THE ASSURANCE OF QUALITY AND RECOGNITION OF RESEARCHER'S SKILSS IN EUROPE TOWARDS SMART ENERGY REGIONS PARADIGM

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ABSTRACT

Abstract— the needs for highly qualified researchers, the necessity to gain PhD faster and in more efficient way and the lack of own, i.e. university's resources, fosters Riga Technical University to enhance acquisition of Open European Initiatives in the beginning stage of researcher's carrier. The quality assurance procedure was modeled with the aim to assure mature recognition of researcher's qualification in EU. The proper planning of acquisition of European initiatives, mainly Erasmus and COST programs for development the individual research of early stage researchers, may have a critical contribution towards strengthening of industry driven research activities and competences of young researchers' generation. The case study of successful contribution into COST project targets achievement made by early stage researchers is described in this work.

Keywords: education, early stage researchers, quality assurance modelling, scientific project management, individual traineeship, COST actions, ERASMUS.

1. INTRODUCTION

Entering in the new education stage as a PhD rises an opportunity for students to open their minds for bringing new ideas practical solutions for new open areas in the frontier of the technology development line. The extreme difference from master studies organization and teaching approach brings difficulties for PhD students for self-organization and bringing sufficient result in limited time. The training planning via individualization of training structure as well as appropriate trainee PhD's in the transferable skills fostering to gain PhD faster and in more efficient way. The proper planning of acquisition of European initiatives mainly Erasmus and COST program for development the individual research of early stage researchers may have a critical contribution towards finalization the specific part of research in more efficient way.

The first sufficient contribution of early stage researchers (ERSs) as finalized standalone research in specific novel topic is very important towards the carrier development and establishing new research directions and groups. The authors believe that sharing the experience and specific case studies among different stages of the research lowers entrance resistance barriers and increases efficiency of individuals within the group.

This work promotes the results of COST 1104 "Smart Energy Regions" project.

The number of examples collecting from individual experience of PhDs on different stage is given. The feedback of individuals in order to improve a common training structure in the PhD gives a common list of real steps to be done in order to structure common education process in the proper way.

The target of the research is to demonstrate, how to structure the education process of PhD students in the proper way managing a training process in own scarce resources conditions, but by acquisition all possible external resources, mostly of Open European Initiatives.

The paper is structured as follows. Authors describe the specific of doctoral studies in Riga Technical University in Section II. The individual training plan case study of one of PhD students is depicted in Section III. Section IV reveals a single computerized Kuldiga region utilities management and control system case study, implemented by PhD students with their leader – RTU professor. The main contribution of the research, general results and possible directions for the future work are discussed in the Conclusion of the paper.

2. THE SPECIFIC OF DOCTORAL STUDIES IN RIGA TECHNICAL UNIVERSITY

The Riga Technical University is developing on the way from good regional technical education structure towards the third level university, active in both research and education dimensions. The budget structure transformation in the past ten years shows that the income from research activities in RTU grows from nearly ten present up to nearly forty presents of the budget, and a trend of this growth is remaining stable therefore, it requires well trained researchers in very limited time.

There are about 500 doctoral students in RTU (Ribickis, Kunicina, and Galkina 2010). The number of students in all programs is shown at Fig. 1. The doctoral students of RTU are employed for the basic work as scientific assistants according to qualification.

The main scientific cooperation is ongoing cooperation with Latvian industrial partners. Nowadays, when Latvian economics appears recovering after the crisis, the financial state of Latvian companies allows them invest more in research and development. Therefore, a cooperation with academics becomes more productive.

One of the opportunities for PhD student – ESR to apply their knowledge and to strengthen collaboration between the industry and RTU, is to take part in the small projects. RTU usually supports annually approximately 30 projects with the budget no more than 12000 euro per one project. RTU finances by 30%, but an industrial partner - the other 70%. A competition among postdocs for participation in such projects is very high, for example, in 2014 the number of applications, submitted for financing, exceeded 5 per one accepted for financing project.

The usual state stipendium of a doctoral student is 114 euro per month, the direct state crediting of PhD students is 85 euro. Is not need to reimburse this credit, if a student defended successfully PhD thesis in 5 years after starting of PhD studies.

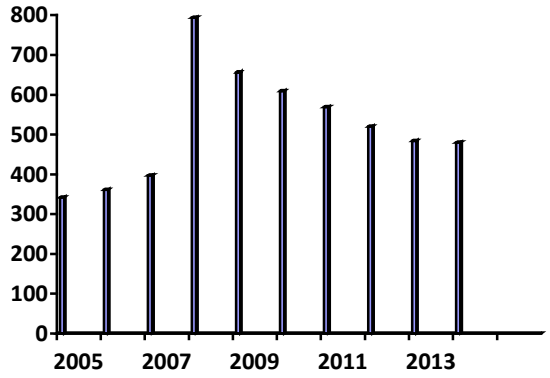

Fig.1. The dynamics of Doctoral students in RTU (2005-2014 years)

In 2014 RTU 480 full time PhD students. The RTU strategic priority is to archive 30% incomes of budget from scientific projects.

The annual competition for the young scientists Award 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 young scientists.

The main priority in the research staff training in RTU is development of doctoral studies in high-technology research-intensive fields. Financial tools, which RTU applied during the last years, allowed to upgrade and modernize scientific equipment for experiments and PhD student training.

There are several other opportunities to support postdocs, for example, participation in the Cooperation of science and technology (COST) projects, but it is very much dependent on the initiatives of postdoc.

2.1. The quality assurance

The quality assurance of new generation of researchers is a new direction of the training education approach. The international experience of motilities, secondments as well as industrial projects rises a need to train new generation of PhDs and masters as internationally focused researchers to be able to establish carrier in industrial and in research centers in Europe. The aim of establishing of voluntary quality assurance procedure is to assure education' system relevance and effectiveness, the relevance of indicators selected, suitability of system to needs, quality of evaluation and monitoring reports, and relevance of report findings. Taking into account the lack of quantitative criteria used in curricular development/ improvement activities the process of quality evaluation is mostly based on qualities' assessment approach. Unlike routine evaluation and accreditation procedures in the universities, our project does not plan to arrange evaluation committee for new developed curricular quality evaluation. The quality assurance procedure consists of 6 main parts of PhD students.

1. Research objectives and tasks

Researchers explain the problem issues and motivation, why they decided to develop a particular topic. They shortly describe the targets and tasks to be implement, they shortly explain results and achievement, as well as its impact.

2. Study content and organization

The student's opinion regarding those points is evaluated by regular annual monitoring reporting system in RTU Extranet ORTUS.

3. Studies and evaluation of knowledge

The student's opinion regarding those points is evaluated by regular annual monitoring reporting system in RTU Extranet ORTUS.

4. Study provision, resources and management

The Doctoral Study department with cooperation with doctoral school makes a specific annual monitoring reporting.

5. Quality Assurance

The Doctoral Study department with cooperation with doctoral school makes a specific annual monitoring reporting.

6. Sustainability

The evaluation of carrier impact and future plans done by Doctoral Study department with cooperation with doctoral school provides specific annual

monitoring reports, and also includes individual fellowship programs and grants efficiency evaluation.

The results of 2014/2015 year evaluation shows that competence of young generation of researchers involved in quality assurance procedure is much higher than average level of Riga Technical university, mainly due to the availability of very intensive industrial and international scientific research opportunities.

2.2. PhD Students Training Support by EU Financed Projects

The support of "*European Social Fund project Support for the implementation of doctoral studies at Riga Technical University*" is available for very limited number of PhDs, and it is 1138 euro per month. The limited resource for individual supervision of trainers requires to arrange individual trainings in the well-structured way. The cooperation with industrial partners helps to ensure proper quality of the research results of the early stage researchers.

As the majority of Latvian universities and research centers RTU faces difficulties to finance scientific research due to the lack of finance, allocated by Latvian government. On Fig. 2, the structure of scientific research financing in RTU in 2014 is shown. It becomes obvious that new PhD have to have the abilities to acquire financing sources via variety of EU and other international organizations scientific research programs and projects.

- State budget financing: 29%
- RTU internal sources: 0.6%
- Contract works for the industry: 8%
- EU and other international sources financing: 62%
- Other sources: 0.1%

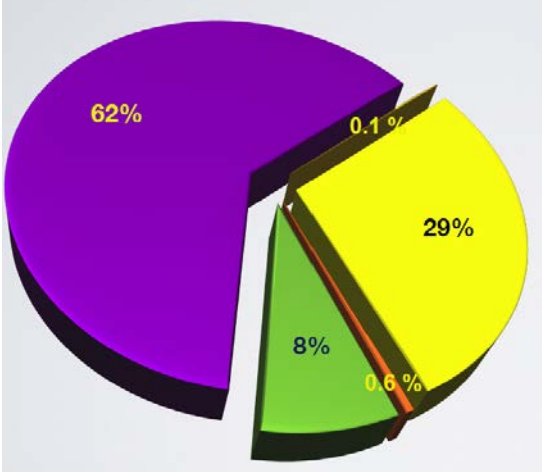

Fig. 2. The structure of scientific research financing in RTU in 2014

The introduction of a course "*Scientific project management*" (RTU 2014) has to help young PhD researchers to obtain necessary skill. Introduction of such course appeared successful, due to well-structured study material, comprehensive course hand book and competent teaching staff. However, the implementation of this training course is not enough for "financial successful", because necessary knowledge is only one of three necessary components to develop and manage a new projects. The motivation of project initiators and ongoing support are essential for initiation of new projects.

The other important competence is the ability to sell final product on real market and the next one is the ability of a young scientist to work in risk conditions. In the real life the ability to develop and sell final product on real market is mainly competence of a scientific adviser, i.e. a head of a structural unit of a scientific institution. In particular, in a frame of European Social Fund financed project „*Development of doctor program and its quality in Riga Technical University*" two important free choice study subjects „Intellectual Property Protection" and „Planning of experiments" were introduced. These study subjects help students to formalize and finish their research results and also to make results of their research ready to the market.

The technical support of doctoral students was ensured due to the participating in the project "*Improvement of doctor studies effectiveness with the use of distance education*" ensured PhD students a lot of new technical possibilities. Due to new equipment: computers, notebooks, cameras, microphones, it is possible to connect by ten users into one net, that is useful for the doctor student's individual tutorials and communication in scientific work as well.

The subjects that are interested for doctoral students are elaborated and published on RTU website, using new equipment, which was bought in last four years. Such website environment is used for training purposes and for communication among doctoral students and contacts with cooperation partners in other countries.

2.3. PhD Students Involvement in Scientific Research Projects

Doctoral student's involvement in scientific research projects, as a part of practical training, gives them valuable knowledge and practical skill, how to make qualitative project proposal, how to apply for international founding projects and how to cooperate inside international research teams.

The most real possibility for a student is to take part in COST, EUREKA (EUROSTARS), seventh framework programs or other projects. The usage of some structural funds programs, which are managed in Latvia, is also actual. The information about program's aims, structure, application procedure, samples of successful and not successful applications, all this is the way, how to motivate doctoral student to make his (or her) first project application. Students realize, that they really could take a part in such projects, even that they do not have previous knowledge about this scientific program and financing possibilities, before they take part in this training course.

EUREKA program's project development now is very actual, because this is ongoing European Regional Fund program in a frame "Business and innovations" 2.1.1.2.activity "Support for the international co-operation of the projects in science and technologies" (EUREKA, HORIZON 2020 program, etc.). Furthermore, this financial resource allows to reimburse project proposal preparation expenses and it is a chance for new researchers to get financial support for its future work in RTU as researchers. Unfortunately only few new calls in EUREKA program were issued last years, because of shortage of financial resources in Latvian budget. For example, cooperation in EUREKA project Hybrid Modular Home Media Equipment was not so efficient, because a project team had to postpone the project activities, waiting till the next year for financing. Obviously, all this troubles negatively influenced the project realization.

In Latvia, where research capability of small country is limited, a cooperation with other international partners is critical to increase efficiency and financial incomes from research activities. Partners search sometimes is not so simple, and the existing relationships of scientific advisers are not enough for preparation of successful proposal for international project. The possibilities to find partners in conferences or from scientific societies are not so efficient, as direct cooperation during research in common projects. Therefore, nowadays the Erasmus exchange program, *European Cooperation in Science and Technology (COST)* actions or any other direct cooperation programs are critical.

The RTU annually awarded young scientist, for example, Dr. Kaspars Kalnins, which has a particular experience in Seventh Framework projects, during scientific project management course hold practical seminars that help students to prepare HORIZON 2020 framework project proposal in efficient way.

3. INDIVIDUAL TRAINING PLAN CASE STUDY

The individual traineeship planning is the obligatory activity coordinated by RTU Doctoral Study department. It gives a certain degree of independency to PhD student and his supervisor. The individual traineeship plan consists of study subjects, scientific work stages, other works (including summer schools, traineeships), and publications.

Each PhD student possess different skills. Let's consider case of PhD student, which defended his PhD in July, 2014 in electrical engineering. Before applying for PhD studies he had extremely good background in the telecommunications. In addition, he came from an industry with very good knowledge of technology area, having contacts in the sector, expertise in the project management as in national as well as in the international research projects. The main motivation was to enlarge his potential working area, to shift in the academic research group as well as to gain a new level of knowledge and expertise in the area of electrical engineering. His area of research is related to design of ICT systems for control of geographically distributed critical infrastructure objects in the dedicated geographical region.

The missing skills in electrical engineering to be developed during PhD training time were the preparation of scientific articles, the ability to scientifically justify innovation, the ability to define targets and millstones for scientific research activities, as well as Matlab modelling and simulation.

The annual individual plan of PhD training was settled up for him. He has been involved in research activities of the systems control branch of Institute of Industrial Electronics and Electrical Engineering (IEEI). The first two years of training where dedicated to the development of prototype, as well to specific training in electrical engineering. He utilized the possibility to use Short Term Scientific Mission, first of all in Lulea University of Technology (Sweden), and then in University Tor Vergata Rome (Italy) in order to develop a specific model to research interdependencies of Critical infrastructures in cooperation with prof. E. Casalicchio. The results of this research are published (Zabasta, Casaliccio, and Kunicina 2014; Zabasta, Casaliccio, and Kunicina 2013). In the last decade of his PhD he joined the COST TU 1104 (Smartener, 2014) Latvian team. This opens the opportunity to gain experience in the area of wider application of his technological prototype in the other types of critical infrastructure in terms of smart energy regions.

His prototype is applicable for green house concept promoting in terms of definition in the Energy efficiency directive (Directive, 2012). This concept was also discussed during COST TU 1104 meetings, and it gave a possibility to formulate new ideas for future research and develop a carrier after PhD study as qualified researcher and a project manager in the area of smart metering, infrastructure control, and electrical engineering in the control team of IEEI.

The results of overall empirical self-evaluation contribution of different training aspects towards successful PhD is depicted in the Fig. 3. It is possible to make a conclusion that the main factors of successful PhD becoming are regular training and close collaboration between a student and adviser.

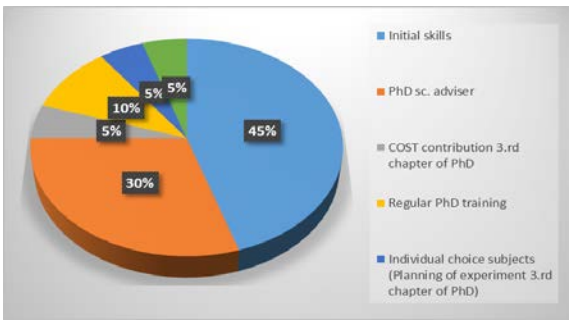

Fig.3. Overall empirical self-evaluation contribution of different training aspects towards successful PhD

4. JOINT DOCTORAL SCHOOLS

Annual Doctoral School sessions (Doctoral School, 2013), held in the spring semester, have become a good tradition in Riga Technical University. The School brings together all doctoral students of the faculty Energy and Power Engineering as well as visitors from other technical universities to discuss jointly the progress and results of research and to find new ideas for future work. It is also a great opportunity to hear lectures from internationally recognized experts in the field of electronics and power engineering. The School sessions have place in RTU Sports and recreation center "Ronisi".

To participate in this event, each PhD student or a group of students submits an essay and prepares a presentation of their doctoral thesis, the relevance and preliminary research results. In 2014 the, besides Latvian and Estonian students, the students from two Azerbaijan universities, from Kosovo and from Ukraine also participated in the School thanks to bilateral cooperation and Erasmus agreements signed between RTU and its partners.

In parallel the annual Doctoral School sessions also are held in Pärnu, Estonia, usually in January in cooperation with Tallinn University of Technology. For example, Fig. 5 shows the students at symposium "Topical problems in the field of electrical and power engineering" and "Doctoral School of Energy and Geotechnology II" held in January 2014.

The Symposium is an activity specially intended for PhD students to present their research projects and to get in touch with many international PhD students and highly experienced professors and researchers from partner universities and enterprises.

Here are only some topics for discussion at Symposium in Parnu, in January 2015: Renewable Energy Sources and Resources, Micro grids, Energy Saving and Power Management Systems, Power Electronic Converters for Energy Generation, Transmission and Distribution, Electrical Drives and Robotics, Electromagnetic Compatibility, and Electrical Engineering and Lighting.

In order to promote multidisciplinary collaboration between PhD students from different engineering areas, the following special sessions will be organized during the Symposium:

- Mechatronics;
- Mechanical and thermal engineering;
- Education, cooperation and financing in higher education;
- PhD Studies in European Universities: Possibilities and Opportunities;

Fig. 4. The Estonian 15th International Symposium

In addition to the regular sessions organizers invite tutorials on various topics related to the general theme of the Symposium. A tutorial should present the state of the art technologies from the leading European universities. Fig. 4 shows PhD students of RTU Electrical and Power Engineering faculty, who participate in the demonstration session of Doctoral School.

5. A SINGLE COMPUTERIZED KULDIGA REGION UTILITIES MANAGEMENT AND CONTROL SYSTEM CASE STUDY

5.1. Administrative reform in Latvia

In a frame of the COST 1104 "Smart Energy Regions" Latvian research team consisting of two PhD students an in years 2012-13 elaborated a research in order to discover problems faced by Latvian regions in the field of energy management in region public utilities.

In 2009 Latvia implemented an administrative reform aimed to move from a *two-level* local public governmental (1st level - 26 regions and 6 cities comprised, and the 2nd level - approximately 400 parish councils) structure to *a one local level* - 110 new regions and 9 cities. Before the administrative reform, public district heating (DH) and water supply management had been operating in each parish, town or city substantively, but due to the reform, the water infrastructure and DH ownership and maintenance has been shifted from the parish level to region municipal one. Therefore, the new established regions have faced an important problem, on how to organize DH and water supply services throughout the region area.

Before the reform, each parish administration operated public infrastructure all alone, (in rare cases getting contributions and resources from the region budget). The majority of parishes did not have sufficient competence and enough of resources to maintain adequate infrastructure that partly was built with the support of EU Funds. Therefore, the majority of region governments recognized necessity to create a single system for providing utility services across its territory.

A study carried out by the team covering three regions in the Kurzeme district: Kuldiga, Aizpute and Ventspils, revealed common problems. Each parish independently

performed public water and DH services, maintained accounting and obtained payments from customers; therefore, the regions administration did not have correct information concerning the overall situation on its territory. Since each parish maintained its own customer billing and property accounting system, the region administration was not able to provide a common policy related to clients and debtors, due to a lack of timely information. A significant part of the municipal property was not equipped with water and heat meters at the entrance to the building, thus water consumption in many cases was determined by local consumption standards, for example, per person and sometimes by the number of animals owned by property owner. Different water tariffs were applied, which were not determined based on actual costs. Because of privatization formerly public DH, water supply and sewerage infrastructure in many parishes was ended up in private hands and the new owners charged.

5.2. Objectives and Methods

This case study was based on a research on public utilities and public services provided after Kuldiga region has been created during administrative territorial reform in Latvia in 2009. The case study investigated three municipality's owned utilities: Kuldiga Heat, Kuldiga Water and Kuldiga Public Facilities.

The objective of the research was to make a study in Kuldga region, related to district heating, water supply and public facilities services:

- Identify the regional public water management, DH and public facilities companies' technical support, human resources, financial resources and maintenance organization.
- To provide recommendations how to optimize the public utilities organization and management by offering the necessary action plan for single computerized water and DH networks management and control framework.

The next target of the research was to offer a computerized model for optimizing water supply and DH management in the regions under consideration:

- To develop a description of the technical solution;
- To prepare a description of the technical equipment and technical documentation;
- To prepare an indicative cost estimate and recommendation about implementation steps.

Outcomes of the study are related to the following fields: Social, Economic, Environmental, and Technical. This research outcomes to be used for further regional utility companies and public facilities development and modernization. Furthermore, the outcomes provide perception for the industry about technological solutions required by municipalities and public utilities.

Methods have been used: stakeholders interviews (the heads and the specialists of utility companies, Regional Council key persons), statistics investigations, innovative projects experience research related to ICT technology accommodation for local needs. Representatives of utility companies, Regional Council and parishes representatives and Ventspils High Technology Park researchers also participated in this research.

5.3. Outcomes of Research

- The research revealed that the public services, provided by community's utilities, are decentralized, fragmented and inefficient.
- A single computerized utilities management and control system model for Kuldiga region has been developed.
- Introduction of single computerized utilities management and control system in Kuldiga region would improve social, economic, environmental and technical situation of the region.

Development of the single utilities management and control system was supported by all involved utilities and region council members. However, local administration faced significant barriers, such as the lack of financial resources, fears related to increasing of tariffs, the lack of technical competencies and necessity to adjust legislation (Zabasta, Kunicina, Korjakins, Ziravecka, and Patlins, 2014).

6. SUPPORT OF POSTDOC AND RESEARCHERS MOBILITIES

The support of postdocs provided by COST actions is very useful for Latvian PhD students, postdocs and researchers. The several scientific supports was done, for example Short Term Scientific Mission in University of Madrid, Lulea University of Technology (Sweden) and then in University Tor Vergata Rome (Italy), and University of Applied Sciences of Berlin (Germany) and etc.

The Erasmus and Erasmus plus support could be used for very limited number of motilities. For example, Dr.sc.ing. Professor Nadezhda Kunicina from Riga Technical University (Latvia) visited University of Applied Sciences "Hochschule für Technik und Wirtschaft Berlin" nine days in October 2014, and delivered lectures on the topics "Specific of project management in Baltic countries and "How to write scientific paper". The lectures topics comprise overview of literature, introduction in Energy saving technologies and its application in Latvia according to the program "Construction and Real Estate Management". The visit has been implemented in accordance with the Erasmus+ Inter-Institutional Agreement between University of Applied Sciences and Riga Technical University.

7. CONCLUSIONS

Doctor studies and individual researchers training play an important role in the training of scientific staff for sustainable development of Latvian economics.

It becomes obvious that new PhD have to have the abilities to acquire financing sources via variety of EU and other international organizations scientific research programs and projects.
Thanks to acquisition by early stage researcher's competences necessary for scientific project management, several projects were implemented in order to improve infrastructure and capacity of the training process in RTU.
The individual traineeship gives a certain degree of independency for PhD student and his supervisor and encourages a student to achieve the end result in more effective way. It is possible to make a conclusion that the main factors of successful PhD becoming are regular training and close collaboration between a student and adviser.
The international PhD School, specially intended for PhD students, encourages them to present their research projects and to get in touch with many international PhD students and highly experienced professors and researchers from partner universities and enterprises
PhD student's participation in the EUREKA, COST, ERASMUS networks and in particular in the COST 1104 "Smart Energy Regions" demonstrated ability to provide a research in order to discover problems faced by Latvian regions in the field of energy management in region public utilities. From the other side, participation in COST actions gives PhD students an invaluable experience and enlarge their contact net.

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