

Opportunities of University Business Incubation in the Less Favoured Regions of Transition Countries

Zoltán Bajmócy¹

Recent paper examines the opportunities of University Business Incubators (UBIs) in less favoured regions. The topic is underlain by the fact that the idea of setting up UBIs has recently gained attention in the less favoured regions of the new entrants of the European Union, but the foreign best practices almost always derive from highly developed regions, which makes them difficult to adapt. We raise the questions whether a UBI programme can be successful in a less favoured region of a transition country or not, and which are the main peculiarities that have to be considered when adapting the patterns of more developed regions.

First we review the most important findings of the literature on UBIs with a special emphasis on the service providing function and the spin-off process. To interpret university business incubation we attempt to apply an evolutionary approach. Second we examined the expectations of local SMEs towards university-related incubation in the Szeged sub-region, Hungary. When outlining the main characteristics of the region we utilize the results of a survey on the entrepreneurial activity of undergraduate and PhD students (samples of 286 and 134). We conducted regression and cluster analyses on the SME-sample, and realized certain peculiar patterns. In the concluding part we point out the factors which are necessary to consider in our opinion when planning and managing a UBI project in a less favoured region. The main conclusion is that incubation can only be the second step in enhancing the local knowledge commercialization, a well-developed pre-incubation strategy must be implemented prior to that.

Keywords: university business incubation, pre-incubation, evolutionary approach, less favoured regions.

1. Introduction

Research universities and institutes can have considerable direct and indirect effects on the development of a given region which is underlain by several success stories (e.g. Silicon Valley, Route 128, Cambridge). However the presence of knowledge-concentrating institutes only provides an opportunity, the strengthening of the university – local business sphere relations is not deterministic. This recognition led several regions to apply deliberate strategies to enhance the local impacts of universities (e.g. Turku, Oulu, Cardiff). The spontaneous growth fuelled by knowledge-spillover is only probable in areas with strong

¹ *Zoltán Bajmócy*, PhD student. University of Szeged, Faculty of Economics and Business Administration, Institute of Economics and Economic Development. E-mail: bajmocy@eco.u-szeged.hu

urban economies, however in small regions universities can serve as a substitute for agglomeration economies (*Goldstein – Renault 2004, Varga 1998, Varga 2003*).

The regional impacts of universities and research institutes can be manifold, they range from the local spending impacts through the direct technology impacts to the contribution to innovative milieu (*Goldstein – Renault 2004, Morgan 2002*). Beside the backward linkages (short run multiplier effects) the examination of forward linkages (knowledge effects) has gained particular attention recently. These effects manifest themselves through the improved skills of human resources, the increased R&D activity and the attractiveness of the region (*Armstrong – Taylor 2000, Varga 2004*). Furthermore there are strong arguments that in a knowledge-based economy the appropriate functioning of the teaching and research roles of universities requires the well-operating role of the “economic utilization of the knowledge” as well (*Etzkowitz et al 2000*). These three roles are complementary and able to reinforce each other. However the university outputs can generate regional impacts only if they are transmitted by well functioning mechanisms (university-industry relations). In Hungary these ties are rather sparse and informal or affect large enterprises, and can not be characterised as triple-helix relations (*Inzelt 2004*).

The concept of university business incubation which has become a widely applied tool for developing new technology based firms (NTBFs) fits into the abovementioned conceptual framework. The essence of the university business incubator (UBI) concept lies in the objective of the local commercialization of the knowledge-base and in the university-related services, and not necessarily in the proprietorship of a university or a research institute. In line with the original concept of incubation, UBIs aim to help the NTBFs through the most vulnerable initial phase of their life-span in the expectation of a longer-term return. Certain evidences prove that UBIs can be an effecting tool in this respect, while also supporting the aims of the host university (*Celine – Garnsey 2000, Tornatzky et al 2003*). However the success stories almost always derive from highly developed regions which make them difficult or even impossible to adapt in less favoured areas.

By today the issue of creating UBIs has won focus in transition economies of Central Eastern Europe too. It is clearly apparent in Hungary’s big cities that universities are unable to realize a UBI project by themselves but only in cooperation with local governments and probably by involving EU funds. Hence university business incubation can (and in our opinion) must be interpreted as an economic development intervention. Therefore it is necessary to examine the underlying rationales, and to reveal those peculiarities which are inevitable to consider when adapting such programmes in less favoured regions.

The paper *first* reviews the most important peculiarities of university business incubation, with a special emphasis on the service providing function of the incubator and the spin-off process. When interpreting incubation we attempt to apply an evolutionary framework, which might be useful for better understanding of the incubation concept. In the second part we analyse the opportunities in less favoured regions, namely in Szeged, Hungary. After providing an overall view of the region, which is supplemented by an analyses of the entrepreneurial activity of undergraduate and PhD students, we examine the attitudes and certain behavioural patterns of local small and medium-sized enterprises (SMEs) towards business incubation. We use logistic regression and cluster analyses on a sample of 170. In the concluding part we outline the factors which are necessary to consider when planning and managing a UBI programme in a less favoured region of a transition country.

2. University business incubation as a local economic development tool

The UBI supplements the original functions of incubation with the objective of the commercialization of research achievements and thus with certain formal university or research institute relations (*Mian 1996*). Just like incubation itself the concept of UBI is also a collective term which can refer to several different practical types. A common trait is however, that they provide complex services temporarily to innovative start-ups during the initial phase of their life-span. The most important service types are: the provision of incubator space and business support services, the assistance in fund-raising, the encouragement of networking and the special university-related services (*Carayannis – von Zedtwitz 2005*).

The essence of the concept is the special environment (milieu) provided for start-ups and thus the spatial proximity, which raises the chance of survival and enhances the ability to grow. Incubation is a twofold process. The first element is the value-addition to the supported enterprise, the second element is the investment to the incubator and its direct or indirect local return. The performance of the incubator, which is usually measured by the growth² of the supported tenants, consists of three main elements (*Hackett – Dilts 2004a*):

- *Selection performance*: the incubator's ability to choose the enterprises with the highest development potential (the incubators ability to work as an ideal venture capitalist). The

² Growth can be interpreted as income, profit, value or employment growth. The different aspects may lead to different empirical results.

incubator is not only successful if the supported enterprise survives the incubation period, but also if failures take place as soon as possible.

- *Resource munificence*: all the resources (e.g. infrastructure), skills, knowledge, information and external linkages which can be used for the successful development.
- *Monitoring and business assistance intensity*: refers to the intensity and standard of the service provision.

This interrelation had also formerly been assumed implicitly. Empirical studies usually tested the effect of some function on the performance, and on the basis of successful examples tried to draw conclusions in terms of the right practice of management (*Barrow 2001, Hackett – Dilts 2004b, Rice 2002, Richards 2002*). Concerning university business incubators *Sarfraz Mian* (1996, 1997) did pioneer work in this subject by working up a comprehensive model for assessing the operation of incubators.

The basis of setting up UBIs on the one hand is the increasing involvement of universities in economic development and on the other hand their own organizational objectives. Universities compete with each other on at least three levels: for students, for scientists and for financial resources (*Goldfarb – Henrekson 2003*). Hence they deliberately try to achieve a performance and develop such an image that helps to best the rivals. Besides if a university is ready for capital investment, then – depending on the research field – it can realize considerable gain as well, which is backed up by the “Bayh-Dole sort” regulations also in Hungary.

Universities take part in the incubation process in a complex way: as a *sponsor* (who initiates the incubator program) expecting local economic development and the realization of their own organizational objectives, as *service provider* (incubator space and special technology services), and also as the *host-institution of incubatees*, as significant part of the supported start-ups derive from the academic sphere. Accordingly we examine two distinct elements in this chapter: the service-providing role of the UBI and the spin-off process.

2.1. The UBI as a service provider

The underlying rationales of incubator services are usually proclaimed to be the market failures which emerge during the initial phase of the innovation process. At this point we believe that the application of an evolutionary framework (as the widely-used theory of innovation research) gives us better understanding.

By supporting innovative start-up enterprises, UBIs primarily contribute to the development of new knowledge-intensive industries. This is underpinned by the argument that the large number of new entrants is characteristic to new industries, because the barriers of entry are low, and the cumulative learning process is not yet far-gone (*Nelson 1995, Dosi – Nelson 1994*). At this stage the industry-specific institutions do not exist yet, thus in the strengthening of the new industry chance and increasing returns have crucial role (*Boschma – Lambooy 1999*). The emergence of increasing returns heavily depends on the ability of the industry to reach the critical size and to establish the necessary specific institutions which together proved the localization economies. In the evolutionary theory the success of an emerging industry highly depends on the local environment (namely how much investment has been made to exploit the potential), thus a successful industry was not necessarily “fitter” than its rivals elsewhere, but chance and favourable local environment allowed it to strengthen. In the light of this argument incubation is an investment which helps to exploit the potential of the emerging industry.

It is also necessary to consider that the examination of market failures needs a dynamic approach. Market failures which emerge in the early phase of the development are inevitable concomitants of the innovation process, and might be corrected spontaneously later (*Hronszky 2005*). Moreover in an evolutionary framework the economic policy makers’ decisions can be characterized by bounded rationality, thus it is hard to believe that they exactly know where and how to intervene (*Witt 2003*). In such a framework the role of incubation is not the substitution of inefficient market operation, it has to facilitate the development of the emerging markets of industry-related services (*Bajmócy 2005*).

To summarize the role of UBIs in the development of innovative start-up companies and thus in the strengthening of emerging knowledge-intensive industries we can identify two principles:

- First, UBIs play role in the strengthening of the formal and informal connections among the start-up enterprises of the industry and thus initiates the cumulative learning process.
- Second, they take part in the development of the industry-specific institutional and business environment, and so help to exploit the potential of the emerging industry.

UBIs can face these challenges successfully if they are able to modify their service providing function dynamically. In the practice the strong donor-dependence may hinder this seriously, which is necessary to mention, because it is characteristic to Central and Eastern European Countries and to the present Hungarian traditional incubators (*Bajmócy 2004*). The

donor financed programmes turn rather towards the donor than the market, because the subsistence of the organization depends more on the good relations with the donor, than on the appropriate service provision. These programmes have low ability to adjust to the changing circumstances (CDA 2001). *Lalkaka* (1997) emphasises that the main problems of incubators in these countries are the lack of sustainability and the ex-bureaucrat program managers.

Sustainability can be achieved when the services provide real value-addition to the incubatee, accordingly they will be inclined to pay for it at least a part of the market price. This also helps to winnow the unnecessary services. Universities are able to provide such milieu, infrastructure, equipments, laboratories, trainings and technological services for innovative start-ups, which they are not able to develop in their own organizational framework (*Mian* 1996). Incubators characteristically provide these services not solely to academic spin-offs, but also to other innovative local enterprises. This is an absolutely natural behaviour, as the critical size which assures the sustainability can be achieved easier this way.

Certainly a dynamic approach must be applied here as well: when possible, the provision of these services must be passed to private agents, as in long run the supported services themselves can hinder the development of a potential market. The outlined contexture is actually the application of the two main approach of enterprise development³ to an evolutionary framework, as the essence of the approach is to “facilitate the market”, instead of trying to “substitute”.

2.2. *The UBI as facilitator of the spin-off process*

It is an everyday problem of less developed regions that the achievements produced at universities are not utilized locally or do not reach companies of the private sector at all (*Buzás* 2003, *Inzelt* 2004). Utilization outside the region is primarily possible if research has explicit results, which means the transfer of codified knowledge (technology). When the knowledge is embodied in a patent or other intellectual property, than incubation denotes an alternative solution compared to licensing.

But the further development of research results often requires the transfer of tacit knowledge elements, and these transactions have special features and require personal interactions (*Nonaka et al* 1996). For the researcher’s involvement in further developments

³ The two referred approaches are the „substitute the market” and the „facilitate the market” approaches (CDA 2001, *Kállay – Imreh* 2004)

the following three methods are the most usual (*Goldfarb – Henrekson 2003*): *first*, the researcher can be employed as a consultant by the company performing further developments. *Second*, the business sphere may finance further developments, therefore the inventor can continue with private funding but still using university infrastructure. *Third*, the inventor can establish a new enterprise for the commercialization of the idea.

However not necessarily the employee of a university or a research institute stands in the focus of the spin-off process, but also can the intellectual property itself, or a student, a graduate or a PhD student. This latter might have particular importance for transition economies in the future. The case of Hungary shows that formerly almost all of the PhD students continued their career in the academic sphere, but with the sharp increase in their number it is not possible anymore.

The spin-off process can be divided into consecutive phases, in which the entrepreneur has to face different challenges (*Clarysse et al 2005*):

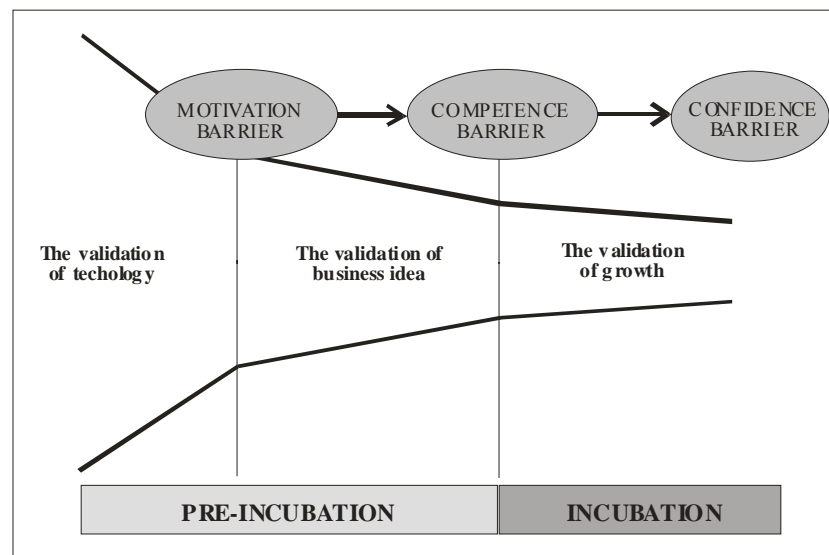
- The first challenge is the *validation of technology*, when technological uncertainty prevails. It is still uncertain whether the idea can be economically utilized or not. The focus is on the improvement of the technology.
- The second challenge is the *validation of the business idea*. Despite the fact that the technological solution can be industrially utilized, the market might not accept it.
- The third step is the *validation of growth*: to set the enterprise on a growth path.

The transition from a phase to an other is characteristically not unhampered, hence only a small proportion of ideas may turn out to be commercialized. Here the use of the evolutionary term "*selection*" is useful for better understanding. Evolutionary theories of technical advance primarily deal with already commercialized technological solutions which are winnowed by the forces of the market and the institutional environment. It is important to identify that the potential technological solutions are also winnowed much earlier than they enter the market. The host institution of the researcher and also the UBI constitute an integral part of this pre-market selection environment. Certainly they are not the only forces, but they are the one that can be improved for the purpose of greater variety in the market, which is considered to be an important element of the development (*Boschma 2004*).

During the process of the commercialization of the idea the (potential) entrepreneur may face several barriers (*Figure 1*). Based on the literature and on interviews conducted in the University of Szeged, *Buzás (2004)* identified three main barriers that may hinder the

academic spin-off process in Hungary⁴. The researchers may *first* face a *motivation barrier*: in spite of the utilizable idea they do not want to take part in the business life (Buzás 2004). The opportunity costs of enterprise creation lie behind this phenomena. On one hand, losing a secure job and on the other hand „wasted time”, because the results of development do not mean any step further in the academic career and do not lead to results that could be published. *Second* the entrepreneur may face a *competence barrier*, they do not have the skills to manage a company. *Third* they will probably face the problem of all start-ups, namely the lack of goodwill, references, formal and informal linkages, which can be called a *confidence barrier* (Buzás 2004).

Figure 1: The spin-off process



Source: Based on Clarysse et al (2005) and Buzás (2004)

The main task of incubation is to treat the abovementioned problems. We must point out that the standard task of the UBI, namely to enhance the growth of the spin-off firm (or to keep it from failure) is the umpteenth step of the process. This is particularly true for Central and Eastern European Countries where spin-off formation is rather an exception than a rule. Thus prior to university business incubation a pre-incubation strategy must be implemented with the key challenge of providing such an environment that is favourable to pass the idea forward to the market.

Clarysse et al (2005) identified that European research institutions apply three main strategy types to enhance the spin-off process. The first is a *low selective model*, where the

⁴ However they are considered to be true more or less generally, not only in transition economies.

main objective is the general stimulation of entrepreneurial activity. In this case most of the established firms do not endeavour to grow. The second (*supportive model*) focuses on the formation of spin-offs with high growth potential. The third model requires significant financial investment into the spin-off firms. The main focus is on the capital gain (they called this the *incubator model*).

In Hungary's recent regulatory environment all the above-mentioned solutions are theoretically possible, however in the practice the low selective and the supportive models are the real alternatives. While the former allows a lax relation between pre-incubation and incubation, the latter one requires tight intertwining of the two-processes.

To summarize the theoretical chapter we found that in connection with UBIs pre-incubation and incubation are two complementary and intertwining phases, which are both necessary, particularly in less developed regions, where spin-off formation is a sparse phenomenon and successful examples are usually missing. In an evolutionary framework the *main challenge of pre-incubation* is to pass the ideas forward to the market, because selection forces start to affect way before the new technological solution enter the market. *The main challenge of incubation* is to take part in the strengthening of the formal and informal relations among the start-up enterprises of the emerging industry, and in the development of the industry-specific institutional and business environment in order to help to exploit the potential of the industry. While facing these challenges the incubator should undertake a "facilitate the market" approach.

3. Opportunities of UBIs in less favoured regions: The case of Szeged

In 2004 and 2005 the University of Szeged conducted a survey among local enterprises to estimate the potential role of the university in the local knowledge-based development⁵. Approximately 1000 questionnaires were sent to local companies, out of which 170 were returned in an evaluable form. We used this sample to examine the attitude of local enterprises towards university business incubation. This examination was supplemented by analyzing the entrepreneurial activity of undergraduate students, and as a new feature, PhD students in order to receive an overall picture. So we do not study enterprises which are

⁵ The research (The Potential Role of the University of Szeged in Knowledge-based Local Economic Development) was conducted by the Faculty of Economics and Business Administration under the supervision of Prof. Imre Lengyel.

located in a UBI, as such an institution does not exist is Szeged yet. We are attempting to estimate the *opportunities* for a UBI in the region.

In this chapter we *first* point out the main characteristics of the region focusing on the state of development, the industrial structure and the available secondary sources on the entrepreneurial activity of researchers. We also outline the main results of the students' sample. *In the second part* we focus on the local enterprises and after summarizing the peculiarities of the sample and methodology, we show the results of the regression and cluster analyses. The consequences on the opportunities of university business incubation in less favoured regions are outlined in the concluding part.

3.1. The main characteristics of the region

Szeged is the centre of one of Hungary's less favoured regions (South Great Plain). The GDP of South Great Plain measured in purchasing power parities is around 38-40% of the EU average and does not show any close up, while compared to the national average a strong drop back has been apparent in the last years. The region falls under the Objective 1 of the EU's structural policy. Within this the GDP of Csongrád County (NUTS 3 level region) is slightly higher but shows an even greater drop back. The GDP and income figures of the Szeged sub-region (NUTS 4 level) exceed the regional average, although still show significant drop back compared to the EU average. In the Szeged sub-region processing industry activities represent low quality that is also apparent in the low export capacity: the whole South Great Plain region provides 4% of the country's export.

At the same time, owing to Szeged, Csongrád County has good performance in the field of R&D. With the exception of the Central Hungarian region (where also the capital Budapest is situated) all the significant indicators show that it excels in the country: number of researchers per 10000 employees (137), number of academic degrees per 10000 employees (58), R&D expenditure as % of GDP (1.7%), R&D investments as % of total investments (2.0%)⁶ (*Lengyel – Lukovics 2005*). However the favourable R&D figures derive from public R&D activities.

In the Szeged sub-region no significant clusters are present. Based on employment-company- and export-LQ data certain traditional industries (food processing, textile industry), traditional services (trade, real estate sales and distribution, economic and legal services),

⁶ The national average values of the four indicators: 77, 27, 1.0%, 1.0%.

certain knowledge-intensive services (health care, education) and R&D activities are concentrated here above the national average (*Patik – Deák 2005*).

The most significant employer of the city of Szeged (which has the population of 160000) is the University of Szeged, whose 11 faculties host more than 30.000 students. The university has great scientific capacity especially in the fields of natural science, medicine and pharmacy. The Szeged Biological Research Center of Hungarian Academy of Sciences, Bay Zoltán Institute for Applied Research and the Crop Research Institute of Szeged contribute to this as the major research institutions. Based on data referring to the citations and publications of its lecturers, the university classifies as one of the 100 best universities in Europe, being the only one from such underdeveloped region⁷.

The development strategy of the city is based on knowledge-based industries that would focus on biotechnology, life sciences and the related knowledge-intensive services (material sciences, IT, business services). As these high-tech industries are not strongly present in the region this is to be achieved mainly by converting the existing scientific capacity into economic success; therefore a business incubator with university ties could be linked to the strategy successfully.

Hence a potential UBI must focus beside the existing innovative firms on those potential entrepreneurs who are able to convert the extant knowledge base into economic value. Researchers, graduate students and PhD students can play significant role in this process. This latter group is especially interesting as due to the sharp increase in the number of PhD students⁸, most of them will not be able to continue their career in the academic sphere.

Buzás (2004) examined the entrepreneurial motivations of the lecturers of the University of Szeged. Among the interviewed researchers entrepreneurial spirit is rather low, what has its reasons partly in motivation and partly in competence barriers. The most important arguments against starting enterprises include the fear of failure, the loss of a free life style and the too narrowly defined research topics. To the question of „would you give up your scientific career in the hope of business success” everybody answered no, although with the help of an experienced businessman 33% of researchers would seem ready to start an enterprise (Buzás 2004). It seems to be clear that present researchers will not constitute the main target group of a potential incubator, however examples of successful entrepreneurs and certain changes in the legal framework and organizational culture may help to encourage them. Accordingly the

⁷ Jiao Tong Univ. (2005): Academic Ranking of World Universities 2005. Jiao Tong University, Shanghai. <http://ed.sjtu.edu.cn/ranking.htm>

⁸ The University of Szeged has approximately 600 PhD students at the moment.

last few years' changes caused a slight turn. The government has launched the "Tech-Start" tender to support the establishment of university spin-off firms, and gives tax benefit for enterprises whose premises are in the property of a university. In the last two years 20 projects from Szeged were supported in the Tech-Start, which is twice as many as the next large university city (except from Budapest the capital city).

In 2005 we surveyed the entrepreneurial activity and motivations of PhD students and undergraduate⁹ students who are graduating in less than two years. We classified the students into three groups (*Table 1*):

- "entrepreneurs" who have an enterprise or intends to set up one in less than a year,
- "potential entrepreneurs" who plan to start an enterprise but in more than one year,
- "not entrepreneurs" who does not want to be an entrepreneur.

Table 1: Entrepreneurial activity of undergraduate and PhD students

| | | Entrepreneurs | Potential Entrepreneurs | Not entrepreneur | Sum |
|-------------------------------|--|---------------|-------------------------|------------------|---------|
| PHD STUDENTS | | | | | |
| | | N = 18 | N = 68 | N = 40 | N = 126 |
| Scientific filed | Natural Sciences and Medical Sciences (n = 83) | 7,0 | 56,0 | 37,0 | 100 |
| | Social Sciences (n = 27) | 11,1 | 55,6 | 33,3 | 100 |
| | Business and Economics (n = 16) | 56,2 | 37,5 | 6,3 | 100 |
| Gender | Female (n = 66) | 10,6 | 47,0 | 42,4 | 100 |
| | Male (n = 60) | 18,3 | 61,7 | 20,0 | 100 |
| UNDERGRADUATE STUDENTS | | | | | |
| | | N = 12 | N = 77 | N = 195 | N = 284 |
| Scientific filed | Natural Sciences (n = 163) | 2,5 | 22,1 | 75,4 | 100,0 |
| | Business and Economics (n = 121) | 6,6 | 33,9 | 59,5 | 100,0 |
| Gender | Female (n = 124) | 6,4 | 24,2 | 69,4 | 100,0 |
| | Male (n = 160) | 2,5 | 29,4 | 68,1 | 100,0 |

The data are in percentage, "n" refers to the numerosity of the given group.

We found that entrepreneurial activity of students and PhD students are low except for the PhD students of the Faculty of Economics and Business Administration. The already existing student-owned enterprises almost exclusively provide knowledge-intensive business services. We were interested in further details about "entrepreneurs" and "potential entrepreneurs" which are relevant in terms of incubation. The group of undergraduate entrepreneurs is too small for further examinations, so we analysed the other three groups. We found that most of them would partially utilize their professional knowledge, and that potential entrepreneurs are more likely to be interested in SME services of the university than existing entrepreneurs. The three groups are very similar in the respect of their service needs. Approximately quarter of

⁹ We reckon undergraduate those who do not have a Master degree yet (they may have a Bachelor degree).

them would be interested in equipment and laboratory services (results and sample features are shown in *appendix 1*).

These characteristics of the region and the entrepreneurial activity of students show that the formation of knowledge-intensive enterprises is scarce and generally confined to business services. In the following we complete this by analysing the existing enterprises of Szeged sub-region.

3.2. The need for incubation among existing enterprises

To examine the need for incubation among local enterprises we used a sample that was created to survey the potential role of the university in the knowledge based local economic development. From the 170 returned questionnaire we excluded 19 that were answered by large corporations. So we used a sample of 151 local small and medium-sized enterprises. The research focused on the potential participants of university-industry relations, so in harmony with the objectives of the research, the sample, compared to the economic structure of the region, includes an over-representation of companies operating in knowledge-intensive fields, also of SMEs, and enterprises conducting processing industry activities.

Most of the variables we used for the analysis are measured in ordinal scale. We asked the enterprises to judge the importance of certain services in terms of the competitiveness of the firm. They had to rate them on a 7 grade scale. We used the variable INCUB (incubation) as a dependent variable in the regression analyses. We created dummy variables to measure the innovativeness of the enterprise (RD_DEP: do they have an own R&D department, RD_COM: have they given R&D commission to other firms in the last 3 years, UNIV: do they have regular professional relation with a university researcher). Furthermore we used the variables AGE (age of the SME), EMPLOY (number of employees) and TRADE (proportion of income realized outside the region). We set up and tested two hypotheses:

Hypothesis 1: *The firm's positive judgement on the importance of incubation in terms of its competitiveness can be explained by its positive judgement on other strategic services (such as R&D services, laboratory service,s special trainings for SMEs) and the innovativeness of the firm.* If the positive judgement of incubation does not go together with the need for some other strategic (mainly technology-oriented) services or the innovative nature of the firm, than it might be underlain simply by hoped cost advantages. Furthermore

the incubation of non-innovative and non-traded¹⁰ firms might cause serious distortion effects when the supported tenants displace other local firms that might have better potential (CEC 2002, Pena 2005). These distortion effects can be significantly reduced by supporting innovative and traded enterprises.

Hypothesis 2: *Regarding the judgement of incubation and other services, enterprises can be classified on the basis of peculiar behavioural patterns.* Such a classification would help us to understand what the service needs are underpinned by exactly. It would also provide us an opportunity to map the focus group of university business incubation.

To test the *first hypothesis* we used a logistic regression model, but prior to that we examined the correspondence between the judgement of incubation and other services by computing Spearman's correlations (the results are shown in *appendix 2*). We found significant although not too strong correlation in terms of all the examined service types. This indicated that incubation is not solely connected to technology oriented services.

We intended to apply an ordinal logit model, but as a connotation of the several missing values, we could not run the model, not even after trying to transform the variables referring to service needs from a 7 grade scale to a 3 grade scale. Even in this latter case we had several empty cells that would have distort the result. In order to cope with this problem we decided to transform the dependent variable (INCUB) into a dummy variable. The zero-value means that the enterprise is indifferent or thinks that incubation is not important in terms of their competitiveness (values 1-4 in the original scale). The value 1 means that the firm considers incubation to be important in terms of his competitiveness (values 5-7 in the original scale). Since we are mainly interested in the positive judgement of incubation, we could order "neutral" and "negative" answers into the same class. This dummy dependent variable let us to apply a *binary logistic regression* model (the summary of the model is in *appendix 3*).

We used a backward stepwise method to choose the most significant variables. In the final step five variables remained in the equation out of which three refers to service needs. The age is negatively related to the need of incubation which could be expected, but surprisingly the R&D commission variable (RD_COM 1) is also negatively related, and certain variables did not turn out to be significant despite the expectations (*Table 2*).

¹⁰ Non-traded: Those firms whose income is mainly realized inside the region, thus can not generate regional income multiplier effects. Accordingly traded refers to the ability to realize significant proportion of the firm's income outside the region (but not necessarily abroad) (Armstrong – Taylor 2003).

Table 2: Variables in equation (binary logistic regression)

| | B | S.E. | Wald | df | Sig. | Exp (B) |
|---|----------|-------------|-------------|-----------|-------------|----------------|
| AGE (Age of the enterprise – scale) | -0,180 | 0,105 | 2,914 | 1 | 0,088 | 0,836 |
| RD_COM (1) (R&D commission for other companies – dummy) | -2,535 | 1,019 | 6,193 | 1 | 0,013 | 0,179 |
| S_NETW (Organizing networks and clusters locally – ordinal) | 0,712 | 0,255 | 7,777 | 1 | 0,005 | 2,039 |
| S_TEND (Counselling on public procurement and EU tenders – ordinal) | 0,853 | 0,309 | 7,595 | 1 | 0,006 | 2,346 |
| S_SME (Training for SMEs – ordinal) | 0,748 | 0,250 | 8,893 | 1 | 0,003 | 2,108 |
| Constant | -8,175 | 0,246 | 11,174 | 1 | 0,001 | 0,000 |

Variables not in the equation: EMPLOY (Number of employees – scale), RD_DEP (Own R&D department – dummy), UNIV (Regular professional relations with university researchers – dummy), S_RD (R&D services – dummy), S_VC (Regional venture capital fund – ordinal), S_BPSC (Business planning and strategic counselling – ordinal), S_INV (Investment and financial counselling – ordinal), S_IT (IT counselling – ordinal), S_LAB (Laboratory services – ordinal).

These results and the fact that incubation is positively correlated to all other examined services indicate that the judgement of services are generally negative, so the positive correspondence between incubation and other services might derive from the high number of negative answers (1 to 3 on the 7 grade scale). This would also explain the negative relation between the variables INCUB and RD_COM (1).

Accordingly the positive judgement of incubation can not be explained by the need for some other strategic (technology-oriented services) and the innovativeness of the firm. Hence *we do not accept hypothesis 1.*

The testing of *hypothesis 2* gave acceptable explanation for the regression results. We conducted a cluster analysis to find characteristic patterns in the attitude of enterprises towards incubation and other services (Table 3). The variables included in the analysis refer to the service needs, the innovativeness of the firm (do they have own R&D department, have they given R&D commission for other firms in the last 3 years, do they have regular professional relations with university researchers) and the proportion of income realized outside the region. This latter variable indicates the potential market distortion effects of incubation, as the support of those enterprises which mainly focus on local market might lead to the displacement of other local firms. The reason for this is that they compete for a constrained local demand, so in short-term the high growth of a firm causes the decline of its local rivals (Lengyel 2003).

The results outlined three clusters with strongly diverse characteristics (Table 3). Approximately half of the enterprises of the sample belong to *cluster 1* which we denominated “*not inquiring*”. These enterprise are not innovative, they do not have relations with university researchers, the proportion of income realized outside the region is well below the average and the do not think that any of the examined services would be important in

terms of their competitiveness. Slightly more than 40% of the enterprises belong to *cluster 2* which we called “*inquiring*”. The proportion of income realized outside the region and the innovative performance of this cluster is average, which indicates that this cluster is not too homogenous. What makes them common is that they judge all the examined services positively.

Table 3: Final Cluster Centres

| Variables | Cluster 1 (52%) | Cluster 2 (42%) | Cluster 3 (6%) |
|---|-----------------|-----------------|-----------------------|
| | "not inquiring" | "inquiring" | "technology oriented" |
| RD_DEP: Own R&D department (dummy) | -0,211 | -0,009 | 2,342 |
| RD_COM: R&D commission for other companies (regularity) | -0,281 | -0,046 | 2,927 |
| UNIV: Regular professional relations with university researchers (dummy) | -0,163 | ,023 | 1,208 |
| TRADE: Proportion of income realized outside the region (%) | -0,105 | 0,009 | 0,909 |
| S_RD: R&D services (importance – ordinal) | -0,440 | 0,279 | 0,649 |
| S_VC: Regional venture capital fund (importance – ordinal) | -0,419 | 0,355 | 0,463 |
| S_NETW: Organizing networks and clusters locally (importance – ordinal) | -0,395 | 0,347 | 1,134 |
| S_BPSC: Business planning and strategic counselling (importance – ordinal) | -0,517 | 0,733 | -0,469 |
| S_INV: Investment and financial counselling (importance – ordinal) | -0,565 | 0,770 | -0,332 |
| S_TEND: Counselling on public procurement and EU tenders (importance – ordinal) | -0,415 | 0,599 | -0,617 |
| INCUB: Business incubation (importance – ordinal) | -0,620 | 0,727 | 0,662 |
| S_IT: IT counselling (importance – ordinal) | -0,463 | 0,648 | -0,332 |
| S_SME: Training for SMEs (importance – ordinal) | -0,521 | 0,698 | 0,464 |
| S_LAB: Laboratory services (importance – ordinal) | -0,390 | 0,346 | 0,454 |

The data refer to the distance of cluster average from the mean.

Only 6% of the surveyed firms belong to *cluster 3*. They can be called “*technology oriented*”. They excel in terms of the innovative performance and the proportion of income realized outside the region, they have university ties and they judge services selectively. They attach value to business incubation, laboratory services, R&D services, special trainings for SMEs, networks and regional venture capital fund, but they judge business planning, counselling on public procurement and EU tenders and information technologies negatively. They supposedly are able to solve these latter activities by themselves, which is quite expectable from an innovative enterprise. Hence it is highly probable that these firms expect real value-adding services instead of simple cost advantages. This cluster forms the main target group of a UBI, but only very small percentage of the sample belong to this cluster.

As a result of the cluster analysis we were able to identify groups of SMEs with diverse characteristics, which helped us to understand the opportunities of a potential UBI better. Hence we *accept hypothesis 2*.

To summarize this case study the main focus group of a UBI consists of potential innovative entrepreneurs (primarily researchers, graduate and PhD students) and existing local technology-intensive enterprises. While in some Western European countries and in the USA

the spin-off formation is a spontaneous and massive process, in less developed regions it is still sparse. However there exist a number of enterprises and potential entrepreneurs that can assure the sustainable operation of the UBI, but still pre-incubation (enhancing the spin-off process) seems to be more important.

In addition the inquiry for incubation does not necessarily represent a real need for strategic services, a large number of enterprises are interested in all accessible types of services. This can be explained by the fact that at the moment in Hungary almost all of the enterprise development programmes are donor-financed and provide services for free. So the enterprises do not risk money when they enter a program, but only time. This indicates the need for a well-developed selection policy.

4. Conclusions

The enterprises of a given region usually change their behaviours and principle routines (the source of their competitive advantage) only in longer term, hence the results of the empirical analysis may give us guidance in terms of the behaviour of today's potential entrepreneurs as well. Besides main findings of the Szeged case might be general to a given extent in less favoured regions of transition countries. In these regions the main orientation of innovation is the adaptation of the already available technologies and their modification (*Inzelt – Szerb 2003*). Beside the formation of the small groups of high-tech firms that exploit the knowledge base of universities, the main challenge in Hungarian university cities presumably remains the quick adaptation of technologies (*Lengyel 2003*).

This argument is reinforced by our results as well, which indicates that a well-developed *pre-incubation strategy must be implemented before launching a UBI project*. Setting up a UBI requires significant investment and the fixed costs of the operation are high. Without the continuous formation of potential tenants the programme can easily turn into a simple real-estate business which tries to keep its tenants after the incubation period as well and decreases the standard of provided services. This is exactly what happened to most of the traditional incubators of Hungary (*Bajmócy 2004*).

Our results showed that in case of setting up a UBI the inquiry would partially be underlain by hoped cost advantages, and would not solely derive from highly innovative traded enterprises. This gives vital importance to *selection policy*, which must focus on the innovative performance. The focus on one given industry or technological field would make

the sustainability very difficult considering the low number of potential tenants. In turn this would limit the opportunity of networking and cumulative learning.

Beside the well-defined admission criteria the often neglected *exit rules* are also essential. The lack of the exit policy is usually observable exactly in those regions where the potential new entrants do not put pressure on the UBI. In this case for maintaining the rental income tenants can remain in the incubator for 5 to 10 years which is absolutely contradictory to the logic of incubation. At the same time in underdeveloped region the lack of adequate premises can seriously constrain enterprises in leaving the incubator, which is an other problem that has to be solved when planning to launch a UBI.

Acknowledgments

The present paper was completed with the support of NKFP (National Research and Development Programme) and the research project entitled “The Potential Role of the University of Szeged in Knowledge-based Local Economic Development”. I would like to thank Imre Lengyel and Norbert Buzás for making my participation in the research possible. I also thank the participants of the 2nd PRIME PhD Summer School, especially Vito Corado Simoes and Jose Guimon for their useful comments.

References

- Armstrong, H. – Taylor, J. (2000): *Regional Economics and Policy*. Third Edition. Blackwell Publisher, Oxford – Malden, MA.
- Bajmócy Z. (2004): Az üzleti inkubáció szerepe a vállalkozásfejlesztésben (The role of business incubation in enterprise development). *Közgazdasági Szemle*, 51, 12, pp.1132-1150.
- Bajmócy Z. (2005): *University Business Incubation in Less Favoured Regions: The Case of Szeged*. PRIME 2nd PhD Summer School, Budapest. <http://www.prime-noe.org/>
- Barrow, C. (2001): *Incubators. A Realist's Guide to the World's New Business Accelerators*. John Wiley & Sons, New York.
- Boschma, R. A. (2004): Competitiveness of Regions from an Evolutionary Perspective. *Regional Studies*, 38,9, pp.1001-1014.
- Boschma, R. A. – Lambooy, J. G. (1999): Evolutionary Economics and Economic Geography. *Journal of Evolutionary Economics*, 9, pp.411-429.
- Buzás N. (2003): Organizational Elements of Knowledge Transfer in Hungary: Towards a Functional System of Innovation. In: Lengyel I. (ed.): *Knowledge Transfer, Small and Medium-Sized Enterprises, and Regional Development in Hungary*. JATEPress, Szeged, pp.32-46.
- Buzás N. (2004): A vállalkozói szellem szerepe a spin-off cégek alapításában (The role of entrepreneurial spirit in the formation of spin-off firms). In Czagány L. – Garai L- (szerk): *A szociális identitás, az információ és a piac*. SZTE Gazdaságtudományi Kar Közleményei, JATEPress, Szeged. pp.257-266.

- Carayannis, E. G. – von Zedtwitz, M. (2005): Architecting GloCal (global-local) Real-Virtual Incubator Networks (G-RVINs) as Catalysts and Accelerators of Entrepreneurship in Transitioning and Developing Economies: Lessons Learned and Best Practices from Current Development and Business Incubation Practices. *Technovation*, 25, 2, pp.95-110.
- CEC (2002): *Benchmarking of Business Incubators. Final Report*. Center for Strategy & Evaluation Services. European Commission, Luxembourg.
- Celine, D. – Garnsey, E. (2000): Emergence and Growth of High Tech Activity in Cambridge and Grenoble. *Entrepreneurship and Regional Development*, 12, pp.163-177.
- CDA (2001): *Business Development Services for Small Enterprises: Guiding Principles for Donor Intervention*. Committee of Donor Agencies for Small Enterprise Development. Washington.
- Clarysse, B. – Wright, M. – Lockett, A. – van de Velde, E. – Vohora, A. (2005): Spinning out New Ventures: A Typology of Incubation Strategies from European Research Institutions. *Research Policy*, 20, 2, pp.183-216.
- Dosi, G. – Nelson, R. R. (1994): An Introduction to Evolutionary Economics. *Journal of Evolutionary Economics*, 4, pp.153-172.
- Etzkowitz, H. – Webster, A. – Gebhardt, C. – Terra, B. R. C (2000): The future of the university, the university of the future: evolution of ivory tower to entrepreneurial paradigm. *Research Policy*, 29, 2, pp.313-330.
- Goldfarb, B. – Henrekson, M. (2003): Bottom-up versus Top-down Policies Towards the Commercialization of University Intellectual Property. *Research Policy*, 32, 4, pp.639-658.
- Goldstein, H. A. – Renault, C. S. (2004): Contributions of Universities to Regional Economic Development: A Quasi-Experimental Approach. *Regional Studies*, 38, 7, 733-746.o.
- Hackett, S. M. – Dilts, D. M. (2004a): A Real Options-Driven Theory of Business Incubation. *The Journal of Technology Transfer*, 29, 1, pp.41-54.
- Hackett, S. M. – Dilts, D. M. (2004b): A Systematic Review of Business Incubation Research. *The Journal of Technology Transfer*, 29, 1, pp.55-81.
- Hronszky I. (2005): Az innováció politika megalapozása evolucionista megközelítéssel (The foundation of innovation policy in an evolutionary approach) In Buzás N. (ed): Tudásmenedzsment és tudásalapú gazdaságfejlesztés. SZTE Gazdaságtudományi Kar Közleményei, JATEPress, Szeged, pp.13-33.
- Inzelt A. (2004): The Evolution of University – Industry – Government Relationships During the Transition. *Research Policy*, 33, 6-7, pp.975-995.
- Inzelt A. – Szerb L. (2003): Az innovációs aktivitás vizsgálata ökonometriai módszerekkel (Econometric analysis of innovative performance). *Közgazdasági Szemle*, 50, 11, 1002-1021.o.
- Kállay L. – Imreh Sz. (2004): *A kis- és középvállalkozás-fejlesztés gazdaságtana (The economics of SME development)*. Aula, Budapest.
- Lalkaka, R. (1997): Lessons from International Experience for the Promotion of Business Incubation Systems in Emerging Economies. *UNIDO Small and Medium Enterprises Programme Paper*, 3.
- Lengyel I. (2003): *Verseny és területi fejlődés. Térségek versenyképessége Magyarországon*. (Territorial Competition. The Competitiveness of Regions in Hungary) JATEPress, Szeged.
- Lengyel I. – Lukovics M. (2005): A Dél-Alföldi régió és Csongrád megye helyzete és versenyképessége. Helyzetelemzés, értékelés (The Competitiveness of the South Great Plain and Csongrád County) . *A Szegedi Tudományegyetem lehetőségei a tudásalapú helyi gazdaságfejlesztésben*. SZTE GTK Kézirat.

- Mian, S. A. (1996): Assessing Value-added Contributions of University Technology Business Incubators to Tenant Firms. *Research Policy*, 25, pp.325-335.
- Mian, S. A. (1997): Assessing and Managing the University Technology Business Incubator: An Integrative Framework. *Journal of Business Venturing*, 12, pp.251-285.
- Morgan, B. (2002): Higher Education and Regional Economic Development in Wales: An Opportunity for Demonstrating the Efficacy of Devolution in Economic Development. *Regional Studies*, 36, 1, pp.65-73.
- Nelson, R. R. (1995): Recent Evolutionary Theorizing in Economic Change. *Journal of Economic Literature*, 33, 3, pp.48-90.
- Nonaka, I. – Umemoto, K – Senoo, D (1996): From Information Processing to Knowledge Creation: A Paradigm Shift in Business Management. *Technology in Society*, 18, 2, pp.203-218.
- Patik R. – Deák Sz. (2005): Regionális klaszterek feltérképezése a gyakorlatban (Mapping Regional Clusters in Practice). *Tér és Társadalom*. 19, 3-4. pp.139-170.
- Peña, I. (2004): Business Incubation Centers and New Firm Growth in the Basque Country, *Small Business Economics*, 22, 3-4, pp.223-236.
- Rice, M. P. (2002): Co-production of Business Assistance in Business Incubators. An Exploratory Study. *Journal of Business Venturing*, 17, pp.163-187.
- Richards, S. (2002): *Inside Business Incubators and Corporate Ventures*. John Wiley & Sons, New York.
- Tornatzky, L. – Sherman, H. – Adkins, D. (2003): *Incubating Technology Business. A National Benchmarking Study*. National Business Incubation Association, Athens, Ohio.
- Varga A. (1998): *University Research and Regional Innovation: A Spatial Econometric Analyses of Academic Technology Transfers*. Kluwer Academic Publisher, Boston.
- Varga A (2003): Agglomeration and the Role of Universities in Regional Economic Development. In Lengyel I. (ed) *Knowledge Transfer, Small and Medium-Sized Enterprises and Regional Development in Hungary*. JATEPress, Szeged, pp.15-31.
- Varga A. (2004): Az egyetemi kutatások regionális gazdasági hatásai a nemzetközi szakirodalom tükrében (The regional impacts of university research in the light of the international literature). *Közgazdasági Szemle*, 51, 3, pp.259-275.
- Witt, U. (2003): Economic Policy Making in Evolutionary Perspective. *Journal of Evolutionary Economics*, 13, pp.77-94.

Appendix 1.

Some findings of the undergraduate and PhD student survey

PhD students: sample of 134. The data refer to 10 of the 11 doctoral schools of the university (Doctoral school of law is not included). PhD students from the fields of natural sciences are overrepresented in the sample.

Undergraduate students: sample of 286. The data refers to full time students of the Faculties of “Natural Sciences” and “Economics and Business Administration” It is representative for the Faculty of Economics, but in the Faculty of Natural Sciences the students studying computer sciences, biology and chemistry are over represented. These distortion probably caused an *overestimation* in the proportion of entrepreneurs and potential entrepreneurs.

| Some characteristics of Entrepreneurs” and “potential entrepreneurs” | | | |
|--|---|-------------------|------|
| | Would they utilize their professional knowledge? | | |
| | Yes | Partially | No |
| PhD entrepreneur | 20 | 80 | 0 |
| PhD potential entr. | 27,9 | 64,7 | 7,4 |
| Underg. Potential entr. | 32,4 | 58,1 | 9,5 |
| | Are they interested in SME services of the University | | |
| | Yes | If it is for free | No |
| PhD entrepreneur | 26,7 | 46,6 | 26,7 |
| PhD potential entr. | 48,5 | 42,6 | 8,9 |
| Underg. Potential entr. | 53,2 | 45,5 | 1,3 |

The data are in percentage

| Service needs of “entrepreneurs and “potential entrepreneurs” | | |
|---|-----------------------------|----------------|
| | Equipments and laboratories | |
| | Interested | Not interested |
| PhD entrepreneur | 20,0 | 80,0 |
| PhD potential entr. | 36,8 | 63,2 |
| Underg. Potential entr. | 21,1 | 78,9 |
| | Office for rent | |
| | Interested | Not interested |
| PhD entrepreneur | 40,0 | 60,0 |
| PhD potential entr. | 41,2 | 58,8 |
| Underg. Potential entr. | 61,0 | 39,0 |
| | Library | |
| | Interested | Not interested |
| PhD entrepreneur | 13,3 | 86,7 |
| PhD potential entr. | 20,6 | 79,4 |
| Underg. Potential entr. | 19,7 | 80,3 |
| | Professional trainings | |
| | Interested | Not interested |
| PhD entrepreneur | 40,0 | 60,0 |
| PhD potential entr. | 51,5 | 48,5 |
| Underg. Potential entr. | 60,5 | 39,5 |
| | Server capacity | |
| | Interested | Not interested |
| PhD entrepreneur | 33,3 | 66,7 |
| PhD potential entr. | 45,6 | 54,4 |
| Underg. Potential entr. | 65,8 | 34,2 |

The data are in percentage

Appendix 2.

Correspondence between the importance of incubation and other services

(Spearman's correlation)

| | r | Sig. |
|--|----------|-------------|
| R&D services | 0,367 | 0,000 |
| Regional venture capital fund | 0,443 | 0,000 |
| Organizing networks and clusters locally | 0,448 | 0,000 |
| Investment and financial counselling | 0,585 | 0,000 |
| Business planning and strategic counselling | 0,582 | 0,000 |
| Counselling on public procurement and EU tenders | 0,464 | 0,000 |
| IT counselling | 0,484 | 0,000 |
| Training for SMEs | 0,631 | 0,000 |
| Professional courses | 0,457 | 0,000 |
| Laboratory services | 0,384 | 0,000 |

All the variables are measured on ordinal scale (1-7)

Appendix 3.

Model summary: binary logistic regression

Method: Backward Stepwise (Wald)

Cases included in analysis: 94

Cases missing: 57

Total: 151

Model summary

| -2 Log Likelihood | Cox & Snell R square | Nagelkerke R square |
|--------------------------|---------------------------------|----------------------------|
| 44,470 | 0,376 | 0,616 |

Classification table

| | | Predicted | | Percentage correct |
|---------------------|---|----------------------------|----------|---------------------------|
| | | Business incubation | | |
| | | 0 | 1 | |
| Business Incubation | 0 | 73 | 4 | 94,8 |
| | 1 | 7 | 10 | 58,8 |
| Overall percentage | | | | 88,3 |

Variables in equation

| | B | S.E. | Wald | df | Sig. | Exp (B) |
|---|----------|-------------|-------------|-----------|-------------|----------------|
| AGE (Age of the enterprise – scale) | -0,180 | 0,105 | 2,914 | 1 | 0,088 | 0,836 |
| RD_COM (1) (R&D commission for other companies – dummy) | -2,535 | 1,019 | 6,193 | 1 | 0,013 | 0,179 |
| S_NETW (Organizing networks and clusters locally – ordinal) | 0,712 | 0,255 | 7,777 | 1 | 0,005 | 2,039 |
| S_TEND (Counselling on public procurement and EU tenders – ordinal) | 0,853 | 0,309 | 7,595 | 1 | 0,006 | 2,346 |
| S_SME (Training for SMEs – ordinal) | 0,748 | 0,250 | 8,893 | 1 | 0,003 | 2,108 |
| Constant | -8,175 | 0,246 | 11,174 | 1 | 0,001 | 0,000 |

Variables not in the equation: EMPLOY (Number of employees – scale), RD_DEP (Own R&D department – dummy), UNIV (Regular professional relations with university researchers – dummy), S_RD (R&D services – dummy), S_VC (Regional venture capital fund – ordinal), S_BPSC (Business planning and strategic counselling – ordinal), S_INV (Investment and financial counselling – ordinal), S_IT (IT counselling – ordinal), S_LAB (Laboratory services – ordinal).