

ABOUT THE PROBLEM OF RESEARCH AND THE TECHNOLOGY TRANSFER IN THE SLOVAK REPUBLIC

Ján Corej¹ - Milan Dado² - Mária Rostášová³

Abstract — *The paper will be dedicated to the problems of research work, science in The Slovak Republic and to the transfer of technology or transfer of knowledge from university research centres to the praxis. The problem of resources for research work will be dealt with the point of view international co-operation, national policy, etc. This is the general problem and it is also related with the changes in the professors life. The task of Slovak Universities in technology transfer we present in four levels – task of the University and their interaction with enterprising environment, legislative and institutional support to technology transfer, another important facts influenced the successful of technology transfer and the relation between innovation and transfer in European context.*

Index Terms \mathfrak{A} *science and research on the Slovak Universities, technology transfer, innovation policy*

1. RESEARCH AND SCIENCE CONCEPTION IN SLOVAKIA

As it is in developed European countries also in Slovakia to put research and science to practice is basic assumption for sustainable development of the country. Importance of science is fundamental for education, social and economical development of the country, but also for creating the competitive economical conditions in the country. Some facts in the frame of the Slovak state [1] scientific and technical policy in the name of reaching these aims are enforcing:

- to reach the level in the sphere of science and technique which is comparable with European states
- consequent science and technique co-ordination with public interest in the are of: ec
- onomy, energy, transport, security, defense, education, health care, social care, environmental politic etc. Government will support preferentially solving of the state researching and development programs
- developing of international science/technology co-operation and creating the conditions for its improving and widening

The main problem of the science and technique not only in Slovakia are very low charges for science development. Meanwhile in USA and Japan the total charges for research and development are between 2,6% - 2,8 % GDP in 1990-97, in European Union they decreased from 2% in 1990 to 1,86 % in 1997 and 1,83% in 1998. This situation is more unfavorable in Slovakia. Extensive analysis of science and research was made in research institutions in Slovakia in the years 1993-98 [2]. The result was that total charges for research decrease from 1,53 % GDP in 1993 to 0,86% GDP in 1998. Average for those years was 1,09 % GDP what is in the proportion to European Union only 58,6 % GDP of charges. In the sense of asserting principles [1] there will be gradually created conditions for increasing total charges for science and research with the aim to be on the same level as the state of European Union.

One of the state science and technique politic principles is creating system arrangements for higher research effectiveness and efficiency. These principles have good reason for existing. Scientific-research base of Slovakia is able to create so much published outputs, but numbered financial effect from input sources is lower than input finances.

System steps which will be realized are as follows: adjustment our legislation in the sphere of science and research in the harmony with the European Union, supporting research by indirect tools (tax and custom policy), state system of research programs, assert the science results in practice and others.

2. RESEARCH CATEGORIES AND DIVIDING RESEARCH INSTITUTION IN SLOVAKIA

Science – research activities is realized in three categories, which create conditions for know-how transfer to practice:

- a) **basic research** is focused on gaining new knowledge about phenomenon substance. In this category freedom of investigation is main principle [1]. The research, which has assumption to have very high quality in international measure, has advantage. Project of basic

¹ Ján Corej, University of Žilina, Faculty of Civil Engineering, Moyzesova 20, 010 26 Žilina, Slovak Republic, corej@nic.utc.sk

² Milan Dado, University of Žilina, Faculty of Electrical Engineering, Moyzesova 20, 010 26 Žilina, Slovak Republic, rektor@nic.utc.sk

³ Mária Rostášová, University of Žilina, Faculty of Operation and Economics of Transport and Communications, Department of Communications, Moyzesova 20, 010 26 Žilina, Slovak Republic, rostas@fpedas.utc.sk

research are solved first of all at the Universities and Slovak Academy of Science. The output of those projects is monographs, articles.

- b) **applied research** is oriented on practical use of knowledge in economical and social practice. The output is new method, new technology etc.
- c) **experimental development** is focused on systematic using science knowledge gain from basic research as new materials, equipment, standards etc.

Cited research analysis [2] show that charges structure according single categories in 1993-98 was following:

* basic research	22,6%
* applied research	53,3 %
* experimental research	24,1 %

In the sense of new preparing law about science [3] research offices are divided for:

- state sector , where are the state research institutions and Slovak Academy of Sciences
- university sector
- enterprising research sector
- non-profit organizations of research and development and civil associations.

3. FINANCIAL SUPPORT FOR SCIENCE AND RESEARCH IN SLOVAKIA

Scientific -research projects are financed by:

- a) state budget
- b) private sources
- c) international co-operation

Charges portion for research and development from the state budget was in 1993–98 about 0,37 – 0,48 %. The state support is realized:

1. direct support – for institution administration. Here are Universities, Slovak Academy of Sciences and state research institutions. They have their aim in solving projects of basic research
2. purpose sources – all research institutions can gain this finances

In [3] purpose sources are determined for solving:

- state research and development programs
- state orders

Important arrangement for research support is creating conditions for gaining abroad sources for research and development. Research institutions, which work in the 5th framework programme of European Union and other international programs, have advantage.

4. SCIENCE AND RESEARCH AT THE UNIVERSITIES

Universities are very important institutions of research. Here is about one half of scientific-research potential of The Slovak Republic. Besides education activities they arrange

science development by solving scientific-research projects, doctoral study for new science workers.

Higher education law sets the duty of university teachers to share on solving these projects.

This law creates the conditions for educational activities based on knowledge development in science and study disciplines of the University.

Scientific -research activities are made by [4]:

- a) institutional financing the science from allotment money. Those are very small amount for most necessary charges,
- b) grants – finances allotment on the competitive base by Grant Agency of the ministry of Education,
- c) international science projects,
- d) projects realized together with practice.

Research projects in a) and b) have the character of basic research.

Themes of these projects are selected according the scientific profile of university institutions and they reflected the most important themes in the state frame and connection with European projects.

Big attention is paid to international science projects. Universities were successful in projects of 5th framework programme of European Union. The projects for supporting small and middle enterprising are not so successful. Another types of international projects are COST, COPERNICUS, both side co-operation with Austria and Czech republic.

Very interesting type of projects – mainly for technological Universities are projects for connection with practice (big firms). These projects bring the transfer of science knowledge to the concrete practice. For instance University of Pílina gains ¼ of its total financial sources from these projects.

5. THE TASK OF SLOVAK UNIVERSITIES IN TECHNOLOGY TRANSFER

There some questions in the sphere of technology transfer from Universities to the practice.

They are:

- a) task of the University and their interaction with enterprising environment,
- b) legislative and institutional support to technology transfer,
- c) another facts influenced the successful of technology transfer,
- d) innovation and transfer in European context.

- a) **Task of Universities and their interaction with enterprising surroundings**

Universities have most important place in technology transfer to the practice. In these institutions is formulated

new knowledge in the process scientific-research activities and they are realized in educational activities. This is the real assumption for successful transfer of knowledge to the practice and also future development of enterprising environment.

Important forms of knowledge transfer as the product of basic research are:

- education, to finish the schooling
- publication outputs – monographs, articles
- communication with environment during various scientific occasions, seminars, exhibitions etc.

The result of applied research or experimental research is new technologies, innovating products, and new types of materials. Transfer of these types of result is realized by contracting research.

Problems of technology transfer aren't simple. There must be solved a lot of legislative questions, creating conditions for financial support. It is important to know the real demand of firms and enterprises in the sphere of the new technologies, to understand their style of communication and thinking.

On the other side enterprise environment can offer some impulses in orientation of applied or contract research, impulses for study plan innovation and innovation study subjects' methods. Benefit from good technology transfer (together with know-how transfer) has both sides – expert as the seller on the one side and the user (firm) on the other side. Then there will be creating the relation in literature known as Win-Win.

Success of technology transfer of projects is depending on understanding forms of transferring the results of the research. They must be transfer to the firms by clear and intelligible speech. They must be oriented on concrete aims and suitable for practice. New side of view, impulses and external impulses are the most important for University.

b) Institutional forms of technology transfer support

For this new form of innovating processes are creating new institutional structures, which weren't usual in Slovakia- as the technology centres, science-technology parks, agencies for science support are. Very effective form for technology transfer to practice is creating the scientific-technology park . It is usual in many European countries. The state scientific politic principles declare the support for creating this type of centre in Slovakia. We must critically said that there wasn't create any function scientific-research park yet.

Institutionalization in Slovak condition can be realized various forms. It support technology transfer by the way of:

- creating the industry liaison office
- creating various innovation centers and productivity centers

- creating common research – development offices between University and enterprises
- creating associations for solving concrete problems
- to base the science-technology parks etc.

At the fig. 1 there is the solution of University of Žilina.

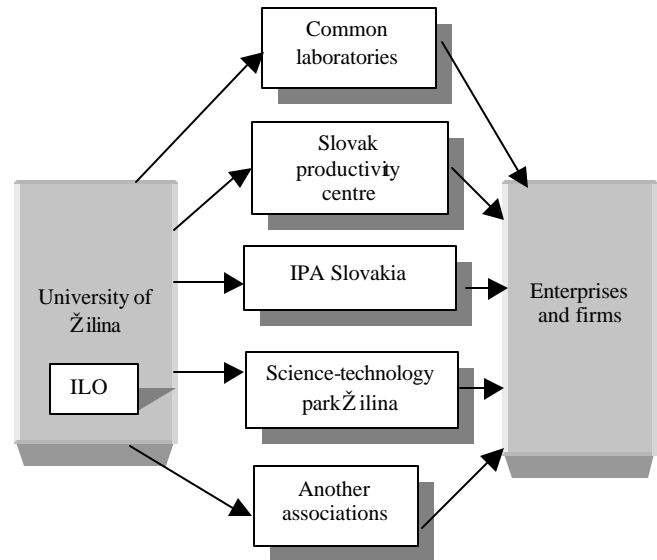


FIGURE.1
THE WAYS OF TECHNOLOGY TRANSFER AT UNIVERSITY OF ŽILINA

Connection between academic environment and the sphere of realisation at University of Žilina is created by contracts drew up at the university or faculty level with the firms from transport, telecommunication, engineering, gas industry, electronics, buildings sphere. Co-operation is developed also with many foreign firms. Outputs for institutions in the form of technological directions, instructions are the results of that co-operation.

ILO, SLCP, IPA, STP are various support institutions for technology and knowledge transfer.

They have different connections to the University of Žilina.

Industrial Liaison Office (ILO) is inside organisation unit created at the University. Its aim is [6]:

- to arrange technology and knowledge transfer, the main theme of single lines is depend on complete aims of the University in the sphere of microelectronics, telematics, mechatronics...
- to arrange advisory, to elaborate special directions, recommendations, studies, audits etc...

- to arrange special courses, seminars, trainings in cooperation with the Centre of distance education of Žilina University and its faculties
- to create database with offers and demands both sides with the aim of effective connections between them
- to create the connections on other offices for contacts with industry

Other three forms – SLCP, IPA, STP are results of cooperation between University and different subjects – firms, enterprise, public administration.

Slovak productivity centre (SLCP) is non-profit and opened association of juridical subjects, its aim is to initiative and develop national movement for raising productivity in Slovakia.. Its activities are oriented on:

- creating well-known centre for new information dissemination and knowledge from the sphere of productivity and competition
- active participation of centre workers in enterprises activities in the sphere of sustainable development and raising competition
- starting the National program for raising productivity in all levels of economy and social life
- oriented all society to the permanent raising productivity and competitiveness with regard to environmental and social connections

IPA Slovakia is association for transfer technology support. It was founded as a result of common initiative Fraunhofer Gesellschaft in Munich and University of Žilina. It brings new knowledge and experiences from productivity to the Slovak industry. Common aim is the development of firms and arrange the most modern methods , which bring them long time prosperity and competing ability in the world.

Science-technology park Žilina (STP) is in the project stadium. It has aim to base professional organisation for small and middle enterprises support in Žilina region. It will work with the ideas of innovations, technology transfer, which will connect University of Žilina, research institutions and firms.

It will:

- react on demands for advisory services from the small and middle firms
- orient on innovations in regional context
- to give higher standard value to the scientific - research base
- partnership between public and private sector in the process of SME development

In several last years was foundation of professional association's support by University (ISDN Forum). They actively support the knowledge transfer from academic to enterprises sphere too .

c) Another facts supporting successful in technology transfer

Projects of technology transfer between employers and universities are based on known methods of project management, on aim, organisation, management determination, on project dividing, plan and control. Knowing the base facts of technology transfer success between academic and enterprises subjects is the first assumption on the way to success.

Facts of success in technology transfer:

- reasons and importance is clear and able to fulfil for all members,
- all aims of project must be define and limited and the same supplementary changes,
- the chance for innovation and raising for collectives and individuals must be clear and understanding,
- the aims of projects are dividing in time. In first phases are important safe and fast successes,
- there exist clear and understandable organisation of project team,
- the methods of project management is used,
- integrator of transfer take care about harmony and real high quality dialogue,
- start and phases of projects are clear signalised,
- about stadium of solving there are open, true and comprehensive reports,
- independent subject (ILO) keep the harmony of interests, not to became a hegemony in project, ...

The way to the success in technology transfer from academic sphere to enterprise surroundings is to understand and react in time on demands of SME and big firms and also to understand their way of thinking. Complex of knowledge, experiences, results of development project must be given to enterprises in clear and understandable way . They must be focused on concrete aim and must be realised in practice. It is necessary to have new original point of view, new impulses and external stimulus.

d) Innovation and technology transfer in European context

The universities in The Slovak Republic want to connect to trends in European Innovation Policy. Innovation policy has become a new horizontal policy linking traditional areas such as economic, industrial and research policies. In Europe are three main aspects, which can be discerned:

- new administrative structures, based on the system nature of innovation,
- building awareness of needs of innovation and promoting a more intense dialogue between universities - science, industry and the general public,
- developing a strategic vision and innovation foresight [5].

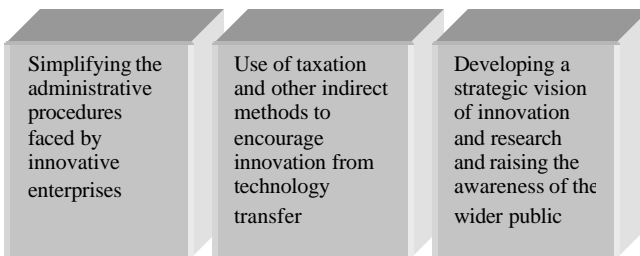
- We are preparing on situation in Europe, when
- for some time now, member states of European Union have been pursuing initiatives for:



- more recently, additional priorities have emerged:



- there is increasing interest in three further themes:



- finally, several general trends may be discerned:



Europe's prosperity will be largely determined by the priority it awards to education and training. The training policies also determine the level of scientific expertise on which our capacity for technological innovation is based.

And here is an important goal for universities - to creating Europe of knowledge and Europe of innovations.

Technology transfer problems and problems of innovating processes of enterprises sphere is not problem only in Slovakia. To know the rules and managing methods of transfer we consider as the one of the most important facts for bettering the economy and social development of Slovakia and European Union. There is enough theoretical experiences in Slovakia but minimum practice in technology transfer to the SME. It is necessary for Slovak universities and all Europe to increase co-operation between universities and business surroundings, enter to international associations for supporting that activities and gain international experiences. The aim is to apply that initiatives as early as it can be in Slovak conditions.

University became active element in business environment development and it declares the responsibility and its place in modern society.

REFERENCES

- [1] Principles of state science and technical politic. Ministry of education SR., Bratislava, 1999
- [2] Research analysis and development at high schools, Slovak Academy of Sciences and research institutions. Ministry of education SR, Bratislava 1998
- [3] Propositions of the Law of science and technique, Ministry of education SR. Bratislava. 2001
- [4] Ěorejová, T. – Rostášová, M.: Transfer technology trends at Žilina University, *Proceedings of International conference COFAX*, Bratislava 2001
- [5] Innovation and Technology Transfer – 11/2000
- [6] Rostášová, M: Industrial Liaison Office on the University of Žilina, Žilina 2000