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Abstract

Knowledge is increasingly perceived as a central factor for company competitiveness. With the transfer of knowledge one of the core functions of knowledge intensive business service (KIBS) companies, the objective of our research incorporates analysis on how the transfer of knowledge takes place between the higher education sector and the KIBS universe. Our empirical results demonstrate that cooperation between KIBS and universities occurs independent of their location (rural or urban) and typology (professional or technological). We furthermore found that rural KIBS have increased their levels of graduate employment faster than their urban KIBS peers.

Key words: knowledge; spillovers; cooperation; universities; KIBS

Introduction

Knowledge is currently perceived as the central core of companies and taking an ever higher profile within the scope of recognising and capitalising on entrepreneurial opportunities (Andersson, et al., 2009; Noel, 2009). This knowledge is the product of universities that thereby contribute towards fostering productivity and innovation, factors fundamental to boosting development and regional competitiveness (Martin, 1998; Muller, 2001; Howells and Tether, 2004; Toivonen, 2004; Koch and Stahlecker,

2006; Tolstoy, 2009). The rising number of studies on the importance of entrepreneurship at the regional level, as well as the characteristics of location, reveal how the key to founding new companies would seem to be knowledge and hence throwing the spotlight on knowledge spillovers generated by universities and other research and development (R&D) institutions. Furthermore, some of the knowledge generated emerges out of cooperation between companies and public research institutions (Varga, 2000; Audretsch and Lehmann, 2005; Riddel and Schwer, 2003). According to Acs et al. (2006), entrepreneurial activities are tending to be ever higher in standard with investment in new knowledge remaining relatively high while companies, especially new companies, simultaneously making recourse to true sources of knowledge (universities and R&D). Meanwhile Varga (2002) studies the location of knowledge spillovers as a type of economic agglomeration and a means of contributing to regional economic development and as such deserving priority within the context of political practices. Furthermore, Roura (2009) holds how the employment of individuals who have completed higher education reflects on the development and competitiveness of regions. Entrepreneurship also plays a role in regional development as first defended by Schumpeter (1934, 1939, 1942). The entrepreneur represents the primary driving force behind economic development. Indeed, entrepreneurship is able to roll out the innovation enabling profits to be obtained through assuming the risks inherent to creativity. Furthermore, such entrepreneurialism, particularly in the case of new companies, and especially high technology and/or knowledge intensive activities, may originate inside universities with many student engaged in developing projects in the course of their studies, which they later go onto implement and commercialise (Smilor et al., 1990; Steffensen et al., 2000; Feller et al., 2002). According to EIRMA (2007), the importance of the transfer of knowledge and cooperation between companies and universities is of great value due to its major input into the development of regional competitiveness.

Correspondingly, interest in Knowledge Intensive Business Services (KIBS) has steadily risen ever since such companies were identified as generating added value to the economy (Acs, 2002; Autio and Acs, 2007; Henrekson and Johansson, 2010). In this way, KIBS are perceived as being of great strategic importance given that they are in the vanguard of innovation practices as well as constantly carrying out practices of overall great importance to the development and diffusion of knowledge (Tether and Tajar, 2008; Acs et al, 2009). As renderers of knowledge intensive services, the

presence of KIBS in a specific location is frequently considered as an important leverage of regional industrial competitiveness (Muller and Zenker, 2009). From the perspective of many authors, there is a clear correlation between the employment rate accounted for by KIBS entities and the level of productivity of non-KIBS companies in the regions hosting the former (Dall'erba et al. 2007; Delmar and Wennberg, 2010). However, there are also studies that take this viewpoint further and differentiate between the KIBS universe breaking down such companies into the professional and the technological with the latter deemed to display a greater propensity to employ individuals with higher education than professional KIBS (Frell, 2006; Corrocher et al., 2009).

According to Malecki et al. (2004), KIBS essentially opt for locations in urban centres as these inherently prove the most propitious to business innovation and networks boosting regional levels of competition. Nevertheless, Sheamur and Doloreaux (2008) encounter a downturn in the numbers of KIBS companies in urban agglomerations in favour of rural areas.

Correspondingly, and in parallel with the sheer scale of the relevance attributed by the literature, this research seeks to study the dichotomy between KIBS location (rural and urban) and the KIBS typology (professional and technological) and the means and ways knowledge is transferred between universities and such companies.

Following this introduction, we set out a review of the literature on the role of universities in the transfer of knowledge and their relationships with KIBS. Subsequently, we put forward our methodology and analysis of the results obtained before closing with some final considerations.

Literature Review

The role of universities in the transfer of knowledge

According to Parker and Zilberman (1993), conveying academic knowledge may be defined as a process based upon understanding, information and innovation being moved out of universities to companies. Meanwhile Varga (2000) describes how this transfer may take place through three mechanisms: (i) through networks (frequent personal contacts) between university and industry professionals, (ii) through the diffusion of technology and the formalisation of business relationships (reciprocal trust),

and (iii) through the utilisation of university infrastructures, such as libraries, scientific laboratories, IT facilities and research centres located on university campuses and thus enabling a sharing of research costs (mutual competences).

However, research on academic knowledge and its transfer dates back only to the beginning of the 1980s, a point in time when attention shifted to the economy in general and new economic policies in particular (Varga, 2009). This new concern led to the emergence in the literature of a new economic geography (Krugman, 1991b), both in terms of endogenous growth theory (Romer, 1986, 1990), which pointed to the importance of empirically testing the existence and spread of knowledge, and in terms of the growing focus on the right "mix" of policies able to best nurture university-based regional development, commonly benchmarked on Silicon Valley or Route 128 (Isserman, 1994; Reamer et al., 2003). Correspondingly, endogenous growth theory began to diverge from neo-classical theory given its emphasis on how economic growth did not derive from diverse forces external to an economic system but was rather the result of properties at work actually within the economic system (Romer, 1990). At the heart of this theory is the conception that technological transfers result from the specific concrete intentions of various economic actors to boost their profits (Romer, 1990; Sugerstrom et al, 1990; Aghion and Howitt, 1992). However, according to Acs et al (2009), endogenous growth theories have failed on one critical factor: the transmission of knowledge by spillovers to entrepreneurship / entrepreneurs (Audretsch, 1995). This implies that knowledge is itself a prerequisite and a fundamental condition for the growth and success of companies (Acs et al, 2009).

Since this period (the 1980s), in Europe, the USA and Asia, an array of technological centres have been founded and intimately related with regional development. The USA attributes 70% of its research budget to technological programs, which are partially allocated to a specific type of university participation and enabling the latter sector to share and reduce research and development costs (Varga, 2002; 2009). As the OECD advocates (2007), universities play an increasingly relevant role in terms of levels of knowledge transfer and the competitiveness of the regions that host them. There is a growing body of work testifying to the importance of entrepreneurship at the regional level and demonstrating the crucial factor in the founding of new companies is knowledge and correspondingly emphasising the impact of knowledge spillovers from universities and other R&D institutions.

Within this framework, we put forward the following three research hypotheses:

H1: Cooperation between KIBS companies and universities is positively related with the sharing of R&D resources.

H2: Cooperation between KIBS companies and universities is positively related with the reduction in research costs.

H3: Cooperation between KIBS companies and universities is positively related with working networks.

According to Acs et al (2009), entrepreneurialism contributes towards economic growth whenever it serves as a conduit for knowledge and hence investing in research and development not so as to commercialise the findings but rather to capitalise on the potentially latent opportunities. Falling within this scope is the underlying relationship between companies and knowledge spillovers with some authors proposing that through this relationship the generation of innovations is possible (whether in products or services) that consequently increase market share (Jaffem 1989; Feldman and Florida, 1994; Anselin et al, 1997, 2000; Varga, 1998; Fischer and Varga, 2003).

We would thus put forward the following research hypotheses:

H4: Cooperation between KIBS companies and universities is positively related with the interests of companies in raising their market share.

H5: Cooperation between KIBS companies and universities is positively related with the creation of innovation.

Various authors have come out in favour of universities taking on a determining role as a motor of regional development. This role may be played out through the implementation of innovative projects, such as e-learning initiatives based upon wireless communication networks, or through the rendering of support to the launching of start-ups and spin-offs, as well as establishing mechanisms for transferring technology (Rogers, 1986; Etzkowitz et al., 2000; Wright et al., 2004; Ferreira et al., 2010).

According to EIRMA (2007), the importance of the transfer of knowledge and joint cooperation between companies and universities is now greatly valued due to the strength of its input into regional development. We would furthermore point out how universities are able to meet company expectations and hence facilitate cooperation between the respective participants through: (i) producing the sustained research that proves of worth and applicable to companies, (ii) training the generations of scientists and engineers capable of being productive and useful outside of the teaching system, (iii) recognising that conveying knowledge is an integral component to the research

undertaken within the university environment, (iv) contributing towards the development of local communities through cooperation with companies, particularly small and medium sized companies, (v) educating individuals and encouraging their creative capacities, and (vi) acting as "guardians of knowledge".

There are various means of processing the transfer of knowledge identified in the literature: the geographic proximity/concentration of companies, related research centres and industries (Feldman, 1994; Koo, 2005; Storper and Scott, 1995; Audretsch et al., 2005; Audretsch and Lehmann, 2006; Goldstein and Drucker, 2006), the level of university expenditure on research (Varga, 2000), social networks (Breschi and Lissoni, 2007), and cooperation between companies (Gebrekidan and Awuah, 2002).

Furthermore, in addition to these conduits for the transfer of knowledge, cultural differences and the prevailing level of entrepreneurialism, especially at the regional level, also very much need taking into account. Indeed, these cultural difference reflect in social networks with different intensities (Saxenian, 1994; Fischer et al 2001; Feldmen and Desrochers, 2004) and the level of entrepreneurship present in a region may determine the level of success attained in the capacity to transform knowledge into actual innovation (Acs and Varga, 2005; Inzelt and Szerb, 2006; Mueller, 2006; Koo, 2007). Gilbert et al. (2008) find that the clusters forming regions, in conjunction with knowledge spillovers, contribute towards regional development through boosting the propensity and capacity for innovation, the launching of new products onto the market and a greater capacity to deal with economic growth in their surrounding environment.

Correspondingly, spillovers would seem to appear in any place: (i) through the movements of highly specialised professionals, (ii) through the utilisation of a specific technology in the production of specific products, and (iii) through the relationships behind the knowledge applied by R&D service professionals, thus, the existence of human capital generating a formal and informal interchange of persons and ideals while simultaneously raising the standards of operational efficiency (Eliasson, 1996; Acs, 2002; Dekmar and Wennberg, 2010).

Within this context, and in accordance with the pertinence of geographic proximity to cooperation between universities and companies, we furthermore formulated the following research hypothesis:

H6: Cooperation between companies and universities is positively related with their respective geographic proximity.

Spillovers also play another role in the transfer of knowledge given the fact that a particular type of knowledge being deployed by one company does not prevent it from being deployed by another. Hence, this dissemination of knowledge stimulates and nurtures economic vitality through the emergence and growth of companies (Dahlander and Magnusson, 2005; Agarwal et al, 2007). National competitiveness and economic development are profoundly bound up with information and knowledge economy related concepts (Cooke, 2002). Any consideration on the "new economy" quite quickly reveals that it is dominated by the information and communication technologies and biotechnology. However, we should also highlight that these innovative industries emerge and grow within specific geographic locations (Rutten, 2003). Cooke (2002) identifies the following factors as fundamental to their formation: financing for scientific research by risk capital firms, new businesses, establishing company incubators able to operate differently to those currently in existence as human capital is frequently in greater demand than that supplied, and capital as this represents an essential ingredient to both knowledge economies and cluster construction.

We may thus correspondingly highlight the following factors of cooperation between universities and companies (Table 1):

Table 1: **Factors of cooperation between universities and companies**

Factors of cooperation	Approach
Geographic proximity, Frequent personal contacts Reciprocal trust, Mutual competence, Shared R&D costs, Expanding the geographic scope of the market covered, Developing new products and/or services, Managing the formal and informal interchange of persons and ideas, Raising operational efficiency, Sharing technologies and knowledge, Learning from cooperation partners, Reducing general costs.	Parker and Zilberman (1993); Rutten (2003); Audretsch and Lehmann (2005); EIRMA (2007); Breschi and Lissini (2007); Varga (2009).

KIBS and knowledge transfers

Within the service industry, the rapid advance of the KIBS sector since the mid-1980s has demonstrated the extent of its highly important role in innovation processes (Muller, 2001; Howells and Tether, 2004; Toivonen, 2004; Koch and Stahlecker, 2006; Strambach, 2008). Nevertheless, Hauknes (1999) draws attention to the need to define the concept of 'knowledge intensity' with this question posed in terms of the transaction conditions and the provision of services. According to Hauknes (1999), the intensity of knowledge may be analysed according to two dimensions: (i) knowledge that is sought after from a specific service provider. Then, depending on whether the supplier is to a greater or lesser extent specialist in its specific type of intensive knowledge, (ii) the knowledge sought after from a specific knowledge intensive service. In this case, the intensity of the knowledge enables clients to choose one service to the detriment of another and taking into consideration the respective fluctuations in the intensity of the knowledge incorporated. Knowledge intensity is also defined in accordance with the structure of employee qualifications, with the greater degree of specialisation reflecting a greater degree of knowledge intensity (OECD, 2001; Hass and Lindemann, 2003).

KIBS may be classified and divided up into two main groups (Frell, 2006; Miles et al., 1995; Doloreux and Muller, 2007, Shearmur, and Doloreux, 2008): technological KIBS Tecnológicos (t_KIBS) and professional KIBS (p_KIBS). The t_KIBS category incorporates activities related with information technology, research and development, engineering activities and architecture as well as activities related to consultancy and testing and analysis techniques. The p_KIBS include the legal, accountancy, bookkeeping and auditing sectors and activities such as fiscal consultancy, market studies as well as the entire publicity sector. The role played by KIBS in innovation is above all testified to by the fact that their performance in innovation is no simple matter as it would be if they simply met the existing market demands and more specifically the desires of their clients (Boden and Miles, 2000; Wood, 2002; Glücker and Armbruster, 2003; Tödtling et al, 2006). Instead, KIBS serve a role analogous to bridges for knowledge or bridges between companies and science for innovation (Miles et al. 1995; Czarnitzki and Spielkamp, 2003). Furthermore, there are authors who maintain that the origins of the third industrial revolution lie in the importance that needs to be attributed to KIBS (Tether and Hipp, 2002).

In this sense, we may affirm that knowledge is simultaneously the greatest input and output (Miles, 2001; Gallouj, 2002). One of the main KIBS contributions towards service and system innovation is the contextualisation that they render to knowledge (Milles et al., 1996; Bessant and Rush, 2000; Strambach, 2001; Wood, 2002; Muller and Doloreux, 2007). Strambach (2008) defends that KIBS contribute to the knowledge dynamic across diverse contexts, with processes involving the creation, utilisation, transformation, movement and diffusion of knowledge (Bettencourt, et al., 2002).

The success of these processes depends on the specialisation of the actors involved (KIBS and their client companies) and the context in which they occur (Malerba and Orsenigo, 2000). The importance of studying these services is demonstrated by Pires et al (2008) in empirically proving the positive effects of KIBS on the competitiveness of other companies and the added value thereby produced. Across the services rendered to companies sector, KIBS companies have recorded faster growth than other segments and a performance due to a range of factors, especially the outsourcing of these services by other sectors, the sheer extent of progress in the field of information and communication technologies, regulatory, legal and marketplace changes as well as the broader prevailing backdrop of globalisation and internationalisation (Teece et al., 1997 and 2000; Dosi, et al., 2000; Bengtsson and Dabhilkar 2009).

While the debate on the growth of KIBS revolves around their new specialisations and the growth of the tertiary sector as a whole, there is growing acknowledgement as to how both new manufacturing processes and new services and innovations in general increasingly originate in KIBS companies (Kakaomerlioglu and Carisson, 1999; Tomlinson and Milles, 1999; Frell, 2006).

Miles et al. (1995) distinguish between three core KIBS characteristics: (i) the high priority attributed by these companies to professional knowledge, (ii) their desire to ensure their companies are actual primary information and knowledge resources, or deploying such knowledge to produce services that serve as intermediaries between these services, their clients and their production processes, and (iii) the great importance of this service type for levels of competition and competitiveness. Strambach (2008) stresses how KIBS utilise three distinctive categories of knowledge (analytical, synthetic and symbolic).

In industry, transactions are knowledge rendered form with the outputs very often containing major intangible components. Innovations in the majority of cases mostly result from new combinations of physical artefacts. Furthermore, its role in regional

competitiveness has also come in for attention and studied by geographers and other regional specialists (Beyers and Alvin, 1985; Coffey and Polèse, 1987; Illeris, 1996). As the suppliers of knowledge intensive services, the presence of these companies in a particular place is frequently considered an important leverage of regional industrial competitiveness to such an extent that a clear correlation between the level of employment generated by KIBS companies and the level of non-KIBS company productivity, that is at all other companies in the respective region, has been identified (Dall'erba et al., 2007; Delmar and Wennberg, 2010).

According to den Hertog (2000), analysing the role of KIBS in innovation processes opens up an understanding of the way that knowledge is produced and utilised in the economy as well as its role in these processes. The production of a specific service is very often the result of the joint efforts of various services, for example, in providing client attendance services where client satisfaction is the main objective (den Hertog, 2000). The interactional processes between KIBS companies and their clients are the main mechanism in the generating, processing and transferring of knowledge (den Hertog, 2000; Bettencourt et al., 2002; Wood, 2002; Miles, 2005; Muller and Doloreux, 2007).

KIBS companies serve as the catalysers driving the fusion of various knowledge types, especially those involving tacit knowledge, localised in the most inner reaches of companies and also in the service sector (den Hertog, 2000, Strambach, 2001). We would here stress the concepts of interactive learning and the user-producer connection, in which the KIBS role is greatly to the fore (Lundvall, 1988, 1992). In summary, the KIBS form a category of service activities incorporating intensive knowledge utilisation that is not only often highly innovative but also facilitates innovation in other economic sectors (Miles et al., 1995; Delmar and Wennberg, 2010).

In the literature, there are few studies focusing upon the difference in the KIBS company profile. According to research undertaken by Frell (2006), t_KIBS employ persons with higher levels of qualification than p_KIBS with this factor impacting on their levels of innovation and in p_KIBS innovation is fostered more in the relationships with suppliers and clients (Freel, 2006).

These findings open up the grounds for questioning as to whether there are clear differences in the types of KIBS (professional and technological) and their location (rural and urban). We correspondingly set out the following research hypotheses:

H8: Do t_KIBS employ a greater percentage of professionals with higher education qualifications than p_KIBS.

H9: Do u_KIBS (urban) employ a greater percentage of professionals with higher education qualifications than r_KIBS (rural).

Methodology

Sample

With the objective of analysing the transfer of knowledge, hence the cooperation ongoing between universities and KIBS companies, we drafted and implemented a questionnaire for a final sample of 500 KIBS companies. The study sample stems from a data bases supplied by Grupo Coface and containing details on KIBS company trends (companies declaring bankruptcy, launched and operational) between 2004 and 2009. Based on the data, in 2004 Portugal hosted a total of 39,254 KIBS companies that declined to 34,610 firms in 2009.

We were also able to verify that 4,633 KIBS (11.8%) may be considered inactive in 2009, with only 88.2% actually operational. The sample was extracted from the data base according to business volume selecting only those companies recording a turnover in business volume of over €0.01.

The sample was then narrowed down by company business codes CAE (REV.3) and NACE (REV 2), similar to the approaches made by other researchers (Frell, 2006, Miles et al., 1995; Doloreux and Muller, 2007, Shearmur, and Doloreux, 2008) so as to incorporate two KIBS groups into the sample: technological KIBS focused upon activities related to information and communication technologies, research and development, engineering and architecture and related activities, testing and analysis techniques (NACE codes: 62.01; 62.02; 62.03; 62.09; 63.11; 63.91; 63.99; 71.11; 71.12; 71.20; 72.1; 72.2) and professional KIBS operating in the legal, accountancy and bookkeeping sectors and auditing, fiscal consultancy, market studies activities as well as the entire public relations sector (NACE codes: 69.10; 69.20; 73.20; 70.22; 73.11; 73.12; 78.10; 78.30; 74.20; 74.90).

The final sample of 500 KIBS companies was structured as follows: professional KIBS (65.6%, 328 companies) and technological KIBS (34.4%, 172 companies). Of the entire

sample, 18.6% of companies were located in rural surroundings (93 companies) with 81.4% found in urban environments (407 companies).

Of the 328 professional KIBS companies, 63 were located in rural regions with 265 in urban settlements while the figures for technological KIBS came in at 30 and 142 respectively (Table 2). We define as rural, all locations containing fewer than 5,000 inhabitants (Kayser based criteria, 1990)

Table 2: Distribution of KIBS: typology and location

KIBS Typology		KIBS Location		Total
		Rural	Urban	
Professional	N	63	265	328
	%	12.6%	53.0%	65,6%
Technological	N	30	142	172
	%	6.0%	28.4%	34,4%
Total	N	93	407	500
	%	18.6%	81.4%	100.0%

Statistical methods and variables adopted

Based on descriptive statistics, we found that only 4.8% (24) of the KIBS companies making up the sample directly cooperated with higher education institutions. Despite not finding any differences in the levels of cooperation either by company typology (professional versus technological) or by location (rural versus urban), the results of the logistical regression model return a logit probability of companies establishing partnerships with higher education institutions is positively influenced by relationships of proximity and confidence, by the types of costs associated with establishing such cooperation partnerships and by the age of the owners.

The indirect effects of the transfer of knowledge generated by universities to KIBS companies were also taken into consideration through the proportion of professionals recruited with levels of higher education. Through the application of the non-parametric Mann-Whitney U test, we find that in 2004 the proportion of employees with higher education was higher in u_KIBS than in r_KIBS. However, this situation did not remain constant as in 2009 the result returns the consequences of a strong rise in the percentage

of graduate employees at rurally located KIBS companies and rising from 67% to 75%. As regards the KIBS typology, both p_KIBS and t_KIBS display high levels of graduate employment, varying between 79% and 82%, with their being no statistically significant difference between these two KIBS types.

Finally, to evaluate the relationship between the KIBS location and the likelihood of employing members of staff who have completed higher education, we once again made recourse to a logistical regression model.

Analysis of Results

Cooperation between Universities and KIBS

To evaluate the significance of the factors of cooperation and the entrepreneur profile (gender, age, academic background) on the probability of ongoing cooperation between universities and KIBS companies, we deployed logistical regression.

In adjusted regression models, the regression parameters were estimated through recourse to the maximum accuracy method. The significance and the quality of the models, as well as the significance of the regression coefficient were all validated. We respectively, made recourse to the accuracy ratio test, the -2LL (Log Likelihood) indicator and the Wald test. The explanatory capacity of the model was evaluated by pseudo-R^2.

The level of significance (α) for determining whether a factor attains significance is set at the value of 0.05 (thus, 5%). The other levels of significance deployed are 0.1 and 0.01. We furthermore respected the rule of rejecting H0 whenever p-value $\leq \alpha$.

Table 2 presents the absolute and relative frequencies for cooperation established between higher education institutions and KIBS companies, as well as the probability of significance resulting from the chi-square test. Correspondingly, we find that only 24 KIBS companies establish direct cooperation with universities, 14 p_KIBS and 10 t_KIBS. Of the 473 KIBS companies stating they do not cooperate with higher education institutions, 312 are p_KIBS and 164 are t_KIBS. Distribution by location is also included in the contents of Table 2.

Table 2: Distribution of cooperation according to KIBS typology

KIBS Typology				Cooperation		x^2 (sig.)	
				Don't Coop	Coop		
Professional		Rural	N	**59**	**2**		
			% Total	18.1	3.7		
		Urban	N	**253**	**12**	0.933	
	K I B S l o c a t i o n		% of Total	77.6	3.7		
Technology		Rural	N	**28**	**1**		0.584
			% of Total	16.4	0.6		
		Urban	N	**133**	**9**	0.865	
			% of Total	77.8	5.3		

Based upon the chi-square statistical test and the respective significance probability, we conclude that the level of cooperation established with universities does not depend on the company typology (p=0.584>0.10) or by means of location (p=0.933 in p_KIBS (professional) and p=0.865 in t_KIBS (technological).

Subsequently, with the objective of identifying and capturing the factors relevant to the relationships between higher education teaching institutions and KIBS companies, we applied exploratory factorial analysis to the set of variable identified in the literature as factors of cooperation (Table 3).

Rotation Varimax factorial analysis demonstrated, through the Bartlett test (sig=0.000), a correlation between factors 1 to 4 and 5 to 12, adjusting the data very well to the analysis according to the KMO (0.855). The two factors created explain 84.3% of data variation. The first factor is entitled **close and trusting relationship** and gathers together items 1 to 4. The percentage of variance explained comes in at 51.6%, and with reliability deemed excellent (0.931). As regards the second factor, this refers to **types of cost associated with cooperation** and covers eight items (5 to 12).

The findings also point to a very good level of internal consistency, measured by Cronbach's alpha (0.969). The percentage of variance explained by this factor was 32.7%. Table 4 summarises the information on the two latent factors extracted through factorial analysis.

Table 3: Factorial Analysis: summary of the latent factors

Factor titles	Item identification	Cronbach's Alpha (No items)	Explained variance (%)
F1: Economic conditions and local infrastructures	1. Geographic proximity 2. Frequent personal contact 3. Reciprocal trust 4. Mutual competences	0.931 (4)	51.6
F2:Access to superior technological knowledge	5. Expanding the geographic scope of the market covered 6. Developing new products and/or services 7. Sharing R&D costs 8. Managing the formal and informal interchange of persons and ideas 9. Raising operational efficiency 10. Sharing technologies and knowledge 11. Learning from cooperation partners 12. Reducing general costs	0.969 (8)	32.7

We now move onto analysis of the significance of these factors as regards the probability of cooperation existing between higher education institutions and KIBS companies deploying the control variables reflecting the entrepreneur profile (gender, age, academic background). The cooperation variable is codified as 0- does not cooperate and 1-cooperates. The qualitative independent variables, gender and academic background, were also codified as dummy variables with the reference classes being male and having graduated from higher education respectively.

Table 5 summarises the information on the independent variables in the estimated regression model, as well as the statistical evaluation of the significance, quality and explanatory capacity of the model. Firstly, given $G^2=160.472$; $p<0.001$, we may conclude that there is at least one independent variable in the model with predictive power over our variable dependent. Secondly, the -2LL statistic presented (where the p-value corresponds to -2LL=X^2(493-5-1=487)=31.419 is 1>0.05) indicates the model does fit the data. The value of pseudo-R^2 (0.862) also reveals that the explanatory variables incorporated into the model reduce the uncertainty of the dependent variable by 86.2%. According to the statistical probability of significance associated with the Wald test, only the model's independent variables Factor 1 (p=0.004), Factor 2 (p=0.000) and entrepreneur age (p=0.017) hold significance at a level of 5%. Re-

estimating the model with only the significant variables, we obtain the final readjusted model.

Table 5: Logistical Regression Model: cooperation

	Initial Model				Final Readjusted Model			
	B	EP	Sig.	Exp (B)	B	EP	Sig.	Exp (B)
FACTOR 1	3.383	(1.16)	0.004**	29.463	2.446	(0.56)	0.000***	11.540
FACTOR 2	2.489	(0.60)	0.000***	12.049	2.065	(0.42)	0.000***	7.884
Age	0.193	(0.08)	0.017*	1.212	0.172	(0.06)	0.006**	1.188
Education (No-HE)	1.071	1.98	0.589	2.918				
Gender (F)	-5.763	3.64	0.114	0.003				
Intercept	-14.714	5.318	0.006	0.000	-13.030	3.458	0.000	0.000
G^2 (sig)	160,472 (0,000)				155,037 (0,000)			
-2LL	31.419				37.052			
Pseudo-R^2	0.862				0.836			

* Level of significance 0.05   No-HE – No Higher Education   F- Female
** Level of significance 0.01
*** Level of significance 0.001

Therefore, the results of the logistical regression model show the probability logit of companies entering into partnerships with higher education institutions is positively influenced by relations of proximity and trust, by the types of costs associated with establishing cooperation alongside the age of business owners. Hence, we find the ratio of companies cooperating directly with higher education institutions rises in accordance with the incidence of close and trusting relationship, with better market perspectives and the higher the age of owners.

Given the high percentage of companies underestimating the importance of cooperating with universities (95.2%) to the development of their businesses, we analysed the effects of universities indirectly transferring knowledge to KIBS companies through the proportion of professionals contracted with higher education qualifications.

Regarding 2004, companies in the study return an average of around 80% (M = 0.80; DP = 0.28) of employees with an undergraduate degree or higher education qualification. In 2009, this proportion remained high (M=0.81; DP=0.26).

Through the application of the non parametric Mann-Whitney U test, we find the percentage of graduate workers in 2004 was higher on average in u_KIBS companies than their r_KIBS counterparts (given p=0.026<0.05) and hence rejecting the equal average null hypothesis). This finding does not hold for the 2009 figures given that the proportion of employees with higher education at rurally located KIBS companies rose significantly between 2004 and 2009 (up from 67% to 75%).

In fact, in 2009, the average proportion of employees with higher education did not differ significantly according to the KIBS location (p=0.152>0.05). As regards the KIBS typology, both the p_KIBS and the t_KIBS companies return high rates of professional employment with graduate levels of education (varying between 79% and 82%), with no statistically relevant differences between the two KIBS types (p_{2004}=0.632 and p_{2009}=0.702 >0.05).

Analysing the KIBS company type separately to location (Table 6), we find that the urban p_KIBS company return a higher level of graduate employment in 2004 than rural p_KIBS companies. In t_KIBS companies, this difference retains statistical significance in 2009.

Table 6: Comparison between the average proportion of graduate employees by KIBS typology and location

p_KIBS or t_KIBS	Type of Location (dummies)		Employees with higher education in 04	Employees with higher education in 09
Professional	Urban	Average	0.82	0.82
		SD	0.25	0.24
	Rural	Average	0.65	0.78
		SD	0.42	0.31
Mann-Whitney U Test		**p-value**	**0.039***	**0.938**
Technology	Urban	Average	0.83	0.84
		SD	0.26	0.24
	Rural	Average	0.75	0.69
		SD	0.32	0.33
Mann-Whitney U Test		**p-value**	**0.390**	**0.009***

* Level of significance 0.05

Finally, in evaluating whether the transfer of knowledge and cooperation between universities and companies is demonstrated through the employment of higher

education graduates, we again made recourse to the logistical regression model (Table 7).

Table 7: Logistical regression model: knowledge transfers in regional development

Independent Variables	B	EP	Sig.	Exp (B)
PTrabCurSup04	-2.212	0.837	0.008**	.110
PTrabCurSup09	2.386	1.001	0.017*	10.866
Education (No-HE)	-1.605	0.424	0.000***	.201
Gender (F)	0.468	0.330	0 .156	1.597
Age	-0.057	0.022	0.009**	.944
Intercept	1.684	1.078	0 .118	5.390

* Level of significance 0.05   No-HE – No Higher Education   F- Female
** Level of significance 0.01
*** Level of significance 0.001

According to the Wald test (more specifically, the probability of significance) associated to the logit coefficients of the estimated model (Table 6), the results do enable us to conclude that there is an effect, statistically significant, of employing higher education graduates ($p=0.008$ and $p=0.017<0.05$), and of the age ($p=0.009<0.05$) the academic background of owners ($p=0.000<0.05$) on the probability logit of companies locating in rural environments. Based upon the model's coefficients, we correspondingly find that the ratio of companies locating in rural communities rises in keeping with the level of employment of higher education graduates, with the owner having completed that level of study and when the business owner's age is lower.

Thus, we may conclude that rural professional and technological KIBS companies employ more members of staff with higher education qualifications. As regards their urban professional and technological KIBS counterparts, we may state that statistically, the employment of higher education qualified professionals is not related to location.

These results enable us to thus state that the employment of graduates, age and the academic background of business owners do have a statistically significant impact on the logit probability of the company locating in a rural environment. This means that, while there is no direct cooperation between higher education institutions and KIBS companies, there is a transfer of knowledge generated by universities through the professionals employed by KIBS entities.

In summary, despite no direct institutional cooperation, KIBS companies receive an input of knowledge generated by universities and conveyed through the professionals employed and the academic learning process that they have been through in the aforementioned academic institutions.

Conclusion

The core objective of this research was to analyse the transfer of knowledge from universities to KIBS companies carried out directly through the formalisation of partnerships or business relationships, or indirectly through rates of graduate employment at such companies. We furthermore sought to verify any differences brought about by the location (rural versus urban) and typology (professional versus technological) of KIBS companies.

In order to achieve this objective, we carried out a review of the literature to conclude on two fundamental points: (i) the role of universities in the transfer of knowledge within the scope of which we extracted twelve fundamental factors to cooperation between universities and KIBS companies (ii) and the knowledge present in KIBS. Through multivariable statistical analysis, we found that there were no differences in the cooperation between companies and universities whether by location or by typology. In practice, this means that companies cooperating with universities do so independently of being professional or technological, urban or rural.

As regards the transfer of knowledge between universities and companies taking place through the employment of professionals who have graduated from higher education, our conclusions demonstrate that the ratio of companies located in rural communities rises in accordance with the level of graduate employment, where the business owner holds graduate qualifications and the younger the respective individual is. Hence, as regards employing members of staff with higher education in rural areas, at both professional and technological companies, this rises in keeping with the younger the age range and the higher the level of the entrepreneur's educational qualifications.

These results mean that despite their being few companies understanding the potential and the benefits from cooperating formally with universities, such cooperation is attained more informally through the employment of professionals who have attained graduate levels of education. This means that knowledge does spillover from universities to companies through the former's graduates. For example, Roura (2009) defends how the indicators best able to capture regional competitiveness and development are employment in research and development and the level of graduate education. Hence, we may also point out that these rurally located companies are making their contributions towards better employment standards in these regions.

With these results, we wish to contribute towards boosting the level of understanding of the cooperation dynamics between KIBS companies and universities. We also provide an input into policy making in identifying a clear need to strengthen the more formal relationships between KIBS and universities, through research project partnerships in conjunction with support for companies to enhance their willingness to engage in direct cooperation with universities and accessing the state of the art knowledge present within such environments. Such is the path towards nurturing business development and competitiveness and with spread effects into the wider surrounding local region. With rural areas lagging the most and seeing that younger entrepreneurs prefer these regions, we should correspondingly establish incentive and support schemes for the founding of companies in these areas as there are currently only 93 KIBS in the rural regions of Portugal. Given that they employ persons with higher qualifications and in contexts when there is so much discussion of youth employment, and especially graduates, this would appear to be a solution for at least part of this problem.

The main limitation to our research was the low number of companies cooperating with universities and hence preventing a broader dimension to the study. Furthermore, we were also unable to analyse which cooperation mechanisms were deployed by KIBS companies and by universities. Finally, we analysed this cooperation only from the KIBS perspective while the same analytical process would also serve to capture the university's perspective.

As further lines of research, we would propose the comparison of our results here with those gathered in other countries so as to verify whether KIBS companies behave in similar or different ways. We would also suggest the completion of a longitudinal study at an interval of five years, following the application of new support policies aiming to bring about this cooperation and to verify whether there have been any changes in cooperation preferences. We might also take into consideration whether start-up KIBS companies display the same type of behaviour as the KIBS analysed within the framework of this study and whether they have greater propensity to cooperation with universities and which means do they use in conjunction with whether or not their start-up category influences the priority attributed to employing specialists.

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