observed inability of European regions to transform top-level scientific research into commercial products, a problem expressed by the Community as 'the European paradox' [11], [12].

Still, knowledge exchange between academia and industry is a highly complex and risky process that often fails due to a number of factors. These factors can be addressed to the particular properties of the knowledge exchanged (tacit-explicit, interdisciplinary, basic-applied) [4] or to the specific context in which the knowledge is developed and transferred, such as the institutional structures (legal framework) or the individual (culture, habits) and organizational (norms, regimes) characteristics of the stakeholders involved [13]. The latter also include firm characteristics that influence its ability to learn and utilize externally generated knowledge, such as the level of 'connectedness', or the firm's 'absorptive capacity' [7], [14]. Finally, it should be added that empirical evidence shows large differences in the way knowledge is being exchanged in different countries, universities [15], sectors [16], and types of industrial knowledge bases (analytical, synthetic, symbolic), a fact that requisites the disposal of a wider set of policy measures that should be taken according to the circumstances.

The complex, interactive and mutually benefiting activity in which new knowledge is being transferred to and utilized by enterprises can be seen as the central function of a 'university-based innovation ecosystem' [17], comprised by a number of components which interact with each other and work cooperatively in a specific/local environment. Apart from the main players at the two ends of this process (universities and enterprises), in this web of interactions are also included technology transfer and liaison offices, financial organizations or even governmental institutions. In this context, it is crucial to identify a set of national or regional good practice policies for the enhancement of knowledge exchange and network creation that would match the regional structural conditions and fit to the specific properties of different ecosystems.

2. The INNOPOLIS project

The survey presented in this paper constitutes a core activity of the INNOPOLIS project (funded by the INTERREG IVC Programme of the European Commission). The main idea of

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the INNOPOLIS project is to realise the potential impact of the mobilisation and valorisation of the existing knowledge endowments in university-city regions towards the advancement of innovation, and by implication economic performance. More specifically, the project aims to enhance the process of knowledge exchange between universities and enterprises with the support of local/regional authorities, with the aim of facilitating knowledge co-creation & innovativeness. The main methodology of the project consists in the identification of regional and national best policy practices that foster knowledge exchange as well as the creation of networks and learning tools that support best policy transfer. INNOPOLIS focuses on localities of high academic concentration (at least three multi-departmental universities and 60,000 students) which are labeled as "university city regions". The metropolitan area of Thessaloniki is a "university city region" identified in Greece[1], which hosts 3 public Universities, one of the biggest public research institutes and a number of public and private academic and research organizations, concentrating more than 100,000 students in total. A mapping of the knowledge exchange between these institutions and companies in the area has been attempted though the examination of 35 best practices of knowledge exchange between academic institutions and enterprises.

3. Methodology

The best practices survey was contacted by interviewing thirty five researchers and company representatives that have been engaged in knowledge exchange activities during the past three years. The survey focuses on identifying the details of existing knowledge transfer collaborations between academic institutions and companies. The participating researchers and company representatives have already been active in knowledge exchange at least once. In this sense, this was not a statistical survey of how much knowledge exchange is taking place between academia and industry in the region, but rather provided an in depth understanding of what the two sides of the exchange are expecting, how they interact and what is the added value they gain from the exchange.

Table 1 depicts the type of companies that participated in the best practices survey. It should be noted that the majority of the surveyed companies belong to the ICT sector, which can be explained by the fact that ICT companies are knowledge intensive companies coupled by the fact that Thessaloniki has a very dynamic ICT sector and also is the home of important ICT academic units. The existence of incubators among the companies was a predictable finding since Thessaloniki has the highest incubator concentration in Greece. Finally the participation of associations of companies underlines the crucial intermediary/facilitator role in KE practices that these organizations play, especially regarding the initialization and the sustainability of the practice.

Table 1 Type of companies participating in the survey.

Sector	Number of companies
ICT	20
Consulting	2
Manufacturing	4
Energy	3

[1] The other three university – city regions participating at the INNOPOLIS project are: Manchester, UK; Lodz, Poland and Helsinki, Finland.

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Sector	Number of companies
Retail	1
High tech incubators	2
Other services	1
Associations	2

The participating Higher Education and Research organisations are shown in Table 2. As expected the biggest University of Thessaloniki (Aristotle University) holds the bigger share, followed by CERTH which is one of the major public research centres in Greece. It is worth noting that a number of companies have knowledge exchange relations with academic institutions outside of the wider Thessaloniki and Central Macedonia area.

Table 2 Academic institutions participating in the survey.

Name	Location	Number of cases
Aristotle University	Thessaloniki	18
CERTH	Thessaloniki	5
CITY College	Thessaloniki	3
TEI of Thessaloniki	Thessaloniki	2
University of Macedonia	Thessaloniki	1
SEERC	Thessaloniki	1
University of Patras	Patras	1
University of Thessaly	Volos	1
TEI of West Macedonia	Kozani	1
Mediterranean Agronomic Institute	Chania	1
Perrotis College	Thessaloniki	1

Thirty five pairs of interviews (one at the company, one at the academic institution) were held based on a pre-defined open questionnaire which was structured around the following issues:

- Description of the knowledge exchange practice
- Characteristics of the organisations involved in the knowledge exchange
- Type of knowledge transferred / exchanged
- Formal aspects of knowledge exchange
- Benefits of the knowledge transfer / exchange
- Risks along the knowledge exchange
- Key success/failure factors & policy for the knowledge exchange

4. Discussion of results

Key motivators

The factors cited by the two parts of the KE practice as motives that encourage the engagement in such activity, vary depending on whether the viewpoint is academic or business. Table 3 presents a collection of the most important of them.

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Table 3 Key motivators of knowledge exchange.

Academia	Companies
Establishment of a market	Financial benefits
Exploitation of research results	Benefits of working with experts
Ability to use in practice and improve knowledge that has been designed in the institute's labs.	Identification of entrepreneurial opportunities
Contribution to the society	Development new products and improvement of existing products
Ensuring practical experience for their students	Easier goal achievement through the use of academic knowledge
More and better academic publications	Use of universities' infrastructures
Gain specific expertise from companies	Acquire knowledge and know how in a specific field that will open new markets
Publicity and dissemination of research results	Explore the possibility of fruitful co-operation with academic teams
Practice new research on fields of interest	Development of human capital

Type of knowledge transferred / exchanged and IPR issues

The majority of the cases (52%) involved transfer of knowledge from academia to the companies. Still a significant percentage (34%) involved reciprocal knowledge exchange and a smaller one (14%) transfer of knowledge from companies to academia. In the cases where knowledge was transferred from academia to companies, this involved highly technical and scientific knowledge in various fields (i.e. atmospheric physics, image processing, 3d modeling, genetic analysis, photo-electro-chemistry) while in the cases where the company disseminated the knowledge towards the university, the knowledge transferred was market oriented knowledge and included i.e. market intelligence, production technology, costing techniques, marketing, branding and product management. The majority of the knowledge created in academia has been "produced" through the core activities of universities/ research centers such as research and teaching activities. In many cases, those activities were part of projects funded by EU or regional/national programmes and initiatives. However knowledge transferred from companies to universities was mainly acquired through market perception, product development and marketing.

Focusing on the recipients of knowledge, it is interesting to note that about 50% of the cases indicated the existence of previous related knowledge in the organisation, approximately 30% answered that there was limited previous knowledge and not sufficient for their operational needs, and 20% claimed that they didn't have any relevant knowledge prior to the KE practice.

Around 40% of the KE cases involved the transfer of intellectual property (IP) and in most cases an intellectual property agreement was in place. It has been noticed that in some practices that involved IP, there was no agreement signed and on the other hand, in cases where there was no issues of transferring intellectual property, an IP agreement was signed. This can be explained by the level of confidence build between the two parties as well the general mentality and procedures of the organizations involved.

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Benefits and risks of the knowledge transfer / exchange

The main benefits of the KE practices are differ significantly for academia and companies and can be divided in 4 categories: Financial, Knowledge, Image and Networking. The following tables describe the main benefits for the two types of organisations involved:

Table 4. Main benefits for academia

Financial	Knowledge/ know how
• Increased income • Easier access to research funds • Creation of extra professional opportunity to researchers • Financial support for travel / conferences / staff mobility	• Testing and improving research results • Getting precious feedback from the market • Increase of theoretical and practical knowledge • Training material and workshops designed and implemented based on the results of a KE practice. • Re-usage of knowledge gained in other fields and areas • Involvement of students in the KE practice procedures • Gaining experience on how to bring purely scientific knowledge closer to the market
Image / prestige	**Networking**
• Academic publications • Publicity, fame and market appreciation • Recognition of the role of the university towards the society • Professional recognition for the university's labs and teams	• Development of new contacts • Gain complementary knowledge regarding the market, entrepreneurship etc • The participation of an organisation in a project, often brings the participation of the same organisation in new projects

Table 5. Main benefits for companies

Financial	Knowledge/ know how
• Creation of new product/service • Gaining a competitive advantage • Expansion to new markets, which were not accessible without the implementation of the KE practice	• Gain of know-how • Reuse of knowledge gained • Experience gained by the co-operation with high skilled scientists • Participation in R&D proposals
Image / prestige	**Networking**
• Improvement of corporate image and prestige • Publicity • Creating value that can be transformed into a business opportunity	• New contacts • Enhancement of the relation with the University for further co-operation. • Networking for further participation in new projects

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Knowledge exchange practises involves also risks that the participants were ready to point out. The major risk that both universities and companies have taken in consideration is the possibility of wasting time and effort with no tangible results. This risk is considered the most important inhibitor for sustaining knowledge exchanges between universities and companies. For that reason, most of the KE practices take place in the framework of EU and other funding programmes that provide for the reduction of the financial risk. Other risks that were common to both academics and companies include the risk of not reaching the desired results, the potential problems due to potential copyright infringements and the possibility of losing the goodwill between the parties. On the other hand academics pointed out the risk of potential disorientation towards entrepreneurial oriented activities while companies were afraid that failure to deliver might affect their image.

Key success and failure factors

Key success factors for a successful KE practice can be identified for the organisations and the people involved. At the level of organisations, the quality of the counterpart organisation plays a significant role. Flexibility, readiness to deal with bureaucratic procedures, clear setting of objectives and roles, having realistic expectations and identifying early the expected benefits for both sides are also important. Finally, existence of previous related know-how, frequent and smooth cooperation and respect towards agreed procedures are also considered as valuable assets in KE cooperation.

At the level of individuals, it is important to establish good communication at a personal level, to assign experienced staff and to make available open-minded, professionally skilled people. The most important success factor though is trust and this has to be build on a personal level.

Other key success factors include higher management commitment, the necessary time frame given to the KE practice, the careful selection of partners and the geographical proximity.

On the other hand, factors contributing to the KE failure are the state bureaucracy, involvement of third parties, unwillingness to cooperate, lack of time, last minute changes to KE practice objectives and the excessive focus on maximizing short term financial gains.

According to academic institutions, the most important barriers for cooperation are the high cost of the cooperation, the lack of trust between potential partners and the lack of appropriate partners for conducting a KE practice. Other barriers reported are the shortage of time, difficulties in communication, bureaucratic obstacles, the lack of devotion of partners to the KE, lack of geographical proximity with large companies and lack of cooperative mentality within their own organisation.

According to the companies the major barriers for the conduction of KE practices are the high cost involved and the lack of knowledge of market needs by the universities. The latter is explained as a possible reluctance on behalf of the academic community to get involved professionally with the private sector. Other barriers include the absence of a mechanism that will bring researchers and industry closer together, the knowledge gap (or complete ignorance) on the part of the private sector about the research activities and results produced by the universities within the region and the lack of incentives for universities to liaise with the industry.

5. Conclusions

Knowledge exchange between academic institutions and enterprises is a complex activity that involves high risk and is build upon trust. The survey confirms the existence of a variety

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of paths towards knowledge exchange that may or may not involve IP agreements and the importance of informal networks and good interpersonal relations. It also underlines the need for more focused policies that will take into account the large differences in the way knowledge is being exchanged based on country, sector and cultural specifics, minimize the inherent risk involved and focus on creating sustainable human networks.

The survey demonstrates that successful experiences tend to be repeated and become sustainable after a number of repetitions. The benefits as well as the direction of the knowledge transfer are often reciprocal, with the academic institutions benefiting from market knowledge and entrepreneurial approach of the companies, as much as the latter benefit from the new research results and knowledge stemming from the earlier. From the point of view of the participants to the KE exercise, it is important to proceed having recognised the risks involved and be clear about the expectations of both sides. It is also important, for anyone involved, to recognize from the beginning the fact that this is a long process that might not yield immediate tangible results but it is one that when pursued consistently brings benefits in the long run.

Based on the results of this survey, the key elements of a successful "university-based innovation ecosystem" as defined in [17] would be:

- Building of mixed teams that will allow for a continuous flow of ideas and knowledge between the researchers and the enterprises based on trust.
- Designing and implementing strategies and policies that will encourage exchange and minimize risks.
- Involve liaison/ intermediary mechanisms that will recognize the expected benefits, reduce bureaucracy and allow the involved parties to engage with flexibility.
- Taking advantage of EU and other funding mechanisms, viewing them not as short-term financial incentives for both sides but as tools to build sustainable relations that will yield major reciprocal benefits in the long term.
- Defining clear and flexible strategies on IPR exchange that will protect knowledge but also make it available for mutual benefit.

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