

Possibilities of Improving the Transfer of PhD Theses Results from Slovak Universities into the Entrepreneurial Practice of Small and Medium Sized Enterprises

Mária ROSTÁŠOVÁ

University of Žilina, Fakulta prevádzky a ekonomiky dopravy a spojov, Katedra spojov, Moyzesova 20, 010 26 Žilina, Slovak Republic, maria.rostasova@fpedas.utc.sk , www.utc.sk

Danuša VAVRÍKOVÁ

University of Žilina, Moyzesova 20, 010 26 Žilina, Slovak Republic, vavrik@nextra.sk, www.utc.sk

KEYWORDS: *Industry-Academic Links, Commercialisation of University Research, Science – Technological Parks, Incubator Units, PhD theses*

ABSTRACT: *The paper deals with the critical analysis of the low interest of entrepreneurs in small and medium sized enterprises in Slovakia in the results of PhD students' research work. It outlines some effective approaches, methods and possibilities of involving young researchers in meeting needs of businesses and industries. It highlights the importance of science- technological parks, incubator units and research centres in preparation of young scientists for their engagement in innovations in small and medium sized enterprises. The article describes in detail how this problem is being solved at the University of Žilina, and in co-operation with other Slovak universities, within its research projects for 2003-2005.*

Interconnecting universities with entrepreneurial environment in the Slovak Republic is a very topical question. It shows the interest with which the Ministry of Education selects tasks that are to be solved within the scope of the state research in the Slovak Republic.

One of such tasks the University of Žilina has been working on, in co-operation with other Slovak universities and some Slovak businesses, is the project entitled **“Improvement of conditions for using the scientific and technical potential of young researchers.”** This project with its character belongs to the programme dealing with the development of personality and talent of young researchers and PhD students under the age of 35. It focuses on the group of young researchers at all Slovak universities. Most of them, after completing Bachelor and Master degree studies, continue their PhD studies.

The PhD studies represent the highest level of university education. Since 1990 their specific character and individual direction under the conditions of the Slovak Republic have gone through several stages. The PhD studies encompass both educational and research activities in science and technology, or creative activities in art. Despite the current insufficient funding for training institutions or PhD students, PhD studies at universities with rich scientific and artistic activities have conditions for a favourable development. Their quality at these schools is guaranteed by university departments (several can compare with foreign ones), guarantees of PhD studies and directors of study (many of them belong to well-known researchers in their fields, recognised also abroad).

In comparison with several countries where PhD students represent approximately 10 % of all university students, their number in the Slovak Republic is about 4.5 – 5 %. The number of PhD students in particular disciplines is shown in *table 1*.

Table 1. The number of internal and external PhD students at the universities of the Slovak Republic in 2001-2003 classified by the scientific disciplines

Scientific discipline	2001			2002			2003		
	Form		Σ	Form		Σ	Form		Σ
	Internal	External		Internal	External		Internal	External	
Natural Sciences	409	688	1097	407	706	1113	457	684	1141
Technical sciences	680	1573	2253	738	1677	2415	791	1892	2683
Agricultural, forestry, and veterinary sciences	169	397	566	159	375	534	151	388	539
Medical and pharmaceutical sciences	167	763	930	154	842	996	184	853	1037
Social sciences, humanities and services	464	2297	2761	512	2513	3025	603	2748	3351
Cultural science and art	81	276	357	92	313	405	100	311	411
Special engineering	0	0	0	5	37	42	9	46	55
Σ	1970	5994	7964	2067	6463	8530	2295	6922	9217

The characteristic feature of the PhD studies in the Slovak Republic is the insufficient transfer of outcome of the Slovak universities research projects to small and medium sized enterprises, which are primarily the focus of their research work, and the insufficient utilisation of the results by SME. Another adversely developing indicator shows quite low interconnection of PhD theses themes with businesses.(Table 2 as an illustration of the situation at one of the Slovak universities).

Moreover, there are only a few young researchers and PhD students who are able and willing, after a successful accomplishment of their research or defence of PhD thesis, to start their own business in spin-off companies.

Table 2: Theme orientation of theses at one of the Slovak universities in 1999-2003

Number	Scientific field of studies	Theme orientation		
		Theoretical	Possible use	Ordered by businesses
1.	33-01-9	13	8	2
2.	33-38-9	8	1	-
3.	33-39-9	11	6	1
4.	62-03-9	6	6	1
Σ		28	20	4

In order to successfully accomplish the project in question, it is necessary to analyse in detail the current situation in technology transfer related to the quality evaluation of research activities at universities and to the topicality evaluation of research and PhD theses themes with regard to entrepreneurial needs. Such analysis should become the base for suggesting quality indicators for

evaluation of research projects with regard to their utilisation by businesses as well as for creating suitable legislation to support technology transfer, creation of connecting links between universities and small and medium sized enterprises (Technology Transfer Offices, or Industrial Liaison Offices), and establishment of several (pilot) “spin-off” companies that will guarantee that young researchers and PhD students will be able to use their knowledge and find employment in the Slovak Republic. In this way, the risk of their potential interest in finding work abroad will diminish.

The risk of starting their own business will be diminished by starting it in so called incubator conditions created in the institutions of the type of technological or entrepreneurial incubators as well as by applying the outcome of the research projects and PhD theses.

The basic task for the researchers of this project is within two years to:

- analyse the current state of legislation regarding linking of universities with enterprises,
- develop base materials for:
 - survey of the low interest of businesses in the outcome of the research work,
 - finding out current and suggesting new identifiers for quality evaluation of the research projects,
 - identification of possibilities of young researchers’ co-operation with entrepreneurs
- suggest and check efficient approaches to improve interconnection of young researchers with businesses.

Other objectives to meet are:

- to suggest an evaluation system of PhD theses topicality with regard to their application in businesses,
- to develop a model of spin-off companies operation in which young researchers would apply the results of their PhD theses, and on the basis of utility and viability of these projects they would start their own business,
- to organise specialists meetings, workshops and conferences where the parties concerned – PhD students and representatives of businesses - could clearly present their proposals for mutual interconnection, which would have a highly positive impact on both sides,
- to search long-term partnerships between universities and businesses,
- to create structures of support for effective technology transfer. As an example can serve the establishment of a technological incubator in Science and Technology park in Žilina.

One stage of problem-solving, which will contribute to a thorough analysis of the present state of the achieved technology transfer or its intensification and quality improvement, is a large survey through electronic questioning at all Slovak universities and on sufficiently large sample of small and medium sized enterprises that are doing business in Slovakia.

The objectives of inquiring are specifically determined for the universities and for businesses. At the universities the questions concern identification and quantification of characteristic features of PhD studies related to transfer of the outcome into the entrepreneurial environment. In enterprises the emphasis is placed on finding causes of the entrepreneurs’ low interest in the results of young researchers’ work.

Special questionnaires were produced for young researchers and PhD students (current and former, internal and external) and for their directors of study who suggest themes for PhD theses and are, therefore, responsible to a great extent for topicality of projects and their utilisation in businesses and industries. As segments of respondents from the entrepreneurial environment are considered small and medium sized enterprises which employ/employed external PhD students, small and medium sized enterprises co-operating with universities, small and medium sized enterprises known for their innovative business policy. The new solutions in the projects of young researchers should be intended primarily for these entrepreneurs.

The segment - **Young researchers** expressed their opinion mainly about:

- the topicality of the PhD theses they are working on,
- the experience they have with the direct contact with the firm that could be interested in the results of their solutions

- interest to establish a company of their own. The object of the entrepreneurial activity would result from the PhD thesis results and from the estimate of its viability in the entrepreneurial environment in the Slovak Republic.

The segment - **Directors of study** were inquired mainly about:

- the way of creating themes for PhD theses and methodology of testing their utility for businesses,
- evaluation of co-operation between universities and businesses as far as PhD theses are concerned and the necessity of such a co-operation,
- their opinion on the character of small and medium sized enterprises which are open to knowledge transfer into their business activities.

The segment - **small and medium sized enterprises** were inquired about:

- the level of co-operation of their firm with a university and their experience ,
- topicality of present PhD theses and research projects,
- how well they are informed about excellent PhD theses and research work at universities,
- their interest to employ a young researcher or to co-operate with him in case the company could benefit from the results of his work.

This group was also asked several questions with the aim to find out how innovative the firm is and how open it is to the process of innovation as the factor of its competitiveness.

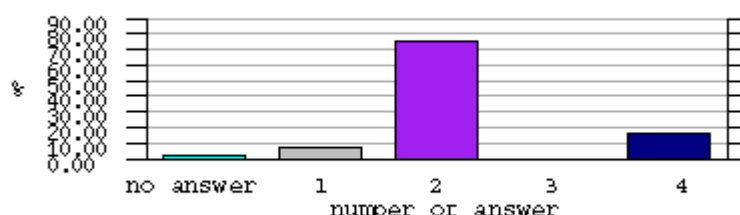
The survey brought very interesting results that clearly point at the necessity to improve the situation in linking university and entrepreneurial environment with the aim to use the results of young researchers' work in small and medium sized enterprises that have a great interest in increasing innovation in their business activities.

Example of one question for Directors of study :

The theme of your PhD thesis was suggested

1. on the basis of requirements from a particular firm and mediated by the training institution
2. on the incentive of the training institution (department)
3. on the incentive of a scientific institution (e.g. Slovak Academy)
4. other (Specify)

Results:



Example of one question for young researchers :

Do you suggest a PhD thesis theme on the basis of:

1. your own proposal without collaboration with businesses
2. your own proposal based on previous collaboration with businesses and related to their needs
3. the proposal and requirements of a specific company
4. other (Specify)

Results:



Example of one question for **small and medium sized enterprises**:

Does your firm co-operate with one of the universities or faculties in suggesting PhD thesis themes?

1. *yes, regularly*
2. *yes, but seldom*
3. *no, though we know about the co-operation possibilities*
4. *no, we do not know about the co-operation possibilities*
5. *other (Specify)*

Results:



The successful accomplishment of this project is a good base for achieving the fundamental objective – improving young researchers' status through the interconnection of university research potential with small and medium sized enterprises and the transfer of scientific and research results into the business activities of small and medium sized enterprises.

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