

Scientific project management course introduction in doctoral studies in Riga Technical University

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Abstract - Research activity is an integral part of the study process and it is to be noted that many of the research programmes are very important for the industry and economy of Latvia.

Keywords - Scientific project management, doctoral study innovation, research and development

I. INTRODUCTION

Creative, effective and prestige – these are the three words that describe the scientific and research strategy of our University. Our goal is to stimulate and improve the development of all forms of human intelligence – from nature and social sciences to the high technologies.

Riga Technical University (RTU) is open to world-wide co-operation in scientific research and in education for sustainable development of knowledge based society. It provides general information on different fundamental and applied research projects carried out in our academic and research units. It also gives the names of our academic staff members as well as institutions involved in particular research areas. RTU plays critical role in technology development in Latvia. A lot of technological research, innovations and engineering activities in Latvia are completed by RTU graduates, RTU staff, but at the same time research organisations, that results in technological development in Latvia. RTU education structure allows pupils from schools to get all possible education in technological areas in the same place. Studies in RTU mostly is State financial supported, it is opportunity for everybody to make also scientific research and get PhD.

Doctoral studies play an important role in the new scientific staff education and attracting. The existing research facilities allow make scientific research, especially in scope of PhD. The main daily research work done by PhD students, mainly in technology development, results of these researches are often patented in Latvia. Nowadays RTU offers 23 doctoral study programs that provide doctor degree in

engineering sciences, architecture, chemistry and economics. Every year hundreds of new students start their PhD's. The changes of student's amount in all programs are shown in figure 1.

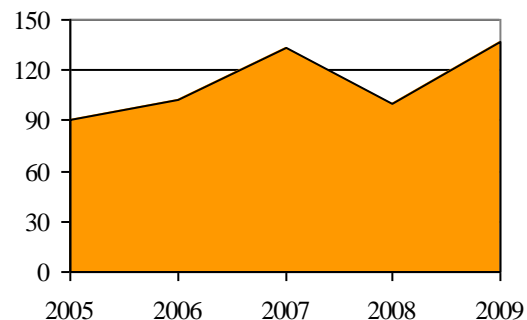


Fig.1. Doctoral students enrolment
(2005-2009 years)

II. DESCRIPTION OF EDUCATION STRUCTURE

There are about 500 doctoral students in RTU. The number of students in all programs is shown in figure 2 [3]. As a basic research force the doctoral students of RTU are employed in RTU as scientific assistants or researchers, according to qualification.

The RTU strategic priority is to archive 30% incomes of budget from scientific projects, involving in this way PhD students in regular research work, is important for RTU sustainable development.

The year 2008 budget of RTU was 62 Mil. EUR, but incomes from other scientific projects was just 2%. This means that the efficiency of usage scientific personal and equipment has potential to growth up in nearest future. The increasing of financial efficiency in RTU needs application of special methods, dissemination of scientific projects results and attracting new researchers is critical priority for RTU as a scientific institution. The main financial targets increased

incoming finances from scientific research by 28 % next 5 years. According new scientific research it is important to have an infrastructure and, of course researchers.

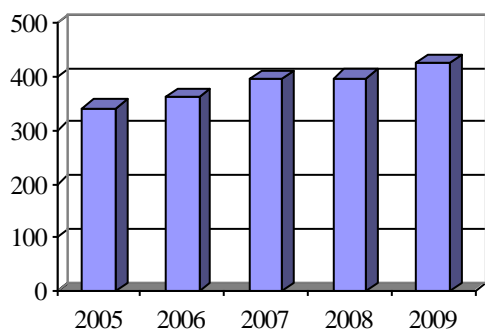


Fig.2. The dynamics of Doctoral students in RTU (2005-2009 years)

During two last years in RTU the common project control instruments and procedures were introduced. In figure 3 the fragment of formal project control tool is shown. In administrative structure of RTU also the special strategic department was introduced, with main responsibility to have formal control project documentation and other formalities, to keep in touch all formal project management cycle. However this control instrument and all departments could only control existing activities, but do not attract new scientific force to reach the target amount of projects. These procedures are not suitable to check scientific quality of project deliverables.



Fig. 3. The fragment of project control e –tool

To control of project deliverables scientific quality is project manager responsibility, and control procedures are different almost in each case, this issue is discussed in contract signature time.

To attract new researchers in scientific project development the such issue like free choice subject for PhD course students was introduced. The other issue is publication of project results in university newspaper “Jaunais inženieris”.

The main scientific cooperation in RTU is ongoing cooperation with industry partners from Latvia. That’s way special RTU support programme was introduced. The amount of application on annual support for research in RTU this year was 34 projects, this amount shows active cooperation amount between RTU scientists and other companies. To attract young people in scientific research the special criteria as involving master students and doctoral students was introduced. To increase this active cooperation the attraction of new scientist is important, and in fact last few years main human resources in research are doctoral students.

The main measure of effectiveness of scientific research is amount of patents and trademarks. The patent and trade mark application amount are shown at figure 4.

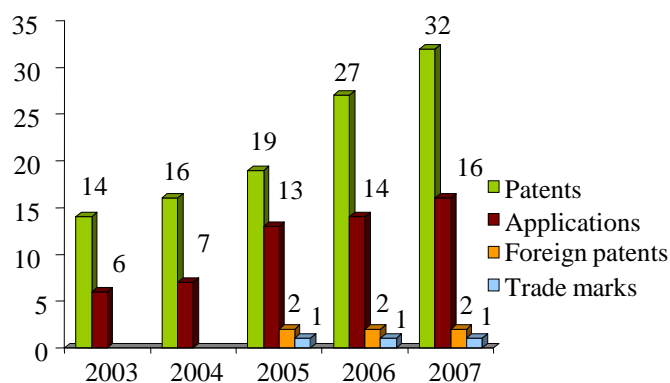


Fig. 4. The dynamics of patent application, foreign patents and trade marks

Most of the experimental works in laboratories were made by doctoral students.

III. SCIENTIFIC PROJECT MANAGEMENT COURSE INTRODUCTION

The doctoral students mainly become main researchers in RTU, so it is important to educate doctoral students, in time of doctoral studies and involve them into financially successful research.

There are doctoral programs, in which study subjects are divided into three blocks of basic subjects: compulsory subjects, subjects of obligatory choice and free choice. Within the time of three years for full time studies the subjects of free choice are considerably developed: „Management of scientific projects”, „Intellectual Property Protection” and „Planning of experiments”, pedagogy and other subjects are also accessible for the students of all RTU programs and from other Universities. During the study time the main is allocated for research and writing thesis. Every year the centralized assessment of doctoral student progress in research and studies is realised. The head of RTU Doctoral study department or deputy head of RTU Doctoral study department are present at

these doctoral students progress meetings, so if the control of progress of research of the studies is centralised.

The development of doctoral studies in RTU deals with three main problems: financing, development of good relationship with industry, national and international partners. The course “Scientific project management“ was introduced in 2007, and still this course structure is under development. In 2006 the lecture note was written by professor I. Rankis and senior researcher N. Kunicina, so theoretical part of the course is written, but there are many practical and methodological issues to apply knowledge of project management into real scientific project preparation.

Each scientific investigation made by doctoral student is controlled by doctoral department of Riga Technical University, and scientific stuff in the Faculty or Institute. The course “Scientific project management“ helps doctoral students to structure their research, and to imagine all the process from the beginning of the research to commercialized result. Before this course it was not clear for students how to achieve market with their research results, because there was no structured information about scientific project management in Riga Technical University.

The main student’s response was that the information about project management and scientific product commercialization makes research more attractive and motivates doctoral students not only to get scientific, but also commercial applicable result after doctoral studies.

The product life cycle could be considered within two main parts: project and product management (see figure 5). The project stage requires financial investments and could be realised by scientific institution. Scientific project development technology could be separated in such project management stages: idea evaluation, research stage, conception stage, and realization and introduction stages. In introduction stage scientific institution should work together with a market company, which has bought product licence, or in other way has rights to commercialised product.

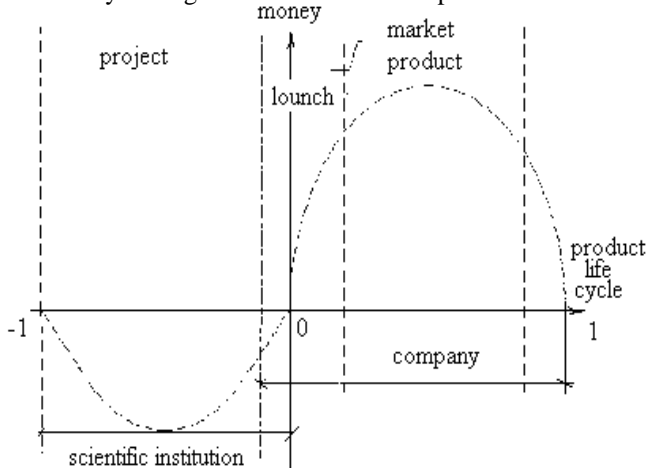


Fig. 5. Successful innovation commercialization cycle

Figure 5. presents a development cycle of a successful scientific investigation from the very beginning of the project

till the final commercial application of the product. This diagram is used in “Scientific project management course” for schematic visualisation among product development and life time on market among time and finances.

Product management is divided in four stages: market introduction stage, growth stage, mature stage, saturation and decline stage. Market product management should be made by market company, and in case, if in product in mature stage will need some innovation, the scientific institution can made technical innovation, which could prolong product time in market.

Innovation is a very wide term that includes investigational, financial, market organization as well as a lot of other measures. Innovation development process is presented in figure 6 [2].

Innovations are connected with new technologies and implementation of the products with the help of scientific methods, i.e. scientific projects and their management. The scientific projects that are connected with new technologies and products implementation are considered to be applied by the researches.

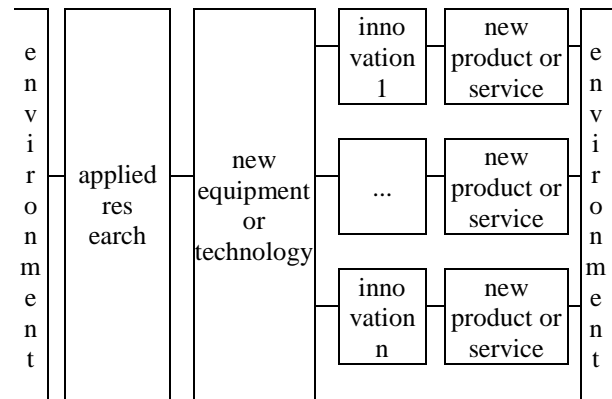


Fig. 6. Innovation development process

The innovative idea commercialization process is difficult for doctoral students. There are stereotypes and non structured knowledge that they have at the beginning of course. At the end of course they become skilled young researchers with structured knowledge about ways and possibilities to realize commercialisation of their research results [1].

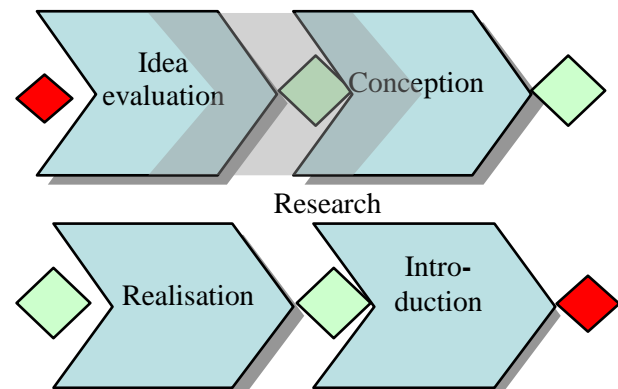


Fig. 7. Project realisation stages - development process and decision-making points

Project management is divided in four stages: idea evaluation, conception, realisation, introduction, and one additional research stage, which is actual for scientific research projects (figure 7).

Idea

Evaluation - Context

- Takes place when the idea has been defined and its strategic fit has been evaluated. Product development project begins

Objectives

- Product development activities aligned with strategic goals
- Ensure that core offering and customer needs and earning logic are defined, there are a basic understanding of market potential & competitive situation
- Ensure that technical feasibility has been reviewed
- The goals, milestones and desired outcome of the product development activities

Research

Context

- Takes place between idea evaluation or concept phases.

Objectives

- Development technology, product or methodology, to fulfil clients' requirements in a new way.

Concept development & evaluation

Context

- Takes place when the concept has been defined and evaluated against standardised concept description and evaluation template
- Implementation begins from this decision point

Objectives

- Ensure that value proposition is defined and core offering is tested by customer survey
- Ensure that the project has a business case and the solution is technically and legally feasible
- Ensure that implementation phase has relevant project plan
- In context of research projects in concept phase is important to ensure intelligent property of authors – make patent application, publishing scientific results, taking part in scientific conferences.

Offer development and launch planning (realization)

Context

- Takes place when the new product is ready to launch
- The market launch of the product is after this decision making point

Objectives

- Ensure that value proposition and business case are valid
- Ensure that the product is technically ready for launch
- Ensure that there are no open regulatory or legal issues

- Ensure that there is a relevant product launch plan

Introduction (Launch)

Context

- Takes place after launch has been carried out and evaluated to launch plan and business case

Objectives

- Ensure that market launch is evaluated and needed modifications are done
- Ensure that ongoing monitoring of product is planned and implemented
- Ensure that the product development project is evaluated

The knowledge structuring for doctoral students is one of three critical components to start scientific project, based on scientific research in doctoral studies. The other components is scientific research, with possibility to gate such final product, with ability to sell it on real market, mainly it should be new device, material or computerised program. The research results should not be too theoretical. The last component is ability of young scientist to work in risk condition.

IV. FINANSIAL SUPPORT

The supports of daily activities of doctoral students are grateful role for European Structural funds projects.

Since 31 of July 2009 doctoral study support project "Support of RTU doctoral study" Nr.2009/0144/1DP/1.1.2.1.2/09/IPIA/VIAA/005 has being realized. The European Union directly supports it in the frames of European social fund financed projects. This is aim stupendous for doctoral students. In working programme annex 1.1.2.1.2. sub activity "Support for doctoral study programme". The activity in this project was started by organising competitions for doctoral students, and persons, who develop doctoral thesis (there is a special support for graduated students, who completes doctoral course, and who are going to defend doctoral thesis). Project realization duration is 76 month till September of 2015.

Aim of project is to increase of PhD defends amount, which will create and introduce in production new products, with high additional value, technological innovations. Doctoral research mainly is a base of new products development with high additional value. In this project frame approximately 300 persons will receive support. For scholars that is also a support of their scientific conference attendance and for supervisors. During four years more than 360 RTU doctoral students and young doctors obtained grant and financial support for the purchasing of materials, visiting conferences, seminars, exchanging experience etc. Using also doctoral support financial resources doctoral students have a great possibility to cover doctoral and research activities and involve them themselves in scientific cooperation projects.

The Scientific project management course introduction in doctoral studies in Riga Technical University gives doctoral students structured knowledge in scientific project, in possibilities to apply projects at international level.

In natural figures, if the budget of RTU is 62 mil. Euro, the incomes from scientific projects should be 18 mil. euro per

year. It seems, that target financing income from one researcher is 50 000 euro, or 550 000 euro per one scientific institute per year.

The main ways to have such financially successful researches are to evaluate scientific institution ability and skills of each researcher and show them possibility to achieve financial results in scientific teams.

Doctoral student's course scientific project management course is divided in two parts theoretical part and applied. Theoretical part allows to structured basic knowledge's about scientific project management, but practical application allows to student write formal application for scientific project tender.

The practical part for students is free choice topic. The experience since 2007 year is positive, but slow. The first students in the course as final paper presented their scientific research and novelty of scientific research, formalised in special way. The scientific projects scope, aim and work packages were formalised mainly in those projects. Next year the students have had prepared proposal for RTU scientific research projects, it was scientific project description with budget calculation, but this project total budget was not bigger then 20 000 euro. This year students prepare scientific project proposals in all three levels; there were students, which prepare projects with total budget more then 300 000 euro.

The introduction of course "Scientific project management" was successful, there was enough structured study material, hand book and competent teaching stuff. The results of implementation of this study course is not enough financially successful, it means, that knowledge's is just one of three components and it is not enough to start new projects. The motivation and ongoing support is important for starting new projects.

The other components is scientific research, was ability to sell final product on real market and the last component - ability of young scientist to work in risk condition.

The ability to develop and sell research final product on real market is mainly competence of scientific adviser head of structural unit - scientific institution. In particular in frame of European social found financed project „Development of doctor program and its quality in Riga Technical University”, agreement Nr.2005/0132/VPD1/ESF/PIAA/04/APK/3.2.3.2/0050/0007 was introduced also other two important free choice study subjects „Intellectual Property Protection” and „Planning of experiments”, this studies subjects helps students to formalised and finished their research results and make the market ready results of their research. Also additional infrastructure features was made for doctorants during this project. During the project „Development of doctor program and its quality in Riga Technical University” three teaching aids for the free choice subjects were developed, synopses of lectures were prepared, the thesis subjects has been developed with the aim to give an opportunity for young scientists to start first research projects within the doctor course, and to obtain scientific contacts and possibilities, consolidate RTU as a scientific institution enhancing from the research and investigations. The doctoral students who do not plan to

continue the research can choose any subject of free choice from the register of subjects.

Using the seminar rooms (that were equipped during the project „Development of doctor program and its quality in Riga Technical University”) provided also the use of the equipment within the project “Improvement of doctor studies effectiveness with the use of distance education” examining a lot of technical possibilities, purchased equipment: computers, notebooks, cameras, microphones, the opportunity to connect ten users into net was reached, that is useful for the doctor students individual tutorials and scientific work as well.

V. RESULTS OF THE PROJECTS AND FURTHER DEVELOPMENT

Third part to attracting doctoral student to take part in scientific research is knowledge in possibilities to apply projects at international level. The doctoral students during practical training have to know how to make qualitative project proposal and have to apply for international founding projects. The main possibilities is to take part in COST, EUREKA (EUROSTARS), seventh framework programmes or other projects. The usage of some structural funds, which are managed in Latvia is also actual. The information about programme aims, structure, application procedure, samples of successful and not successful applications, this is the way how to motivate doctoral student to make his/her first application. Students realised, that they really could take a part in such projects, even that they haven't knowledge's about this projects and financing possibilities before they took part in this course.

The situation in Latvia, when research capability of small country is limited the cooperation with other international partners is critical to increase efficiency and financial incomes from research activities in RTU. The partner searching sometimes is not so simple, and the existing relation of scientific advisers is not enough for preparation of successful proposal at international level. In this time the Erasmus exchange program, European Cooperation in Science and Technology (COST) actions or any other direct cooperation programs are critical. The is possibility to find partners in conferences or from scientific societies, but this ways are not so efficient, as direct cooperation during research in common projects.

The experience in network of excellence was also positive just few years ago. The research activities of Institute of Electrical Engineering and Industrial Electronics of Riga Technical University L. Ribickis, A. Levchenkova, N. Kunicina, Y. Chaiko, A. Ziravecka, V. Brazhis who took part in European rail research Network of excellence (NoE) FP-6 PLT – 506513 was created proposals in such topics: Operation and System Performance; Rolling Stock; Product Qualification Methods; Safety and Security; Environment and Energy Efficiency. Project proposal „SAFCORS: Safe and Cross-operable Rolling Stock” with 20 participants from 12 European countries for FP7 2nd call Area: Sustainable Surface Transport FP7-SST-2008-RTD-1 was applied.

The EUREKA project development now is very actual, because the is ongoing European Regional found project proposal frame "Business and innovations" 2.1.1.2.activity

"Support for the international co-operation of the projects in science and technologies, this financial resource allows to reimburse project proposal preparation expenses and it is chance for new researchers to get founding for future work in RTU as researchers. Unfortunately now work in EUREKA projects is not frequent, because of shortness of financial resources in Latvian budget, for example cooperation in EUREKA project Hybrid Modular Home Media Equipment was not efficient, because project team have to move activities, waiting till new year for financing and all this troubles negatively influence project realisation.

The partners search and project preparation for seventh framework projects are efficient just in particular cases. There is national contact point, which is responsible to support project preparation. The RTU awarded young scientist of 2008 Dr.sc.ing. Kaspars Kalnins during scientific project management course is specially invited to have a practical seminar and help student's to prepare the seventh frame work project proposal in efficient way. The annual competition for the award young scientists was introduced in 2006 with the aim to enhance scientific research in RTU, to involve young scientists in research activities and to evaluate the results of the scientific research work of RTU scientists.

The motivation of doctoral students is organised in all levels directly and not directly, as an example internal RTU projects financing scheme and evaluation criteria. The criteria to apply for research financing includes such quantitative criteria as published monographs, students books, articles, presentation of research results in international scientific conferences. As well the ready to market of final product - patents.

The improvement of the doctoral study program and technical equipment at RTU is long term investment politics in economics' sustainability. The sustainable development depends also on the availability of equipment, which meets modern technological requirements. The main priority in the research staff training in RTU is development of doctoral studies in high-technology research-intensive fields. Many financial possibilities, which we have during the last years allows using of more modern scientific equipment for experiments.

There is a good practice during recent years - support innovation commercializing, based on State financing, CONNECT network, and university – enterprises collaboration agreements. The education by involving the doctoral students in the research is still under development, but in some divisions we could see, that it really works. The subjects that are interested for a lot of doctoral students are prepared in web based format, using new equipment, which was bought in last four years. Implementation of the doctoral studies base facilitates the use of website environment for training purposes and for communication among doctoral students and contacts with cooperation partners in other countries. Development of doctoral studies at RTU promotes the development of human resources and helps to improve the situation on the enterprises developing the ideas ready for commercialization.

VI. CONCLUSIONS

Doctor studies play an important role in the training of scientific staff for sustainable development of Latvian economics. The application of project based learning approach in doctoral studies is main instrument to reach acceptable level of industry in Latvia. The analysis of case study of IEEL, which is a leader in RTU in project-based learning application shows, that such strategy application could increase the financial resources of institution more than two times. Research projects in the field of power electronics and electrical engineering. The annual scientific report informs on the main branches of the research activities, contact information of the staff, scientific results and the present scientific infrastructure. Special attention is devoted to the Doctoral students who will provide the development of science in future as the basic workforce.

The course helps doctoral students to structure they research, and to imagine process from the beginning of the research to commercialization. The main response was that the course research more sustainable and motivates doctoral student's also commercial applicable result after doctor studies.

The main motive force of knowledge based economy is innovative activity, which promotes the use of the newest science and technology achievements. Innovative activities promote the participation of professionally qualified experts in commercial activities and increasing demand of research work in universities and research institutions. The final results of innovation are products which are able to make competition in world market and services with high added value. Result provides important increase rate of gross domestic product, more work places for qualified specialists, which can promote economical growth, social welfare and country up growth.

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