ELECTRONICS AND ELECTRICAL ENGINEERING
ISSN 1392 – 1215 *2006. Nr. 4(68)*
ELEKTRONIKA IR ELEKTROTECHNIKA

ELECTRONICS
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ELEKTRONIKA

Problems of Innovation and Technology Transfer in Lithuania

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Introduction

The last decades of the 20th century represented a turning point in the global development process. It is knowledge that has become the engine of the technological, social, economic and cultural development in today's world.

The knowledge-based economy has a very powerful technological driving force – a rapid growth of information and telecommunication technologies (ICT). Every three – four years there appears a new generation of ICT. Today, the ICT companies are among the largest corporations. The ICT sector is among the fastest growing economic sectors.

A process in which new ideas are applied to create value for society is innovation [1]. Research and Technological Development (RTD) is an essential element in the functioning of innovation system in the European Union (EU) member states. Who should collaborate together so that ideas would come practicable?

The technological innovations within closely cooperating business, science (knowledge) and governmental institutions not guarantee their successful integration into multiform systems (business, society) or its continual use. Lithuania has a lot of problems with the transfer and diffusion of new technologies. It is proved by the statistic of European innovation [2, 3].

The study of innovation and technology transfer models is rapidly becoming a popular line of study in the research of technological systems. Academicians, business managers, IT managers and other commercial organizations have benefited significantly from this line because the result is value-added.

Universities are not normally known for their entrepreneurial attitude and flair. They are recognized, however, as major knowledge and research centers. It might be argued that for many start-ups it is becoming vital to come into a university as soon as possible [4].

The ever changing perception of the role of technology in our society provides educators with a myriad of challenges and problems for the curriculum [5]. The analysis of study programs of electronic engineering shows that Bachelor students not have such disciplines as development of technologies, adoption and transfer of technology, innovations, and technology management. What is most important in study programs: knowledge or application? Or should it go together with mixed disciplines? The issue is very important for Lithuanian Society of Technological Universities, because the system does not work right. Besides, Lithuania's future begins from the focused brains (knowledge) and that determines the level of Lithuanian technological society.

Research object: the system of innovation and transfer of technology in Lithuania.

Research objective: to show the main weaknesses of Lithuanian system of innovation and transfer of technology.

Research tasks set out achieve the objective:

1) Analysis of innovation and technology transfer models;

2) Analysis of other countries' experience.

Research methods applied: the logical analysis and synthesis of scientific literature and European Union reports, the systematic analysis of statistics, and the comparison and generalization methods.

The problems of innovation and technology transfer

The main problems of Lithuania technological sector are stated in the United Nations report [6]:

- ✓ It has been noted by experts, that though the development of technology proceeds and Lithuania has achievements in such fields as laser or biotechnology, however, these cases are rare;
- ✓ Although Lithuania has enough resources for innovations, the interaction between universities and businesses is a casual and uncontrolled process. It should be noted that Lithuania's economy is based on small and medium businesses. Small and medium businesses do not have such favourable possibilities to use knowledge as large international companies do.
- ✓ The changes in business environment particularly influence a small business. Government should create better opportunities for interaction between academic institutions and businesses.

The EU statistics reveal the problems of technology transfer primarily in the technology and innovation sectors (Table1). In all categories the indexes do not reach the average of the European Union [2,3].

On the strength of 2005 Summary Innovation Index (SII) the European Union countries can be divided using hierarchical clustering into the following 5 groups (Fig. 1), where Lithuania's position is not very attractive for our society [7]:

1. Group-1: CH, DE, FI, SE
2. Group-2: AT, BE, DK, FR, NL, AT, UK
3. Group-3: IE, IT, LU, NO
4. Group-4: BG, CZ, EE, ES, HU, **LT**, LV, PT, SI
5. Group-5: CY, EL, PL, RO, SK

The Summary Innovation Index is composed of two main components, Innovation Input (Innovation drivers; Knowledge creation; Innovation & entrepreneurship) and Innovation Output (Application; Intellectual property) [2].

The components of the Summary Innovation Index are the key to solving technology transfer problems in Lithuania. The most important subjects which can determine the SII are University and Enterprises. However, it works when the government creates an environment for researcher (science) and businesses to come together.

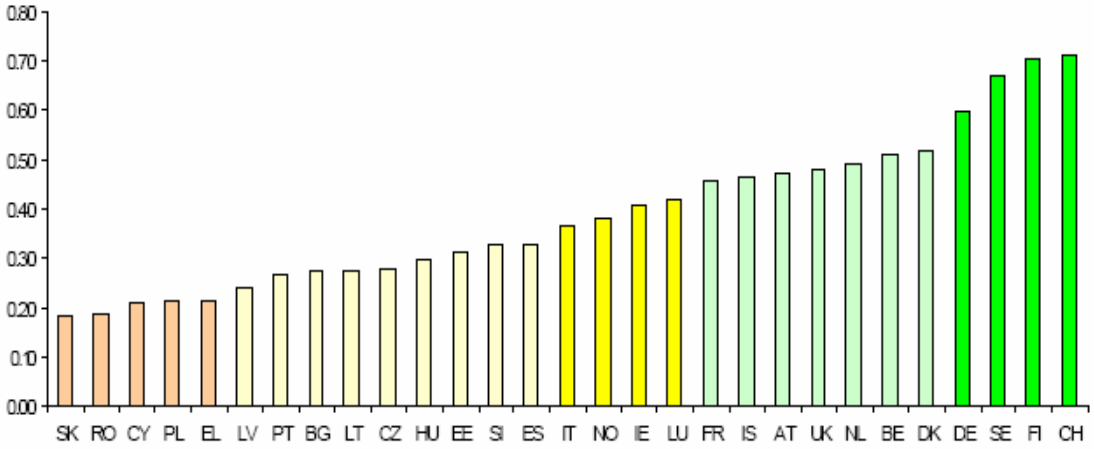

Fig. 1. Plots the SII based on April 2005 data availability

Source: European Innovation Scoreboard 2005

Table 1. Statistics of innovation in Lithuania and EU

Index	Year	Lithuania	EU average	Degree of uneven
Summary Innovation Index – SII (points)	2004	0,26	0,44*	Large
Summary investment level to R&D (% GDP),	2003	0,68	1,94	Large
✓ public R&D expenditures	2003	0,54	0,67	Large
✓ business R&D expenditures	2003	0,14	1,27	Large
The number of researchers per thousand of the working force	2004	4,0	5,68**	Large
✓ in the enterprises (%)	2004	6,7	49,7**	Large
Employed in medium and high tech manufacturing (percent from the total workforce)	2003	3,03	6,60	Large
Employed in medium and high tech services (percent from the total workforce)	2003	1,66	3,19	Large
The number of patents applied to EPO (per million population)	2002	2,6	133,6	Large
The number of patents applied to USPTO (per million population)	2002	0,5	59,9	Large
The goods manufacturing per employee, 1000 EUR/during the year	2003	31,9	169,7	Large
Value-added per employee, 1000 EUR/during the year	2003	9,7	45,1	Large
Labour productivity (per person employed) (ES-25=100)	2004	49,8	100	Large

* EU-15 index; ** 2002 y. Source: "European Innovation Scoreboard"

Innovation and technology transfer model for Lithuania

The scientific literature notes three main models of technology transfer and adoption [8] but full existence of them in Lithuania is questionable. This part of the article shows the main reasons why Lithuania does not have fully operative technology transfer system. Models of technology transfer and adoption:

I. Direct: University – Industry. Does it work? No...

Lithuanian enterprises are not concerned with investment in the development and adoption of technology. The proposition is drawn from the statistic of the European Union [3], where Lithuanian indexes lag from the EU average in all the fields. The direct model of technology transfer (University – Industry) in Lithuania does not exist because:

1) Business R&D expenditures make up 0,14% of GDP while the EU average is 1.27%;

2) The number of researchers per thousand of the working force in the enterprises (%) is 6,7% while the EU average is 49,7%.

II. Intermediaries: University - Science Park – Industry. Does it work? No...

The role of Science Park is undoubtedly positive. The main problem with these institutions is that the enterprises established are not entrepreneurial. Technology Parks are supposed to develop business and science interconnection, the enterprises specialisation in science research and development sphere are engaged there.

Technology transfer and innovation support services in Lithuania [9]:

- ✓ Lithuanian Innovation Centre, with 5 representatives across Lithuania;
- ✓ Science and Technology Parks:
  - Vilnius
    - North Town Technology Park
    - Science and Technology Park
    - Visoriai IT Park
  - Kaunas High and Information Technology Park
  - Klaipeda Science and Technology Park
  - Šiauliai University ST Park
- ✓ Sunrise Valley Initiative
- ✓ Technopolis Initiative
- ✓ Kaunas Regional Innovation Centre

Aston Science Park in Birmingham, the United Kingdom, could serve as an example [10]. The goal of Birmingham Technology is to create wealth and employment by providing facilities for the establishment and rapid growth of knowledge-based companies that can benefit from the business support services, management skills of BTL (Birmingham Technology Ltd.) and interaction with other companies within Aston's business community. In the 5 hectares area are located: Aston University, Banks, Birmingham Business Information Centre, Operating Cornerstones (market rents, flexible licenses, flexible management, range of unit sizes, functional common areas, security and access, scope for fitting out), Business & Innovation Centre, Venture Way Units, Enterprise Way Units, Holt Court Units, Priestley Wharf, etc.

Three core function [11]:

- ✓ Incubation of tenant companies;
- ✓ Delivering programs to the local and wider community;
- ✓ Consultancy.

III. Intermediaries with Business Approach (Establishment of new firms) University – Incubator/Open Lab – Science Park – Industry. Does it work? No…

The basic aim of a business incubator is stimulation of founding new companies and creation of a consultancy support environment with maximum opportunities of "survival" and development of new companies [12]. However, the role of incubators is undoubtedly positive like that of science parks.

Lithuania has incubators, science parks, and open laboratories, however, they are in the developmental stage. Therefore, the most suitable model of technology transfer system for Lithuania at present could be (Fig. 2):

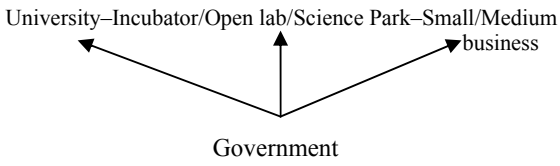

Fig. 2. Innovation and technology transfer model for Lithuania

1)Incubators;

Incubators are concerned with [1]: 1) Specialist, seminars and forums; 2) Business plan development; 3) Finance and Accounting; 4) Marketing and promotion; 5) Banking; 6) Sales techniques.

Now Lithuania has 7 business incubators: Vilnija, Kaunas University of Technology, Telsiai, Alytus and other [12].

Should a expert in technology be a lecturer, business planner, accountant, as well as marketing and banking specialist? Do we have study programs of technology management in Lithuania? Today a manager can not solve engineer's problems, likewise an engineer's can not solve manager's problems. This is the answer why incubators are necessary and why we need technology planners and managers of broad specialization.

The Brain drain problem is especially acute in Lithuania. It arises because of small salaries, existing immigrant nets abroad, also the prospect of living in more developed countries. Therefore the state policy must be very effective in this case. Employees should have opportunities to create entrepreneurial innovative enterprises, to carry out scientific research. The promotion of the activity of business incubators should also serve to this end.

2) University;

The responsibility for managing learning in the knowledge economy needs to be increasingly demand driven and based on individual needs, particularly as individuals progress upwards on the learning continuum. It is vital that the education sector at university level and the business sector work together so that the future workforce has an appreciation of business practices and the importance of innovation. This would also provide an opportunity for the business community to influence the education sector and students at an early stage during their career development [6].

Although they may be very skilled in teaching their subjects many university teachers may not have had the opportunity to be fully aware how businesses function and what their needs maybe be. If they have an opportunity to work closely with businesses, they will adapt their teaching methods and curricula to meet the needs of businesses. Mobility between education sector and businesses is vital to promote this knowledge transfer. Establishing a partnership between schools and local businesses may also bring other benefits such as sponsorships for equipment and facilities for schools. On the other hand, it will enable businesses to play an influential role in their local community and attract a better educated and skilled workforce [6, 13].

It is said in the Lambert review, "it is important for students, particularly science students, to develop entrepreneurial skills to allow them to exploit the innovation and develop the commercial potential of their work" [13]. The analysis of the study programs of electronic engineering shows that Bachelor students do not have such disciplines as development of technologies, adoption and transfer of technology, innovations, and technological management. Study programs should have mixed disciplines: Technology – Law – Management. Then students will gain entrepreneurial skills and that will enable them to successfully manage technologies in enterprises.

Individual characteristics, managerial capabilities and skills are the core success elements in the adoption of technology [14]. Thus education and learning become especially important. Lithuania has created a lot of various learning programs devoted to technology, but they often lack effectiveness and connection between the needs of business organizations and the students' qualifications. The gap between supply and demand of knowledge should be reduced, learning and education should be promoted, creating possibilities of financial support. The creation of carrier centers in enterprises should be promoted, and the lifelong learning must become a daily occurrence. Today in Lithuania a high school diploma is necessary even for unskilled labour. Entrepreneurship is one of the ways in which problem of unemployment could be solved.

Kaunas University of Technology (KUT) is the national innovation support leader. Researchers are orientated towards applied sciences and implementation of scientific results. Since 1995 KUT has been permanently developing innovation support structure. First, they have started with the Innovation Center, which later initiated the establishment of the Business Incubator. Nowadays the Innovation Center is going to be restructured into one of the university's departments (Department for Innovation and Information). KUT also runs a corporate relations office in order to strengthen relations with industrial enterprises. There have been a significant number of spin-offs [6].

Lithuania lags behind most of the EU member states in computerization and the level of use of information technology. Efforts are made, but the high cost making it difficult for small enterprises and the population to use the Internet remains the main problem [3]. Information technologies are needed for the dissemination of knowledge, for example, for distance learning. International standards in the sphere of electronic commerce are not developed and it is seen as the main problem in the business sector.

3) Small and medium business;

Recent Lithuanian legal acts show that small and medium-size enterprise (SMEs) policy becomes most important. In Lithuania small and medium-size enterprises comprise about 80% of all the enterprises [15]. Most of these enterprises function in Vilnius and Kaunas regions, because there is a well-developed business infrastructure. Changing legal acts, bureaucracy, imperfect tax system and its administration remain the main problems for small businesses. The United Nations recommends Lithuania to develop financial services for small businesses [6]. Such conditions should be created for entrepreneurial enterprises so that they could use credits on favourable terms, risk capital funds, the insurance of loans, EU structural funds support. Joint enterprises should be also promoted.

Setting up a successful start-up company in Lithuania is increasingly difficult. Growing a start-up to a size at which it can compete on the global market is only achieved by a happy few. The product life cycles are getting shorter and shorter. It is next to impossible to stay ahead of the technology curves. Competition from China and India is increasing – the Global Entrepreneurship Monitor report (2005) suggests 205 million aspiring entrepreneurs in India and China are waiting to pounce [16].

Strategic guidelines and measures for the development of SMEs are set up as the middle-term vision for the development of SMEs. One of the prospects of this vision is the introduction of new methods of production and the increased use of information technologies. The creation of favourable conditions for implementation of innovations and use of novelties is another one.

4) The Role of Governments;

What is the role of the Government in this sphere? In Lithuania, many of the important technology transfer and innovation support services have been established as a result of government funding. Small research grants from industry can help hundreds of small interdisciplinary projects to flourish, but there is also a critical need for larger bulk funding to develop a cohesive scientific community [17]. Bottom-up identification of scientific agenda through proposals from individual scientists is critical, but when these can be fostered in an environment

of concentrated funding, research communities develop more rapidly.

The Lithuanian Government should identify national priorities for the development of technology, with an emphasis on the integration with the EU. The main features of these policies should affect the most developed sectors:

- biotechnology and pharmaceuticals;
- information technologies and telecommunications technologies;
- laser technologies;
- electronic components and mechatronics.

Other countries experience of innovation and technology transfer

Lithuania does not have a big industry and there are no such companies as Microsoft, Volkswagen, Fiat, Sony which have the possibility to invest in researches and to create high technology laboratories themselves. The best brains leave our country generally after studies or earlier (last year Lithuania lost ~18,6 thousand of inhabitants [15]) and Lithuania loses the possibilities to adopt high technologies. The Government must stop this negative process. First of all, Lithuania should stop the departure of best the brains directly from the university. The solution lies in the experience other countries like Scotland.

Scottish Institute for Enterprise

Set up in 1999 to promote enterprise education/ commercialization of science, technology, and engineering. Mechanisms include:

- ✓ Employ 2 staff in each University to:
  - Deliver courses outwith curricula;
  - Work with staff to embed enterprise in curricula;
  - Support/advise student start – ups (currently about 90 per year);
- ✓ Prepare teaching material (case studies, etc)
- ✓ Train staff (2003/4 - 133)
- ✓ Student business plan competition (with support courses): 2003/4 430 entries;
- ✓ Employ two students part – time to set up enterprise society, run events, student magazine, etc.
- ✓ Student patent fund (2003/4 - 12).
- ✓ Master classes, events, national student enterprise conference, etc.

Remit widening to include creative industries, professions (18-19).

Scotland's Enterprise fellowship scheme

Assists university researchers in selected technologies commercialize their technology via academic spin out. Funded by Development Agency, administered by Royal Society of Edinburgh, provides year salary (£21,000/£31,000) and up to £5k expenses via bi-annual competition:

- ✓ 60% of year on developing technology;
- ✓ 40% on business education/ start up (specialist university provided MBA);
- ✓ Mentor, access to network (venture capital etc);
- ✓ Application needs good science/technology, statement of technology development needs and market potential/ideas;
- ✓ Held University.

Since 1997 launch, 70 completed Fellowships, 50 new companies (many set up by team including Professors with Fellows as Director) [18].

Conclusions

The problems of technology transfer are difficult and as varied as the organizations involved in the process.

The problem is reflected by the European Union statistics in the technology and innovation sectors, where Lithuania in all categories does not reach the average of the European Union.

The main problems in the Lithuanian innovation sphere are: there is no overall managerial system of innovation activity, the mechanism of promotion of innovation development is not effective enough. Enterprises lack financial resources for innovative activity and very often they are short of information. Information about business incubators, science and technology parks must be disseminated. Undergraduate students should be encouraged to create entrepreneurial enterprises under favourable conditions. The research carried out that universities should be promoted guaranteeing their financing and the commercialization of the results.

Lithuania has created a lot of various learning programs devoted to technology, but they often lack effectiveness and brain drain problem is becoming really serious.

The analysis of the situation leads to the conclusion that the system of penetration and development of technology in Lithuania depends on its policy of rationality and co-ordination, and the striving of the country to become a competitive EU member in implementing innovations.

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Presented for publication 2006 01 10

R. Morkvėnas. Problems of Innovation and Technology Transfer in Lithuania // Electronics and Electrical Engineering. – Kaunas: Technologija, 2006. – No. 4(68). – P. 77–82.

With reference to scientific literature and European Union reports, the article deals with the role of universities, business incubators, science park and Government the system of innovation and technology transfer in Lithuania. The best-fitting model of the system of technology transfer for Lithuania is determined. Also, the problems hindering the development of the technological system are analyzed. The possible solution is the experience of other countries like Scotland.

The problem of technology transfer in Lithuania is reflected by the European Union statistics in the technology and innovation sectors. Besides, the analysis of study programs of electronic engineering shows that Bachelor students do not have disciplines prepared for learning about the process of innovation and technology transfer. Ill. 2, bibl. 19 (in English; summaries in English, Russian and Lithuanian).

Р.Морквенас. Проблемы передачи инноваций и технологий в Литве // Электроника и электротехника. – Каунас: Технология, 2006. – № 4(68). – С. 77–82.

Приведен пример отчётов Евросоюза и анализ научной литературы и показано, какую ролъ в системе передачи инноваций и технологий играют университеты, деловые инкубаторы, парк науки и правительство Литвы. Мы установили наилучшую модель передачи инноваций и технологий, а также указали проблемы, которые мешают разработке системы передачи технологии. Как альтернативу решению проблемы, мы представили сотрудничества университетов и производителей в Шотландии.

Отчёты Евросоюза показывают, что в Литве система передачи инноваций и технологий работает нерационально. Анализ программ обучения студентов бакалавра инженерной электроники показывают, что у студентов нет дисциплин по обучению управлением процессов передачи инноваций и технологий. Ил. 2, библ. 19 (на английском языке; рефераты на английском, русском и литовском яз.).

R. Morkvėnas. Inovacijų ir technologijų perdavimo problemos Lietuvoje // Elektronika ir elektrotechnika. – Kaunas: Technologija, 2006. – Nr. 4(68). – P. 77–82.

Remdamiesi mokslinės literatūros analize ir sinteze bei Europos Sąjungos ataskaitomis, straipsnyje parodėme, kokį vaidmenį inovacijų ir technologijų perdavimo sistemoje vaidina universitetai, verslo inkubatoriai ir mokslo parkai bei valdžia. Nustatėme realiausią Lietuvos inovacijų ir technologijų perdavimo modelį, taip pat nurodėme problemas, kurios trukdo sistemai funkcionuoti ir plėtotis. Kaip galimą problemų sprendimo alternatyvą pateikėme Škotijos įmonių ir universitetų bendradarbiavimo pavyzdį.

Europos Sąjungos statistika rodo, kad Lietuvoje inovacijų sistema veikia neracionaliai. Išanalizavus elektronikos inžinerijos bakalauro studijų programą, paaiškėjo, kad studentai neturi disciplinų, skirtų technologijų perdavimo procesams įvaldyti. Il. 2, bibl. 19 (anglų kalba; santraukos anglų, rusų ir lietuvių k.).