3rd International Engineering and Technology Education Conference
&
7th Balkan Region Conference on Engineering and Business Education

IETEC’15 & BRCEBE’15

“The role of engineering/technology and business education in an uncertain future”

1-4 November 2015

Lucian Blaga University of Sibiu, Romania

CONFERENCE PROCEEDINGS

All papers included in this proceeding are double blind peer reviewed.

Editors

Claudiu Vasile KIFOR and Arun PATIL

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Preface

It is with great pleasure to publish Peer Reviewed Conference Proceedings for IETEC-BRCEBE, that is for the 3rd International Engineering and Technology Education Conference (IETEC'15) and 7th Balkan Region Conference on Engineering and Business Education (BRCEBE).

This year IETEC and BRCEBE is being held as a joint conference in beautiful Sibiu, Romania, from 1st – 4th November 2015. IETEC'15 and BRCEBE brings together a wide range of engineering, technology and business education stakeholders from around the globe to explore the building of new capacities that are essential in creating environmentally and socially sustainable 21st century economies. This joint conference aims to identify and explore the latest trends and developments that will shape the future worlds of engineering, technology and business education. Situated in the heart of Transylvania, at the foothills of the Carpathians, Sibiu is one of the most important cultural centres of Romania and one of the most beautiful medieval towns in Transylvania.

The key feature of this conference is continuous cooperation and collaboration between consortium of universities composing of the host university, "Lucian Blaga" University of Sibiu, Romania, Deakin University Australia and Universiti Teknologi Malaysia. This conference also showcased unique collaboration between engineering, technology and business education through joining two reputed and highly popular conferences (IETEC and BRCEBE)!

The conference set-up included not only research and practice paper sessions but, keynote addresses, interactive workshops and panel discussions. In addition, facilities were provided for group meetings and one-on-one interaction of the participants to discuss issues of engineering, technology and business education and to network with conference participants and organisations.

The conference theme *the role of engineering/technology and business education in an uncertain future,* is highly valuable due to emerging inter-disciplinary trends in higher education and world economies. The papers and sessions at the conference also deliberated on the impact of the highly interdisciplinary nature of new technologies, trends in business education as well as research and development.

Several participants from countries covering the Asia Pacific, Europe, the Indian sub-continent and the Middle East regions had the opportunity to interact and discuss concepts, ideas and practices at the conference. The conference stimulated highly productive discussion and reflection. All papers contained in the Proceedings were presented at the conference and were refereed (double blind) by independent peer referees.

We would like to express our sincere gratitude to all contributors for submitting significant and quality papers. Special thanks to our reviewers, sponsors, supporters, conference speakers and special guests who have made this event a great success! We look forward to meeting again in 2017!

Claudiu Vasile Kifor and Arun Patil
Editors

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The organising committee of IETEC-BRCEBE wishes to thank our sponsors and supporters for their support of our efforts to facilitate engineering education and research in Romania/Europe and the world.

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PEDAGOGY AND CURRICULUM DEVELOPMENT

Learning Strategy for a Prospective Professional Engineer

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ABSTRACT

The paper proposes a learning strategy as a tool for professional development of graduate engineers. The aim of the study is to define elements of a learning strategy for prospective professional engineers and to identify a way for forming this strategy. Feedback questionnaires for certified professional engineers in Russia and two-round Delphi questionnaires for practicing engineers and evaluators involved in certification examinations are among used methods.

Keywords: *learning strategy, professional engineer, continuous professional development.*

INTRODUCTION

Certification of professional engineers is a feature of countries with established professional community of practicing engineers: Canada, the USA, Japan, Korea, Australia and others. It is seen as a tool for regulating and developing the engineering profession. Set and level of competencies of a graduate with a degree in engineering and a professional engineer differ according to the requirements of the Washington Accord, the International Professional Engineers Agreement and the APEC Engineer agreement implemented within the International Engineering Alliance (IEA). A lot of attention is paid to the continuous professional development (CPD) of young engineers through the mentorship and professional development programs in countries where the certification of professional engineers is one of the main instruments of engineering profession regulation. Young engineers should choose a route approved by a relevant engineering association which is in charge of profession regulation.

Engineering in Russia faces a number of challenges that have to be addressed to retain the best Russian engineering traditions. Nowadays there is no federal law concerning professional qualifications in engineering. It is an issue for a company to develop and maintain an internal qualification framework. A majority of companies have such regulations. Usually all technicians, technologists and engineers are examined in accordance with corporate criteria periodically. Ranks held and financial rewards are stipulated by the results of this examination. There is no consistency among corporate regulations throughout the country. The Association for Engineering Education of Russia (AEER) initiated development of a national certification and registration system based on the best international practices in certification of professional engineers and the requirements of the IEA Graduate Attributes and Professional Competencies. The Association involves major stakeholders in discussion of the issue: the State Duma (the national legislative body), the Government of the Russian Federation, the Chamber of Commerce and Industry of the Russian Federation, the Russian Union of Scientific and Public Organizations, engineering universities and companies. In 2008 the AEER received an official proposal to join the APEC Engineer Register and applied for its membership at the International Engineering Congress organized by the International Engineering Alliance in Kyoto in 2009. The first operational office – the Centre for International Certification of Engineering Education and Profession – was opened at Tomsk Polytechnic University. The next step of the system development was the transfer of operational functions to the regional Chamber of Commerce and Industry for more active involvement of employers in certification activities. At present over one hundred of engineers are certified with the title APEC Engineer. This first stage of certification development in Russia can be titled 'normative'. Standards and procedures for assessment provided by public and professional associations are the core of professional engineers' certification. Formation of professional engineer culture remains a challenge for academic institutions, industry and other stakeholders.

Graduated engineers should be more self-sufficient in determining personal professional development. A significant part of applications for the professional engineer status was rejected because of lack of evidence of professional development in a necessary scope. Furthermore some certified engineers became not eligible for recertification with the same reason. It is supposed that implementation of a relevant learning strategy can be an effective tool for professional development of graduates and experienced engineers.

THEORETICAL FRAMEWORK

Litzinger, Lattuca, Hadgraft, and Newstetter (2011) highlighted features of expertise in engineering:

- The knowledge of experts is organized around key concepts to be applied to novel problems.
- The knowledge is linked to the context in which it is useful.
- Everyone needs to invest 10 years of active engagement in a domain to become expert.
- The practice has to be performed with the intention of improving a skill.
- Multiple opportunities should be provided for learners to practice their skills on authentic tasks that require the integrated application of various knowledge and skills.

- Learning experience should be arranged to identify the knowledge and skills needed for expert practice, as well as to develop that knowledge and skill set.

These principles can form a basis for mentoring programs.

Siemens (2004) specified limitations of the most often utilized learning theories (cognitivism, constructivism and behaviourism) and proposed connectivism as a learning theory for nowadays. The main factors are shrinking half-life of knowledge and technologies proliferation. Among principles of connectivism outlined by Siemens these ones should be emphasized:

- Capacity to know more is more critical than what is currently known.
- Learning is a process of connecting specialized nodes or information sources.
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Ability to see connections between fields, ideas, and concepts is a core skill.
- Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

So, information technologies are an integral part of life-long learning and a tool for a learning strategy implementation.

General tips on effective study strategies (Cottrell, 2013) can be also applied in forming a learning strategy. They cover attitudes to learning and techniques to organize learning activities. Comparative analysis of guidelines on continuing professional development applied by the members of the International Engineering Alliance (Chinese Institute of Engineers, 2012, Engineers Australia, 2009, Engineers Canada, 2004, Engineers Ireland, 2013) grounded the proposed guidelines on recognition of professional development of engineers in Russia.

METHOD

To reveal effective forms of professional development of certified engineers a feedback questionnaire was composed and sent to all engineers registered in the Russian section of the APEC Engineer register. The response was got from one third of engineers (56 persons). The survey of proposed guidelines on recognition of professional development of engineers was arranged with two-round Delphi questionnaires distributed among certified engineers and evaluators involved in certification exams. Recommendations on improvement of the guidelines were also received within application procedures to the APEC Engineer agreement and the International Professional Engineers Agreement.

RESULTS

A graduate needs a learning strategy if his / her background and level of competence are inadequate for being certified as a professional engineer. For the purposes of this study a learning strategy is considered to be a general plan of learning activities for a long period of time (2-7 years) for achieving a challenging goal.

Certification as a professional engineer can be the goal of a learning strategy. 43 % of respondent claimed that the certification as a professional engineer is an impetus for professional development. It should be taken into account that the wording of answers for the question 'Your reasons for taking certification procedures' was free. Other reasons of taking certification are provided in the diagram 1 below.

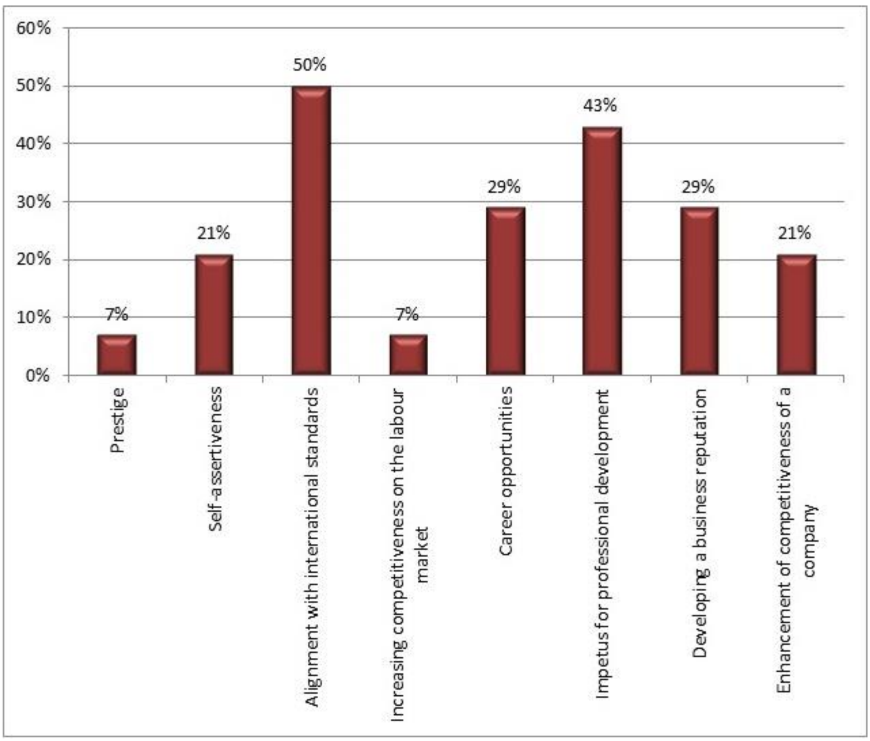

Figure 1: Reasons for taking certification procedures

Feedback received from certified engineers reveals that certification criteria for professional engineers adopted by the IEA provide a comprehensive framework for learning strategy building. 94.6 % of respondents agree that there is no need to enlarge the list of competencies required from a professional engineer according to the IEA standards. According to the questionnaire results the five most effective professional development activities are:

- mentoring (71.4%),
- professional development programmes delivered by HEIs (62.5%),

- short-term workshops (35.7%),
- long-term training in a non-affiliated company to master best practices (26.8%),
- R&D activities (25.0%).

Complex learning strategy formation is fostered with recognition of non-formal and informal learning by organizations responsible for regulating the profession. The following guidelines (table 1) were elaborated upon profound review of international practice of formal, non-formal and informal professional development recognition and consideration of national traditions. The guidelines were approved at the AEER Administrative Board Meeting on the 19th of November, 2013. Necessity in conversation of CPD activities in hours is entailed by the requirement for professional engineer to perform professional development no less than 50 hours a year.

Table 1. AEER guidelines on recognition of professional development of engineers

CPD Activity	Level	Type of Involvement	Amount of Hours
Ph.D. or D.Sc. studies	Russian and International	Candidate for a degree	Equivalent to the required CPD activities for three years
Educational programmes on professional development	Russian	Learner	Equivalent to indicated academic hours
		Teacher	2 hours for 1 academic hour
	International	Learner	Equivalent to indicated academic hours
		Teacher	3 hours for 1 academic hour
Seminars and training	Russian	Learner	Equivalent to indicated academic hours
		Trainer	2 hours for 1 academic hour
	International	Learner	Equivalent to indicated academic hours
		Trainer	3 hours for 1 academic hour
Conferences	Russian	Participant	10
		Reporter	20
		Member of the board of editors	40
	International	Participant	15
		Reporter	30

		Member of the board of editors	60
Training in non-affiliated company	Russian	Trainee	Up to 100 hours
	International	Trainee	Up to 6 hours per day
Invention	Russian and International	Author	50
	Russian and International	Author	25
Involvement in grant research	Russian and International	Researcher	Up to 50 hours
Membership in professional societies	Russian and International	Member	Up to 10 hours
On-the-job training (e.g., technology modernization)	Russian and International	Trainee	Up to 50 hours
Writing articles for publication in professional journals	Russian	Author	20
	International	Author	40
Writing monographs, study books	Russian	Author	40 hours for 40,000 typographical units
	International	Author	60 hours for 40,000 typographical units
Review of articles, research studies	Russian	Reviewer	3 hours for 40,000 typographical units
	International	Reviewer	4,5 hours for 40,000 typographical units
Review of degree thesis	Russian and International	Reviewer	4 hours for 1 reviewed thesis
Review of study books	Russian and International	Reviewer	4 hours for 40,000 typographical units
Consulting of a Bachelor or Master student on a graduation thesis	Russian	Consultant	20 hours for Bachelor thesis 25 hours for Specialist thesis 30 hours for Master thesis
	International	Consultant	30 hours for Bachelor thesis 35 hours for Specialist thesis 40 hours for Master thesis

Involvement in development of a degree programme	Russian and International	Consultant	Up to 10 hours
Supervision of student traineeship	Russian and International	Supervisor, trainer	1 hour for 1 week per 1 student of 1st-3d year (Bachelor students, Specialist students) 3 hours for 1 week per 1 student of 4th-5th year (Bachelor students, Specialist students), Master student or intern
Elaboration of questions for professional engineers certification examination (for certified engineers only)	Russian and International	Author	1 hour for 4 questions of written exam
Involvement in examination of professional engineers	Russian and International	Examiner	Oral examination: 1 hour for 1 interviewee Written examination: 1 hour for 1 test

There is no obvious replication of international experience in CPD hours allocation, however main types of formal, non-formal and informal professional development activities are listed. The main emphasis is put on the outcomes of these activities, so candidates for the professional engineer title or professional engineers wishing to renew their certificates are motivated to be involved in continuous professional development. These guidelines are a subject for a further periodic review.

CONCLUSION

It is supposed that examination is not a crucial function of a system for certification of professional engineers. An essential function of the system is the process of professional engineers formation. Provision of an impetus and resources for professional development means engineering body improvement. A learning strategy of a graduate, who wishes to be certified as a professional engineer, should at least encompass self-assessment according to the certification criteria and the IEA Graduate Attributes and Professional Competencies, a plan of recognized CPD activities for two years minimum and reflection on its implementation. According to the survey results one of the most effective tools for forming a learning strategy is mentoring by experienced engineers.

There are two issues among prospects of further research. The first one is to determine can be a mentor effectively substituted by an intellectual on-line system to assist graduate engineers in professional development. The second one is to find out impetuses for engineers to systematically reflect on their competence and contribute to professional community improvement.

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A Cooperative Project Based Learning Course for Engineer Students in Biotechnology and Chemical Engineering

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ABSTRACT

Problem/project-based learning is the base for the new curriculum at the department of Biotechnology and Chemical Engineering, Helsinki Metropolia University of Applied Sciences. The problem based learning concept, in connection with practical solutions for organizing the courses, is discussed. The new way to pursue studies in biotechnical and chemical engineering has meant a significant change for both students and educators. A positive response from the students can be seen in the form of augmentation of motivation and activity. Team skills have improved, as well as independent study capacity. Cooperative teaching and being more of a facilitator than a traditional instructor, challenge the role conceptions for the educators.

Keywords: *project, problem, cooperative, learning*

INTRODUCTION

Abandonment of studies and lack of engineering practice and abilities of graduated engineer students has long been a central problem in engineering education all over the world. Technical universities such as MIT, Stanford, Aalborg and Chalmers have, among many others, detected the problem several years ago and together designed a new educational program worldwide. The program is based on the needs from the employable industry and is structured according to the outline of the engineer´s work process: conceive-design-implement-operate (Crawley *et al.* 2014). A natural tool for teaching these skills was found to be project- or problem based learning projects. Mills and Treagust (2003), among others, discuss the effectiveness and relevance of these methods for engineering education.

Within the degree course of Biotechnology and Chemical Engineering at Helsinki Metropolia University of Applied Sciences, the amount of student drop outs had been be around 50 % in the past. This phenomenon has caused problems in many aspects for the university, not to speak about the student´ point of view.

To solve the problem broad measures have been taken to make the student stay and graduate without exceeding the time limit, rise the throughput speed, improve the overall performance and the quality of the graduated student´s engineer abilities and skills. One of the more comprehensive changes that has been done, is to form broader study modules (5, 10 or 15 ECTS) with several teachers cooperating and include problem based learning projects to one third of the total credits (80 out of total 240 ECTS).

In this paper we will describe our experiences from the Project Based Learning (PBL) courses running for first year students, and the cooperative teaching within larger modules.

STRUCTURE OF THE PROBLEM BASED LEARNING PROJECTS

The chosen approach for the projects is closer to the engineering method than the scientific method seen in figure 1 (Science Buddies, 2015). Especially at the third and fourth steps, i.e. the requirement specifications and brainstorming steps, the differences were emphasized.

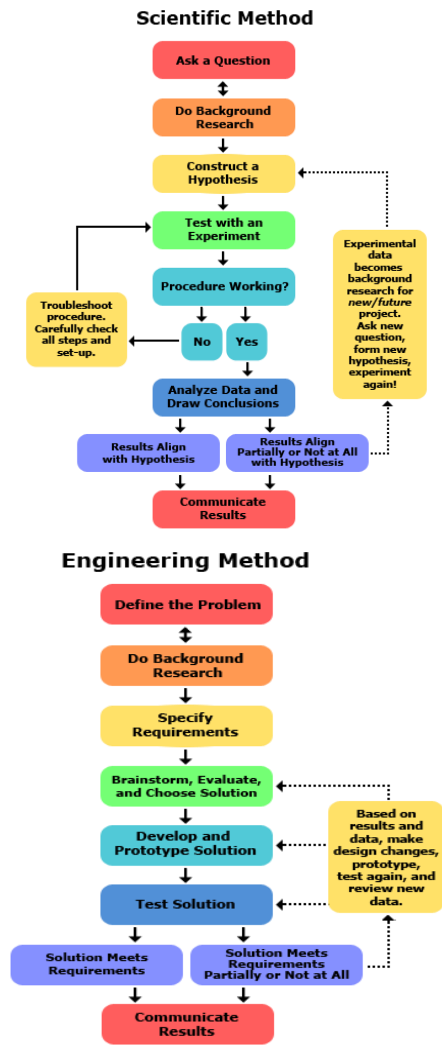

Figure 1: Comparision of the scientific and engineering approach for problem solving (Science Buddies, 2015).

During the first year of studies the students perform three different projects. The aim of the first introductory project during the second autumn period is to get familiar with the PBL process, how to organize a project, roles and group dynamics training. The professional substance content plays a minor role. The two projects during spring semester are more focused on substance learning and the subject for these projects is to get familiar with industrial processes of the field. Each group performs one project based on a food technology or a biotechnology process, the other based on a chemical engineering or a surface treatment process.

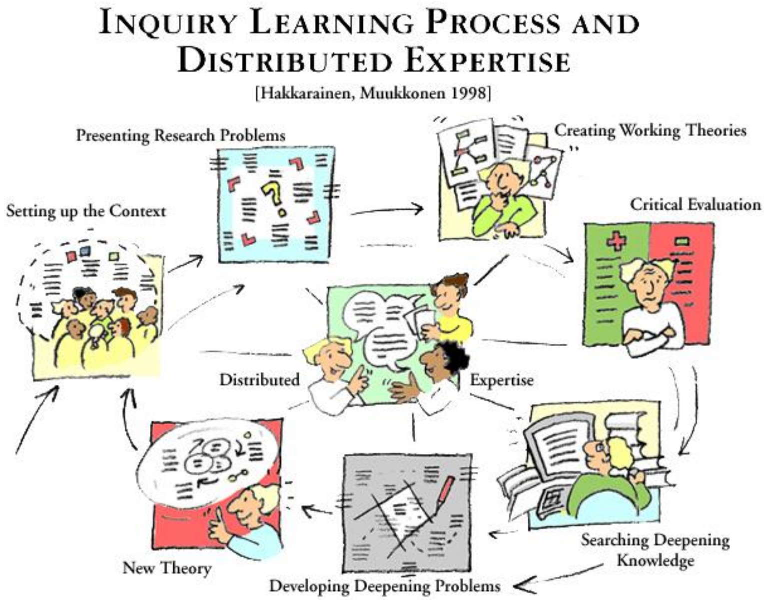

Figure 2: Cyclic learning process and distributed expertise applied in the PBL projects (Muukkonen *et al*., 2005)

The study process follows a cyclic Problem Based Learning approach (fig.2). One cycle takes six weeks and consists of the following steps:
First tutorial

1. Explore the given issues and choose one
2. Brainstorming around the issue
3. Discussion about ´What do we know, what more do we need to know?´ Dividing of learning assignments to be done before next tutorial

Learning assignments (one week time)

Second tutorial

4. Discussion about the learning tasks
5. Specification of the problem to work with
6. Structuring of the project plan

Writing of project plan & material delivery, equipment check
Practical, experimental work in the labs
Reporting of the results
Presentation of the results

Beside the projects lectures in mathematics and physics, as well as in the project subjects, were given.

STARTING POINTS AND INCITEMENTS

Lack of commitment and motivation are often the strongest reasons behind poor study attainments. It is sometimes hard for the student to understand why he/she has to study things that seem to have no connection to practical life. This is one reason why real life problems are strong tools for opening the eyes of a student. Working with the project subject he/she realizes that he/she needs mathematics to solve an equation for an enzyme reaction, or physics to construct a thermal isolator. Then it is suddenly interesting to learn both mats and physics.

Finding good starting points is one of the most crucial phases during the project. We started by analyzing the central learning goals, such as to get familiar with the industrial field in either chemical engineering, food industry or surface treatment area, and understand the properties and technical quality of the products produced in these fields. Then we tried to find good incitements that could inspire the groups around the given theme. We also wished that while working with the project the student would use some key methods, so this was also included. The incitement. An example of an incitement can be seen in figure 3.

Figure 3: One of the incitements used as starting point for the Applied Project in Biotechnology and Chemical Engineering

EXAMPLES OF PROJECT THEMES

The main theme for the second project course is industrial processes and their products. We divided the processes into three main groups according to the major subjects of the degree course; biotechnology and food production, chemical processes and surface treatment processes. This year the theme was chose between

Biotechnology and Food Technology:	Enzymes in food processing Bioethanol production
Chemical Engineering:	Industrial chemicals, i.e. biodiesel production with transesterification Wastewater treatment
Materials and Surface Treatment:	Pigments in paint production Material testing

Figure 4: Experimental work during the practical part of the projects

ORGANIZING AND SCHEDULING THE PROJECTS

The class usually consists of around 100 students. From the very beginning the students are divided into project groups of eight students per group. Each group choose a project leader, a secretary, a contact person for communication inside the group and for keeping in touch with outer quarters. Also other roles can be used, person in charged for analytical methods etc. Each teacher supervises three or four groups.

During the two first tutorials the students form their own project themes, based on the starting point they have been given. Even if several groups are given the same starting point each project will be different and will need different kind of support.

This is often a challenge for the supervisors, especially when the projects proceed at different speed.

One way to facilitate the communication between different actors is to use an open-source learning platform. We built a managerial system for the course with Moodle and we also used a program called FLINGA for brain storming documentation.

Well-designed scheduling is one of the most difficult things during the planning and implementation of the projects. Normally the courses run in eight weeks periods with a fixed weekly timetable, but the structure of these project courses demands variations in the weekly programs depending on what is going on at that time. So timetable problems have been really challenging!

FEEDBACK SYSTEM AND ASSESSMENTS

To evaluate the projects we used both self-assessment and peer evaluation, in addition to the teachers´ standpoints of the individual´s and group´s achieving and results. In most cases the assessment was very similar independent of who did the evaluation, the student itself, the other group members or the teachers. We also asked the students to give feedback about this study form (table 1).

Table 1. Student feedback after the first project. Percent of affirmative answers and free comments. Answering proportion was 52 answers out of 76 students participating in the project course.

What did you learn?	**%**	**What would you change?**	**%**
Working methods	60	More own planning	40
Team work	35	Studious inspection of the subject	29
Substantial know how	21	More information retrieval	23
		More independent work	23
Negative feedback	**%**	**Positive feedback**	**%**
Remote guidance	35	It was fun	19
Remote instructions	17	Good educational method	10
Unsuitable timing	17	Nice to choose the subject for the project	9
Scarce information	14		

The common opinion was, that this is an inspiring form of studies. It was really motivating to form the project theme together with the group, and then design the project plan. They realized that a good and detailed project plan is one the most crucial things. Also to look for background facts and do the incitements well is very important for a successful project.

Most students wished more guidance during the first project - but not so much anymore after the third project! A few groups had problem with group dynamics and the allocation of responsibility. In these cases we tried to interact at an early stage so that the problems would not get insurmountable.

TEACHER´S ROLE

The major change for a teacher is to change his/her role from a traditional educator to a coach or facilitator. The first year projects are challenging since students have not yet the necessary knowledge to carry out practical projects. They would need a lot of instruction, but the teacher’s involvement in early stage will also guide the course of the project strongly. However, to keep up the motivation of the students it is necessary to keep the ownership of the project within the student group. This creates challenges for a teacher to balance between facilitating and involving role.

The first tutorial is the starting point for a project and therefore the starting point or trigger is in an essential role for the project. Problem based learning was found to be a good tool to get student groups interested in the subject. After the first tutorial the students will have an incitement/learning task where they will study the background for the project. This was the way to avoid too much involvement. After the second tutorial the project plan was created, and in this stage the role of the teacher was to guide the project in a direction that could be put into practice. From the teacher’s point of view the most important is to plan the starting point such that there are practical projects that can be carry out within a given timeframe and resources. It should be avoided that the subject is too difficult or the necessary equipment are not available, since it will only frustrate the students.

Cooperative teaching is required in large projects since usually they are multidisciplinary and the know-how of a single teacher does not cover all required areas. Even small practical projects involve usually many disciplines, which makes them also interesting and motivating as well for students as for teachers. They will help the students to have a more profound understanding of the subject they study and keep them motivated. However, it is not easy to put into action such a project course, since it requires a lot of time for planning. The teachers may have to study different disciplines for understanding their connections to the project subjects. It requires enthusiasm, resources and motivation to keep oneself updated of the recent development.

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Improving Teamwork Skills of the Students by Extra Curricular Activities

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ABSTRACT

Teamwork skills become increasingly a pre-requisite for employment success. All employers want to recruit graduates who are able to cooperate, share ideas and knowledge, solve problems, quickly adapt to new situation and work in teams. Romanian educational system is mainly based on the individual study, but it has to adapt to this request. The paper presents two different extra curricular activities that were organized in University POLITEHNICA of Bucharest, Faculty of Power Engineering, in order to develop these skills on the students. The students had to work together two weeks to develop a project, but in one of them they worked without having to physically be together at all times, by using the internet as the main communication method. Both events involved students or young graduates from different countries. The Romanian students never had an experience like these before, they were very enthusiastic and they really appreciated the skills and knowledge gained in these events.

Keywords: *team working, elevator pitch, extra curricular activities, project*

INTRODUCTION

A lot of papers have been devoted to investigate the necessity and importance of using group work in students programs. It is very important that students in engineering learn to work in a team, but this skill is not explicitly taught in the Romanian educational system. After the students graduated they have difficulties in their job because the employers expect they have this skill.

Engineering is by nature a collaborative process and most production systems are designed by teams working over long periods of time, but most programs in engineering do very little to develop this skill of the students, (Lingard, 2010). Adams et al (2014) reported the experiences of an instructional team at Arizona State University that introduced a new module on conation in a mandatory freshman engineering education course. The study illustrates how the inclusion of conation in the classroom can have a significant impact on students and teamwork experience.

Sharp (n.d.), demonstrated using Kolb's theory by the students to work in lab teams or to audience analysis and strategies for writing and speaking.

The students can improve teamwork skill by participation in different extra curricular activities, like team projects and team competitions. This paper presents two experiences of Romanian students from Environmental Engineering undergraduate and master programs of Faculty of Power Engineering, University POLITEHNICA of Bucharest and foreign students from different countries, that improve teamwork skill of the students and at the same time enhance their presentation and communication skills.

WETSKILLS CHALLENGE

Wetskills Water Challenge is an international student exchange program that lasts two weeks (www.wetskills.com). The participants work in mixed teams of international students to develop original innovative concepts for water related case-studies sponsored by organizations within the water sector. In multidisciplinary and intercultural teams, the participants gain more in-depth knowledge on the challenge topic by workshops of renowned water experts and field trips. In addition, a special attention is paid to the development of presentation skills and collaboration among the team members.

In 2013, this challenge took place in Bucharest and it was connected to Regional Water Forum. There were twelve selected participants from University Politehnica of Bucharest and Technical University of Civil Engineering that worked together, in five mixed teams, with students from Dutch universities (Wageningen University, Utrecht University, VU University Amsterdam, TU Delft) and one young professional from Waterschapsbedrijf Groningen, an organization on water related issues. Each team had to focus on one specific case study, on which they work during an extensive two-week program.

The program started with a team-building event outside Bucharest. It involved a study trip at Wastewater Treatment Plant of Campulung and a "breaking the ice" weekend spent by students teams together at the mountain.

In the first working day the participants got a training of making an attractive Poster and presenting an inspiring so-called "Elevator Pitch". Elevator pitch is usually used in business context. It is a very important communication tool and for this competition it was designed to give the audience and jury concise and clear information about the idea of the project and made them interested in the subject. It represented a starting point of the questions and comments. A good elevator pitch should last no longer than a short elevator ride of 20 to 30 seconds, hence the name, ("Crafting an Elevator Pitch", n.d.), ideally less than 60 seconds, (Parsons, n.d.).

The case studies were formulated by organizations of the Dutch water sector (Berson UV, Waterschapsbedrijf Limburg, HoogheemraadschapRijnland, MARS and UTES consortium, consisting of Dutch and Romanian organizations) and they tackled very actual problems in water sector, (Manea et al., 2013): *Small-scale sludge treatment techniques, Management of Aquifer Recharge and Storage (MARS), Macro algae in the Black Sea, Satellite treatment of drinking water, Underground Thermal Energy and Storage (UTES).*

In the first two working days each teams developed its Plans of Actions, well justified and researched, and presented it to the experts and to the supervisors. They are guided for their future work in order to develop an innovative solution for the case-study. The teams used extensively laptops and internet and they worked around on a table, Figure 1.

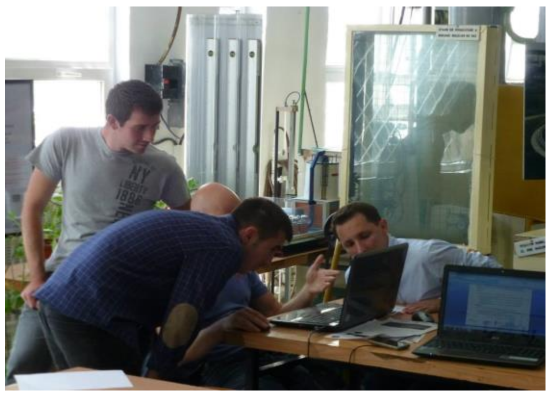

Figure 1: Team working.

A pre-presentations event was held a few days before the final presentation. Each team presented the draft – poster and the pitch and it was advised by other teams, experts and case sponsor to improve the posters.

At the end of the two-week pressure cooker, each team had to present to a judge committee their solution with an attractive Poster and a catching ‘Elevator Pitch’ in the framework of Regional Water Forum.

The participants were required to complete a questionnaire of 21 questions in order to know their opinion regarding the experience in Wetskills Challenge and to find the paths to improve the overall program of the challenge. They are asked about accommodations, working locations, support from the supervisors and from the case providers, teambuilding, working days, workshops/presentations/pre-presentations, official finals, their expectations, their feeling about professional career development, personal development, teamwork skills development. Furthermore, they are required to name two things good and two things that could be better and that should be changed in the next program.

Figure 2 shows the students responses about their expectations regarding Wetskills Challenge on the scale from Excellent to Poor. Most of the students were very enthusiastic, but some of them didn't have any prior expectations from this competition, they only hoped to learn things about their profession. One student said: "Wetskills Water Challenge – Romania 2013 not only met up with my expectations, but it exceeded them by far. It is definitely much more than just a case study competition, because it focuses not only on problem solving, but especially on the social and networking component, which is far more important for a starting or an early stage career" and another one: "Personally, from this Wetskills, I received more than I've expected. I thought it's going to be like another workshop, meet new people, spend two weeks working and then goodbye. But, actually it was a great experience. Now, I know more about Dutch people and The Netherlands. Somehow, in only two weeks we bended to well, become friends and it's pity that it ended so fast".

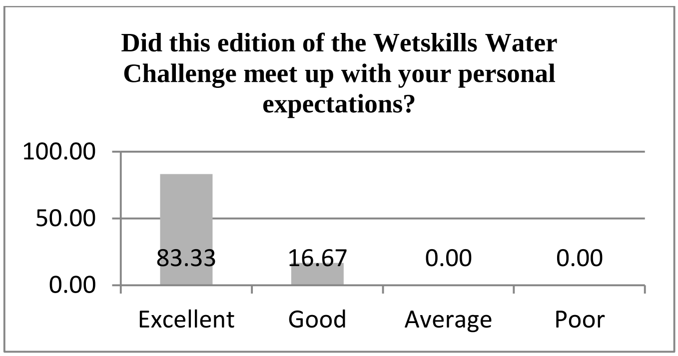

Figure 2: Students responses about their expectations regarding Wetskills Water Challenge.

About the help of this challenge in their professional career, students are generally satisfied, Figure 3. They think that Wetskills helped them in professional career by growing intellectual skills and education level.

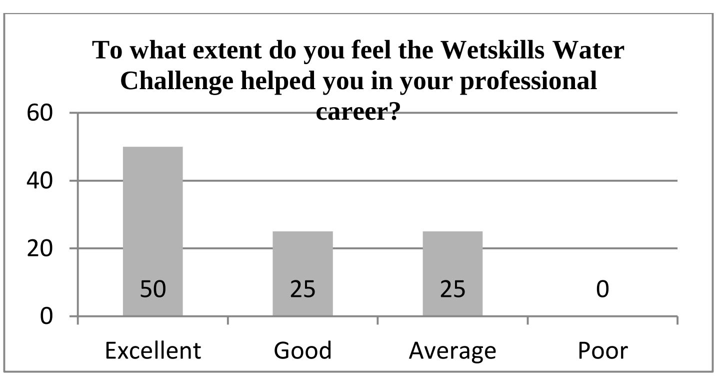

Figure 3: Students responses about Wetskills Water Challenge help in their professional career.

A student that participated in two editions of Wetskills wrote: “Wetskills help me to improve my knowledge related to my field, my English, to speak in public and to think out of the box”. However, there are some distrustful students regarding competition’s help in their career in Romania, even though they learnt a lot.

In terms of the quality of the cases that they have worked on, students were very satisfied. They have to grade on a scale of 1 to 5: 5 being the most enthusiastic agreement. Almost 84% of students responded 4 or 5.

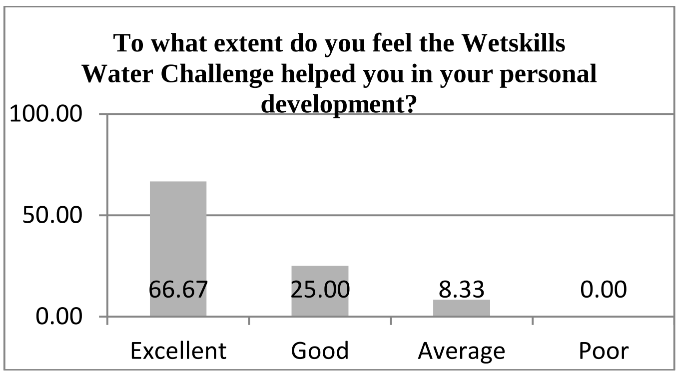

Figure 4: Students responses about Wetskills Water Challenge help in their personal development.

However, about the help of the case providers, their opinions are very different. Approximately 63% of the students responded 4 or 5. Some of the case owners were always there for the team, ready to answer any question and facilitated work on the case, but some teams could not interact with the providers of study case or they had only one Skype meeting and a lot of unanswered questions.

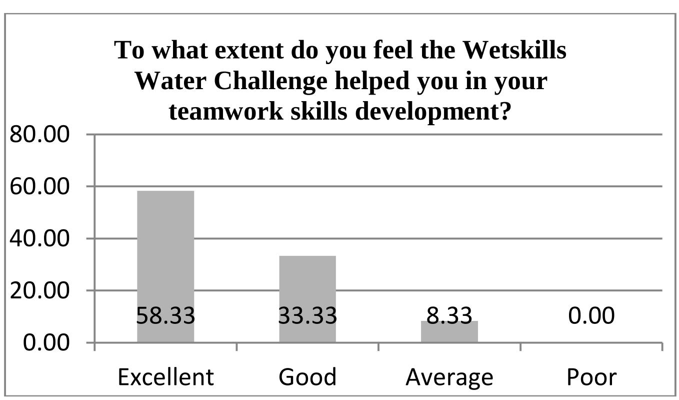

Figure 5: Students responses about Wetskills Water Challenge help in their teamwork skills development.

Generally, the students felt that this competition helped them in their personal development, Figure 4 and in team work skills development, Figure 5. A Romanian student commented that “This program challenged my social skills and knowledge and driven them to a higher level” and a Dutch student said she learnt “helping others, managing the group, learn how to hold peace in the group, and make choices that can be a bit selfish but better for the group and explain them”.

The feedback about the ratio of teambuilding/excursions, working days, workshops and the official event was very positive. All the students answered Excellent or Good on the question “What is your opinion on the ratio of teambuilding/excursions, working days, workshops and the official event?”. One student said: *“*All those events were like baby steps to help us know each other and helped us to be united so that we have better results”. Almost all of them mentioned teambuilding trip one of very good thing about the program that should be remain part of it.

A very encouraging support for this challenge was shown by all participants. All of them would recommend the program to other student or Young Water Professionals because, as one of them said, this event was “The best working-learning-fun experience ever!”.

WATER ESSAYS COMPETITION

Water Essays Competition was also two-week international, which was organized in 2013, based on the experience gained in Wetskills. The topic was “Smart solutions for water industry”. The teams had to develop the essays in the two-week time, but unlike Wetskills without having to physically be together at all times, by using the internet as the main communication method. The aim of having this kind of cooperation was to create the possibility to have as participants students form more than two countries, thus having teams with varied backgrounds and experiences.

The competition aimed at identifying fresh solution for unresolved problems in the water sector and to develop young professional’s skills and capacities for team working. Teams of four students had to elaborate an essay on a given topic. Each essay had to obey a given template and had to be at most six pages long. There was registered 32 students and young water professionals, that made 8 teams, from Romania, Bulgaria, Albania, Serbia, Moldavia, Burkina Faso, Palestine and Uganda. They presented the essays focused on very modern themes: *Hydraulic Fracturing Impact on Water Resources Quality, ”In situ” Methods Against Eutrophication, Cyanide Hazards from Gold Mining to Water Issues, Using Nanotechnologies in Wastewater Treatment, Solutions for Positive Energy Wastewater Treatment Plants for Temperate Areas, Water Supply and Wastewater Treatment in Cities of the Future, Influences from Antiquity to the Modern Water and Wastewater Treatment* and *Future in Obtaining Alternative Fuels from Wastewater Treatment Processes.*

All essays were introduced to the jury in 5 minutes during The International Conference on Energy and Environment. The accent in the essays was put on the originality and innovativeness of the solutions. At least one team member had to be present in the final competition day to present the essay, but there were present at least three members of each team. Also, a lot of students were in the public.

Participants were requested to complete a questionnaire of 18 questions. The main purpose of the analysis was to investigate weaknesses of the program and where are the points in need of improvement for the following editions.
Because all interactions were online, two teams out of eight could not communicate successfully and task assessment was done without all the team members coming to an agreement. They said that it is better when the participants are working face-to-face. That was an unexpected problem taken into account that in the competition were involved young people. They couldn't manage to work as a team because, as one of participant wrote, "We didn't agree on a communication channel until very late in the competition; different timetables coupled with some general unavailability resulted in very little opportunities for communication.".

Almost all participants thought that competition helped them in professional career, personal development and teamwork skills development. One of the students said "From this experience I learned to listen carefully to my co-workers and to understand their needs and ideas.". But, not all agreed that the competition met their personal expectations. Some of them felt the competition like an experiment.

With its weaknesses and strengths, the competition was still a success taken into consideration that all participants said that would recommend it to other students and young water professionals. However, it is necessary to rethink the competition framework, particularly the working of teams in a virtual environment.

DISCUSSION

The two types of competitions, face-to-face and online, were well received by participants, but some of them thought that "brings people together physically as well, since communicating and working together is generally more effortless".

Wetskills started with a teambuilding and study trip, when the participants developed friendships and the teams started bonding. This initial phase was missed in online competition and probably this is one contributing factor for the poor performance of some teams.

Generally, in both competitions the teams worked very well together to generate an innovative solution, in Wetskills Water Challenge, or an attractive original essay in Water Essays Competition.

The competitions had a positive influence on participants' networking and social development, but also on their professional career and teamwork skills.

Nevertheless, the framework of Water Essays Competition should be improved by creating opportunities for easily remote collaborative work of the teams.

CONCLUSIONS

The knowledge exchange in a team has already been proven as being the best way for capacity development. The team competition represents a viable solution for preparing the students for a future in research and development companies.

The competitions described above had an extremely positive impact on personal development, professional career and teamwork skills of the participants as almost all of them desired to repeat the experience and recommend the programs to other students and young professionals. Furthermore, they improved their presenting and communication skills. The participants challenged to work in unusual working environment and under pressure. The competition between teams was high and making a difference between the teams was almost impossible, so that the mission of the jury was very difficult. Each case solution, respectively essay, had its importance and up points.

The competitions also lead to development of knowledge on the Romanian water sector, wastewater treatment, sewerage systems, renewable energy sources and environmental impact.

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A Case Study: Technology Education Internationalization

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ABSTRACT

This paper investigates the internationalization of education, specifically technology education in National Research Tomsk Polytechnic University (TPU). Through a conducted case study of a course in a Master of Information Technology (MIT) program development, it investigated the challenges that TPU faced and how they could overcome the challenges in internationalizing their programs and curricula. The research adopted a qualitative case study research method. It used survey, observation and documentations as the data collection techniques, as they are best suited for this research. Ten students were involved in a delivery of a course in a developed internationalized MIT program. The research team observed how the students learnt, whether there were challenges and difficulties in the delivery of course learning and how they were overcome. The results showed that the students were highly satisfied with the course developed and they believed they greatly benefited from the developed course.

Keywords: *case study, higher education, internationalization, course development, teaching and learning challenges.*

INTRODUCTION

There have been a variety of definitions for higher education. For the purposes of this research, higher education is defined as 'all types of studies, training or training for research at the post-secondary level, provided by universities or other educational establishments that are approved as institutions of higher education by the competent State authorities' (UNESCO,1998). Globalization refers to the flow of technology, economy, knowledge, people, values and ideas across country borders which affect each country differently, due to its history, traditions, culture and priorities; and internationalization of higher education is a way a country responds to the globalization impacts (Knight, 2001; Delgado-Márquez, Bondar & Delgado-Márquez, 2012). In this paper, internationalization is not about 'Englishesation' or 'Englishization' whereby universities use English as the medium of instruction.

The trends of globalization and internationalization of university programs and their curricula have largely impacted on Russian higher education (hundreds of Russian universities) in the last 10-15 years. Meanwhile, the demand for engineering education increased substantially in Russian technical universities. To date, every second student in Russia considers technical education as the most prospective. One of such universities is National Research Tomsk Polytechnic University (or TPU), which was ranked in the top four leading universities by the end of year 2014 in Russia (Chernyh, 2015). It also has a place in QS Rating of Universities within the group of 501-550. It was a strategic approach to develop TPU into a research university to improve its competitiveness. Particularly, TPU aspires to become one of the world leaders in the area of resource-efficient technologies, which would help to improve humanities and economic developments globally following some scientific guidelines and directions. The examples are non-destructive testing and diagnostics in industrial and social fields, nanotechnologies and plasma-beam technologies of material creation with set properties, intellectual monitoring and control information-telecommunication systems , rational nature management and deep processing of natural resources and, traditional and nuclear energy as alternative technologies to energy generation.

It is a strategy for TPU to transform in order to produce more better-benefited graduates and post-graduates. To implement the strategy, the masters and other post-graduate programs were actively re-developed. The redevelopment is of high necessity, as it would attract not only post-graduate students from Russian universities but also from foreign universities. The stake of students undertaking master and post-graduate programs in year 2014 is over 25%, and this index is expected to increase significantly to year 2020. In year 2014, the amount of international students has grown by 23% from its traditional amount of students into over 3.5 thousands of international students. It is one of the best indices among Russian universities. Over 15% of the educational programs in TPU will soon be delivered in English language. Therefore, another strategy is also to attract more foreign teachers-researchers. Considering all of the above, it requires some different approaches and the changes to the forms of educational process. For examples, networking between universities around the world using mixed forms of learning in Russian and English languages, using Internet technologies and, if possible, implementing face to face classes with foreign specialists.

To investigate the challenges that TPU could possibly face and how they could overcome the challenges or difficulties in internationalizing their programs and curricula, this research paper provides a case study related to a particularly selected course in the program developments. The research adopted a qualitative case study research method. The case study investigated the technology education development for Master of Information Technology (MIT) program in TPU. In TPU, the majority of student learners' first language was Russian but not English. The research specifically examines a course 'Systems Analysis' as a small part of MIT program development by engaging an invited Australian university academic as a foreign researcher-teacher from Central Queensland University, Australia, to co-plan, co-develop, and co-execute the teaching delivery of a course (or subject). The research investigates whether there were challenges, how the challenges were overcome and whether the students achieved the planned course learning outcomes as an additional component to MIT program. Before the course could be conducted to test whether the redevelopment benefit the students, the course was collaboratively and actively planned, designed and developed involving both TPU staff and the foreign researcher-teacher. Many special careful considerations were given to the selection of students with English language abilities, skills to understand the lectures, abilities to complete their tutorials work, and needs for teacher-student consultation or extra help.

Ten students from the MIT program were selectively chosen by the TPU senior management to attend the course to obtain the best possible learning benefits. The researcher-teacher delivered the course. The students were assessed through different tutorial tasks and a final examination. This research uses qualitative case study research method. It used the data collection techniques such as survey, observation and documentations due to the techniques could much better examine the research context and contents. All classroom activities and discussions were monitored, collected and recorded. The related staff closely observed all aspects of the course. At the end of the course, the staff collected student opinions and feedback through a survey. It was found that most students achieved very well in regards to different learning outcomes though a few of them achieved moderately. The students reported that the skills they learned were very useful, they highly enjoyed the course and they greatly benefited from different skills learned in the course.

This paper is structured as follows. The next section will go through the related issues in the existing literature to identify a knowledge gap to be filled by this research about technology education internationalization. In the third section, it explains a selected research method that could better address the research aims and research questions. Section 4 explains the data collection process and analysis results. Section 5 discusses the research findings, implications and contributions from this research. Section 6 provides a conclusion of this research paper.

LITERATURE REVIEW

In this section, the related work in program internationalization, and all kinds of program development and subject development related to internationalization will be explored. Higher education internationalization is a broad area of research. Maringe, Foskett and Woodfield (2013) remarks that internationalization has been the most significant areas of change in higher education globally over the past few decades. Luijten-Lub, Wende and Huisman (2005) maintain that internationalization refers to the increasing interconnectedness between different national education systems across borders and national authorities, and internationalization is perceived as a policy-making process. Song and Tai (2007) comment that higher education (HE) institutions that look into internationalization aim to be world class universities. In the modern days, universities compete within the global market of higher education.

In analyzing the dynamics in HE internationalization, Pricopie, Nicolescu, Reinhardt and Almãsan (2009) discuss two major dynamics. They are: 1. the mobility of student, faculty and institutions, and 2. the use of information and communication technologies (ICT) to influence the offer and demand of HE services in the global market. They also use the terms ‘transnational education’, ‘cross-border learning’, ‘university extensions’, ‘joined universities’, ‘integrated programs’, or ‘borderless education’ to describe the institutional mobility to offer study-abroad programs with offshore courses and programs (pp. 103-105). These terms and the two dynamics discussed are different attributes that Maringe, Foskett and Woodfield (2013) analysed, further classified and supported in their emerging internationalization models. Some previous research (Choi, 2015; Maringe, Foskett & Woodfield, 2013; Jackson & Huddart, 2010; Mthembu, 2012; Teixeira & Coimbra, 2014; Olatokun & Utulu, 2012) reflects that many universities look into internationalizing their programs and curricula and upgrading their programs/subjects to meet the global standards.

The above-discussed research generally covers the ‘motives, aims and purposes of HE internationalization’, which brings along the tasks of internationalized curriculum (or program curriculum) development. Vajargah and Khoshnoodifar (2013) regard curriculum internationalization as a critical process of developing and changing the curriculum in order to infuse various international aspects into formal operational dimensions of curriculum. Altuwaijri (2007) adds that the program curriculum development processes will include needs identification, academic development and institutional development and the program should meet the highest international academic standard based on latest knowledge and field development. It is important that universities provide their students with constantly updated knowledge through continuing education such as online learning (Choi, 2015).

For constantly updated knowledge in internationalization, Phan, Siegel, Wright and Siegel (2009) comment that many universities work much more closely with industry and government. Knobela, Simõesa and Cruza (2013) observe that universities encourage faculty members to collaborate internationally, which is not only a trend, but is mandatory for any individual, research group or country to seek visibility on the science and technology scene. Odrakiewicz (2013) remarks that some better highly-regarded Polish MBA programs partner with foreign business schools, and the graduates receive a degree from both the Polish school offering the program and its foreign partner school. To further stress the knowledgeability in HE teachers in our uncertain world of changes, Kalantzis and Cope (2012) highlight the needs as: 1. to teach as action researchers; 2. become transformative leaders of change; 3. have capacities to work; 4. accept diversity; and 5. build capacities for innovation. In the new global HE changes context, Yang (2004) reminds that universities need to develop a new capacity to make selective and flexible responses. Many country governments and universities adopt dissimilar strategic approaches in HE internationalization within different country contexts (Altuwaijri, 2007; Choi, 2015; Denise, 2014; Gray, Chang & Kennedy, 2010; Song & Tai, 2007; Taylor, 2004; Teixeira & Coimbra, 2014; Yang, 2004). Internationalization strategies are shaped at the program level by the different relationships these programs have to the market and society (Accreditation Organization of the Netherlands and Flanders, 2010).

Participating of Russia to the Bologna process has resulted in a revolutionary modernization of the higher education system and has become a step towards integration with the global educational domain. Nowadays, the process of internationalization comes to the forefront when analyzed by the experts as one of the constituent parts of the mission of the Russian university. The aspects of the higher education system internationalization were studied in the work of the following Russian researchers: Agranovich (2010), Elkina (2010), Leontyeva (2012), Pleshakova (2015), Tatur and Medvedev (2012), and Chuchalin (2013). To more carefully investigate the aspects, these researchers further explore the cultural mission of the university education in Russia, the synergy of humanitarian and scientific developments, the integration of international and national education system, intercultural communication and meeting the educational standards laid out in Bologna Declaration. Changes in the higher education system in Russia, including the development of its internationalization process, started not long ago but since Russia's inclusion of the Bologna process in 2013. As a result, as shown by literature review, in Russia there is limited amount of practical research related to the study of internationalization issues of higher education. This research aims to fill this research gap.

RESEARCH METHOD

This research aims to specifically focus on investigating internationalization of technology education within the Russian HE internationalization context and exploring its related challenges and difficulties.

Case study research method was warranted most appropriate as: 1. Its research questions are mainly 'how' and 'why' questions; 2. The researchers have little or no control over behavioral events; and 3. The focus of study is a contemporary phenomenon within the research context (Yin, 2014). Further, case study research is most useful in investigating Russian technical education internationalization as a new research phenomenon (Yin, 2012), when considering case study research is methodologically viable in the study of extreme or critical cases (Miles & Huberman, 1994). For the purposes of this research, a case study was chosen for a technology education program development, i.e. the MIT program, in TPU. Case study data collection techniques 'survey', 'observation' and 'documentation' were adopted. The data collection techniques were used, as interviews that needs to take the interviewee time away from staff and students would prevent them from focusing on their usual role responsibilities in normal learning and teaching activities. Other considerations were survey with related usefully prepared questions would effectively collect the answers from the staff and students in the researched learning and teaching context in TPU. Furthermore, by observing the day-to-day operations and activities in learning and teaching, and collecting the related program administration documentations will help minimize the interferences to all the learning and teaching members. With the researchers being a few TPU staff members in Russia and a researcher-teacher from Central Queensland University, Australia (CQU), who are usually located in two geographically distant countries with time zone differences, the three data collection techniques are most useful for the research purposes.

The research project was planned with all researchers involved in data collection processes, specifically from developing and delivering a chosen course (also known as a subject or unit). The course was developed with collaborative efforts involving all related academic staff from the two universities (TPU & CQU) for a new MIT (English) program in 2014/2015. Traditionally, the MIT program in TPU has had materials written in and been delivered in Russian. The new MIT (English) program was newly developed by aligning with the traditional program contents and learning outcomes, but written and delivered differently in English. The TPU academic members developed the entire MIT (English) program before and including 2013, where the researchers in TPU were able to closely observe, to be well-informed and to keep effective track records of the program development. In 2014, the researcher-teacher from CQU was invited to develop a course in the MIT program that would be useful for students in TPU. The TPU academics provided the CQU researcher-teacher with useful URL links of some redeveloped MIT (English) program with helpful website pages to understand the program aims, structure, courses, schedule, learning outcomes, etc. The CQU researcher-teacher planned and developed a course 'Systems Analysis' not already included in the program but believed would further enhance the program. The CQU researcher-teacher was also engaged to physically deliver the course in TPU over 3 weeks towards the end of 2014.

Ten students were registered and actively participated in the course to completion. For the 3-week course, it was closely observed. The course involved 9 1-hour-35-mins lectures, 6 1-hour-35-mins tutorials and laboratory sessions, 3 1-hour-55-mins student-teacher consultation periods, and a 2-hour examination. TPU MIT program normally cover teaching of all parts of all courses in Russian and only this 3 weeks' course part was taught in English as an approach to HE internationalization. All invited students were carefully selected as they were those in the current MIT students who were believed to have a good command of English either because they used English in their previous education programs or they went through education exchange program in other English speaking countries. Further, they fulfilled another criterion with skills mastery, capabilities and high academic achievements in other MIT program courses. All learning and teaching activities were closely observed and recorded. All useful aspects of the related course materials, administration and correspondence documentations were collected.

The CQU researcher-teacher delivered the course in lectures, tutorials and laboratory sessions at TPU in three consecutive weeks i.e. between 20 Oct 2014 and 7 Nov 2014. There were also student-teacher consultation sessions where students could ask questions if they had any doubt about the course. Students could access and download course materials on a common learning & teaching website and correspond with the CQU researcher-teacher over emails or in person. At the end of the course, the ten student participants were invited to take part in a course survey. The survey aims to explore: 1. How the students feel about the course; 2. The student backgrounds that they have to support them for the 3 weeks' course delivered in English within their MIT program; 3. Whether they could accept MIT program in English medium; 4. Why the students were selected for the course; 5. What previous education backgrounds and experiences each of them have before doing the MIT; 6. At what stage (which semester in the whole program and the duration of program) is each of them in their programs; 7. Was the course related to their TPU studies and enhance their knowledge and skills in their program; and 8. How the course will help and benefit the students.

All activities were carefully observed and recorded. All forms of collected data were eventually put together for concepts mapping to discover its messages and hidden meanings under careful examination. The analysis results were discussed with and/or sent to other researchers for data verifications, examinations, discussions and feedback as a form of cross-checking (Krefting, 1991) and member-checking (Anfara Jr., Brown & Mangione, 2002).

DATA COLLECTION AND ANALYSIS

Through the observation records, it showed that the students generally obtained highly positive learning experiences. 10 Students attended the classes. On most of the teaching days, there were at least 6 to 8 students who attended the classes regularly. Those students who skipped classes did not understand English well and sought help from other classmates to relay messages to them and teach them in their language afterwards.

During the course delivery period, particularly over their interactive lecture discussions, tutorial tasks, and computer laboratory work, the students talked with class members in their different languages and talked with the teacher (the CQU researcher/teacher; ‘teacher’ is used in this section to better explain things in the learning and teaching context) in English. The teacher communicated with all students in classes, in consultation office and via emails. In the tutorials, some students confidently typed out and recorded their tutorial answers electronically as MS Word files using laboratory computers. A few students used language translator on their laptops to understand their English tutorial questions before attempting to answer them in English using their translator assistance. It was amazing to see that Visio could show up in a Chinese and a German-like (not sure of what language script it was) versions when two students used non-English Visio versions on their own laptops. For any tutorial or laboratory tasks that any student could not complete during class times, all the students were allowed to complete it as homework for submission the very next day. They were strongly encouraged to submit all tasks as emails directly to the teacher for feedback. Every student would either have a timely email reply feedback or a direct classroom verbal feedback for a submitted task when attending the subsequent class. Some students sent emails about doubts in courses and received email replies with clarification and learning advice. Students who could not attend one or a few classes sought advice and laboratory tasks catch-up instructions over email correspondences. Most students performed very well in all submitted tutorial/computer laboratory tasks with only a few submitted tasks showing some mistakes.

The majority students completed the course demonstrating confidence in their skills and told the teacher they enjoyed the course. During the course, the students told the teacher the course contents actually complemented the contents they learnt in their other courses within the program. In particular, two students, who showed great interests by attending all classes without any record of absence, showed excellence in all assessments and course learning outcomes, particularly evident through their final examination with highest marks in their class. They also demonstrated very impressive computer laboratory work and tutorial tasks with very good grasps of concepts. Two other students who did not achieve in the course so well were mainly due to their low English proficiencies. For one, even though his English proficiency initially hindered or slowed down his performance, due to he frequently checked with the teacher and sought help, he followed the course through well. The other one who was mostly absent in nearly all the classes, could only work out tasks with help from classmates, bypassing the teacher, for rough work submissions. Nonetheless, even though the two of them passed the course with borderline results, the former showed a higher total course mark than the latter.

All students were observed to be different and had different learning experiences in this course. In the 3 weeks, all related TPU staff provided the best possible help and support to the teacher, so that the course went through smoothly and completed successfully. It was such a pleasant experience for the teacher to work with all staff and interact with the ten students. At the end of the course, just right after the final examination completion, the students requested the teacher for taking a group photograph with them. When they were asked whether they enjoyed the course and what they liked most in this course, they answered “very much” and “everything!”

For the purpose of this course, all students, a TPU staff member and the teacher accessed a common Google drive to share all learning and teaching materials. The documentations from various class communication sources including google drive showed that all students retrieved their classroom materials regularly as advised. The students also checked their emails timely and responded to the teacher promptly about their tasks, class work and activities. The records of email correspondences reflected that there were active classroom communications electronically, in addition to those face-to-face interaction/communications in classroom or in consultation periods. The documentations analysis reflected that there were frequent class communications, regular provisions of answers to students and active student-teacher interaction. There was no record of student complaint in any aspect of the course.

In the student survey feedback, students commonly revealed that 1. It is an excellent opportunity to expand the knowledge in the subject area; 2. They were able to practice their communications in English; and 3. They were able to gain international experience and obtain the most recent and relevant knowledge and skills in order to become a competitive specialist in the future.

Below is a student survey feedback further summarized and prepared to reflect the students' background, learning experiences or opinions having attended their 3 weeks' course.

- The previous education backgrounds and experiences each of them have before doing the MIT. The students came with a background in Bachelor degree of: Applied mathematics (62%) and, Computer science and engineering (38%)
- The stage the MIT/bachelor program (which semester in the whole program and the duration of program) each of them is in. All students were 1st year students in their MIT program.

- The relatedness of 3 the weeks' course to their TPU studies and how the 3 weeks' course will enhance their knowledge and skills in the MIT program.
    1. 85% of students commented that the course significantly expands the students' knowledge in system analysis and software design. The course was related to and shared a lot in common characteristics with other courses in their TPU master's program.
    2. 65% of students agreed that it was highly appreciated that the course was taught in English by a lecturer from a foreign university. It helped to improve their knowledge of English and enabled them to receive new information. The course was very well-correlated with the TPU program of study. It strengthened their knowledge and skills gained at TPU.
    3. 88% of students reflected that it was a very interesting course with the following interesting topics: the development of requirements, structural analysis of the software, and the development of use case diagrams. The course contents and topics were very well-correlated with the studies at TPU.

- How the 3 weeks' course helped the students.
    1. 100% of students reported that they gained useful knowledge in system analysis and software design.
    2. 65% of students considered the 3-week course as an English language immersion program where they had good times of communication with an interesting English-speaking teacher.
    3. 97% of students revealed they enjoyed their communication with the professor of the leading foreign university with a great opportunity to ask the questions they had and obtained interesting answers overall.
    4. 60% of students revealed they gained new knowledge in project management.
    5. 81% of students remarked that when giving the course, the lecturer demonstrated interesting examples and offered practical tasks execution which helped to improve their skills at every stage of the system design.

FINDINGS AND DISCUSSIONS

The three-week course reflected the relevance of the Systems Analysis course in the MIT program and the interests of the students in pursuit of this course. However, their learning experiences differed based on their different levels of English language mastery and the actual difficulties and challenges encountered within the course. While some did not have or did not have much problems in their learning processes, some experienced learning difficulties in classroom activities, tasks and work in following through the course like the peers. A student who was shy and absented from most classes struggled to pass the course with the course-mates to help in all learning activities outside the classroom. One who attended class with lower English proficiency ironed out his language difficulties by seeking frequent help and advice about tutorial work and laboratory tasks directly from the teachers and other students who attend the classes together.

The analysis results indicate that the students' previous English study programs, exchange program in English-speaking countries or individual English exposure background directly benefited them and impacted on their learning performance. As all the course students were different with different English proficiency levels, while some could enjoy the course simply without or without much English difficulties, some struggled through with means of language translator assistance or with frequent help from the course-mates and/or teacher. Having enrolled in a Russian MIT program but having to attend a course in an English-speaking classroom could indeed be a great challenge for those who have not mastered English well (i.e. listen, speak, read and write).

In the process to internationalize the curriculum and implement the English-speaking classes, TPU could consider giving effective help to all the commencing students on the internationalized MIT programs by providing the students with induction classes with basic, medium and advanced academic English language skill trainings. During the program, students could be further supported by providing them with on-going English language assistance, study advice and consultation workshops. It would greatly help if one or more English advisors are appointed to help the students with low English proficiencies and clear signs of struggling in their learning.

In essence, the three-week internationalized course Systems Analysis in TPU presented a case about how the ten selected MIT students faced challenges and overcame their different degrees of difficulties when going through an internationalized course. The results of the investigation suggest that there may be future internationalized program students who may also have English language deficiencies or academic learning difficulties. Hence, to help the students overcome the presented different challenges and learning difficulties in the learning processes is critical since they will directly impact on their performances. In hindsight, there need to be measures to overcome the students' learning difficulties and mitigate the presented challenges to the internationalized program students. Some useful approaches recommended for TPU include the considerations to provide students, especially the commencing students in the internationalized programs, with induction English language training at various levels to increase their English language proficiencies to help them meet their study requirements. There should be frequent consultation workshops to help these students in the internationalized programs. TPU could hire study advisor to understand the student learning difficulties and problems in order to more effective solve their learning problems to improve their work on an on-going program-wide basis.

CONCLUSION

This research provides an insight into Russian higher education internationalization through a case study investigating students' learning experiences. The case study was based on a selected group of ten students going through a course offered by a foreign university teacher delivering it in English-speaking classroom, as a new research phenomenon (Yin, 2012). The findings reflected some students' difficulties in listening, speaking, reading and writing in English and their challenges to seek assistance and support to complete the course when dealing with the three-week course in an internationalized MIT program.

There are some recommendations for teachers to understand why some students skip lectures conducted in English and the needs for working out strategies to help such students. One of the reasons is their imperfect English skills. For example, these students often read English texts much better than listening to it. Therefore, the teachers may recommend to their students to read their study materials ahead at home before classes. In this case, students will be interested to attend classes with their questions ready with them. Such practice is very useful for international students who study courses in Russian as a foreign language to an international student. As for internationalization in the higher education, it is important to understand that the training process usually happens and needs to happen in English. In a university like TPU where the training is carried out in two languages i.e. Russian and English, it is critical to help all students manage their studies. It is because for some international students in TPU, both Russian and English languages are not native. In this case, the invitation of professors with native English from other universities is very important. The mixed language study is useful not only for the students, but also for the Russian teachers.

Currently, the research results are restricted to how TPU internationalized their programs. To strengthen the validities of the research results, more case studies should be anticipated to further investigate how other Russian universities internationalizes their programs and how their students faced and overcome challenges and difficulties encountered. To generalize the research outcomes, many more case studies in higher education internationalization in more foreign universities should also be anticipated to further investigate how various foreign universities internationalizes their programs and what/how the challenges or difficulties encountered were overcome

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Using CFD Techniques in Teaching Rectangular Settling Tank Hydrodynamics

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ABSTRACT

Sedimentation is one of the most important phenomena applied in wastewater treatment. The paper presents the CFD techniques used in teaching students the influence of the inlet baffle on the primary settling tank hydrodynamics. Different sizes and dimensions of the baffle are studied in order to highlight the optimum configuration that assures uniform flow in the settling area and prevents dead zones. By this mean the students have the possibility to evaluate multiple configurations in short time intervals and with low costs, when compared to hands-on experiments.

Keywords: *CFD, modeling, settling tank, simulation, wastewater treatment*

INTRODUCTION

The importance of wastewater treatment is given by the decrease in water bodies' quality due to uncontrolled discharges. Depending on the type of pollutants in the influent and the discharge water body type, a multitude of processes are necessary in order to moot the legislation effluent loads (Cheremisinoff, 2001).

Sedimentation is a physical treatment process of wastewater used to separate suspended solids from water under the influence of gravity. The terms *sedimentation* and *settling* are used interchangeable, (Metcalf&Eddy, 2003). In wastewater treatment plants sedimentation process takes place in the following facilities: a) grit chambers - for grit removal; b) primary sedimentation tanks – for removal of suspended solids; c) secondary sedimentation tanks – for floc removal, resulting from the biological treatment in the activated sludge bioreactor or the biofilm reactor; d) sludge thickeners - for solids concentration.

Settling tanks commonly used in wastewater treatment can be either rectangular or circular (Robescu et. al. 2001). The wastewater enters the rectangular tank through different inlet systems, full-width inlet channels with inlet weirs, inlet channels with submerged orifices or inlet channels with wide gates and slotted baffles, (Metcalf and Eddy, 2003). The inlet should be so designed as to provide a uniform distribution of water and solids in the settling tank. A submerged baffle is placed at the inlet area in order to reduce the high initial velocities and separate the turbulent inlet region from the laminar settling zone, to make the heavier particles settle down in the hopper and to shorten the altitude from which solid particles start settling, thereby increasing their removal rate of discrete particles, yet maintaining a convenient depth that permits the flocculent particles to continue their paths.

The solids settling in the tank are scraped towards the hopper by one or more scraper blades suspended from the bridge that travels forward and backward the tank on the rubber wheels or on rails. In the case of secondary clarifiers the necessary method consists in continuously pumping in order to assure the biological substrate for the activated sludge process development (Ragsdale, 2015).

The efficiency of the settling tank is affected by design and operational factors, and it can be easily evaluated before the construction phase by using CFD (Goula et. al. 2008). Some of them are the eddy currents due to the non-uniform distribution at the wastewater inlet and outlet, baffle position, tank geometry, wind, density and thermal currents, inappropriate operation of raking equipment and sludge draw off. To avoid suspension of settled particles, horizontal velocity through the tank should be kept sufficiently low (Metcalf&Eddy, 2003).

The use of in-class computer simulation has the aim of covering studies that are normally impractical or have a high cost. By this mean students can evaluate current design methods in wastewater treatment facilities and have the possibility for better understanding of the processes that lead in obtaining pure effluents. Early reports of using computer simulation in teaching had the aim of evaluating the topic understanding when compared to hands-on experiments in chemistry (Bourque and Carlson 1987). The use of computer simulation in teaching laminar-flow reactors allows the students to explore the concepts taught during the theoretical and hands-on laboratory work, for it allows visualization of the flow phenomena (Madeira et. al. 2006).

In wastewater treatment, simulation was constantly used in learning, both in class and outside it due to its low cost and reduced duration when compared to practical evaluations (Morgenroth et. al. 2002).There are previous studies that have been devoted to modeling flow field in the settling tank, some of them presented by (Robescu, 2012).

Shahrokhi et al., 2011, investigated the effect of a baffle with different angles on the hydrodynamics of the flow field in a primary sedimentation tank by the application of a computational model. Goula et al, 2008, studied the influence of a feed flow control baffle for the improvement of solids settling in a full-scale circular settling tank used for potable water. CFD modeling is used by Esping et al, 2012, to evaluate primary settling tank performance and a novel wet weather chemically enhanced high rate treatment tank configuration.

Computer simulation may play an important role due to the fact that they can be used with instructive or constructive pedagogy. By using this method the students have the opportunity of observing real world experiments, impossible to run in a laboratory (Sahin, 2006).

This paper presents the using of CFD techniques in teaching students the influence of the inlet baffle on the primary settling tank hydrodynamics. Different sizes and dimensions of the baffle are studied in order to highlight the optimum position that assure uniform flow in the settling area and prevent dead zones.

Using simulation software and applications in classes has proven to be a widely used and debated. Electronic Learning facilities were found to lead to extensive self-learning, fact that enhances student's knowledge and capacities (Parush and al., 2002). Simulation is used at the moment as a learning tool in most of scientific and life fields- from health sciences (Harden, 2010) to management (McKone, 2003) starting with evaluating the possibility of replacing the traditional laboratory work with simulations of experiments (Moore and Thomas, 1983).

Computational Fluid Dynamics is widely used in illustrating fluid properties and phenomena in hydrodynamics, mainly for Master's and Ph.D. students with the proper background in Hydraulics form Bachelor courses.

SIMULATION STUDY

The theoretical simulation study was conducted for a laboratory model of the real settling tank with the geometry shown on Fig.1. The model is distorted in order to respect the hydrodynamics of a real settling tank – the depth and length were not reduced alike in order to maintain the velocity limit inside the clarifier of 10 mm/s.

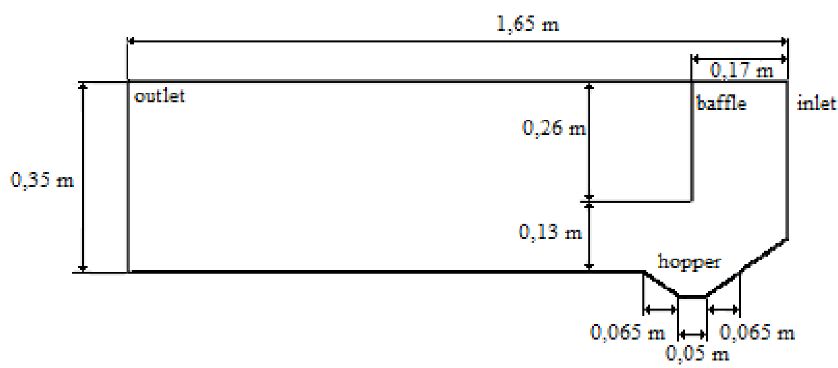

Figure 1: Scheme of settling tank geometry – 1st position of the baffle

The simulation study has in view the following things that the students should be learned: the importance of the baffle, the influence of the baffle size and shape on the conditions and hydrodynamics of the settling area as well as the influence of the inlet wastewater velocity on the settling tank hydrodynamics.

More configurations were studied with and without a baffle. The laboratory setup is similar to the configuration shown in Fig. 1. Experiments were carried out with students for an homogenous fluid (water) and different inflow values (between 90 and 500 ml/s). The velocity inside the tank was determined by dividing the inflow by the flow surface. Thus, an average value was identified in each case in order to evaluate if it complies the sedimentation velocity values range. A tracer was used to determine the fluid movement and it was permanently monitored. Results can be seen in Fig.2. Hands-on experiment help students understand the basic principles of fluid flow in longitudinal clarifiers, the need for baffle, as well as its size and position importance. Having a laboratory model is useful to a limited extent, because modifying it to evaluate, for example, the baffle position turns out to be difficult.

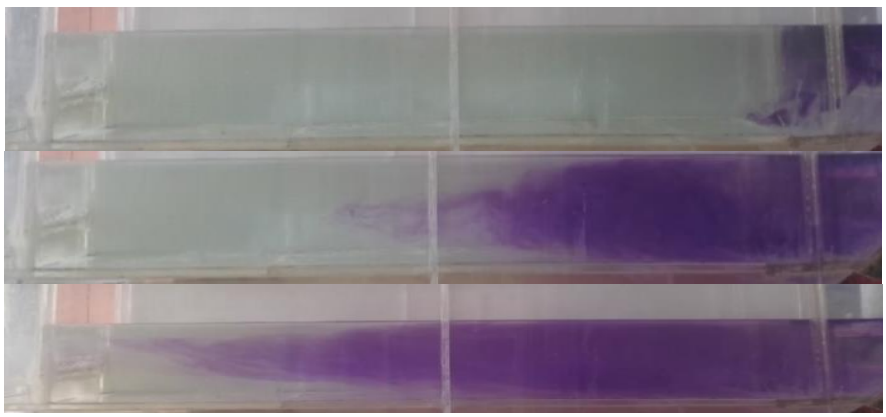

Fig. 2. Fluid flow in the longitudinal clarifier – laboratory experiments

The students gather visual information during experimental work, but these kinds of experiments are, in most cases, time consuming (Morgenroth et. al. 2002). Being familiar with modeling and simulation tools in wastewater treatment gives new opportunities for graduates to work in process design and optimization, as well as consultancy companies (Hug et. al. 2009).

The model was meshed in Gambit^{TM} using an unstructured mesh. The computational fluid dynamics package FLUENT^{TM} has been used to carry out the simulations. The solver used was a segregated solver as the flow is incompressible. A steady state laminar flow with absolute velocity formulation was considered. Some of the results are presented and commented below.

RESULTS AND DISCUSSIONS

The necessary steps before elaborating the practical simulation consist in elaborating the geometry and the domain mesh, as well as establishing the boundary conditions. A laminar flow and segregated solver were considered in all cases. The same type of influent as in the experimental setup was considered. The aim of evaluating the cases is to determine the baffle influence on the velocity profiles in the baffle area, while maintaining the same influent value.

The simulation case evaluated the fluid behavior for an influent velocity of 0.5 m/s. the velocity vectors colored by the velocity magnitude values are presented in Fig. 3. This first configuration considers the tank doesn't have any baffle. The results obtained in the configuration without baffle can be seen in Fig. 3. By using this representation the need for a baffle in the entrance area can be easily explained to students.

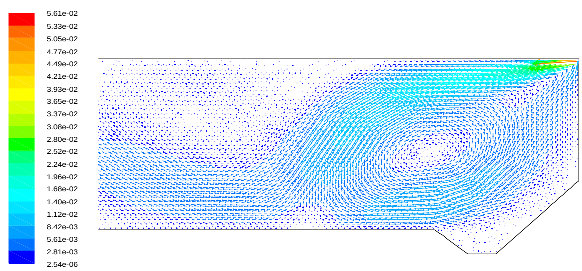

Fig. 3. Velocity vectors colored by the velocity magnitude values for the configuration without any baffle

The third case evaluated a different configuration, with a baffle depth of 0.13 m. The same conditions as in the previous one were considered and the results can be seen in Fig. 4.

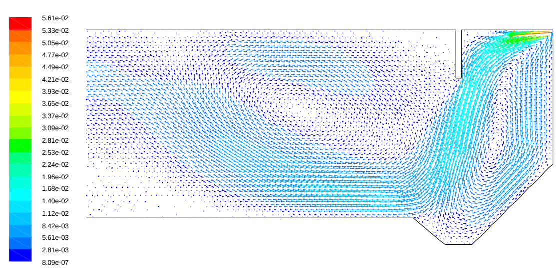

Fig. 4. Velocity vectors colored by the velocity magnitude values for the 0.13 m baffle

As can be seen in Fig. 5, for the baffle depth of 0.26 m below the water level, the water washes the hopper, thus not allowing the solids to settle, due to the vortex that occurs. The results indicate the need for either modifying the geometry or inflow value reduction.

The aim of using simulations in class is to have the students understand the importance of the baffle shape, size and placement on the water flow inside clarifiers and to be able to choose by means of modeling and simulation the optimal configuration.

The objectives can be acquired with Master's and PhD students that have graduated Environmental Engineering bachelor studies, and have focused on Wastewater treatment, Multiphasic fluids flow, Fluid dynamics. In this case they have the necessary background to understand and interpret the results obtained by using CFD. This way they are able to identify the flaws in the results that lead to poor solids retention and also to suggest the solution for improving the sedimentation efficiency by applying the knowledge gained in the wastewater treatment courses.

As can be seen in figure 3 the velocity in the clarifier is high and considering the high entrance point, the heavier particles settling near the baffle is not accentuated. Thus, by seeing the results, it's easy for students to draw the conclusion that the solids removal rate will be increased with a baffle near the inlet area. They are able to see the need to insert a structure that redirects the short-circuit currents in the clarifier that could lead to high solids contents in the effluent. There are multiple baffle configurations and potential placements and in this study the same position for the baffle is maintained while modifying its shape.

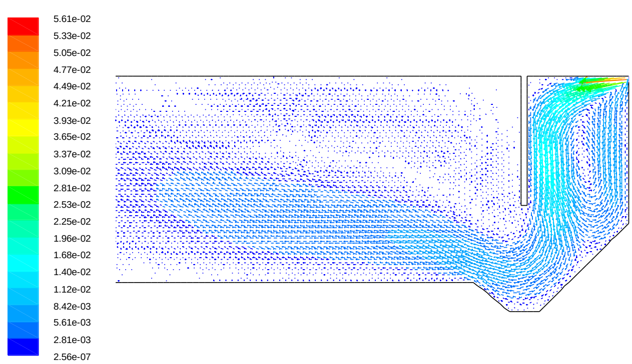

Fig. 5. Velocity vectors colored by the velocity magnitude values for the 0.26 m baffle

In both cases that a baffle is provided at the inlet area, the settling conditions are improved, as can be observed in Fig. 4 and 5 when compared to Figure 3. It can be seen that it separates the turbulent inlet region from the laminar settling zone and forces the heavier particles settle down in the hopper.

The inlet height provided by using the baffle in figure 4 may not be sufficient for heavy particle sedimentation in the hopper. That was the reason to have the students simulates the configuration presented in Figure 5 that gives a lower entrance point for the solids loaded wastewater.

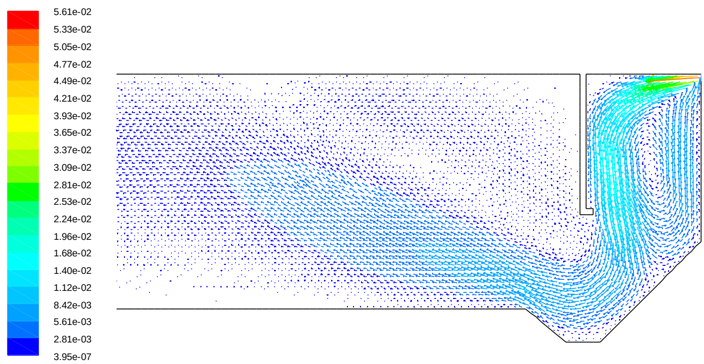

Fig. 6. Velocity vectors colored by the velocity magnitude values for the 0.26 m baffle with the modified geometry

The aim of modifying the baffle shape, as is the presented case in Fig. 6, is to obtain to reduced velocity values in the inflow area when compared to the results presented in Fig. 5, thus reducing the possibility of baffle washout while maintaining a low inlet height.
Multiple similar scenarios can be evaluated both in and outside the class in order to accentuate the students understanding of the hydrodynamic of wastewater treatment facilities. It leads to better understanding of the processes with low costs and in reduced time intervals.

This was only one of the many examples that can be analyzed, step by step, and it was conceived as being a two-hour class for Master's students that already have done experimental work on the existing laboratory model. This teaching technique allows intensive interaction between the involved parties and stimulates ideas exchange among students- they have the possibility to give solutions for practical problems based on their experience and they have the possibility to verify their assumptions.

CONCLUSIONS

In this paper CFD simulations were done in order to highlight the influence of the inlet baffle on the primary settling tank hydrodynamics. The importance of the baffle is shown and the importance of its size and shape is evaluated. Three cases have been studied and the resulted lead to a better understanding of its influence on the global fluid flow. It is obvious that the study cases can be extensively developed but the aim is to introduce an example that can be easily understood and replicated by students during a class or right after one. Thus their interest and skills will develop and a better understanding of processes can be achieved.

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Enhancing Engineering Education via Physical Experiments: The Case of Learning Energy Storage with a Flywheel System

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ABSTRACT

Design thinking is complex that is hard to learn and harder to teach. The purpose of engineering education is to graduate engineers who can design (Dym CL, 2005). How to enhance students' reasoning and cognizing about data has gained an increasingly visible role in the K-12 curriculum (Doerr H. M. and Lyn D., 2003). In order to enhance teaching and learning engineering mathematics, a modeling approach by shifting the focus on finding solutions to a particular problem to create a system is proposed in this study. Besides, a training process for the college students who are intending to be the instructors of guiding physical experiments is included. Nonlinear systems, signifying any system is not linear, cannot satisfy the superposition principle. In this paper, a new modeling method for nonlinear systems based on an Adaptive Network-Fuzzy Inference System (ANFIS) for operation and practice was used (Jang, J.S.R., 1993). Through this method, students were able to learn how the transfer functions work for identifying an unknown system. This method had well helped the participated students how the nature of nonlinear system is and how to find out the optimal solutions in controls.

Keywords: *engineering enhancing education (EEE), physical experiment, system modeling, electromagnetic flywheel (EF), Adaptive Network-Fuzzy Inference System (ANFIS).*

INTRODUCTION

There are many types of training methods which can guide students to learn and distinguish what the linear and nonlinear systems are. Here, nonlinear regression is learned to be the common method for nonlinear modeling. This method is not only concise but also remains in the shape of mathematical model. However, it may increase more complicated nonlinear model which is difficult to be used in real applications. In order to avoid above problems and simplify the computation process in nonlinear modeling, the methods such as neural network, adaptive neural fuzzy systems etc. are always adopted. Although these methods can accurately fit the nonlinear system, for they are model-free methods which are difficult to let students observe the mathematical properties existing in these systems for further applications. For the educational target at EEE, instead of those complicated system modeling kits this study adopted and integrated the Taguchi method (Ho, W.H., et al., 2009) and ANFIS (Huang, C.N. and Chang, C.C., 2011) to achieve system identification works.

Nowadays, the energy issues have become one of the most important topics in the world. In order to shorten the distance between EEE and those most concerned issues in the world, an energy storage device, the electromagnetic flywheel (EF) system, was selected as the demonstration platform for EEE in this study. EF systems, with the progressing of high-strength and light-weight composite material, and technologies of power electronics, battery, bearings and controls, instead of traditional battery systems, become an alternative for energy storage issues. EF systems with a lot of complex nonlinear uncertainties, such as electromechanical coupling, magnetizing, and demagnetizing etc. that was selected to be the experiment platform to enhance the impression of what nonlinear system is and how the EF works for this EEE. For the EF system is characterized with lots of nonlinearity and uncertainties, there would be a lot of restrictions and difficulties existing in traditional mathematic ways for modeling. In this study, initially an EF system was design and set up, then through the proposed learning process to confirm the effectiveness of EEE. The works of the EF system in design, setup, and experiment etc. were accomplished by the participators, including advisor, students and the offerors of system parts.

SYSTEM DESIGN & SETUP

According to the experimental demand for data collection, the EF system platform was designed by advisor and machine manufacturer. Where, the main components were marked as follows: ① Motor / generator, ② EF (in Fig. 2), ③ Switching box for charging and discharging control, ④ Power analyzer（No. DM2436AB）, ⑤ Motor driver (DELTA 220V/2.2kW), ⑥ Control box of excitation voltage and current adjustment, ⑦ Control box for Manually loading. According to above design, the EF system was accomplished. Fig. 2 shows a motor/generator device coupled with a flywheel. Through this setup, the nature of energy transformation between kinetic and electric powers can be observed and recorded for analzing the nonlinearity. Table 1 shows the geometric size and parameters of EF system.

In order to let students understand the charging and discharging characteristics of the EF system, a series of required approaches for experiment were designed. In the approaches, nine sections in accordance with the frequency setups as 20, 25, 30, 35, 40, 45, 50, 55 and 60Hz were given to observe and record the input/output energy data corresponding to different rotational speeds. In this experiment, the concerning data was automatically recorded from a desk PC in every two seconds.

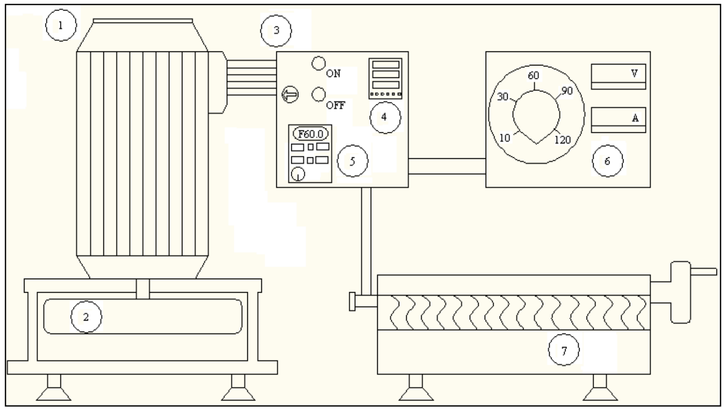


Figure 1: System Design

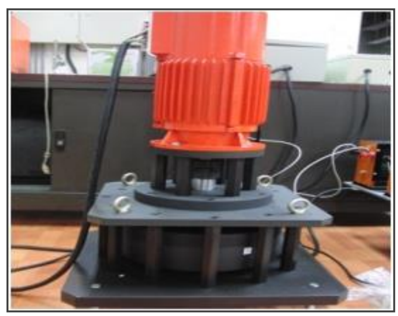


Figure 2: System setup

Table 1: System parameters

Motor rated voltage	**220V**	**Flywheel weight**	**60kg**
Motor rated current	**1.9A**	**Flywheel Material**	**Iron**
Motor horsepower	**2HP**	**Flywheel radius**	**0.15m**

FUNDAMENTAL KNOWLEDGE REQUIREMENT

Before participating to this study, some of the fundamental principles in physics and calculation skills to ordinary linear equations are required for students as Newton's law of motion, feedback control, and Laplace transformation etc..

FE energy storage.

According to the Newton's Second Law of Motion, the rotational kinetic energy E_c (J) can be expressed as Eq. (1) as the flywheel is driven.

$$\mathrm{E}_C = \frac{1}{2} I\omega^2 \tag{1}$$

where, I (kg-m^2) is the rotational inertia of flywheel (or moment of inertia), and ω(rad/s) is the rotational speed of flywheel.

The moment of inertia depends on the object's mass distribution. Its definitions is the second moment of mass with respect to distance *r* from an axis integrating over the entire mass *m*. When the object is a solid disc-type ingot with weight *M*(*kg*) and the radius is *R*(*m*), moment of inertia I can be expressed in Eq.(2).

$$I = \int_m r dm = \frac{1}{2} MR^2 \tag{2}$$

By substituting Eq. (2) to Eq.(1), the energy storaged in the rotating object can be found as;

$$\mathrm{E}_C = \frac{1}{4} MR^2 \omega^2 \tag{3}$$

For the rotational inertia can be calculated and changed via adding or descreasing the number of disc-type ingots, makes the experimental works become simplified. That is, participators can only measure and then record the variation of rotational speed which subject to the input frequencies of driving motor.

Parameter identification.

In order to find the model of an unknown system presenting in the type of a continuous function, first, a second-order transfer function with three unknown parameters was given for system identification. Next, through identifying the parameters of a transfer function which characterizes an unknown system, the model was able to accurately obtain. Finally, using the well-identified transfer function via the calculation of inverse Laplace transform, a differential equation with time variance as well as a continuous function representing the unknown system could be obtained.

In this study, A simple method for fitting the parameters of a transfer function with over-damped responses (Chen, 1989) was used. The approximate model of a controlled object is given as a second-order transfer function with time-delay term as

$$G(S) = \frac{C\infty}{\tau^2 S^2 + 2\zeta\tau S + 1} e^{-ds} \tag{4}$$

where, the parameters, including $C\infty$, ζ, τ and time delay constant *d*, are unknown. For finding model, initially the system should be set in the open-loop state, then inputting a unit step signal to obtain the step response of the system as shown in Fig. 3.

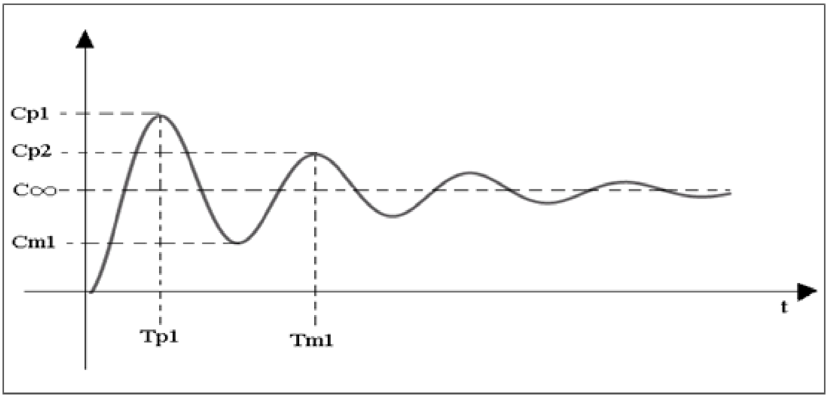


Figure 3: Step response of a system

The equations describing the relation of the values in Fig. 3 and the unknown parameters including $C\infty$, ζ, τ and time delay constant *d* are expressed as follows.

$$C\infty = \frac{Cp1Cp2 - Cm1^2}{Cp1 + Cp2 - 2Cm1} \tag{5}$$

$$\zeta = \frac{-\ln(H)}{\sqrt{\pi^2 + \ln^2(H)}} \tag{6}$$

$$H = \frac{1}{3}\left[\frac{Cp1 - C\infty}{C\infty} + \frac{C\infty - Cm1}{Cp1 - C\infty} + \frac{Cp2 - C\infty}{C\infty - Cm1}\right] \tag{7}$$

$$\tau = \frac{(Tm1 - Tp1)\sqrt{1-\zeta^2}}{\pi} \tag{8}$$

$$d = 2Tp1 - Tm1 \tag{9}$$

A second-order transfer function with four unknown parameters was used to represent the unknown system for modeling as;

$$T_i(s) = \sum_{i=1}^{n} \frac{a_i}{b_i s^2 + c_i s + 1} e^{-d_i s} \tag{10}$$

By observing the data of step response found by experiment and substituting them into Eq.(5)-Eq.(9), the initial values of a_i, b_i, c_i, and d_i could be obtained.

ANFIS model.

Fig. 4 illustrates the parameter approaching mechanism of transfer function via ANFIS (Huang and Chang, 2011). The objective function is to minimize the difference e(t) between the real system response T_r(t) and the calculated result Ti(t). Here, a threshold value η and an error tolerance ε are set for system identification as;

if $|e(t)-e(t-1)|>\varepsilon$, then continue calculation.

if $|e(t)-e(t-1)|\le\varepsilon$ but $|g_r(t)-g(t)|>\eta$, then i=i+1 continue identification.

if $|e(t)-e(t-1)|\le\varepsilon$ and $|g_r(t)-g(t)|\le\eta$, then end identification.

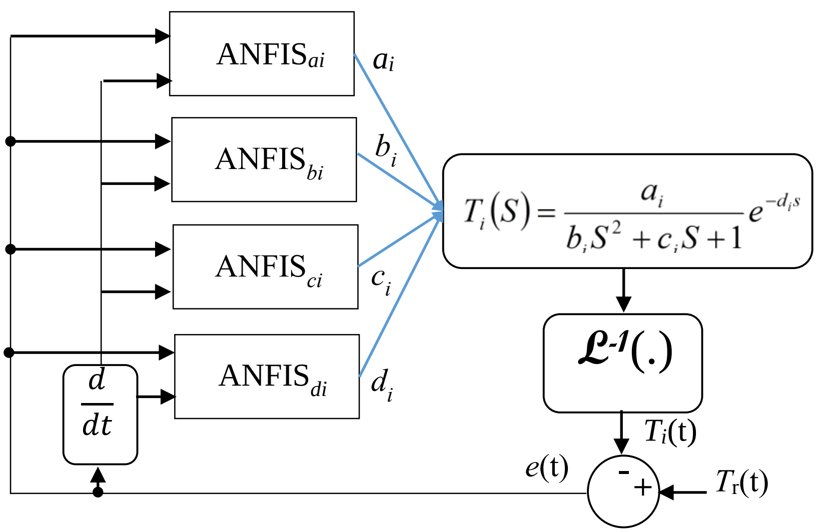
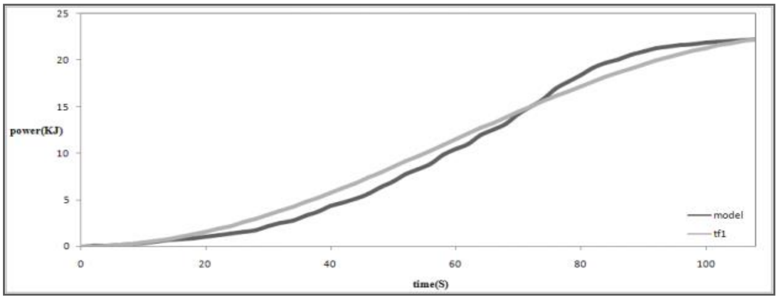


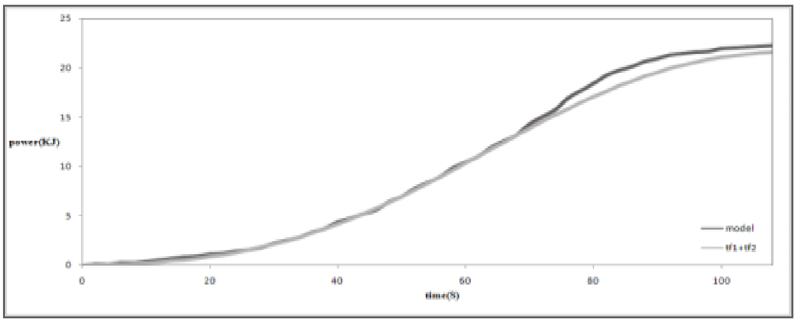
Figure 4: Parameter identification via ANFIS

CASE STUDIES

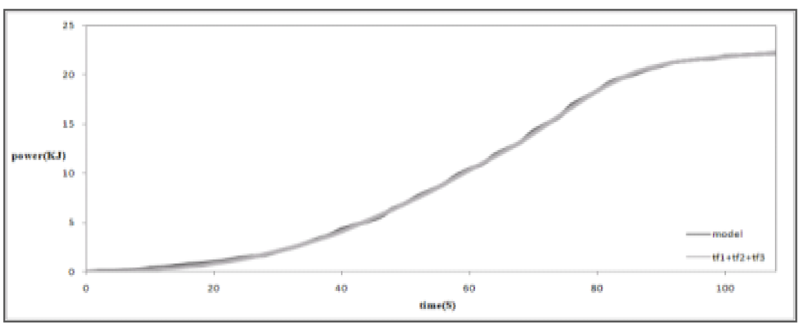
Due to learning the operational skills of experiment in engineering is one of the most important motives in this study. To let students familiar with the whole operational flow of the part in physical experiment, an energy-charging-and-discharging experiment via the designed EP system was taken place. The data of input and output energies were obtained via the experiments on the EP system subjected to the input variables as frequency variations, which were equivalently separated into nine parts in the range of 20 to 60 Hz. On the other hand, the performance of discharging experiment was achieved via tuning the magnetizing currents at the values of 25%, 50%, 75% and 100% of satisfactions. According to Eq.(3) to Eq.(1), the input and output energies of EF can be found by using the measured EP rotational speeds which were recorded via a PC in every two seconds.



(a) by using single transfer function



(b) by using two transfer functions



(c) by using three transfer functions

Figure 5: Approaching performance

Through ANFIS model, Fig. 5 shows the approaching performance by using single transfer function. Obviously, the error between model and real data is still large. According to the approaching mechanism in Fig. 4, for the error e(t) is larger than the threshold value η, then i=i+1 another transfer function was added for modeling. Fig. 5(b) shows the approaching performance by using two transfer functions. To compare with Fig. 5(a), the error e(t) in lower part of the curves was well-compensated by the added transfer function. However, for the error in the upper part of the curves was still existing, then, according to the approaching mechanism in Fig. 4, again, another transfer function was added. Fig. 5(c) shows the approaching performance by using three transfer functions. Obviously, the errors mentioned in above were completely compensated by using three transfer functions.

CONCLUSION

In this study, a completed trainning process for EEE was designed and proposed. Here, the potential students who are going to be the instructors in laboratories or engineering can learn how to design a studing flow for undergraduate students via physical experiments. In this paper, the flywheel stiorage system was setup and used to be a nonliner case for learning how to identify and then modeling by ANFIS, a model-free tool. It would be with much educational benefit on realizing what the importance is in data collection and analysis, phenomena of energy transformation and the applications of artifical intelligent technologies. In the near future, the evaluation of learning effectiness will be comfirmed through LDC (Literacy Design Collaborative) modules and questionnaire (http://ldc.org/).

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Study upon the invertebrates with economic importance for the vegetables cultures in the Guşteriţa ecological garden (Sibiu County)

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ABSTRACT

The fortified church in Guşteriţa got its final shape during the 16th century. During more recent times it became a leisure park and then a vegetable garden named "The Prioress Garden". Nowadays there is developing an agricultural-educational experiment having an original character. The main idea of the experiment is the educational one in the idea of knowing the practice of an agriculture based on ecological concepts and also adding the concept of the biodynamic. The specific aims are: identifying the general measures of prevention and reduction of the attack of the pests and finding ways in order to maintaining the population of the invertebrates under the pest limit. The evaluation and classification of the invertebrates/insects was done in accordance with their food. The specific methods applied in the field were: the observation upon the elements of the biocoenocis, collecting of the biological material directly from the plants. In the lab, on the base of the determinatives there were identified the beneficial and pest invertebrates fauna. The result of the researches emphasizes that a biological, modern and profitable gardening is based on the living component in the cultivated ecosystems which reduces the pest populations, proving the beneficial role for the man.

Keywords: *invertebrates, ecological agriculture*

INTRODUCTION

The fortified church in Guşteriţa was built during the 13^{th} century having the form of a Romanic basilica. During the time, due to the attacks of the Tatars, Turks and others, the inhabitants added defensive constructions, fortifications and wide inner walls. The shape of a fortress church was definitive during the 16^{th} century. The wide inner court within the walls was transformed in more recent times in a leisure park and then in a vegetables garden, named, suggestively "The Prioress Garden". Nowadays here is developing an agro touristy educational experiment having an original character.

The Evangelic – Lutheran Parish in Sibiu founded at the fortified church in Gusterita an educational centre for environment and young people. Sibiu Parish is certified in the community system EMAS (Environmental Management Systems). EMAS is defined by the Minister of Environment, Water and Forests as "a system of an operational management of environment, which leads to a continuous improvement of the performances of environment at the level of the best available techniques of the moment as well as with the improvement of the economic performances".

Within the centre the stress is on reduction of the electricity and fuel consumption, the use of regenerable energies, recycling the scraps, adequate urban mobility and on ecologically produced food. All these have as a goal the protection of the environment. Within this context there was reestablished "The Prioress Garden" as the first school of non-formal education.

In nowadays is practiced a coming back in the past regarding the agricultural practice to which are added the new concepts like biodiversity, the use of natural factors and the elimination of any alien element in practice, sustainability, durability and education of the population regarding the understanding and practice of a ecological agriculture. An important element, among others is knowing the beneficial and pest fauna; the use of beneficial one in restraining the pest fauna and the total elimination of the chemical materials in order to remove the animal or vegetal pests.

The study aims the following specific goals: the identification of the general measures of prevention and reduction of the pest attack in the Guşteriţa ecological garden; giving the ways regarding the maintaining of the population of pest invertebrates under the pest limit; the evaluation of the invertebrates in accordance to their food.

MATERIAL AND METHOD

I. The time during the investigation was done: 2014 – 2015;

II. The locality where the investigation was done: Guşteriţa (Sibiu County);

III. Special methods applied in the field:
- The direct observation upon the elements of the biocoenosis;

- The method of direct collecting, which is a qualitative one and allow us a more thorough analysis regarding the relation between host plant and phytophagous insect or between the latter and other beneficial species in the biocenoesis;
- The application of warning measures against the pests attacks, taking into account the concept from 2005 emphasized by Badea and his coworkers in the work "Guide of traditional and ecological practices in the ecological vegetable gardening" the fact that in the biologic gardens the pests are kept under control by intensification and application of prevention methods. The authors underline that these "have to be used intensively, and the protective and fortifying preparations must have priority".

As a result of our research we identified the culture technology applied in Guşteriţa Garden and established that this adjusted on this methodology of the traditional and ecological works accepted by the ecological agriculture. In this respect, the general measures of prevention or reduction of the attack of the pests in the ecological garden Gusterița are as follows:

1. The use of adequate tools for the work of the soil: the hoe for the roads, the grubbing hoe for planting.

2. In the researched agro ecosystem, a fast method of enriching the soil in humus is used "green fertilizer" made of *Sinapis alba* L. (white mustard), *Brassica rapa* L. (rape) and *Avena sativa* L. (oats). For this the plants are mowed and then are left for some days to dry and then are incorporated into the soil at a depth of 15cm. In the solar is used *Galinsoga parviflora (Asteraceae)*.

3. A mix named "mulch" is considered by many farmers the "ointment of the soil". This operation may be considered like pre compost. This has as an effect the enrichment of the soil with nitrogen. For this operation was used a mix of horse dung with sawdust. The stratum measured some centimeters.

4. In October 2014 took place the action of autumn compost. This operation lasts for 12 months and finally was obtained good quality compost, well decomposed. The great part of the compost comes from own resources: sawdust, saw grass, leaves from the orchards, corn cob, bean stalk to which is added dung (from horse and cow). In order to obtain a quality compost is used the Klickitat Kounty Program "Compost Mix Calculator", which identifies the components of the compost and the ratio among them. The decomposed compost was spread on the soil and after that was incorporated. It is a natural fertilizer of extreme importance both for the soil and the plants.

5. For increasing the biologic activity of the soil in the Guşteriţa ecological garden, this was aspersed with sting nettle leaven. There was also used a mix of garlic with onion against the coleopteron *Phyllotreta atra* F. (black flea) that attacked the radish culture.

6. The seeds used in Guşteriţa garden were acquired from Eco ruralis Association in Cluj Napoca and Agrosem International Alba Iulia that produce seeds in ecological conditions.

7. In the future, in order to reduce the attack of the pests is considered also the crop rotation.

8. Using the allelopathy guide, there were done the most adequate associations of plants both in the garden and solar.

9. The cultures are associated and cultivated under the shape of concentric ribbons. The goal of these measures is to prevent or to reduce the attack of the pests as well as to favor the biologic activity of the soil and to diminish the weeds. This thing was taken from nature where plants don't grow in monocultures.

10. Among the beneficial weeds kept among the cultivated plants are: the dandelion, the clover and the spontaneous leguminous plants. The pests, such as horse radish, *Senecto vulgaris* L., and road-weed are greatly taken away because they represent the host for the pests. There is used the shovel (without turning the stratum), eliminating the rhizome.

11. There is used the foul water because is rich in bacteria. This is put into the soil at the temperature of the environment.

12. The culture hygiene is an important measure of prevention or reduction of the attack of the pests. In this respect the dry vegetal material is chopped and the sawdust is used for compost.

III. Specific methods applied in the lab comprise the unpacking operations of the samples, labeling, numbering and determining. For the last operation were used the determinants: Panin (1951), Teodorescu & Antonie (2008); Harde & Severa (1988); Koch (1992), Năstăsescu & col. (2007). For the raw sorting of the biologic material we used the magnifying glass IOR 1983, and for determination and photos the magnifying glass IPM Scope.

RESULTS AND DISCUTIONS

Another purpose of the ecologic agriculture is to know and to protect the beneficial fauna (prey and saprophagous). As a result of the direct observations there was identified a part of the beneficial fauna belonging to the researched agro system (Table 1).

Table 1: The beneficial fauna with economical importance identified on the base of the observations and direct collecting from the plants in the agro system Guşteriţa

Taxon	Trophic base	Observations
Subkingdom *Arthropoda* Class *Arachnida* Order *Araneae*	aphids	Attack against eggs, larva and adult stadium

Class *Chilopoda* Family *Lithobiidae* *Lithobius forficatus* L.	insects, worms and small reptiles	Attack against egg, larva and adult stadium of the insects
Family Geophilidae *Geophilus flavus* De Geer	insects	Attack against eggs and larva stadium
Class *Diplopoda* Family *Julidae* *Chromatoiulus unilineatus* Koch.	saprophaguos	They have an important role in decomposing the vegetal remains and putting back into the circuit of some substances.
Class *Insecta* Family *Dermaptrea* *Forficula auricularia* L.	aphids, moths	Attack against eggs and larva stadium
	acaridae belonging to family *Tetranychidae*.	Adults
Family *Coccinelidae* *Coccinella septempunctata* L.	aphids	Attack against eggs, larva and adult stadium
	acaridae belonging to family *Tetranychidae*.	Adults
Family *Cantharidae* *Cantharis obscura* L.	aphids	Attack against eggs, larva and adult stadium
Family *Carabidae* *Carabus gigas* Creutzer	other invertebrates, especially insects	Attack against eggs, larva and adult stadium

In the Guşteriţa vegetable garden there identified 4 classes of invertebrates (*Arachnida*, *Chilopoda*, *Diplopoda*, *Insecta*) belonging to 8 families (*Araneae, Lithobiidae*, *Geophilidae*, *Julidae*, *Dermaptrea*, *Coccinelidae*, *Cantharidae, Carabidae*) and 6 zoophagous species (*Lithobius forficatus* L., *Geophilus flavus* De Geer, *Forficula auricularia* L., *Coccinella septempunctata* L, *Cantharis obscura* L., *Carabus gigas* Creutzer) and a saprophaguos one (*Chromatoiulus unilineatus* Koch.). These are beneficial species and play an important economic role in a good functioning of the agro ecosystem. Their presence in a great number confirms the fact that in this ecosystem the technology of an ecologic culture is respected.

If in the nature each group of invertebrates, each species plays an important role in the good functioning of the ecosystem, from a human point of view, which stress the man's interests, there are pest species for the cultures that can produce important damages having major economic effects because they feed with cultivated vegetables. During our study there were identified pest that had produced damages in the researched biotope (Table 2)

Table 2: The pest invertebrates with economic importance identified on the base of the observations and direct collecting from the plants in the Guşteriţa agro ecosystem

Taxon	Trophic base	Observations
Class *Insecta* Order *Homoptera* Family *Aphididae* *Brevicoryne brassicae* L.	Attack the plants belonging to *Brassicaceae* family: cabbage, radish, cauliflower, mustard, turnip cabbage, rape	Pest in the larva and adult stadium.
Order *Heteroptera* Family *Pentatomidae* *Eurydema ornatum* L.	Attack the cabbage, cauliflower, rape, mustard, and radish.	Pest in the larva and adult stadium.
Order *Coleoptera* Family *Curculionidae* *Baris laticollis* Marsh.	Attack the cabbage and the cauliflower	Pest in the larva and adult stadium.
Family *Chrysomelidae* *Phyllotreta atra* F.	Pest specific for the plants *Brassicaceae* family.	Attack as an adult.
Family *Scarabeidae* *Melolontha melolontha* L**.**	Strawberry, herb plants	Attack in olygopod larva stadium but also as an adult
Order *Lepidoptera* Family *Noctuidae* *Mamestra brassicae* L.	Polyphagous pest attacks cabbage, cauliflower, turnip cabbage, mustard	Attack in polypod larva stadium
Family *Pieridae* *Pieris brasicae* L.	Attack cabbage, cauliflower, horse radish	Attack in polypod larva stadium.

The pests with economic importance observed and collected in the Guşteriţa vegetable garden belong to class Insecta. There were identified 4 orders of insects (*Homoptera*, *Heteroptera*, *Coleoptera*, *Lepidoptera*), 7 families (*Aphididae*, *Pentatomidae*, *Curculionidae*, *Chrysomelidae*, *Scarabeidae*, *Noctuidae*, *Pieridae*). There were identified a number of 7 pest species (*Brevicoryne brassicae* L., *Eurydema ornatum* L., *Baris laticollis* Marsh., *Phyllotreta atra* F., *Melolontha melolontha* L., *Mamestra brassicae* L., *Pieris brasicae* L.) but damages had been produced only by 4 (*Brevicoryne brassicae* L., *Phyllotreta atra* F., *Mamestra brassicae* L., *Pieris brasicae* L.).

CONCLUSION

In a healthy garden there must be created favorable conditions of habitat in order to attract the beneficial organisms and to keep them there for a longer time. We mention the necessity that the system must have its own, independent life in which the fauna to be subjected to the auto regulation both from the quality and quantity point of view. The farmer must be attentive that these mechanisms of auto regulation to function, they being a natural break against the uncontrolled proliferation of the pests.

The ratio between the beneficial and pest fauna are to be set naturally, so the existence of a limited number of pests not to worry the farmer. We must understand that in this biologic equilibrium the beneficial fauna multiplies only if there is plenty of food. We underline that in the same time with multiplication of the pest of the plant there will proliferate the number of its preys and saprophagous.

Knowing the ratio between the beneficial and pest fauna in the researched agro system has economic, social effects as well as effects upon the environment:
- Monitoring the invertebrates offer data regarding the quality and duration of life. Our researches demonstrated that where the ecologic principles are respected the indicators of the soil quality grow and as a result there will be obtained bigger harvests (economic effects); these invertebrates belong to the classes *Arachnida, Chilopoda, Diplopoda* and *Insecta.*
- A correct management of the beneficial invertebrates determines the lower of the pest invertebrates belonging to the insecta orders *Homoptera*, *Coleoptera*, *Lepidoptera*. Maintaining the pests under the pest limit leads to a bigger productions and diminishes the costs for the main food products (social effect);
- Knowing the rules that govern the researched agro system allows the selection the optimum method of keeping the equilibrium among the invertebrate species and the application of the methods and measures of a proper biologic control in order to maintain the health of the ecosystem on the base of the eco sangenesis principles with beneficial effect upon the environment.

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Case study regarding teaching Design for quality at graduate level

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ABSTRACT

This paper presents a case study regarding the methods used in teaching Design for quality at graduate studies level, in order to help practitioners derive enhancement ideas for their own demarches in related fields. The methodology consists in surveying existing experiences in the Quality engineering and management master program at the Technical University of Cluj-Napoca in a comparative study and defining a set of criteria for analyzing them. The two options of delivering the targeted competences, which have equivalent content, rely on different teaching approaches: classical for one group and computer aided for the second group. With the help of a focus group, the investigation criteria are defined and ranked using AHP (Analytical Hierarchy Process), while Pugh's method is further used to detail the proposed comparison. A discussion on the results of the two scenarios is included, showcasing advantages and disadvantages, together with implementation suggestions.

Keywords: *design for quality, graduate studies, AHP*

INTRODUCTION AND BACKGROUND

Design for quality (DfQ) is an important topic in the field of quality engineering and new product development (NPD). It is part of the larger Design for X approach and constitutes an interdisciplinary connection between quality engineering and design engineering. The Technical University of Cluj-Napoca has successfully ran for the past 6 years a Bologna master program in the field of Quality engineering and management, having Design for quality (as part of the process of new product development) as a main competence targeted to be imparted to the master students.

As the master program's faculty is always searching for ways to enhance the learning experience and the learning outcomes of the students, we present the following work, which deals mostly with a comparative educational experiment achieved in the last academic year, but which also incorporates insights from previous years in delivering the specific knowledge and skills required to fully grasp this topic.

The core of this experiment is focused upon trying to transmit the same competence in Design for quality to two student groups, by using different (but equivalent) content and different support tools (namely computer aided quality in one case and classical quality techniques in the other) and analyzing the results through an objective set of criteria to determine the characteristics of both methods and to establish their suitability.

A literature survey shows an important connection between the Design for Quality (Design for Six Sigma) concept and the new product development concept. Some interesting results reported refer to actual best practices in teaching this approach to university students in an integrative manner that combines industrial design, engineering and marketing (Vogel, Cagan & Mather, 1997) or to employed and experienced adults (Rosenau, 2002). The case under study in this paper deals with both of this issues: one group is formed out of mostly inexperienced students and the other contains a significant proportion of working professionals, and both methods used merge economic competences with technical and artistic ones.

It is a common sense feature for this topic and it is also present in literature, both for lectures and for practical work, to target high student involvement and teamwork (Pun, Yam & Sun, 2003), as well as interdisciplinary teams and project practical work (Okudan & Zappe, 2006).

The use of simulation software (Munteanu, Popescu & Neamțu, 2009), simulation games (Baalsrud Hauge & Riedel, 2012) and other ICT support elements (Brad, 2014) is becoming widespread and it is difficult to imagine today's engineers working with only pen, paper and slide rules. This, however, does not mean that in the educational environment, before skills are mastered and automated for the job market, classical teaching ways are no longer needed. Much like in the case of blended learning, which seems to supersede pure e-learning as knowledge delivery mechanism, the starting premise of our undertaking is that both computer aided and classical methods can be useful in yielding a well-rounded engineer with a deep understanding of new product development within quality engineering. It is the teachers' responsibility, and even talent to vary this mix according to the students' characteristics and the environmental constraints in order to obtain the best results.

COMPARATIVE STUDY

Study characteristics

As it as mentioned before, our study has been carried out in parallel, on two student groups of similar size. In the table below (Table 1), we present the main characteristics of the two groups and methods used, which have been considered defining for the targeted objective of the paper (to assess the type and level of competences transmitted through the two applicable options):

Table 1: Main charatcteristics of the groups and applied teaching methods

	Group/Method 1	Group/Method 2
Number of students	16	20
Work experience	100% Entry-level	Ca. 33,33% entry level Ca. 33,33% medium level Ca. 33,33% senior level
Content delivery schedule	Modular	Modular
Task / Evaluation form	Semester project / Presentation	Semester project / Presentation
Project teams	3-4 persons	4-5 persons
Main instruments used	Questionnaire Analytic Hierarchy Process Voice of the customer Brainstorming Quality Function Deploym. Computer aided design	Interview Pairwise comparison Flowcharting Brainstorming Matrix diagram Schematic design
Supporting tools	Qualica QFD 2.5 SolidWorks Microsoft Word	Pen and paper Existing projects Modified pictures

The activities themselves included a number of 3 meetings for lecture and 3 for practical work, in a modular format, complemented by approx. 6 weeks for individual study, to finish the projects within the student teams. Evaluation was based predominantly on project results (75%), complemented by scores on a theoretical knowledge test (15%) and attendance (10%). The project mark itself was composed of scores attributed to the following criteria: 30% for the correct application of solutions, 30% for the scope and detail of the work performed, 15% for the presentation, 15% for the answers to questions.

It should be noted that the make-up of the two groups is slightly different: group 1 is formed mostly from young people, entry level professions, recently graduated from bachelor studies, while group 2 is formed in equal parts from entry-level, mid-level and season professionals, with significant work experience, although not in the field of Design or Design for quality. Another variable in the study can be considered the fact that the two instructor teams (both for lecture and for practical work) were different. However, they were acting under the same principles and with similar teaching methods, so the influence of this factor can be neglected. The slight difference in the project team members number is due to the fact that group two has to perform more intensive manual calculations.

Main project steps
Both student groups have been instructed to use the same, rather classic, requirements engineering and design process (a simplified version of the Design for Six Sigma approach). The main steps are described below (Table 2):

Table 2: Project used to teach Design for quality

No.	Project step	Target competences
1	Identification of the market segment and the niche of requirements	Understand customer focus Individualize products within the market
2	Determination of customer requirements	Perform customer communication Identify and formulate requirements
3	Rank requirements through the "eyes" of the customer	Understand customer requirements and their justification
4	Predefine technical product options	Perform conceptual product design
5	Select most suitable variant	Critical and comparative analysis
6	Determine technical characteristics that are "critical to quality"	Perform detailed technical design of the product and its components
7	Deploy customer requirements through the product decomposition levels (Clausing model)	Ensure that the specifications respond to the requirements of the customer
8	Product design based on importance levels of characteristics, functions and components	3D modelling and component selection to substantiate the detailed design

We should note that this structure is used as a medium level task at graduate level, generally for mixed background groups (e.g. mix of engineers, economists, social science graduates in the master group), but it can be either simplified for lower instructional levels or enhanced for homogenous groups with greater expertise levels.

The results obtained by the two student groups are:

- an average grade of 9.00 with a standard deviation of 0.632 for group 1 - technically enhanced group, and
- an average grade 9.35 of with a standard deviation of 0.813 for group 2 - classic group.

However, it should be noted that these numerical values are only for informative purposes, as the low sample size does not allow for a full and correct statistical analysis.

DISCUSSION

In order to properly carry out a comparative analysis, a group of 7 criteria is defined, taking into consideration the grading criteria presented above and criteria coming from the curriculum design process and from the received employers' feedback for previous graduates of the same program. These criteria are ranked here using the Analytical Hierarchy Process within the Qualica Planning Suite 2012 software (trial version). Pairwise comparison and manual calculation would have had the same effect, so this is not to show a preference within the study itself, but to ease the calculation and presentation of elements needed for the analysis. The results of the ranking performed with the help of a small focus group (which help in defining them also), consisting of 1 student, 1 professor and 1 company representative can be seen in Figure 1 below:

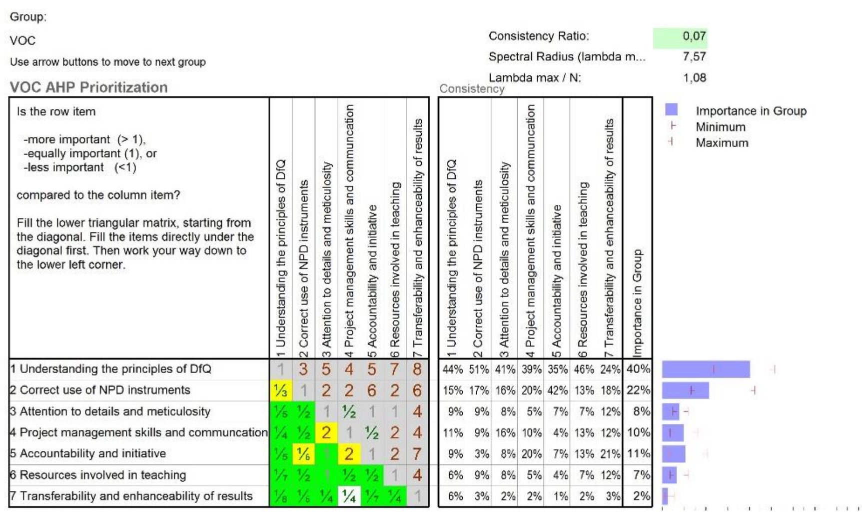

Figure 1: AHP ranking of analysis criteria

Based on these results, the two most important competences are related to the correct use of DfQ in terms of approach (40%) and methods (22%), no matter what the chosen transmission vehicle is. Also, "real-world" application is not possible without the proper tools (project management – 10%) and the proper attitude (accountability and initiative – 11%). The third groups of results includes the technical criteria, whose attainment is necessary to ensure success within the study program and beyond (meticulosity, resources, transferability).

One important thing to underline here is the existence of a Pareto-type distribution, with the first category of criteria cumulating a very high importance rating and being asked for by both the academic and the industrial environment. Of course, no method of teaching that does not meet these two criteria cannot be considered valid and useful in training future quality engineers or product development engineers. This distribution can be better seen in the figure below (Figure 2):

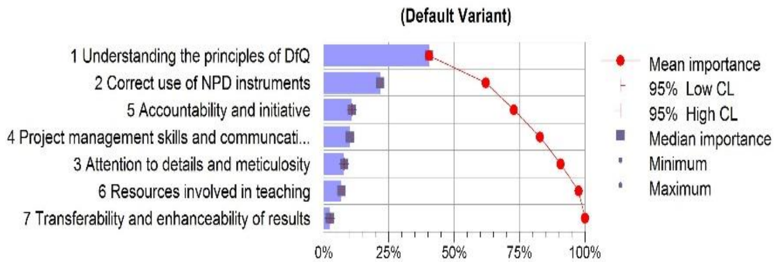

Figure 2: Pareto distribution of criteria importance scores

Based on this criteria scale, another method is employed to compare the two project applications discussed above. Although, it is usually used for concept selection, Pugh's method/matrix has here the role of providing the layout for analysis (see Figure 3). As such, we can note that both approaches have been scored by the focus group rather high with the help of the Qualica Planning Suite 2012 software (trial version), with positive marks (effects) associated with all criteria.

--	0,00	Unacceptable
-	2,50	Borderline
O	5,00	Almost meets requirement
+	7,50	Meets requirement
++	10,00	Exceeds requirement

	% Importance	Group 1	Group 2
1 Understanding the principles of DfQ	40,4%	++	++
2 Correct use of NPD instruments	21,7%	++	+
3 Attention to details and meticulosity	7,8%	+	+
4 Project management skills and communcation	10,0%	++	+
5 Accountability and initiative	10,8%	+	++
6 Resources involved in teaching	6,8%	+	++
7 Transferability and enhanceability of results	2,5%	++	+

		Group 1	Group 2
Weighted Sum		9,4	9,0
Pugh	Sum of Positives	11	10
	Sum of Neutrals		
	Sum of Negatives		

Figure 3: Comparative analysis based on Pugh's method

At first glance, we could say that the two options considered are rather similar in providing the expected overall results (9.0 score vs. 9.4 score), and this is a very important finding because it means both can be used interchangeably to achieve the desired competence when teaching DfQ. However, in order to learn more we must consider for analysis the matching and direct relationship among the groups' characteristics and the structure and intent of the approach used for each of them.

When going into the details of the study, we must underline and analyze the rationales behind the choices made along in the way, both in terms of possible options and implementation issues:

- both methods produce very good results in terms of learned principles and approach pertaining to DfQ, as demonstrated by the high scores obtained by both student teams;
- the computer aided variant has been given preference regarding the use of NPD instruments because it uses software dedicated for this purpose that includes templates, help and automated features that prevent mistakes;
- both methods have been scored as good for the criteria "attention to details and meticulosity", as in the first case students tend to rely too much on the automated calculations and in the second case they can make calculation mistakes;
- the file structure and graphic interface of the support software can help in steering the project and communicating its results, so method one gets a higher score on this criterion;
- the students accountability and the resources need for teaching have been considered better for the second method, because the trainees feel more invested in manually carried out tasks and because the second methods only requires pen and paper, with no software investment;
- the last criterion, transferability of results, was considered better for the assisted method due to the features of the software packages (e.g. exporting files, graphic display, etc.).

Also, as mentioned previously, this study has some limitations concerning the noise factors that have been encountered and minimized during its duration, but which cannot be completely eliminated. The two student groups involved differ in composition of the members with respect to their background and work experience, a situation which is common for master programs, but not so much for the bachelor ones. However, the impact of this factor is attenuated by the fact that a modern approach to DfQ, as is used in this course, is new in the same way for both groups. Also, the advantage that Group 2 has in terms of conceptual design is balanced by the digital competences of Group1 when dealing with tasks such as finding correct and updated information, communicating with representatives of the target market, creating professional looking documents and presentations, etc.

In terms of the differences in the composition of the teaching teams, this has been managed by using the same syllabus (targeting the same competences and allocating the same amount of time for training), by having a similar scientific background of the persons involved and by frequent communication and information exchange among the teams in order to dynamically adjust their styles and requirements towards the students. Also, except for the specific subject studied (i.e. the methods used), the teaching materials have been similar in content and scope and based on the same general principles.

Some other influence factors, such as scheduling differences and presentation aesthetics considering printed / projected material versus the documents drafted with a simple pen, have been largely considered not to influence the research in a significant way.

CONCLUSIONS

In terms of effectiveness, the overall assessments are very close, and give a slight preference to the computer aided method. It possibly even better to evaluate the results in the context of efficiency, as the first method requires some investment, which is not the case with the second one, so it would be a good idea to choose the first method if funding is possible, and the second one if it is not. This conclusion applies to an educational environment. Of course, in a competitive setting, such as in a company, the computer aided method would be given even more clear preference due to speed and accuracy of results and because of the fact the it would be applied by professionals and not by students during training. However, from the point of view of the output (project in class) and outcome (competence on the job), both scenarios can be considered validated and both methods can be considered useful, with strengths and weaknesses, as signaled above. In this way, it is up to the instructors to make a choice for each specific situation, or to find a proper way of blending them in order to achieve the mission of their of course.

It is perhaps easy to adopt the attitude “to each their own”, but in this case we consider it to be true and we would like stress the importance of matching training methods (in this case the tools of the trade and their implementing support - classic or software) to the competence needs of the group that are identified by answering both the question “what do the students know already and feel comfortable with?” and the question “what will serve them better through graduation and, especially, afterwards?”. Most teachers would agree that learning and mastering new digital skills in one semester is quite difficult, so we consider it wiser to not focus on this aspect when the students have less computer related experience, but to help them discover and use correctly the principles and devices of DfQ by using the classical route.

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Teaching and training Values in Vocational Education. Retrospective view

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ABSTRACT

The Leonardo da Vinci project entitled EViVE - European Values Vocational Education- LLP-LDV / PAR / 2013 / RO / 032), took place between September 2013 and July 2015. In this a project, professors from the Educational Sciences Department of the Lucian Blaga University of Sibiu along with partners from Germany, France, Great Britain, Bulgaria and Turkey were involved. The project stages started with the detection of existing values in vocational education in each country. These values were compared afterwards with the values promoted by the European Union as a standard and in case they did not coincident, the common values in accordance with European values were transmitted. In order to ensure the teaching and learning framework of these values, there had to be accomplished a common curriculum, in which specific national features were inserted, exemplifying how these values can and must be taught. The taught lesson showed the importance of awareness of the teachers in teaching these values during the didactic process, as well as the importance that students, through means of education, have to internalize these values, in order to become fully trained Citizens of the United Europe.

Keywords: *values, vocational training, curriculum.*

INTRODUCTION

The issue of active citizenship is extremely important in Europe. A world where people share common values, respect and support the values of others is an ideal for that we all strive, with the desire to remove misunderstandings, injustice, discrimination among people. Every nation and every individual has a set of common national values and a set of personal values. Often, however, although people seem to have the same set of values, they understand them differently.

Hence, the idea EViVE project was born, and its main objective is to design and reflect over a common European curriculum, having as a starting point European values such as democracy, gender issues, teamwork etc.

The values are not static, they can be amplified or minimized, can disappear or new ones can appear, which often represent for the young generation a complete disorientation.

Especially in Europe young people are led to confusion, disorder and loss of key values through the changing of values in an alert manner, the tendencies of globalization, and those of plurality.
Therefore, training providers in schools and enterprises have a duty to teach, discuss and reflect the proposed values as a challenge in achieving their educational mission.

The translation of these values and support offered to students, in order to internalize them, is therefore an important goal of schools. EViVE- program in Vocational Education Program Values Europeans Leonardo da Vinci LLP-LDV / PAR / 2013 / RO / 032) explores the existing values in the national cultures of the countries involved and the way they could be better aligned with values that ensure a common living to the Europe inhabitants, accepting one another without discrimination and in peace.
In the EViVE program context, the main aspects were:

1. What is the meaning of “values” in the partner countries?
2. What values are important in the partner countries?
3. Are there national concepts promoting the values in VET?
4. How and what teaching methods are used for an effective promotion of values promoted in VET?
5. Is there a common set of European values?

EUROPEAN VALUES IN ROMANIAN EDUCATION

In order to speak in a joint vocabulary, the first project meeting started from the question “what is a value, which is our meaning for it.” Only after it got a common understanding, we could then move on, to find out, what values teachers transmit through vocational education in schools.

The approach of the notion of value started from a humanistic point of view (Figure 1), presented in the paper “Definition of the most basic European Values and Their significance for our modern society” (EuropeanValues.info, n.d.). Starting from here, we can reach the Human Rights.

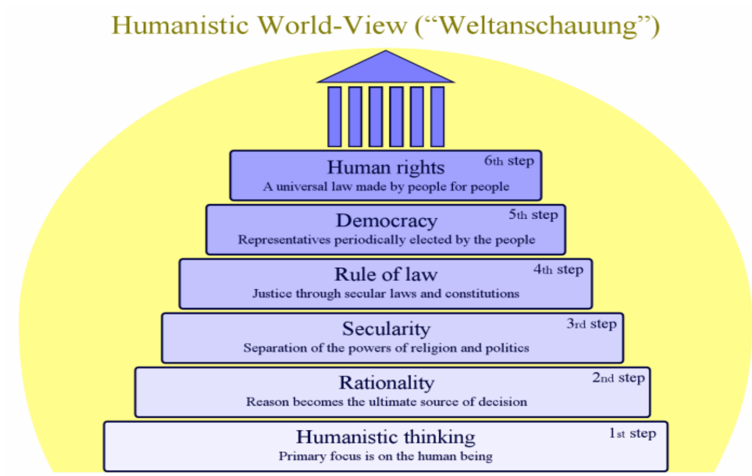

Figure 1: The 6 most fundamental European values.

In order to identify the values transmitted in VET, we conducted a bibliographic research on key curriculum documents relating to this kind of education.
As known, values and attitudes that will shape students, after completing the discipline are explicitly noted in the syllabuses of subjects taught in secondary education. In an overview, following only 3 of the 7 existing subject areas in the curriculum, following values were highlighted:

a. For the Curricular Area "Languages and Communication", the main values to be taught in order to form the students are:
- aesthetic taste;
- the pleasures of reading;
- autonomous thinking;
- reflective and critical reading;
- literary sensibility, for art in general;
- assuming the fundamental benchmarks of European spiritual heritage;
- taste of beauty;
- personality development;
- development of attitudes and beliefs that foster self-esteem and respect.
- scepticism towards unsustained generalization

b. Considering the Curricular Area of "Science", teachers must follow the values as:
- manifestation of initiative and willingness to tackle a variety of tasks;
- use of mathematical concepts and methods;
- respect for rigor;
- interest in data obtained by scientific method;
- respect for scientific argumentation ;
- caring towards themselves, towards others and towards the environment;

- interest for continuous improvement of their performance in the field of scientific knowledge

c. Having a look at the “ Technology” Area , the most important values listed are:

- adapting to market demands and dynamics of technological change;
- responsibility for ensuring the quality of work performed;
- the manifestation of aesthetic sense;
- critical thinking and creative event in the technical field;
- availability, interest and initiative for the implementation of projects;
- proactive social behaviour;
- civic spirit;
- positive relationships with others;
- spirit of cooperation;
- ability to make rational decisions;
- Creativity, critical thinking and flexibility.

And finally, the Hierarchy of values according to frequency, you can find in the Official Curriculum for VET system as follows: critical and divergent thinking; positive attitudes towards the others; curiosity; tolerance; initiative and implication; coherence and rigor; truth; dialogue; independence; self-confidence; perseverance; health (preoccupation for cultivating a healthy life); aesthetic taste; responsibility; environments (preoccupation for cultivating ecological values); human rights.

As it can be seen, there is a different approach on the values hierarchy.
The next step of the project was about to teach these values, in a way that, in the end, pupils should internalize them and introduce them in their personal and professional life.

This was the moment, when a curriculum likely to respond to a new educational approaches was designed. Thus starting from framing the Concept Maps, a group of representatives of vocational education teachers was asked to conduct an instructional design. Through talks with the involved teachers, the difficulty of tracking pupils achieving and maintaining those values, given that the values transmitted by school faced those transmitted from the social, political and even personal area, were highlighted. Also, as structured at present in the Romanian curriculum, the emphasis still exists on quantity, on the transmission of a large number of information, which crowds the learning process and makes it difficult to be learned by students. Because of this, the student's reflection time is decreasing. Therefore, what is learned is not truly transformed into competence, but only in a short-term memory acquisition of the individual. It is therefore absolutely required a radical change in the education system in general and of VET in particular.

CONCLUSIONS

The school is the institution that participates in a decisive way to the education of the young generation of the country, for the transmission of cultural values and moral prerequisites in order to build social changes.

Although the formation of the younger generation is not limited to the transmission of information and to the cognitive development of children, the school puts great emphasis on intellectual education and transmission of knowledge.

Education is not only about cognitive development. Learners need a full training of their personality and even if it has no consistent influences, they will search for these items in average adult models.

For Romania, the chances in promoting values in vocational education are, from students' point of view:

- joining Romanian vocational education to the demands of an enlarged labor market;
- a better understanding of their world, of the national and as well as the international (European) one;
- a chance for finding a job beyond the country's borders;
- understanding the environment in which they will perform their work or will spend their holidays;
- easy integration in communities they will live in;
- Better quality of life with fewer conflicts and disputes.

On the other hand, for the society:

- the highest educational level of future employees;
- decreasing the gaps in comparison to other countries in terms of improving social relationships;
- formation of active and responsible citizens;
- encouraging foreign investments that can find educated workforce to a common European standards;
- a better understanding and acceptance of cultural elements which differentiates us and brings us closer to other European countries.

Education involves multiple contexts, contexts which require a variety of skills (education and training policy ascertaining, setting goals, and drafting means) with a less stabilized institutional stratification, difficult to compare with that prevailing in school. In fact, the school education subject is a child which becomes a teenager, and the subject of training (professional) is a young man who becomes an adult. Educational and training network requires that in the socio-educational relation frame, the teacher/trainer has to achieve the interpersonal recognition of subjects, as creative actors in the world, capable of initiative, ethical interrogations and rules /codes creators (Cucos, 2000).

The forming of attitude and learning values is a complicated and long endeavor. The current problem in VET education is not only about preparing children for society but also to create the possibility to give them intellectual reference points for understanding the world around them, in order to behave responsibly and correctly.

The general objectives of moral-cognitive, affective, volitional education are considered to be: knowledge of values; theoretical justification of values; sense of duty; willingness to conform, to conduct to these values; willingness to act according to these values.

By means of formal education/ school education can teach formal structures (normative and institutional structures of society, of policy); one can obtain training on data collection, on the contact with media. The question is whether VET education and the fundamental social attitudes - which are the individual and social trust can "be taught".

The simultaneous development of a sense of national identity, of dependent competence (in compliance with applicable laws) and of participation (on decisions making and creating rules) in the social trust and civic cooperation are required. As to these, the educational opportunities for participation of students in debate, in dialogue, in participation at cognitive skills training, but also the symbolic components of school culture in order to create affective commitment and unity at a symbolic level are important. Their implementation is an objective of moral education, in the absence of which it would not be possible to meet the training and the creation of ethical (professional) norms.

From this perspective, a priority is the formation of axiological consciousness, characterized by the pursuit of values and willingness of valuation. The best educational strategy is not to impose values, but to make the indirect action by means of creation and stimulation of value needs (W. Veugelers and P. Vedder, 2003).

Between the educational values one may identify certain tensions: between the aspirations of students and the values promoted by adults; between the values promoted by teachers and the demands of higher education institutions; between the values promoted by school and those promoted by society; between the plan of obtaining the values and the practical plan of achieving values (C. Cucos, 2000).
The curricula must ensure epistemological transfers, a global vision of the world and also an axiological agreement between subjects (the values transmitted by a discipline not to be denied by other disciplines). School programs (curriculum) must leave sufficient autonomy to teachers in order to propose topics according to the students' needs, given the fact, that the information transforming into knowledge involves cognitive, affective and attitudinal dimensions driving of the student. Programs and textbooks should avoid overfilling, leaving enough time for reflection and dialogue, stimulating creativity.

With reference to evaluation from an axiological perspective, this implies: orientation of evaluation functions in order to assess ways that favor the development of student autonomy; the transition from product evaluation (graduate evaluation) to the education evaluation process (taking into account the motivations and students learning pace); the concern for the ethical assessments and examinations (the correct supervision and proper notation issuance of study); the building of self-evaluation capacity.

As to the perspective of contemporary ethics, the distinction between education and training must take into account that the teacher lines in the midst of the education area, in which the action contexts are multiple and most often are contractual defined (W. Veugelers and P. Vedder, 2003).

The real question that arises is that teachers are trying to convey values only in theory, or in the best case, giving students to solve exercises in which those values are found. This method proved to be the least effective in helping students to internalize values. An effective training for students involves the internalization of values by mentioning that capacity which will be increased in a learning activity or a project stage (S. H. Schwartz and K. Boehnke, 2004). There may be many different capacities appropriate, but teaching abilities towards a single once will give better results. For example, Swartz recommends asking questions when students work at problem solving situations/case studies, organizing students to work in groups, to develop of graphic organizers to guide students work etc. The capabilities delivered in this way will be transferred to new situations, where students will reuse the strategies they have learned in similar learning situations.
In a research on school accountability in the moral formation of students (2011), there are important conclusions.

Between school and society the report is contradictory at best, if not in an antagonistic opposition. Some teachers even deny the existence of a partial consensus between the school and the values of society "it seems that the school is at struggle with the media, with the street and especially with the family." There are no clear bench-marks in society, witnessing to "overthrow the authentic values of society". The school wants to oppose to "money" values, moral values as correctness/ honesty, seriousness, work, done with perseverance and passion. But successful models of society are represented by individuals wealthy, well situated, who did not have any particular school education: "people without culture, without education, which came very easy to make money." They are violating the minimum standard of success, based on the merits (degree of training, skills, competences, professional quality). There is, however, a fan of the findings on the relation between morality and other school educational environments: partial overlap between these occur (even some full) and the point of incidence can be approximated to 50%. The report is not always in a strictly Manichean connotation; it could be defined as "oscillating jumps" as the "interference pot". The position of the teenagers is one of an ungrateful person, caught between the street values and what they think or seems that's good, tired parents, school moral message and the dramatic fall of teacher's authority. They live "in a state of uncertainty and insecurity because they lack of firm benchmarks".

In fact, even as a starting point, ideals and values of family, school and community should coincide: “The school is trying to cultivate some common things”.

The EViVE project was conceived as described (European Values in Vocational Education- LLP-LDV / PAR / 2013 / RO / 032) and the problems it approaches can bring us draw many conclusions, that talk about the need of deep moral education, that has to be included in all disciplines. Basically we can say that the fabrication of the values of the young generation is compulsory to all teachers through civic culture and it is the duty of every teacher to establish moral values by means of the discipline they teach. Each subject, that concurs in the formation of a student’s personality profile, and the shape, the school teachers of today bring over, is what society will get tomorrow.

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ACADEMIC ADMINISTRATION AND MANAGEMENT

Preparing Smart Students Through Performing Problem Based Learning Activities Within University-Industry Collaborative Knowledge Sharing Platform

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ABSTRACT

During last few decades, different teaching and learning approaches have been proposed around the world aiming to enhance the student's knowledge acquiring ability. The purpose of this paper is to explore a modified problem based and project based learning (PBL) approach, which helps to develop smart students through acquiring knowledge using various sources from University and Industry. In this research, a collaborative knowledge sharing platform has been developed within PBL activities through engaging the facilitators both from University and Industry. After practical application of proposed approach within textile engineering domain, the student's knowledge acquiring ability has been assessed through conducting a survey. The Survey results revealed that the students have upgraded their knowledge level significantly through acquiring knowledge both from University environment with the help of faculty members and Industry environment with the help of technical experts. This article has pointed out the necessity of collaborative PBL activities within University and Industry for developing the knowledgeable and smart students in order for better performance in their future carrier.
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Keywords: *Problem-Based Learning (PBL), knowledge sharing, smart student, collaboration, University, Industry.*

PBL AND STUDENT'S KNOWLEDGE

Problem based and project based learning (PBL), as an instructional teaching method, is now used globally in many areas of higher education, such as dentistry, health sciences, nursing, pharmacy, public health, veterinary medicine, architecture, business, computing, education, forestry, law, policies science, social work, engineering and other professional fields (Matthews, 2004; Baral et. al., 2012). This methodology provides an opportunity for students to explore technical problems from a system level perspective and to develop an appreciation for the inter-connectedness of science and engineering principles (Richard et al., 2003; Baral et. al., 2013a). PBL prepares students to think critically and analytically by using appropriate learning resources (Duch, 2008). Moreover, the PBL-concept representing a learning philosophy of experiential, experimental, contextual, situated, social and team-based activities, which can be modeled in many ways in preparing the curriculum (Kifor et. al., 2007). Through adopting PBL learning system, students can gain skills in solving practical real world problems (Jason, 2012). Many researchers have documented about the student's knowledge gain from PBL activities, which helped in enhancing their professional competencies (Richard et.al. 2003; Aalborg University, 2007; Jonassen, 2011; Abhonaka et. al., 2011; Baral et. al., 2013a). Baral et. al. (2013b) have also published a case study on application of PBL, where Industry related real life problems have been solved by the students through PBL activities and acquired competent knowledge.

The purpose of this paper is to present a modified PBL approach, which has been executed through developing a collaboration knowledge sharing platform (KSP) within University and a Textile Industry. The student's knowledge acquiring ability has also been assessed by means of a quantitative survey through structured questionnaires.

PBL ACTIVITIES AND KNOWLEDGE SHARING PLATFORM

In order to execute the PBL activities, a project has been launched through collaboration between textile technology department of "Lucian Blaga" University of Sibiu (LBUS) and a textile industry situated in Sibiu, Romania aiming to enhance the quality of higher education as well as preparing the smart and knowledgeable students. Due to the limitation in the curricula brought about by the Romanian ministry of education, the model of PBL activities has been modified from the traditional Alborg model (Kolmos et. al., 2004) in order for implementation, which is presented in Figure 1.

The PBL activities were performed within 14 weeks of semester duration by full filing the key elements of PBL (Richard et.al., 2003) both in factory and university premises with active participation of a group of under graduate students of textile engineering courses, sponsor, coordinators (faculty members from University) and mentors (technical experts from Industry). The PBL activities has been performed by following a proposed knowledge sharing platform (KSP) as presented in the figure: 2. During PBL activities, the students were guided by both faculty members from University and technical experts from Industry for better knowledge acquisition (Schmidt, 1994).

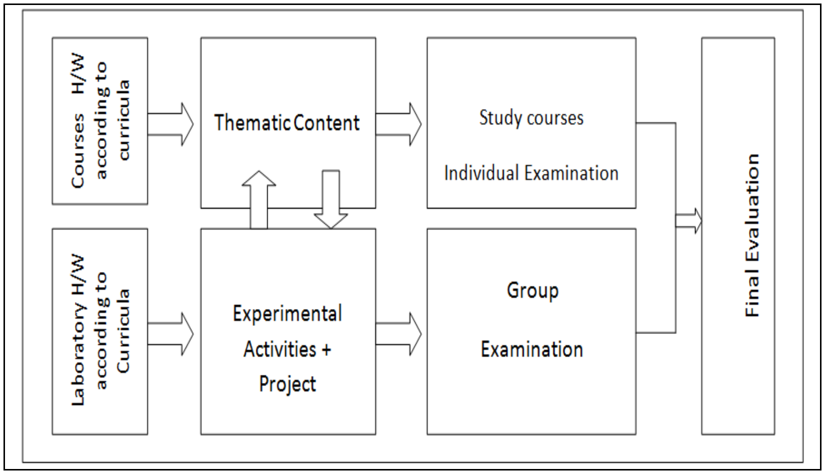

Figure 1: Modified PBL Model for the Textile Technology Department of "Lucian Blaga" University of Sibiu

As figure 2 shows that the knowledge sharing platform (KSP) can facilitate the students to gain knowledge from different sources i.e. from institutes (University and Industry) and from facilitators (Faculty members and Content experts). The students may acquire the theoretical knowledge from University through studying the traditional curricula with the help of faculty members. On the other hand students can gain the practical knowledge about Real Life Problem Solving Methodology (RLPSM) from Industry with the help of mentors. At the same time, both faculty members and content experts have also the opportunity to gain knowledge by overlapping practical and theoretical know-how between them. Both the University and the Industry can enhance the organizational performance by developing their employee and finally students will be smart and knowledgeable by acquiring knowledge from all possible sources.

During the PBL activities, all project teams (5 teams) were involved to solve 5 real life problems from Industry, which have been taken from the production process. After completing the projects, a quantitative survey has been conducted collecting information through interview process within the 26 students; those participated in the PBL activities.

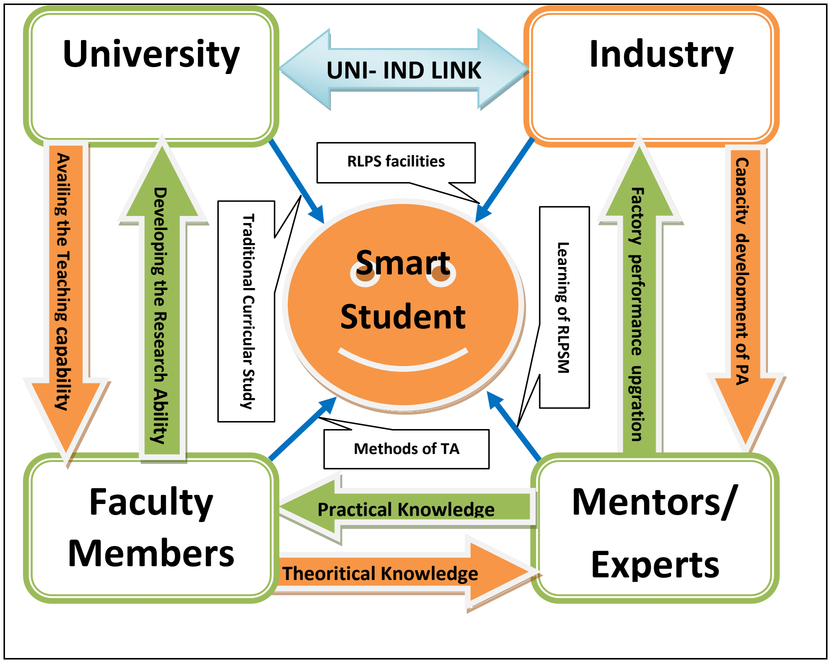

Figure 2: Proposed knowledge sharing platform within PBL activities

ASSESSMENT OF STUDENT'S ACQUIRED KNOWLEDGE

A set of 5 scale Likert-type (1- Poor, 2-Satisfactory, 3- Good, 4- Very Good 5-Excellent) survey questionnaire were sent directly to all the students, those who participated in the PBL activities.

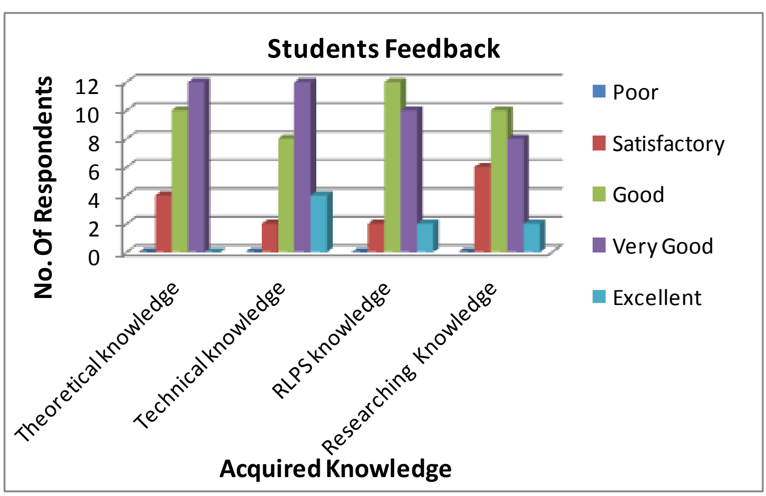

Figure 3: Student's acquired knowledge through PBL activities.

The questionnaires were formulated relating to their knowledge acquiring experiences during the PBL project execution such as: i) acquired theoretical knowledge, ii) acquired technical knowledge, iii) acquired knowledge for Real Life Problem Solving Methodology (RLPSM) and iv) acquired knowledge for research. The survey result and the responses regarding the student's acquired knowledge are presented in the Figure 3.

- According to survey results, a majority (46.15%) of students considered that they acquired very good "theoretical knowledge" and "technical knowledge" and good "Real Life Problem Solving (RLPS) knowledge" through the PBL exercise.
- 38.46% of respondents agree that they gained very good "RLPS knowledge" as well as good "theoretical knowledge" and "Researching knowledge" within these PBL activities.
- 30.76% of the respondents gave their opinion as very good achievement of "Researching knowledge" and good "technical knowledge".
- Just 23% of respondents also mentioned that they achieved excellent "Technical knowledge" and satisfactory "theoretical knowledge".
- Above 15% respondents mentioned that they achieved excellent "RLPS knowledge" and "Researching knowledge" through PBL practice.

CONCLUSION

This paper has highlighted the impact of PBL activities on acquiring knowledge by the students within the University and Industry collaborative knowledge sharing platform. The Survey results revealed that the student's knowledge has been significantly upgraded through PBL activities. The main implication of this results maybe a favorable knowledge sharing platform, which is created through engaging faculty members from university and thematic content experts from Industry. All the knowledge creating sources have the opportunity to share the knowledge for better acquisition. And finally students gained knowledge from various sources, which is very much important to develop their competences. Though survey showed positive result, this research has some limitations due to the fact that the survey in this project has been carried out within a small number of participants. This implies that this research could be conducted through involving large number of participants to generalize the results.

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An important factor of research university development: the role of a pre-masters program for international students

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ABSTRACT

This paper considers the important practicality, scientific and methodological principles in the design of the pre-masters program in National Research Tomsk Polytechnic University (or simply TPU). TPU is a university that mainly provides technical education, particularly education in engineering, science and technology disciplines. The design of the pre-masters program also considers the incorporation of educational technology for its realization for the international students, who received the bachelor's degrees in other countries in English language and want to study masters programs in Russian language in Russia. According to the results of a comparative analysis that explored the experiences of the international students from English-speaking and Russian-speaking universities in the world within their pre-bachelors and pre-masters programs, this paper explains the differences between these programs and the specific features of the pre-masters programs. Further, this paper reports the analysis results of the implementation, monitoring and outcomes of the pre-masters program in TPU. It also presents some proposals for its further development.

Keywords: *International students, pre-masters programs, adaptation, educational technology.*

INTRODUCTION

The development strategy of the National Research Tomsk Polytechnic University (TPU) is formulated by considering the global trends in science and education, and also by the global challenges towards humanity. TPU has a strategic goal to develop into a research university and one of the world leaders in the field of resource-efficient technologies. The strategic goal (reflected in the Program development of TPU) decomposes into some sub-goals, where one of them is “transformation of TPU predominantly to expand masters and postgraduate programs by means of internationalization and integration of research, education and training of engineering elite”. Nowadays, TPU rates among the 15 leading universities of the Russian Federation and it is one of the leading Russian universities participating in the project for competitiveness enhancement among the world leading scientific and educational centers (National Research Tomsk Polytechnic University, 2015).

To reach such goals, TPU updates the available masters programs (MP) and develops new ones. They are interesting not only for the Russian and international students who received bachelor degrees in the Russian universities, but also for those of overseas countries. International students, who were trained through bachelor programs in Russia universities, enter a masters program with good knowledge in Russian. However, the international students with Bachelor degree of other countries encounter a so-called language barrier in using Russian language in their studies of masters programs in Russian universities. Consequently, they need in a special preparation program before commencing a masters program. The Russian universities and TPU in particular have an extensive experience in conducting the pre-university training (pre-bachelor programs) of international students including teaching Russian language as an integrated element before the commencement of Bachelor degree studies (Surigin,2000；Surigin,2001；Izotova,2007；Petrovskaya & Guzarova,2010). However, pre-masters programs (PMP) for international students have not been specifically designed, developed, widely integrated and applied as those within the framework of Bachelor degrees.

This paper reports scientific and methodological principles in the design of TPU pre-masters program. The design of such program focuses on the engineering education and also considers the incorporation of educational technology for its realization for international students, who received the bachelor degrees in other countries in English or native languages (other languages besides Russian) and want to study masters programs in Russian language in Russia. According to the results of a comparative analysis that explored the experiences of training international students from English-speaking and Russian-speaking universities in the world within their pre-masters programs, this paper explains the differences between these programs and the specific features of the pre-masters programs in Russian universities. Although the analysis is not considered to be extensive and in-depth, it went through some technically rigorous processes to explore and discuss many important and basic principles towards the design of a pre-masters program in TPU. The resources used for analysis involved different publications of foreign and domestic universities, as well as, numerous articles covering several essential aspects of the topics.

ANALYSIS OF WORLD EXPERIENCE IN THE PRE-MASTERS PROGRAMS

The studies (University of Huddersfield, 2012-13; 7. Widener University in Philadelphia, 2014; King's College London, 2014; University of Sussex, 2014; University of Kent, 2014; University of Sheffield, 2014; University of Southampton, 2014; Soon, 2013& 2013a) of foreign experience in the world leading universities in Germany, Canada, Great Britain, Australia and the USA revealed the fact that pre-masters programs (PMP) exist since 1990's in the last century. The major objectives of these programs are as follows:

- Improving English language skills for academic purposes (writing, reading proficiency, note-taking, discussions, presentation skills);
- Acquiring research skills needed for masters programs;
- Improving Information Technology (IT) skills;
- Learning professional skills and knowledge needed for a particular type of enrolled masters program;
- Cultivating positive relationships between staff and students within a new academic and social environment.

Regardless of the type of university, the well-structured pre-Masters programs include the following three basic modules:
<u>Module 1</u> aims to enhance a foreign language (in this case, English) used by each student for academic purposes (English skills for university study), which embraces the research module, depending on specification.
<u>Module 2</u> focuses on improving the proficiency of student academic skills and abilities before commencing a masters program. This module includes trainings in writing, reading professional texts, note-taking, discussion skills, information surfing and its systemization, and critical thinking useful for academic reading and writing. The module provides trainings to bring the students' skills up to a high adaptation level (e.g. introduction to University campus environment, cultural and social traditions and customs of the country).
<u>Module 3</u> is a 'Specific Module' that aims to professionally train the students in their prerequisite subject areas to prepare them for their masters program. For example, the discipline "Computing" would include the courses such as 'Research Methods', 'Hardware' and 'Network, Programming (Software Engineering)', 'IT Management', and 'Information Management Systems'.

Furthermore, a pre-masters program sometimes includes the following basic trainings: 'Research Methods', 'Business Quantitative Models', 'Introduction to Economics', 'Business and Management', 'Operating Decision- Making' and 'Strategy Management'. In comparison, pre-masters programs in the English-speaking universities are well-structured which often targeted at the students who have already known some English or known English well. These students could improve English within such programs. The experience and the realization of pre-masters programs in foreign countries however may not be completely suitable for the Russian universities. It is because international students have to both learn Russian (beginning with a zero level or close to zero level) and meanwhile undertake foundational knowledge training to be effectively prepared for the masters program within a short term of 8-10 months.

RUSSIAN AND TPU EXPERIENCES IN THE IMPLEMENTATION OF THE PRE-MASTERS PROGRAM

The implementation of the pre-masters programs for international students is not widely presented on the websites of different Russian universities, although this problem has been discussed at different universities, such as Lomonosov Moscow State University, Moscow State Technical University, St. Petersburg State Polytechnic University, and Bauman Moscow State Technological University “STANKIN”. Nevertheless, the perfect and complete designs of pre-masters programs for international students in Russia do not exist. As such, the existing programs include only Russian language courses. It should be noted that some authors (Gilevaya, 2005; Avdeeva, 2005; Loktionova & Allakhverdieva, 2012; & Pinevich, 2012) consider the course “Academic Style” as a very important component within the framework of the pre-masters programs. Within the framework of such programs, pre-masters students study each subject and its subject terminologies in Russian together with pre-bachelor students. In recent years the number of international students who want to receive the masters degree in Russia significantly went up. At the same time, the experience of Tomsk polytechnic university indicates that there is a need for creating profile pre-masters programs for different disciplines like engineering, economy, natural sciences, humanitarian, medico-biological and others (Guzarova, Kashkan & Shakhova, 2013).

Table 1: A sample curriculum of the pre-masters program preparing students for the engineering masters program.

Subjects	Class hours		
	1 semester	**2 semester**	**Total**
MODULE I «Language training» (a base level)			
Russian language (general)	312	264	576
Academic style (for Russian language)	24	-	24
MODULE II «Professional skills» (a base level)			
Researches in the field of natural sciences – special chapters of math, physics, chemistry (electively)	84	264	348
Modern researches in the field of technical equipment and technologies (electively)	12	132	144
Philosophy of science	-	44	44
MODULE III «Adaptation practitioners»			
Introduction to masters program (electively) Russian language for special purposes (electively)	-	22 66	22 66
TOTAL			1224

In 2012-2014, a new pre-masters program curriculum for engineers as in Table 1 was developed and implemented.

RESEARCH METHOD FOR EXPLORING THE EXPERIENCES OF THE FIRST YEAR MASTERS STUDENTS IN TPU

Through the above two sections, they have provided an important basis for a comparative analysis. It was discovered in the former section that pre-masters programs are not new and they are widely used in many foreign countries. However, through the latter section, there are some salient needs for a different type of pre-masters programs in Russian and TPU. Clearly, the needs and requirements in Russian higher education truly differ from those in the higher education contexts in the foreign countries.

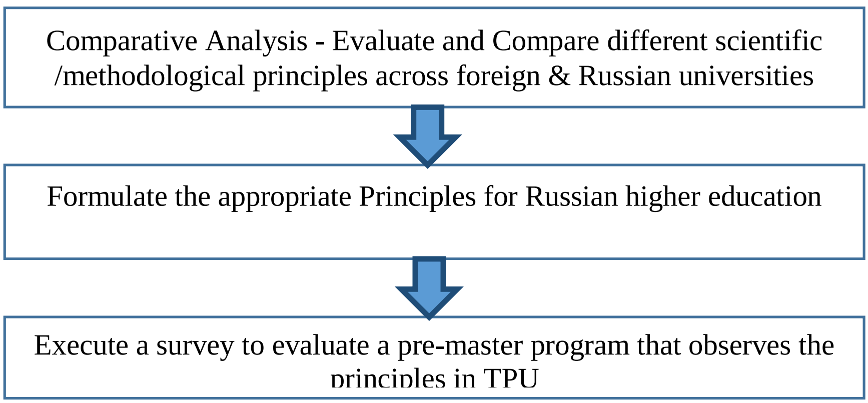

Figure 1: Research processes in this research.

In Figure 1, the top rectangle shows that the comparative analysis discussed above was performed in this research. Following its results, as in the second rectangle, a curriculum for a pre-masters program of an engineering masters program is developed closely observing the following principles:

1. Intensity of teaching Russian language as a foreign language;
2. Maximum integration of language and pre-masters training into masters program;
3. learner-centered approach;
4. Modular programs;
5. Interdisciplinary approach in designing specifically-based teaching aids and guidelines as a tool in the harmonization of pre-master academic adaptation and key factor in developing their professional competence (Bushkovskaya, 2010; Kashkan & Provalova, 2009);
6. Priority in Russian language training as a foreign one for professional and specific purposes (Eremina & Eremina, 2007);
7. Seminars with research advisors to forward the training process;
8. Wide application of an intermediate language (i.e. English) during the pre-masters training stage; and
9. Examination after a pre-masters program.

The curriculum aimed to help first year masters program international students who come to Russia to effectively undertake their studies using Russian language in all their learning activities, like reading, writing, listening and speaking. The program consists of three modules, namely, ‘language and language-subject preparation’, ‘vocational training’, and ‘the adaptation practitioners’. 55% of classroom times are allowed for the development of Russian for the academic and professional purposes with possibility of a "sub-language" choice of profile subjects within the professional module. The program content of the second and third modules is determined by the future masters training programs and coordinated by the research advisors. The meeting with the research supervisor of future masters theses is organized too.

A monitoring system of educational activity of pre-masters students in TPU was designed with respect to the principles underlying a competence-based approach. The monitoring reveals that there were alignments between the learning process, the planned objectives and the learning outcomes in the pre-masters program. Monitoring also helps to identify the academic learning difficulties of students, during both the pre-masters and masters programs, and to find ways to overcome them. Annually, the first year pre-masters students are questioned to explore their academic learning difficulties as PMP graduates. The issue of their academic learning difficulties is complex. There are many factors which influence their learning, such as the complexity of a learning material, the teachers’ education and skills, the ability of students, their readiness to learn and their self-motivation towards training. Nevertheless, the questioning of students helps collect some important data about the productivity and relevance of PMP.

As in the bottom rectangle in Figure, to establish feedback between implementation of this pre-masters program and the expected outcomes, two surveys of the same international students in their pre-masters program and their first year masters program were conducted. The two questioning surveys aimed to obtain some comparative data. The questioning results from the graduates of pre-masters programs in years 2012 and 2013 were checked and compared against the questioning results from the same students in their masters programs in years 2013 and 2014. The purpose of the questioning before and after the pre-masters programs aimed to confirm whether the academic learning difficulties which they experienced in their pre-masters program were still what they had in the first semester of their masters programs.

12 students took part in a survey in 2013 and 11 in 2014. Most of them (9 persons in 2013 –or 75% and 7 persons in 2014 –or 64%) were trained in the engineering masters programs. A vast majority (83-91%) were from the East Asia countries. 84-90% of them did not know Russian language at the beginning of PMP, but at the end of PMP, 100% of the graduates received certificates BI and B2 (B1 and B2 are the levels of Russian language. The same applies to English levels B1and B2). Such result indicates that the pre-masters program graduates (age about 24-26) have the self-motivation to go through the intensive training in the program. They differ in their levels of diligence but their diligence yields excellent results.

ANALYZING THE EXPLORED EXPERIENCES OF THE FIRST YEAR MASTERS STUDENTS IN TPU

The survey results showed different subjective perceptions of the international students about their academic learning difficulties in the first semester of masters educational program. When they were asked a question "How well do you know Russian after your training in the PMP program?" they provided different answers as in Table 2.

Table 2: International students' perceptions about their academic learning difficulties in pre-masters program.

Questions	Answers of premasters students (% to the total number of answers)	
	2013 year	2014 year
I can freely communicate	20%	19%
I can communicate, but it is difficult to study	20%	27%
I know insufficiently to study	40%	27%
I do not have enough knowledge in core subjects (the higher mathematics, physics …)	20%	27%
I know some phrases	0%	0%

Through the provided data in the last two years, it demonstrates a slight decrease in the number of answers about language difficulties in the masters program students (from 60% in 2013 to 54% in 2014). In general, a little more than half of the graduates of PMP revealed that, in their opinion, there were difficulties in study because of their in sufficient knowledge and skills in Russian language. As a reflection from all the analyzed answers, the students improved their Russian over time when they actively used Russian in their education, e.g. at conferences, round tables, in competitions, etc. The analysis of survey questionnaires (Kashkan & Provalova, 2009) have showed that, in general, the masters program students had rather high level of the general knowledge of Russian, but they were uncertain about their Russian language proficiency for the professional purposes. The survey was designed with different rating scales for the student to indicate their subject difficulties that they experienced when studying them. The introduction of Russian language in general professional courses such as "Introduction to geology", "The economic theory", "Economy of firm", "Fundamentals of linguistics" that were fitted into the PMP curricula has benefited the international students. The elementary courses helped the students improved their professional Russian language skills, etc.

RESULTS AND DISCUSSIONS

The most important aspect of pre-masters program is audition training which would equip them with the skills to understand their lectures on hearing. Participants of the two surveys never answered that they "hear nothing and understand nothing about what a teacher speaks". In 2013, 20-40% of survey participants answered that they "hear all words, but not always understand about what the teacher speaks". In

2014, all masters program students did not answer that he or she "hears familiar words, but not always understands what the teacher speaks". 45% of pre-masters students answered that they "understand well what the teacher speaks", 55% answered "hear not all words, but understand what the teacher speaks". It should be noted that one of the reason for obtaining the positive results was to have practically added a phonetic training in the pre-masters program and to have improved the teaching technique of the subjects. However, the problem of training in Russian for the professional and special purposes actually continues. One of the survey questions was for these same pre-masters students to explain the kinds of difficulties which they met in the first year of masters program on a 10-pointLikertscale. For each group of students, the rates of the same rated item from all the related students were summed first and averaged out. Their average rates (presented as weight point e.g. 7,3 on a 10-point Likert scale) for each item of the two groups of students in 2012 and 2014 are shown as follows in Table 3.

Table 3: International students' perceptions about their academic learning difficulties in first semesters of masters program.

Academic difficulties	**Assessment of difficulties (10-point Likert scale) (1 point – I have no difficulties, 10 point – I have very great difficulties)**	
	2013 year	**2014 year**
I know insufficient terms in my subjects	6,5	7,6
Insufficient baccalaureate preparation	6,3	5,6
It is difficult to speak in Russian	5,6	4,6
It is difficult to listen and understand a teacher	5,3	4,8
It is difficult to do written tasks	5,1	6,2
It is difficult to read textbooks and manuals	4,6	5,0
Difficult climatic conditions of Russia	3,9	4,8
The educational system of Russia considerably differs from an education system in the native land	3,6	3,7
Manuals of TPU are not helpful	2,3	2,4
Not enough electronic resources	2,2	4,4
Difficulties with Russia culture	2,0	2,6
Difficulties with Siberian climate	2,0	2,0
Difficulties with Russian educational system	2,1	1,9
Teachers are not approachable	1,9	2,2

The comparison on results in the table above has the following implications. Firstly, none of the masters program students indicate any kind of difficulty at 10 point. As in Table 2, the first item 'knowing insufficient terms in my subjects' shows more difficulties in a masters program than in a pre-masters program seeing the point change from 6,5 to 7,6. This fact indicates a rather high level of academic challenge and adaptation through a PMP to a masters program. Secondly, language difficulties decrease over time, e.g. speaking difficulty drops from 5,6 to 4,6 and audition decreased a little from 5,3 to 4,8. Thirdly, a lot of undergraduates highly appreciate manuals (from 2,3 to 2,4) and electronic resources(from 2,4 to 4,4). The students are provided with electronic resources, but did not search for more related electronic resources themselves. It suggests some future training to teach them how to conduct individual information seeking for useful electronic resources in their subject areas. Fourthly, the students do well in their learning to listen (from 5,3 to 4,8) and speak (from 5,6 to 4,6) Russian than in their reading (from 4,6 to 5,0) and writing (from 5,1 to 6,2) in Russian. It suggests more training assistance and teacher attention are to be given to improve the students' reading and writing skills. Lastly, in general, they do not consider the climatic conditions of Siberia (from 2,0 to 2,0; no change) and the Russian educational system (from 2,1 to 1,9)as great challenges to them.

The survey results, to some extent, reflect some self-assessment of the masters students and how they thought proudly of their academic achievements. For example, for the question: "What educational activities did the students take part in?" The answers were as follows: 100% of participants have presented reports at the scientific conferences; 90% have conducted presentations at the scientific and creative exhibitions; 60% have made speeches in the club of Russian language; 30% have taken part on round tables. In closer and more careful examination, we found that the students associate their non-participation and no actions in activities not so much with language problems, but more with their psychological barriers (fear of a public statement, etc.).

CONCLUSION

Through this research, the approach in implementing the pre-masters program described above is an integrated part of the masters Program that contributes to an effective and successful training of engineers. Taking this approach could increase the quality-level of the education not only for the pre-masters program, but also for the masters programs. The pre-masters program plays an important role in helping the international students achieve academic successes. It is also a key factor in TPU's development of Russian higher education internationalization.

The efficiency of PMP, as demonstrated in the survey outcomes, helped us comprehend the academic learning difficulties of international master students in their first year of study. In general, the survey outcomes indicate a rather high level of international master students adaptation in their given training conditions and their formation of a necessary minimum level of language competence for training continuation. Having known from the surveyed students that they felt unready for professional subjects (it is not enough of Russian terminology), TPU could help the future masters students who start with zero Russian knowledge to better acquire sound language and speech competences of language and profile preparation within the short term (8-10 months) of PMP.

The greatest academic difficulties are related to the understanding of difficult texts in textbooks, especially, for special subjects. The solution of this problem would be to create textbooks with specific language features and semantization in a necessary format for international students. Development of such textbooks by a group of teachers of special subjects and the teachers of Russian as foreign language will need to take into account the specific international students training. The survey outcomes also showed that the update of curricula within PMP had to be carried out by further considering the organizational and methodical improvement of language and vocational training within the pre-masters program. In the organization of PMP, it is probably necessary to consider using IT technologies to (1) specially prepare the international students in Russian language even before their arrival to the university, (2) to expand a set of special subjects in the professional module of the curriculum with accordance to master programs and (3) to expand possibilities of independent work of international students with audio-, video resources, language exercise machines, electronic textbooks.

Teaching staff who deliver different subjects (besides Russian language) should improve their professional levels of research and education, i.e. they should apply the latest technology to improve the academic performance and improve the English language level (as intermediate language for English-speaking students), as well as enhancing the Russian language teaching.

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Empirical Study of the Factors which Have an Impact on University Performance in EU Countries, Reflected by the Shanghai Ranking

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ABSTRACT

The study tries to prove the existence of a significant relationship between EU countries academic excellence measured by international university rankings scores and the level of attainment for the EU strategic objectives in higher education and research, as are measured by the countries' values of the afferent indicators. The study was applied to the correlation between some headline indicators of the Europe 2020 strategy and the Shanghai Ranking scores. Measuring the strength of a linear association between variables by using the Pearson Correlation, a strong correlation was found between the country Shanghai scores and the country values for indicators such as: "public expenditure in education", "expenditure in R&D", "patent stock", and "lifelong learning". A moderate correlation with students' international mobility was also identified.

Keywords: *university rankings, academic excellence, higher education and research excellence, Europe 2020 indicators, Shanghai Ranking.*

INTRODUCTION

In a world where knowledge became the main resource, higher education and research are crucial activities and the universities are main actors in a competitive economy. In such a context, for policy makers, the investment in education and research should be present as a high priority in achieving a sustainable growth (UNESCO, 2015) while for universities, to target society wellbeing should become the main component of their mission.

From the decision bodies side, this holds true for most of the countries, on all continents, and a special focus is placed on it in the countries of the European Union (EU), which has become one of the largest economic areas of the world. At the beginning of this decade, the European Commission has brought to light “Europe 2020” (EC, 2010) a programmatic framework to support the implementation of its growth strategy. As part of it, the EC proposed a set of higher education and research objectives for the EU countries, sustained by coherent policies and measured by specific indicators. At the same time, on the universities’ side, they are more concerned with "excellence" expressed as visibility. Public and scientific acknowledgments as: academic prize, titles, publications and citations are quantified and encouraged more as bridging the knowledge gap between research and economy.

The Academic Ranking of World Universities, ARWU or Shanghai Ranking, started in 2003 as an exercise of a research team from Shanghai Jiao Tong University in China, was initially intended to establish the standing of Chinese universities internationally following the launch of a government initiative to create world-class universities (The Guardian, 2013). ARWU had a butterfly effect (Hazelkorn, 2015) both on the academic and stakeholders’ worlds. As in other cases, this exercise demarche, becoming popular, has passed from the wing fluttering of a butterfly to the storm of a lot of university rakings promoted by international, national bodies, private companies and newspapers, being integrated by universities and policy makers in their strategic frameworks and followed by the public as representing academic quality. Each ranking measures university performance through different indicators connected generally to the academic recognition of research and education such as: international prizes, publications and citations, etc. Some are using also surveys collecting the feed-back of the stakeholders from society.

Very popular, strongly praised and criticised by different specialists and stakeholders, university rankings brought up at the same time significant questions concerning their correlation with the society’s long term objectives. Some assumptions can be made, but it is rather impossible to determine in a reliable way the impact of universities’ positions in these rankings on the economic and social wellbeing of the areas they serve.

This paper place its intentions in an opposite approach: to establish if there is a certain correlation between the main indicators for education and research in the EU 2020 Strategy and academic excellence measured by ARWU (currently the most popular university ranking). In other words, the research intends to determine the degree in which the increasing of the mentioned indicators will also have a significant impact on the EU universities’ positions in the ARWU ranking.

ACADEMIC QUALITY, EXCELLENCE AND RANKINGS

Quality became a much debated subject in the academic field in the first decades of this century as it was 20 years earlier in the economic domain, where now it has reached its maturity. This attention given to the teaching and research quality in universities is coming mainly under the pressure exercised, on one hand, by the society for university accountability and, on the other hand, by the competitive attitude created and encouraged by globalisation within the international higher education and research environment. The first pressure has led to accreditation as an institutional answer meant to check the conformance of academic activity to minimal standards while the second one found its representation in academic rankings, homologous to the excellence models and quality prizes in the economic environment.

University ranking systems are built upon “some combination of institutional performance, institutional characteristics, and other factors” (Shin & Toutkoushian, 2011, p. 6) that, after being evaluated, allow the listing of academic institutions in a descending order, highlighting the best placed from those points of view. Rankings were facilitated by the increasing amount of information available on the world wide web about the activity and results of universities and the facilities to access and process that information but also to disseminate it. “University league tables which compare the performance of different institutions have been advocated as a potentially efficient and effective means of providing needed information” (Dill & Soo, 2005, p. 525) for consumers (students, policymakers, etc.). In the following, a brief characterisation of some of the main world academic rankings is presented. It is not an exhaustive one, as it could be completed by other numerous international, national and domain specific university rankings.

The already mentioned **Academic Ranking of World Universities ARWU**, is focused on measuring especially research performances. For that purpose it uses indicators (CWCU, 2013) connected to alumni and staff winning Nobel Prizes and Fields Medals, highly cited researchers, papers published in the journals Nature and Science, papers indexed in major citation indices, and the per capita academic performance of an institution.

QS World University Ranking has started in 2004 as combination of QS (Quacquarelli Symonds) and THE (Times Higher Education). The partnership has ended in 2009 and, from 2010, QS is promoting this ranking alone. It is based on six performance indicators designed to assess universities through four perspectives: research, teaching, employability and internationalization (QS, 2015) by collecting information from both public databases and global surveys of academics and graduate employers. QS allows for the ranking deployment on regions or countries (worldwide), as well as on topics, highlighting best institutions in five broad areas and in 36 individual subject areas.

The **THE Thomson Reuters** world academic ranking methodology (Times Higher Education, 2015) focuses on: teaching, research, knowledge transfer and international outlook and employs 13 calibrated performance indicators. There is a significant emphasis on research (research connected indicators > 60%). The novelty is the extension named “most innovative universities” list based on four indicators established starting from university-industry collaborations.

The Ranking Web or Webometrics is performed from 2004 by the Cybermetrics Lab (Cybermetrics Lab, 2015) and provides information about the performance of universities based on their web presence and impact. The ranking is built from publicly available web data, and it measures three indicators: university web presence, visibility and web access.

U-Multirank assumes to be a “multi-dimensional, user-driven” approach to international ranking of universities. It was prepared with EU funding by CHERPA, a consortium of European institutions including the "Center for Higher Education Policy Studies" (CHEPS) from the Netherlands and the "Centre for Higher Education" (CHE) from Germany (EC-CHERPA, 2014). Its ranking criteria are: teaching and learning, research, knowledge transfer, international orientation and regional engagement. The information is supplied by institutions, extracted from international bibliometric and patent databases and collected by surveys of students. Based on these data, U-Multirank allows the comparison of institutions with similar profiles and allows users to develop personalized rankings by performance indicators, geographical region or scientific area.

Even if its intended result is not a university ranking, the **“Composite Indicator for Scientific and Technological Research Excellence”** introduced by European Commission in 2013 (EC, 2013) can be used to rank countries by their levels of research excellence and integrates rankings of institutions. Elaborated by an “Expert group” formed in 2011, the “composite indicator” evaluates the research excellence based on four indicators: highly cited publications (Scopus 10% most highly cited publications where at least one author is affiliated to the given country), top scientific universities and public research organizations (calculated in relation to a country's population, per million inhabitants based on top 250 universities and top 50 public research institutions in the Leiden Ranking respectively in the Scimago Institutional Ranking), patent applications (counts patents that are registered in multiple countries under the Patent Cooperation Treaty PCT), and value of ERC (European Research Council) grants received divided by public R&D spending performed by the higher education and government sectors.

(Hardeman, Van Roy, & Vertesy, 2014), an interesting review of European approaches to academic excellence, consider the Composite indicator as a mature approach to research excellence and argue that "excellence should be seen in the context of the knowledge-based economy” (p. 3). The authors of the present paper have a similar understanding in this matter and within their contribution they try to emphasize that between economic strategies and excellence approaches there is a significant correlation even if that is not declared as an explicit intention.

RESEARCH METHODOLOGY

To achieve the mention purpose, this paper will analyse the relationship between university performance of each country from European Union (EU27) that has at least one ranked university in the Shanghai 500 classification, plus Norway, Turkey and Croatia, and a set of indicators connected with Higher Education and research modernization chosen from the EU targets deployed from the Europe 2020 strategy.

The research supposed (statistic alternative hypothesis) that these variables will be significantly correlated with the national Shanghai scores.

The collected data for the present research were placed in 2 consecutive years: 2010 being the Europe 2020 strategy launching year and 2011, used for results redundancy / confirmation. As statistic tool, the Pearson correlation was used, the correlation coefficient r validating the hypothesized linear relationship between two variables “x” and “y” in terms of strength and direction. In our case, the dependent variable was “y = country score”, and the independent variable was “x = country values” for the chosen indicators. The three steps of the research methodology will be briefly presented in the following.

The first step *will describe the method of determining the Shanghai scores for each country.* Each university from the Top 500 Shanghai Ranking has a final overall score that is obtained when we divide each institutional score to the highest scoring institution, which is a score of 100. In such a way, the best institution will have score equal to 1, and the other universities’ scores will be <1. For each country, we then compute the sum of Top 500 Shanghai ranked institutions that belong to this country, and divide the sum by the country's population.

The second step *includes the rationales for the independent variables selection*. From the Europe 2020 strategy the intention was to take into consideration only indicators which are relevant to higher education and research. In our case, for higher education there were selected (Eurostat, 2015a) the following indicators: *Public expenditure on education, Tertiary educational attainment (counted by graduates aged 30-34 years), Student mobility in tertiary education (measured by international students) and Lifelong learning,* while from the R&D indicators (Eurostat, 2015b) there were included in the research: *R&D expenditure and Patents*. The selection of the mentioned variables was based more on data availability for each country and for the studied period. If, in the case of education, the choice satisfies also the condition of relevance, for the research case some indicators relevant for excellence (e.g. EU funding for research and innovation, Innovation performance) have been avoided for reasons of momentarily access to information. Normally, in the authors’ opinion, this does not affect the research results regarding the stated research hypothesis. If there will be a confirmation for the majority of chosen indicators, it is reasonable to extend the answer for other connected indicators or for most of them.

The third step *includes the calculation method of the correlation coefficient and its interpretation*. For each year and indicator, the set of country values, was represented in a scatter plot that correlates these values with the Shanghai ranking country scores for the same year. For exemplification, the scatter plot for the 2010 correlation between EU countries’ R&D expenditure and their Shanghai ranking scores is shown in figure 1. For calculation of the Pearson correlation coefficient *r* and for determining the significance level p-values, the SPSS software was used. As interpretation intervals there were considered: low correlation for $r \in (0\text{-}0.29)$; moderate correlation for $r \in (0.3\text{-}0.49)$ and strong correlation for $r \in (0.5\text{-}1)$. If the p-value is not less than the significance level (α=0.05) it was considered that there is insufficient evidence to conclude there is a significant linear relationship between x and y.

RESULTS AND DISCUSSION

Table 1: Correlation Coefficients

Correlations		Expenditure in R&D	Public expenditure in education	Graduated students	International students	Patent stock	Lifelong learning
Shanghai scores 2010	Pearson correlation (r)	0.878**	0.796**	0.382	0.501*	0.874**	0.873**
	Sig. (2-tailed) (p)	0.000	0.000	0.080	0.018	0.000	0.000
	N	20	20	22	22	22	22
Shanghai scores 2011	Pearson correlation (r)	0.857**	0.826**	0.348	0.520*	0.865**	0.820**
	Sig. (2-tailed) (p)	0.000	0.000	0.113	0.013	0.000	0.000
	N	20	21	22	22	22	22
** Correlation significance level (2-tailed) ** p<0.01 ; *p<0.05							

The correlation results (table 1) for 2010, between Shanghai scores and R&D expenditures, Public Expenditures on Education, Patents, Life Long Learning describe a strong, positive relation between variables, all of them taking values in the interval [0.6:1]. The correlation was significant at 0.01 level (2-tailed). For the *Students' international mobilities* variable the correlation coefficient has a value 0.51 that placed it at the limit between a moderate and strong positive relationship with the Shanghai score, the correlation significance level being 0.05. Comparing with the situations for the before mentioned variables, the option for this one was to take it into consideration as a moderate correlation. The variable which does not pass the statistical test is *Graduated students aged 30-34 years*, the p value = 0.08, which is greater than 0.05. In this case, there is insufficient evidence to conclude that there is a significant linear relationship, a fact that is revealed also by the last scatter plot (figure 2).

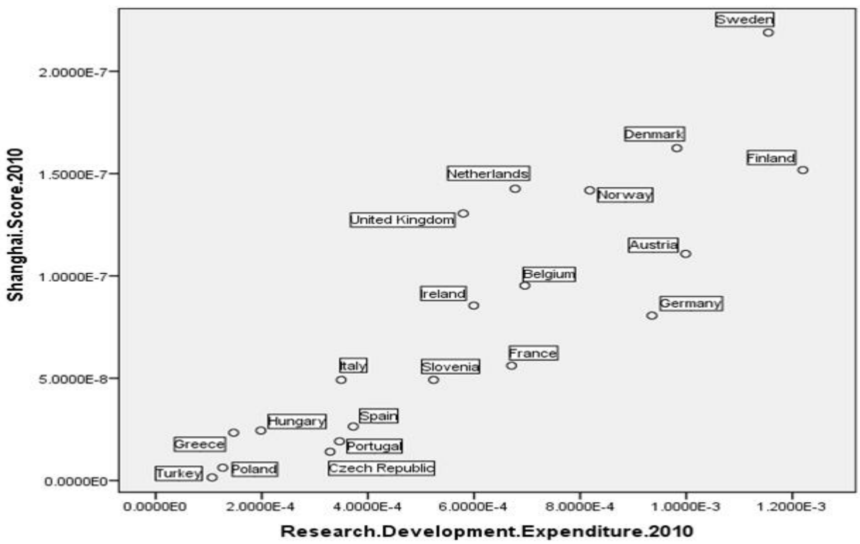

Figure 1: Scatter Plot for the 2010 correlation between EU countries' R&D expenditure and their Shanghai ranking scores

Correlation results for 2011 are very similar with correlations from 2010, confirming that the conclusions' set for 2010 is correct. The same inconclusiveness is observed for *Graduated students*, which once again fell the statistical test, with p value = 0.11.

As a final result, we can say that the majority of the headline indicators on education and R&D of the Europe 2020 strategy have a strong positive relationship with university performance measured by scores obtained in the Shanghai Ranking.

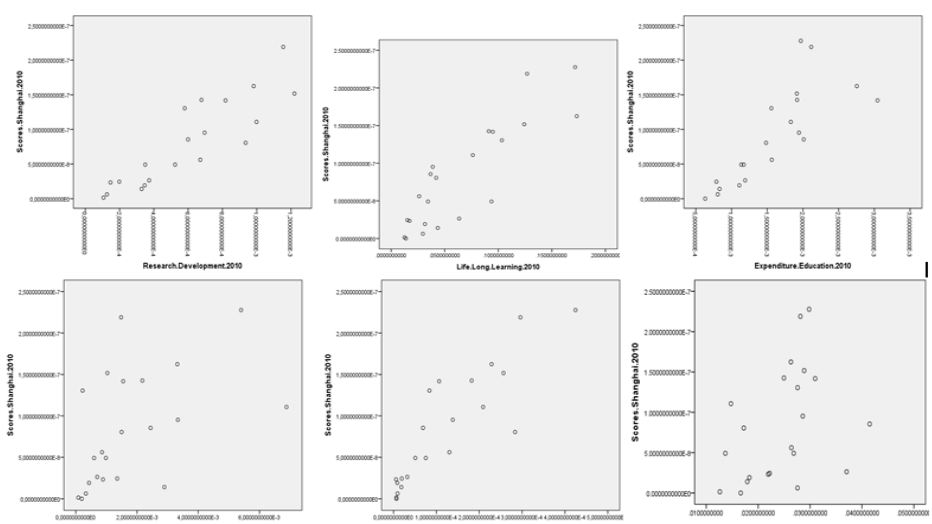

Figure 2: Scatter Plots for 2010 correlations between countries' values of the Europe 2020 indicators and their Shanghai ranking scores

CONCLUSIONS

The objective of this paper was to assess whether there is a significant relationship between performance of the universities calculated by scores obtained in a world university ranking (ARWU) and headline indicators set by the strategy of the European Union for achieving modernization of higher education. Our results show there is a strong positive relationship between R&D Expenditure; Public Expenditure on Education; Patent stock; Life Long Learning indicators and scores obtained by European countries in the Shanghai Ranking.

Without falling into the trap of finding any causal relationship, the above study points to the fact that by following the EU strategies in the field of higher education and research, European countries have an increased chance to also increase their scores in the Shanghai 500 ranking.

Two possible continuation scenarios can be foreseen to further refine the results of this study, beside the already mentioned extension to the entire set of 2020 indicators: one is to continue in a chronological approach and identify changes in correlation profile going from year to year, using the same variables, while the other one is to perform similar studies on other world university rankings. Both directions could yield information useful for the strategic piloting of higher education systems in Europe.

Among the limitations of this method, we reiterate the fact that the choices for the studied variables have been limited by the available data and that, once a correlation is discovered, investigating it further, to establish if there is indeed a causality and in which way countries could act upon it, is a considerable difficulty.

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Engineering Education Quality Assurance within the School of Engineering: A Holistic Approach

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ABSTRACT

BACKGROUND
Quality assurance is a key element of engineering education at Deakin University and is monitored through various mechanisms which also include the process of collecting students' feedback within the Schools and faculties. The information received are then looked at holistically and action plan is developed to implement. This has proven to be very effective to ensure feedback received from the students has been properly addressed.
PURPOSE
The School of Engineering at Deakin University, has initiated the formation of Engineering Educational Quality Working Group (QWG). The aim of QWG is to provide a focal point for learning and teaching quality and its assurance in undergraduate and postgraduate Engineering courses. The school approach complements Deakin University processes of collecting and analysing student feedback on unit curricula design, delivery and facilitator delivery performance; feedback regarding individual facilitator, unit evaluations and graduate course experiences.
DESIGN/METHOD
The data are collected through face to face feedback from both on and off campus students. Feedback received from the end of trimester student evaluation process was also analysed.
RESULTS
The motivation behind the practise is to close the loop for the feedback received from the students and take appropriate action against the feedback. This is to enhance overall delivery of engineering education at Deakin University.
CONCLUSIONS
This paper outlines the activities planned by the QWG and elaborates on quality assurance approaches and key strategies to be implemented by the working group to achieve the desired quality as well as efficacy of those recommendations/actions undertaken at the school level.

Keywords: *Quality assurance, Quality systems, QA in engineering education, student feedback.*

INTRODUCTION

The quality assurance at Deakin University is monitored through the process of planning, decision-making, implementation and reporting quality issues based on student feedbacks, unit enhancement and staff peer to peer discussion. Within the School of Engineering, the School's two main operational committees until recently were the Teaching and Learning Committee and the Research Committee. The emphasis of this Quality Working Group (QWG) approach is to promote improvement of quality, not just to ensure quality is maintained. Consequently, shifting the emphasis from quality assurance to quality enhancement (QAA, 2008). Another important objective of the QWG is to provide a formal interface between stakeholder groups (students, industry advisory groups, schools reference group, university administration, employers, etc.) and the school teaching and learning committee in order to enhance teaching and learning quality within the school.

When identifying graduate attributes particularly for undergraduate engineering programs in Australia, the program accrediting body (EA) (EA, 2012) initiates a set of attribute elements mentioned in "Stage1 competencies and elements of competency". It states that one of the important engineering application ability is application of systematic engineering synthesis and design processes. Every unit outcomes in all engineering courses should meet the standards required by the newly introduced Tertiary Education Quality and Standards Agency (TEQSA, 2012) and Australian Qualifications Framework (AQF) to provide a high quality education to students. The focus of this paper outlines the activities planned by the engineering educational Quality Working Group and elaborates on quality assurance approaches and key strategies to be implemented by the working group to achieve the desired quality as well as efficacy of those recommendations/actions undertaken at the school level.

Engineering Educational Quality Working Group (QWG)

Author Arun Patil proposed that (Patil et al., 2012) the quality assurance processes in higher education can be carried out at different levels, such as; internal (school/department, faculty or university), external (professional bodies), national (national agencies) and regional or international (international agencies) . An initiative process of the learning and teaching in the School of Engineering at Deakin University is to form Engineering Educational Quality Working Group. The aim of QWG is to provide a focal point of learning and teaching quality and its assurance in the Undergraduate and Postgraduate engineering programs. In addition it builds Engineering programs to follow and maintain the Australian Qualifications Framework Standards.

The key objectives of QWG are:

- To create and facilitate strategic approaches for the improvement of quality of learning and teaching in the undergraduate and postgraduate Engineering programs through students feedback (SETU results).

- To monitor key indicators of learning and teaching quality in each and every engineering course units.
- To summarize feedback from stakeholders, educational partners, students and staff members and make recommendations to the learning and teaching committee for their review and adoption.

Structure and Fuction of QWG

The QWG role is to provide a summary of the findings/recommendations to the learning and teaching committee for discussion, endorsement and further action. The Engineering Education Quality Working Group members includes:

- Associate Head of School (Teaching & Learning)
- Course Director for the Bachelor of Engineering Courses
- Heads of Disciplines of Electrical, Civil, Mechanical and Mechatronics courses
- First Year Coordinator
- External member from other universities

The group conducts regular meeting and work on the set targets as planned and devised. The group discusses about the quality issues in learning and teaching, student satisfactory on unit learning outcomes, unit enhancement and staff development.

PLANS/ACTIVITIES

The QWG works on three main activities within the School of Engineering such as:

Face to face student feedback:

The School of Engineering collects and evaluates students feedback from various modes. One of such scheme is through face to face feedback. The feedback collected in these forums are collated and compiled by the learning and teaching committee which is utilized by the QWG for the further action. The students feedback comprised of various aspects of learning and teaching and assessment issues. The QWG proposes suggested recommendations to the learning and teaching committee which were then transformed into actions and communicate back to students with proposed actions.

Unit evaluation and enhancement data:

QWG also collects units data from the Students Evaluation of Teaching and Units (SETU) which is done centrally by the university. Feedback received from each unit is compiled and appropriate actions and recommendation are made.

Staff mentoring on learning and teaching:

Teaching staff for the units which have low student satisfactions are identified and appropriate support and feedback are provided. This approach is working very effectively and staff are appreciating the support and care given to them. The staff develop the skills to better deliver their units and learn to engage with the students better. Excellent learning and student engagement is a positive experience and also a result from quality teaching. Over many decades, researchers believe students will engage more deeply and learn more thoroughly when their teachers care about them to educate, learn, communicate and be innovative in the classroom. From the literature (Anderson, Johnson, & Milligan, 2000) it is clearly mentioned that academics need the perspectives of students to analyse their experience in practicing and learning a particular approach. It also helps teachers to understand the level of expectation of students in their area of expertise. A teacher must ensure that course design, program structure, teaching and learning assessment should help learners to learn.

Peer review of teaching is a well-established practice in many academic environments. In Australian universities, the aim of peer review teaching is to enhance learning and teaching. In peer reviewed teaching, staff members obtain an opportunity to share their professional responsibilities that enhance learning and teaching approaches. The benefits of peer reviewed teaching for individual staff members are shown below:

- Improving professional relationships with colleagues.
- Developing teaching practices from peer feedback.
- Sharing broader knowledge of curriculum and implementing new teaching ideas.
- Enhancing student assessment and learning outcomes.

CONCLUSION

From 2012 onwards the school has implemented a more holistic structure of quality and assurance. The school now has an overarching Board of Studies (BoS) committee responsible for final approvals of all school functions prior to submission to faculty and university committees. The learning and teaching committee is responsible for innovation and alignment of local, national, and international initiatives to the school. The integration of student feedback from various resources help to enhance the quality assurance process of academic programmes, which also provide valuable improvements for engineering classrooms, practical learning, design thinking in an engineering education environment.

The QWG aim is to enhance the quality of learning and teaching for all engineering programs in the School of Engineering at Deakin University. The engineering teaching staff at Deakin University seem to have an adequate understanding of quality assurance, which will help QWG to perform the future plan and activities mentioned above. This is encouraging to the School of Engineering, which will enhance student learning and staff teaching processes to better align with the learning and teaching model. The formation and activities of QWG in the School of Engineering at Deakin University is a key hub for all learning and teaching enhancement activities within the School to improve learning/teaching and assessment, student satisfaction and systems development.

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Managing knowledge in public - private partnerships for R&D centers

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ABSTRACT

The organizations from private sector are living into an era of innovation, innovation that can be enhanced through research inside academic sector. The European and national initiative is to foster collaboration between them and develop a climate of challenging both sectors pursuing innovation.
The paper is proposing a model of collaboration between a private organization from automotive industry and four layers of higher education. The academic side: bachelor, master and PhD students together with a PhD Adviser, is involved into a vivid bidirectional feedback with the private organization, creating a Research Group. The methodologies used during research consist of bibliographic research, observational research inside organization and interview technique. The research proves that existing models tend to fall off when faced with frequent changes but the proposed one can enrich academic and private results.
The main purpose of the model is to develop an efficient collaboration for R&D PPPs into creation of a Software platform that integrates the continuous improvement techniques inside projects, organizations and onto human resources.

Keywords: *R&D PPPs, collaborative model, automotive organization, academic sector.*

INTRODUCTION

The collaboration between public and private sector are called PPPs (Public Private Partnerships); PPPs fill a space between traditionally procured government projects and full privatization [1]. The term partnership covers a variety of concepts and practices and is used for describing a wide range of types of relationship in different circumstances and locations [2].

Horizon 2020 is the new European Union research strategy and one of its primary objectives is the collaboration with private sector for funding the most preeminent domains of research. It is estimated that across of seven years the UE initiative will gather 10 billion EUR from the private sector, most being aimed towards Common Technologies Initiatives (CTI [3]. The national initiative, CDI2014- 2020 (Research, technological development and innovation) is mapped on the European program and supports as well the PPPs by budgeting 50% [4] of programs founding for projects with private support on the defined lead axes. The list of intelligent specialization as defined by the CDI2014-2020 consists of (enumeration is exemplificative [5]): bio resources for the food sector, bio technologies for medical field, cybernetic security, the internet of future, Big Data, Extreme Light Infrastructure - the Laser project from Magurele [6], ICT; *Technologies, Instruments and methods for software developments* is the domain that is further analyzed in this paper.

It was observed into the CDI 2014-2020 development that it is a low degree of scientific paper collaboration between private and public sector [7], which is further reflected into a parallel, non-productive approach on the research and development area. The main purpose of this paper is to develop a model that will offer an efficient collaboration for PPPs inside automotive R&D centers.

TRADITIONAL MANAGEMENT MODELS

Traditional management models can be classified as: “top-down”, where main directions and objectives come from the top and requirements are clearly set to each participant; “bottom-up”, developed as an improvement for the previous method, focuses on participation and motivation from team members on all stages and transparency of information (schedule, budget)[8].

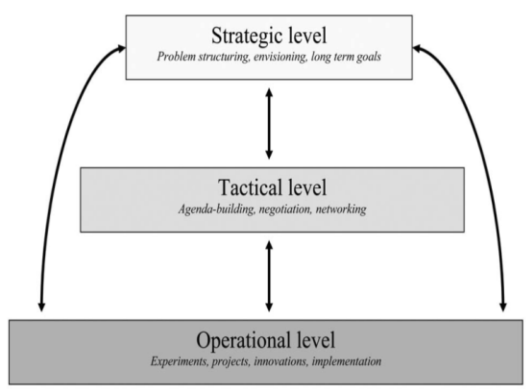

Figure 1: Top-Down and Bottom-Up strategies, Source [8]

Weaknesses have been identified at both of them (overcrowding an individual / lack of control, lack of innovation / unnecessary proposals) and hybrid models emerged.

One of them is the "Transition Management", which focuses on sustainable development by using "innovative bottom-up developments in a more strategic way"[9]; but is tailored to be a model of governance and aims for long-term change, not one that enhances innovation and creativity, needed in the academic and R&D field alike.

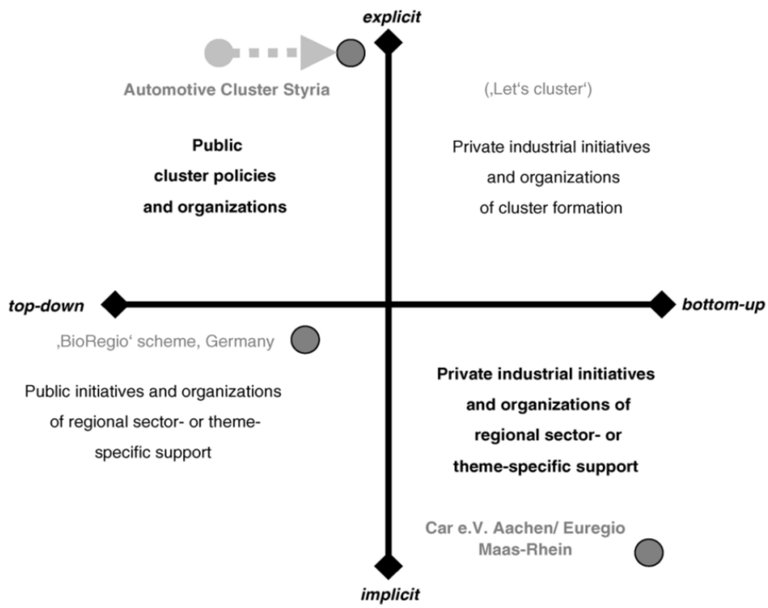

Figure 2: Updated top-down model for PPPs, Source "Categories of institutionalized cluster promotion" [10]

Other proposed models for PPPs target innovation, like the "Institutionalized Innovative Cluster" that adds to the top-down/ bottom-up view the explicit-implicit factor [10] for expanding initiative promoters, but notes the possible rivalry emergence between private and public sector.

MODEL OF COLLABORATION

The model (Figure 3) was conceived with the focus on "continuous collaboration", a goal that can only be reached in a nonlinear, non-hierarchical environment. This has been observed in the Leadership/ Management field, where the top-down approach is decreasing [11] and giving more space to the new collaborative view, suited for the fast-paced and complex environment that exist today.

This model is an applicative approach of multi team system (MTS) where it has been observed that effective collaboration is not something granted [12]. It is necessary for the inner circles to pave the gaps and to offer the guidance inside the teams.

The academic side: bachelor, master and PhD students together with a PhD Adviser, is involved into a continuous bidirectional feedback (inner and outer circler alike) with the private organization, creating a Research Group. Modularity (from Model View to Specific Project View) is also an advantage of this structure, being possible to add new persons regarding the project needs in any layer.

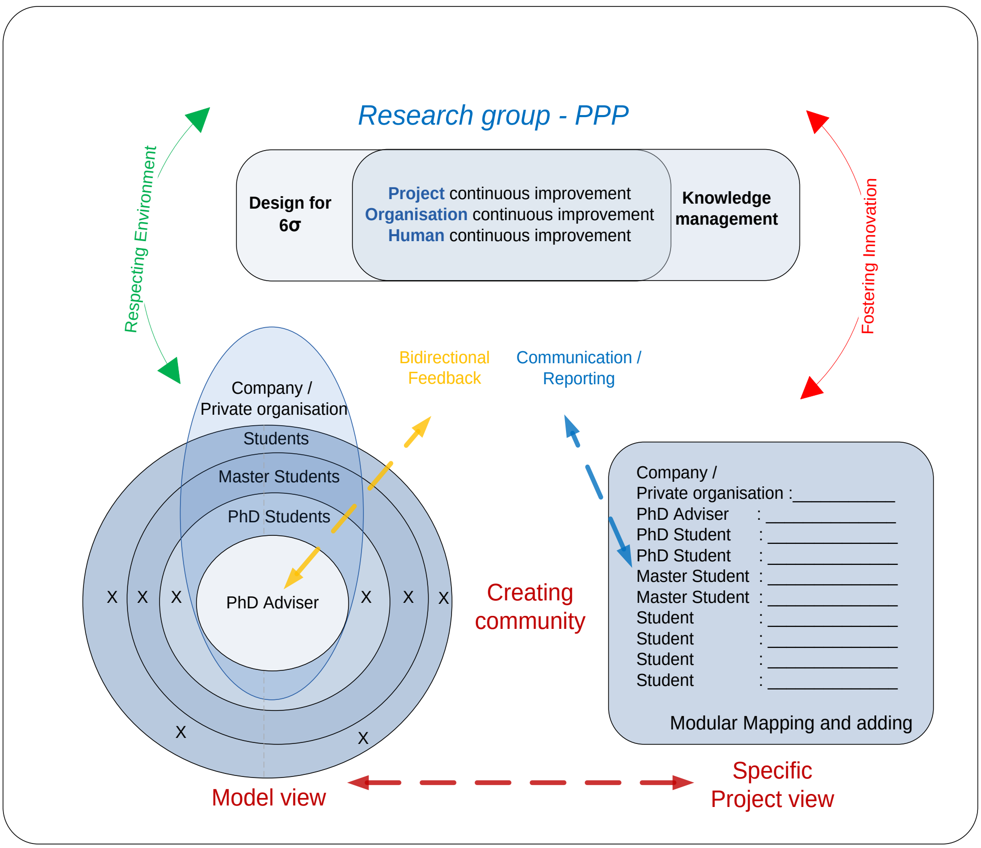

Figure 3: Model of public – private partnership in R&D centers

The model limit unnecessary communication (spamming), issues will travel only until the layer where they will find its solution, without further escalating to other involved parties. The PhD Students will function as a middle interface for effective communication and reporting for inner and outer layers.

The creativity will not be limited like in a top-down management / leadership model and everyone will have the equal opportunity to enrich the project with ideas and enable a multicultural community.

The architecture of project that is developed through the previously described collaboration must be structure in a way that offers high flexibility and opportunity to divide big phases of development into small activities. The desired flexibility is the possibility to add or remove functionalities from the project with few amounts of work and with small or no changes into the other modules, modularity being the key objective.

PLATFORM ARHITECTURE

In order to prove the efficiency of the proposed model, a complex project was started in collaboration with Continental and LBUS. The project consists of a core software platform with different functionalities that can improve the performance of an organization: a knowledge management system, a quality approach for R&D and an intellectual capital measurement system.

The modularity of the model described earlier is mapped perfectly on this kind of projects and well suited for complex activities with requirements / clients demands that are in a constant change.

The architecture of Intellectual Capital Management Platform (ICM) is structured into two layers, the Core layer and the application layer. Into the core layer are implemented all the functionalities that are common for the entire platform like the connection, storage and manage of databases. Also the interfaces with the tools that are already used inside organization will be implemented into the core layer, in order to load data for processing in an automatic way.

The application layer is divided into three approaches that are focused on: project continuous improvement, human continuous improvement and organization continuous improvement (Figure 4). This structure will make possible the management of activities during development to be divided between 2 and 4 teams; one team will be responsible for the core part and the others for the application layer.

The project continuous improvement is implemented through a model that integrates the knowledge management techniques and Design for Six Sigma methods; DFSS is a structured method developing new products, align with needs of customers involved during early stages of product development [13]. The model has as main purpose the prevention of the firefighting syndrome, the increase of product quality and customer satisfaction. The software platform is offering a guideline, a tracking of the QEC model and also a way of handling of knowledge inside a DFSS project.

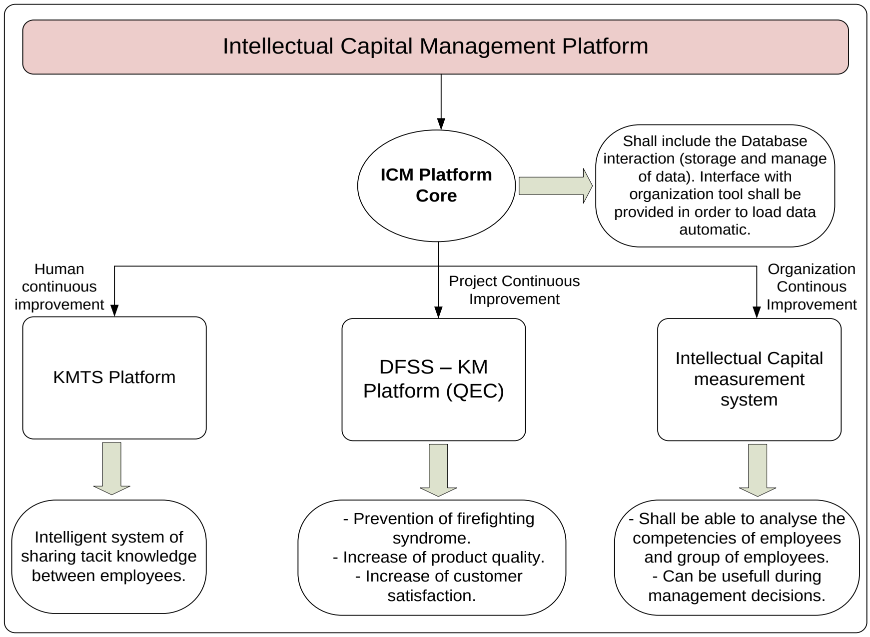

Figure 4: ICM Software Platform

Knowledge processes are non-stationary and in today accelerate rhythm of doing business all KM systems are in danger of becoming obsolete before the benefits will appear the paradox of a game with its rule in a continuous shifting. A corrective action can be the creation of a flexible KMTS system of sharing tacit knowledge between employees. Here everyone can be an agent of change and propose new models so the KMTS model will shift in the same phase as the corporations shift.

The development of the organizations depends greatly on harvesting the knowledge, being important to learn from previous mistakes and to capitalize this asset [14]. Intellectual capital measurement is a system that is able to analyze the competencies of employee and to make correlations between the needs of the project team or department. The results will measure the knowledge inside a team and will support the management decisions.

AUTOMOTIVE ORGANISATION COLLABORATION PARADIGM

This study presents a best practice example: Continental Automotive Systems Sibiu – Lucian Blaga University of Sibiu Partnership, focusing on the both-sided, successful collaboration between these two entities. Continental Automotive Systems Sibiu could be an example of applying our R&D PPP model due to the fact that it already employs students, master graduates and PhD attendees and also has a long lasting relation with LBUS, “Lucian Blaga University of Sibiu”. This year, 2015, marked the ten year anniversary of this PPP [15], with the contract being prolonged from 2013, and new investment paths on continuous development were opened for fostering innovation and promoting excellence in teaching and research.

Below, a selected overview of the collaborative activities between Continental Automotive Systems Sibiu and Lucian Blaga University of Sibiu (for collaboration activities before 2012 details can be found at Burdusel, Balan and Plohod study [16]) organized into four distinct categories, are detailed:

1. *Activities* include
- Job shops: Promoting employment opportunities and recruiting suitable candidates for available jobs or internships (yearly participation, 3rd edition 2015)
- "Open doors" activities: LBUS students visit the Conti location (organized yearly during spring time)
- Student events: Organizing student events in order to offer them the opportunity to openly address Conti specialists (Technical & HR): Breakfast for Brains (4 editions since 2013), Conti Day (1 edition in 2014) etc
- Contests: Hardware, software and mechanical engineering student competitions; Conti Mechanical Design Contest (500 euro prizes)

2. *Programs* consist of
- Student Summer Internship Program: Organizing a 3 months paid internship program for students during the summer time, targeting over 60 students yearly
- Graduation Diploma Project: LBUS students are being supported by Conti specialists in the development of the structure and implementation of the practical part of the Diploma Project, targeting about 15 students each year

3. *Curriculum design and development* on
- Courses: 15 courses included in the mandatory curriculum - delivered by Continental Sibiu specialists focusing on: Microcontrollers in Automotive, Electronics. Hardware in Automotive, Embedded Systems, CATIA V5 seminar, Dedicated Systems Applications
- Graduates: an increasing performance with each edition of the courses (in 2010 the average number of graduates was 30 students, in 2014 the number is higher, at 40 students)

4. *Frame contract* based on
- Conti info point: A permanent info stand within the university where students can access updated information about Conti programs
- Conferences: Participation to an average number of 5 local, national and international conferences by scientific presentations each year
- Sponsorships: Sponsor different events each year according to the strategy of Conti and LBUS (e.g. academic competitions, conferences, events etc)
- Student Scholarships: Grant scholarships to best performing students (yearly a number of 9 students of different profiles are targeted for their outstanding results)

-Master scholarships: Supporting Conti employees in continuing education on Master study programmes at LBUS, yearly with a target of 30 employees

-PhD scholarships: 2 PhD students received study funding, one from 2014, and one from 2009

-Laboratories: Branding and equipping laboratories in Conti style. Courses are developed within these laboratories, currently 2 fully equipped laboratories and other 2 in the process of being updated; 2014 marked the finalization of an Electronic Conti Lab inside LBUS, valued over 35.000 EUR [15]

-Main hallway: Branding and renovating the main hallway of the Engineering Faculty in Conti style

The collaboration can be enhanced with experience-exchange workshops and seminars managed by both teams, Continental and LBUS, where best practices and practical examples are held regularly for developing students' competencies and prepare them for the career path.

CONCLUSION AND FURTHER APPLICABLE WORK

The classic approaches are limiting the innovation in both academic and private organizations research and development. Therefore, a new model is needed in order to ensure further improvements and collaboration, a model aligned to European and national research strategy 2014-2020.

The proposed model is assuring a continuous flow of communication between all actors involved in the process, being closer to the real, natural life models.

Further upgrades of the module will be based on the financial collaboration side: accessing academic grants, European / national research funding programs and private, organization based, credit lines for all the actors involved.

The proposed model of collaboration is currently being used on the development of the "Intellectual Resource Management Platform" and will be enhanced with fine tunings as the work proceeds, based on the defined targets and results. These findings will be documented and detailed in a forthcoming research study.

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Quality Management Principles in the University-Industry Partnership

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ABSTRACT

Purpose of the work
In the context of an intensified and successful cooperation between Continental Automotive Systems SRL and Lucian Blaga University of Sibiu, Romania, the most recent initiative is to undertake a research investigation meant to examine the collaboration between higher education and business and identify new means to increase the efficiency of their partnership taking into account the present challenges addressing both academia and industry, as well as facilitating the transition from the former to the latter in the context of the labour market demands.
Methodology
The study will provide an analysis of the public-private partnership based on a recent case study endorsed by a thorough theoretical framework. In this respect, an anonymous questionnaire was addressed to two target groups: employees and team/department leaders at Continental Automotive Systems SRL Sibiu.
Important findings
The results of the case study will provide relevant feedback about the ability of new employees to integrate on the labour market and make full use of the abilities and competencies developed and trained throughout their academic education. Since the present study is a follow up of previous research projects, the case study will now focus on "non-technical talents", therefore the target group of the questionnaire is represented by employees and team leaders from the following departments: translation services, human resources, purchasing, logistics, finance and controlling.
Conclusions that identify implications for future practice and/or policy and key "Take Home Messages"
The present paper highlights the relevance of each component of the knowledge triangle – education, research, innovation – as a means to prevent and overcome crisis evinced as: unemployment in addition to graduates` inability to integrate or

adapt to the requirements of business community, labour market mobility and financial instability, economic competitiveness.

Keywords: *non-technical talents; knowledge triangle; academia-industry partnership*

SETTING THE CONTEXT

"As the global knowledge economy grows, the need for greater synergies between education, science and business becomes even more urgent. Whether we work in an EU institution, a university, a research institute, a company, or a government agency, we have all a role to play in building a more competitive, sustainable and cohesive Europe." (Navracsics, 2015) In a very recent speech addressed on the occasion of the 2015 Science Business Horizon 2020 Conference, EU Commisssioner for Education, Culture, Youth and Sport, Tibor Navracsics reinforced the connection among the components of the knowledge triangle. Furthermore, the EU Commissioner emphasizes the commitment to strengthening partnerships between universities and the world of work and promoting culture as a catalyst for innovation, economic growth and new jobs, illustrated in a number of key speeches addressed mainly on the occasion of Conference opening ceremonies.

The present study, undertaken by a collaborative team representing both university and industry, aims to provide a recent, fair, well-documented and balanced perspective – the educators and employers alike – on the right mix of skills, attitudes and values – i.e. key and transversal competencies – for better employability and facilitating the transition from the curriculum-based learning institution to the task-oriented learning organization. In the work-based environment, core competencies evince the employee`s expertise in a specific area acquired throughout formal education, whereas transversal competencies, also referred to as "21st century skills", enable the employee to "successfully navigate the changing global landscape and … to meet the challenges of technological advancement and intercultural communication." (Unesco, 2015)

Further to previous studies jointly developed by Lucian Blaga University of Sibiu and Continental Automotive Systems SRL Sibiu endorsing the successful collaboration between academic and business organizations, the paper aims to raise awareness – of scholars, practitioners and community – and enhance understanding of the vital necessity to empower graduates with "life skills" and transversal competencies hence to facilitate their employability and integration on the labor market. The connection and interaction of the triad - higher education institutions, business and community - has become a hallmark of the knowledge cycle paradigm, especially acute at a time of changing context: legislative, socio-cultural, economic and scientific.

Knowledge creation and dissemination are essential components of the learning organization in the knowledge-based society and economy. Now, more than ever, the mission of universities is to act as knowledge brokers and consider thoroughly the demands of all stakeholders. According to the European Commission 2012

Communication on Rethinking Education, "investment in education and training for skills development is essential to boost growth and competitiveness: skills determine Europe`s capacity to increase productivity. In the long term, skills can trigger innovation and growth, move production up the value chain, stimulate the concentration of higher level skills in the EU and shape the future labour market." (European Commission, 2012)
Summing up, the process of rethinking education is designed in a socio-economic context; thus adapting education to the needs of the workplace needs requires: delivering the right skills of employment in addition to new ways of teaching and learning

The goal of the present study is twofold: on the one hand, it will highlight the successful partnership between Lucian Blaga University of Sibiu and Continental Automotive Systems Sibiu as an example of best practice in university – industry collaboration given the interdependence of the higher education and economic sectors; on the other hand, it urges the reader to balance the study in humanities and sciences (Nussbaum, 2010).

The future of higher education is linked and even bound by economic crises or progress, especially in terms of funding, contribution to economic growth and community outreach; moreover, education has still untapped potential to shape and design the future. It is in this context that the present study will argue for the necessity of training "non-technical talents" supported by a case study.

KNOWLEDGE CYCLE PARADIGM: UNIVERSITY – COMMUNITY – BUSINESS

Nowadays, higher education institutions – notwithstanding the multiple challenges they have to cope with and successfully overcome, operating in an economic and legal context marked by unpredictability and subject to increasing internal and international competition – act as knowledge brokers in a new paradigm of learning and innovation. Universities not only create knowledge, they should also connect their research findings to business organizations, transfer technology advancement to society development and evince an active engagement in the life of their community. However, let us not consider universities as mere consultants to companies, instead a more sustainable approach points out to a shift from a "transactional" to a "transformational" intervention according to the EU Practical Guide *Connecting Universities to Regional Growth. "*In meeting major societal challenges, which have both a global and local dimension, universities and other higher education institutions have a key role to play in knowledge creation and its translation into innovative products and public and private services, a process that can engage the creative arts and social sciences as well as scientists and technologists." (Goddard, 2011)

As mentioned in the rationale of this study, the major goal is to call attention to the role of social sciences and humanities in both industrial and academic organizations – especially at a time when triggered by utilitarian, pragmatic, market-oriented considerations and the need to overcome and survive in the aftermath of the recent economic and financial crisis, whose effects are still with us – in addition to the acute need of reconciling the divide between soft and hard sciences.

According to the 2011 Romanian Education Law, the major *vision* of the national education system is to promote "an education focused on values, creativity […] fundamental knowledge as well as applied knowledge, competencies and skills in view of further use in society and profession" as well as undertaking the *mission* of training "by means of education, the mental infrastructure of Romanian society, in keeping with the new requirements entailed by Romania`s recent EU membership accompanied by globalization, as well as the sustainable creation of highly competitive national human resource, able to perform efficiently in the current and future society." (Monitorul Oficial, 2011) Professional and transversal competencies, in addition to the eight key competences for lifelong learning (European Parliament, 2006) enable graduates to evince an integrative approach to the assigned professional tasks, to communicate their ideas effectively, as well as their willingness and propensity to relate and perform properly in a team. Furthermore, the 2009 Leuven Communique (The Bologna Process 2020) highlighted the relevance of employability and the urgent need for intertwining education - research – innovation as main priorities for the second decade subsequent to the adoption of the Bologna Process.

Based on the knowledge cycle paradigm that brings to the forefront the interdependence of the three stakeholders: university – community – business, as well as Daniel Smihula`s theory that "technological revolutions are the main engine of economic development and hence long-term economic cycles are dependent on these waves of technological innovation." (Smihula, 2011) Nowadays, in the aftermath of the recent economic crisis with global and multiple consequences, key decision and policy makers should be aware that – despite ineluctable financial considerations or constraints alongside the pressure for economic growth in a society characterized by profitability and resource efficiency, as well as high performance and measurable impact in terms of academic output – the contribution of each academic discipline, area or researcher is essential for the development of society.

CASE STUDY

In the context of an intensified and successful cooperation between Continental Automotive Systems SRL and Lucian Blaga University of Sibiu, Romania, the authors of the present study have undertaken a new scientific project endorsed by a questionnaire addressed Continental employees. The aim of this anonymous survey is to analyze, based on a case study endorsed by a thorough theoretical framework, the cooperation between the higher education institution and the industrial organization, i.e. public-private partnership, from an employer`s perspective in accordance with the requirements of the labour market. The results of the case study provide relevant feedback about the ability of new employees to integrate on the labour market and make full use of the abilities and competencies developed and trained throughout their academic education. Since the present paper follows up on previous research projects, the case study will now focus on "non-technical talents", therefore the target group of the questionnaire is represented by new entries to the company and university graduates, as well as team leaders from the following departments: translation services, human resources, purchasing, logistics, finance and controlling.

Here are the results of the questionnaire addressed to new entries and former university graduates:

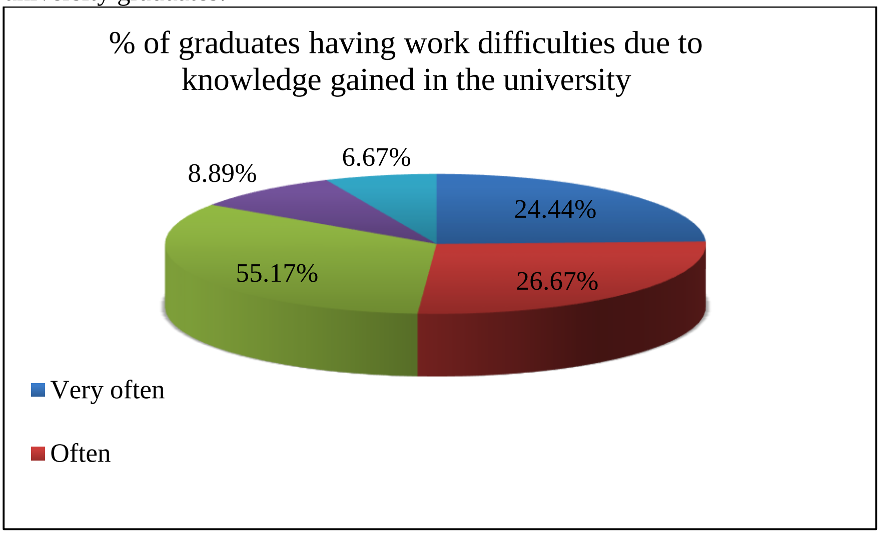

Figure 1: Percentage of graduates having work difficulties due to knowledge gained in the university

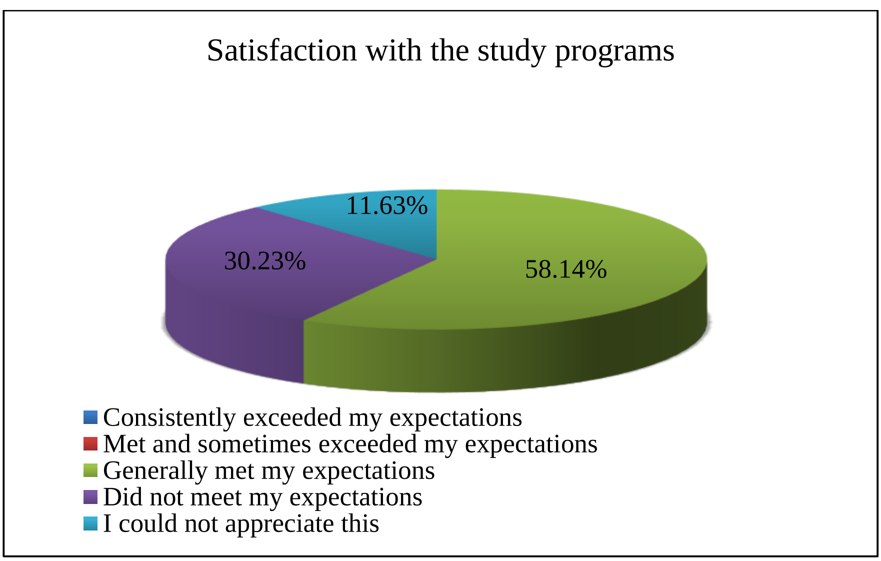

Figure 2: Satisfaction with the study programs

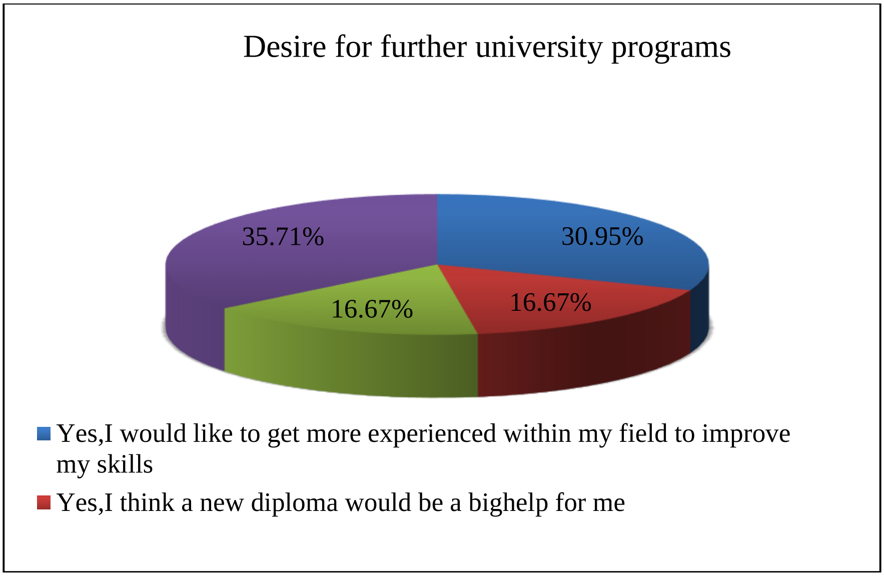

Figure 3: Desire for future university programs

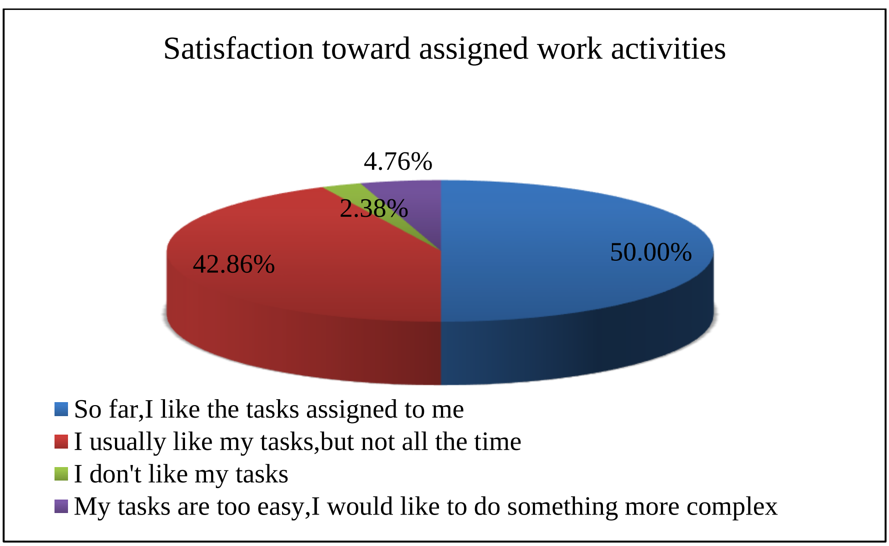

Figure 4: Satisfaction towards assigned work activities

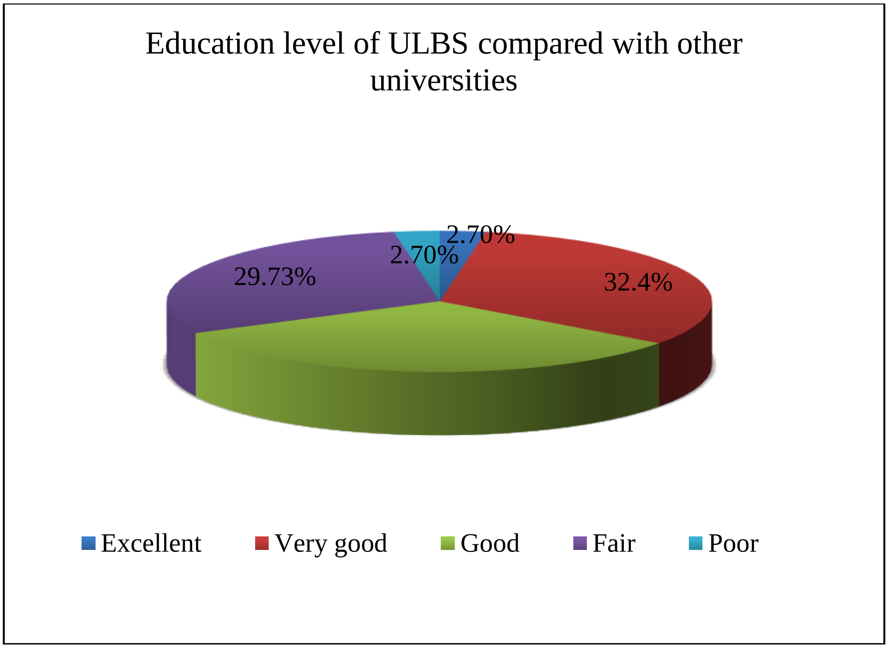

Figure 5: Education level of ULBS compared with other universities

Secondly, the questionnaire addressed to team and department leaders shows the following results:

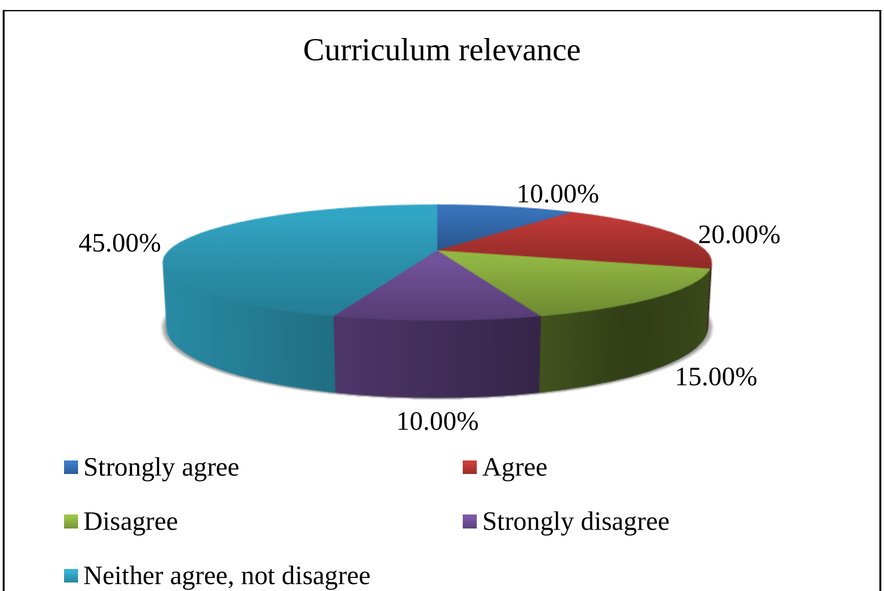

Figure 6: Curriculum relevance

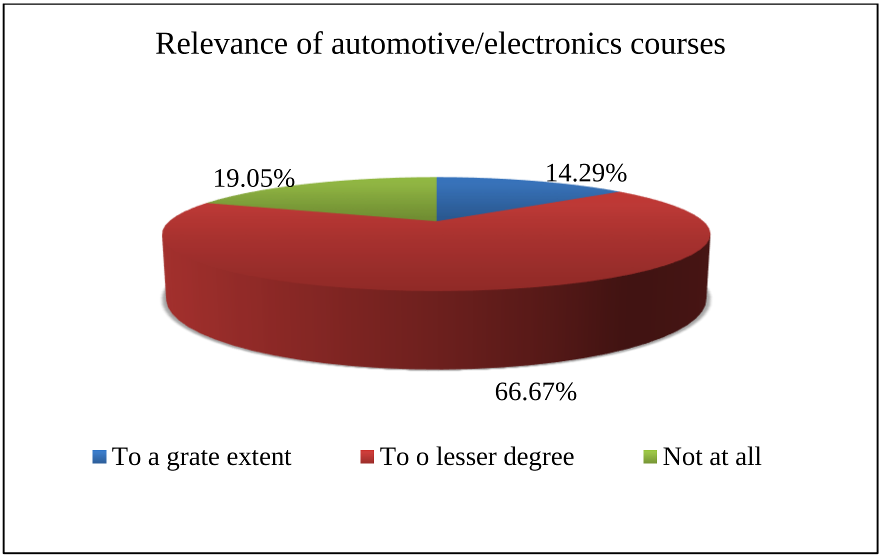

Figure 7: Relevance of automotive/electronics courses

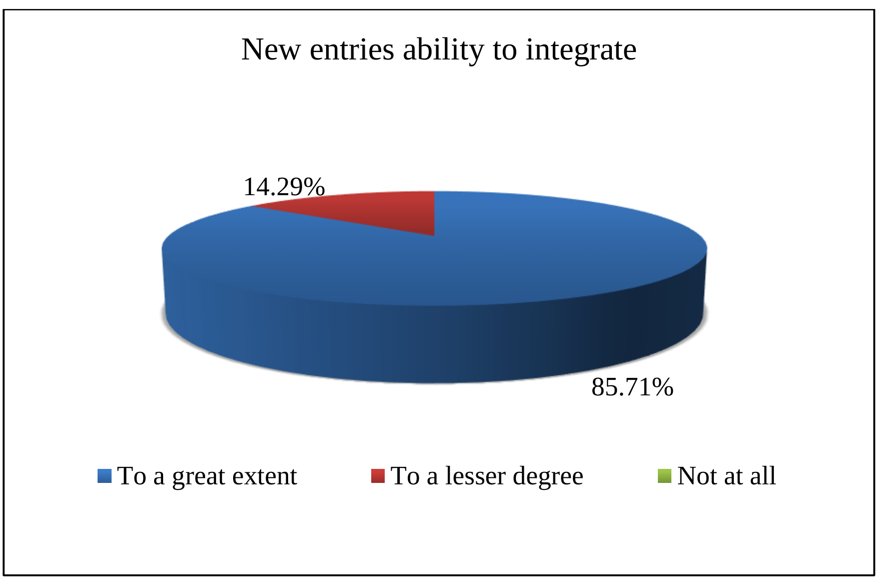

Figure 8: New entries ability to integrate

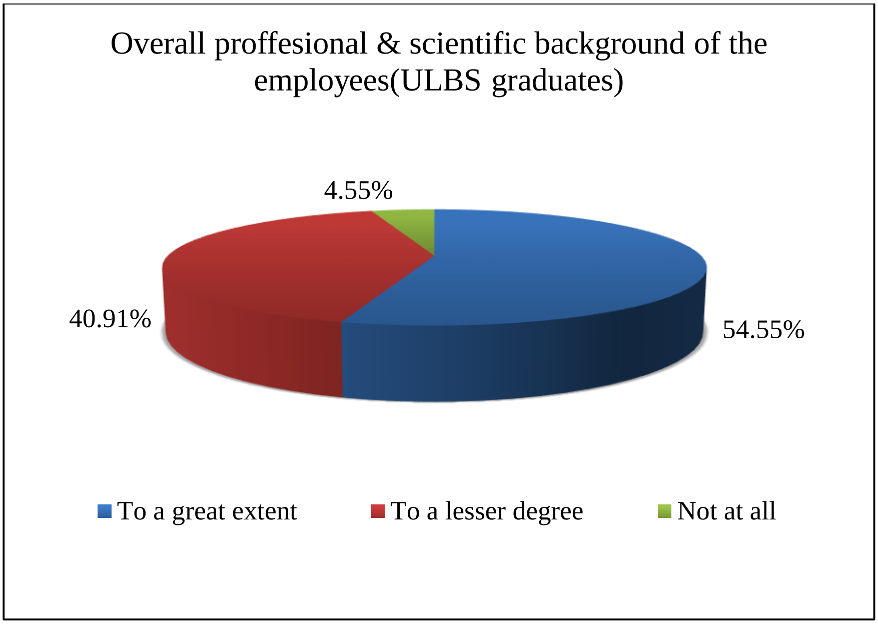

Figure 9: Overall professional and scientific background of the employees (ULBS graduates)

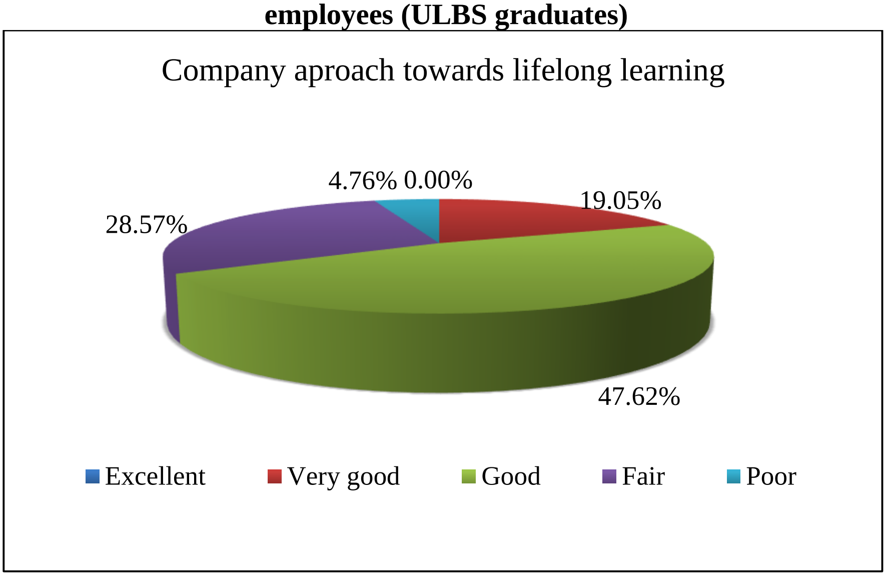

Figure 10: Company approach towards lifelong learning

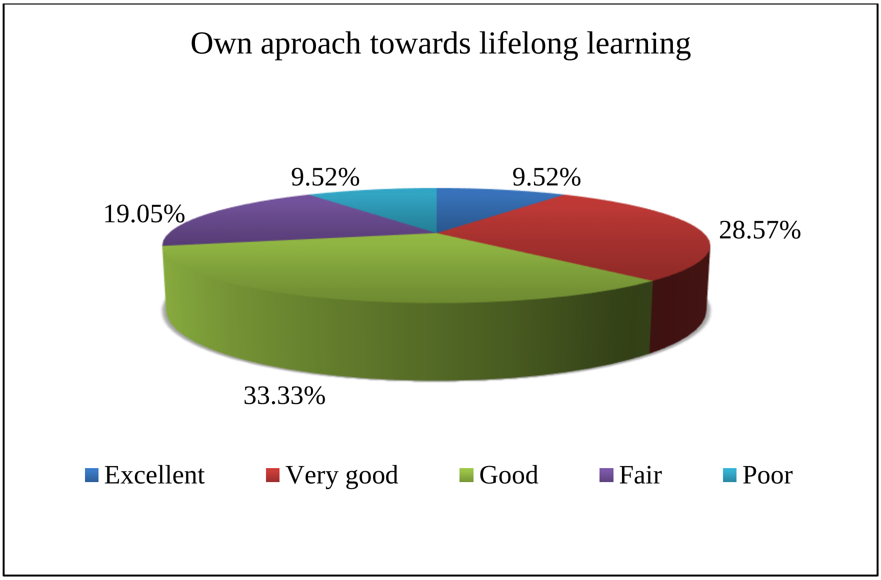

Figure 11: Own approach towards lifelong learning

KEY FINDINGS AND RECOMMENDATIONS

European Commission 2012 *Communication on Rethinking Education* points out that “European education and training systems continue to fall short in providing the right skills for employability, and are not working adequately with business or employers to bring the learning experience closer to the reality of the working environment.” (European Commission, 2012)

The survey results show that the employers` perspective endorses the graduates` view regarding the gap between theoretical knowledge and work-related assignments, pointing out to the fact that their ability to apply theoretical knowledge does not fully meet the expectations of their team leaders. Mention should be made though that practical experience made a relevant difference in the case of former university graduates who benefited from the Conti internship program, and later became new entries to the company. Internship has complex, long-term and multiple benefits for both employers and employees as it proves to be an efficient tool in facilitating a smooth integration of new entries to their assigned team and tasks.

Furthermore, in their capacity as company representatives, team leaders strongly encourage and support lifelong learning and self-study in addition to technical and soft skills trainings provided by the company to all employees; besides, employers place a great emphasis on verbal and communication skills and recommend that such transversal competencies need to be improved by university graduates.

Effective communication has come to be considered by employers as a top-ranking criterion in the recruitment process. „The main aspects that employers are concerned about regarding a university graduate have little connection with his or her academic studies. In a hierarchy of ‚things'employers look for in a graduate, the first four positions are poorly connected with the academic characteristics: the graduate`s ability to work in a team, to organize his or her work, his or her punctuality, morality and communication skills – with peers, superiors, customers, etc." (ARACIS, 2009) Not only is communication a key competence for employability but it is also an essential characteristic of an „effective teacher" as mentioned in the ARACIS Report on *The State of Quality in Romanian Higher Education – Quality Barometer 2010:* "In the students` opinion, communication and dialogue with students, professional qualities and the ability to explain represent, in this order, the basic qualities of a 'good teacher'. Thus, the pedagogical abilities are emphasized, namely the *trainer* abilities (the capacity to communicate and explain), and the abilities of a good professional in the field, only come next." (ARACIS, 2010)

The graduates` perspective also emphasizes the increasing need for improving foreign language skills in addition to a selection of the following courses that have proved relevant in the working context: communication, cultural management, translation, marketing, accounting, economics, human resources, business English. The questionnaire results identified and highlighted a selection of courses or competencies that would have been helpful in fulfilling the professional tasks assigned, such as: practical courses, foreign languages for specific purposes, logistics, project management, time management, problem solving, strategic planning, leadership, presentation skills, ethics and deontology, communication and negotiation.

To conclude, it is worth mentioning that employability is a combination of three major factors: "personal (personality, network, social background, special talent, etc), acquired in education (knowledge, know-how, etc) and external (labour market)." Hence, employability is a complex concept and it refers to "the ability to be employed, which requires some knowledge (know), skills (know how) and attitudes (how). A particular combination of these three types of factors makes a successful professional." Furthermore, "employability can be defined from the point of view of the individual (professional, job seeker), from the point of view of higher education institutions and from the point of view of employers." (EURASHE, 2013)

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"These competencies encompass a range of non-traditional ideas, including: innovative thinking, creativity, adaptability, respect, global awareness and communication."

European Commission 2012 *Communication on Rethinking Education*, p. 2, retrieved 20 May 2015 from https://ec.europa.eu/digital-agenda/en/news/communication-rethinking-education

EU Practical Guide *Connecting Universities to Regional Growth* (September 2011) prepared by Professor John Goddard commissioned by DG Regional Policy (European Commission), pp. 3, 10-11

Legea 1/2011 Legea Educatiei Nationale – Legea Invatamantului publicata in Monitorul Oficial 18/2011 din 10.01.2011; art. 2(1) and art. 2(2)

Recommendation 2006/962/EC of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning [Official Journal L 394 of 30.12.2006]

Note: the eight key competences are: communication in the mother tongue, communication in foreign languages, mathematical competence and basic competences in science and technology, digital competence, learning to learn, social and civic competences, sense of initiative and entrepreneurship, cultural awareness and expression

The Bologna Process 2020 – The European Higher Education Area in the new decade: "Communique on the Conference of European Ministers Responsible for Higher Education, Leuven and Louvain-la-Neuve, 28-29 April 2009

Note: here are the priorities for the Bologna Process 2020: providing equal opportunities to quality education, increasing participation in lifelong learning, promoting employability, developing student-centred learning outcomes and teaching missions, intertwining education, research and innovation, opening higher education institutions to the international fora, increasing opportunities for and quality of mobility, improving data collection, developing multidimensional transparency tools , guaranteeing funding

Daniel Smihula, *Long Waves of Technological Changes* (Studia Politica Slovaca), Issue 2, pp. 50-68, 2011

Note: this is a follow up of the author`s previous article "The Waves of the Technological Innovations of the Modern Age and the Present Crisis" (2009). Based on the Kondratiev wave theory (long-economic cycle; including three phases: expansion, stagnation, recession) he developed a new approach modern technological waves: financial-agricultural revolution (1600-1780), industrial revolution (1780-1880), technical (1880-1940), scientific-technical revolution (1940-1985), information

ARACIS Report on *Statistical Distribution, interpretations and options on The State of Quality in Romanian Higher Education – Quality Barometer 2009*, p.14

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EURASHE Initial Study on Employability Among Professional Higher Education Graduates in Europe, Study undertaken on the initiative of EURASHE`s Working Group 6 on Employability and Lifelong Learning, project funded with support from the European Union (2014), pp. 1-2

Student Career Management – Private and Public Sector Involvement

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ABSTRACT

The need of high level prepared students into the private sector is continuously increasing because of the raised innovation level requested by market. In this case study, experts were involved from the private sector in collaboration with the academic sector for a career management project initiated for students; the monitored KPIs had a positive trend.
The purpose of the paper is to analyze and show the results of a project with big impact on the education of students from Romania and on the collaboration between the private and public sector. A model of career management is proposed, in which the knowledge is mobilized into a spiral of education levels with influence from the public sector, the private sector and the government. The positive influence of private sector it is highlighted and it is advised to introduce the management of career into student's education.

***Keywords**: education, career management, private sector, private-public collaboration, knowledge mobilization.*

INTRODUCTION

Work has always been an inseparable part of human activity and working careers can be understood in many ways [1]. Private sector and academic sector are in an institutional conflict based on the reason that the theoretical aspects are not possible to be transposed into practice [2]. The career literature has many researches which can be found inside, but also outside of the career management system found in organizations [3]. Gangl argued many young workers have difficulties entering a sustainable working career, as they attempt to build their personal lives and work life identities [4].

Today's unpredictable employment environment and frequent transformations in work organizations cause uncertainty, anxiety, stress and symptoms of depression [5]. For example in Europe, depression has become the major reason for work disability pensions [6]. Any experience in the organizations brings a positive attitude on the students in their employment process in the private sector or entrepreneurship [7]. Structured work experience has clear, positive effects on the ability of graduates to secure employment in "graduate level" jobs within six months of graduation [8].

The older organizations have their strong point in the human resources, but they also increasingly use more traditional methods of career management (e.g. strategy, training, integration, paternalism) and the new trends in the organizations should focus on the talent management [9]. It was found that are four crucial dimensions to successful career support for new academics: managing expectations, career management, mentoring and professional development [10].

The reason of this study regards the need of bringing up on the labor market for students from different domains to an increased percent of hiring. One of the challenges of linking results of academic research to industry is the tacit nature of knowledge [11]. The transition of academic researchers to private sector employment is increasingly [12]; this gives a motivation of exploring the partnership of public and academic sector into improving the education of student's career management.

Students of the superior level (master/PhD) are easily integrated on the private sector (industry/entrepreneurship) if their individual's career mobility depends on their research field [13].

The impact of research is on both on private and academic sector, the private sector needs prepared employees and academic sector has as main objective the employment of students. The literature is focusing on what a person should do for the management of career. This paper is focusing on how the stakeholders are influencing the career of a student and how this can be enhanced; the stakeholders are the public sector, the private sector and the govenment.

Today, the trend of society is focus to creation of knowledge. On the one hand, new forms of knowledge production are emerging, and on the other, both science and society are experiencing a rapid acceleration in new forms of knowledge utilization [14]. In this fight for bringing more students in the workplaces, the key is Knowledge Mobilization which has influences from private sector, academic sector and government.

KNOWLEDGE MOBILIZATION

The knowledge mobilization is the process that links the academic research (social science and humanities and other knowledge) with the non-academic decision makers, in such away this researches brings decisions about public strategy and professional practice. Based on that, the social innovation is the results of this process. [15]

The knowledge mobilization has various terms, among organizations, which has a small difference in meaning, such as: knowledge transfer, knowledge translation, knowledge exchange, knowledge transfer & exchange, knowledge translation and transfer, knowledge mobilization, and knowledge integration.

Knowledge Mobilization "is the open process of putting available knowledge into active service to benefit not just one particular corporate or organizational structure, but for the greater benefit of all in society"[15].

The focus of the private – academic sectors partnership is on the methods of mobilizing knowledge to create innovation. In 2008, Beth Levin create a tripartite frame and one of this questions is applicable to the study case from this paper because is based on finding the process which make available the knowledge to all involved students. Another applicable question is about how create an easily interaction and feedback between the students and influential sectors [16].

CASE STUDY

This paper is presenting and analyzing a project that has as main objective the education of students regarding management of career.

The case study is applied to education from Romania, the project has as main objective the integration of students on the labor market in relevant professional fields of the studied specialization; this was done by developing students work skills as a result of participation into a counseling and guidance integrative program.

Some prestigious universities from Romania are involved into the project; the partners are listed into table 1.

Table 1. Main project Partners

Type	Name
Solicitant	West University of Timisoara (UVT)
Partner 1	SC Gi Group Staffing Company SRL
Partner 2	„Lucian Blaga" University of Sibiu (ULBS)
Partner 3	University from Oradea
Partner 4	University from Bucharest
Partner 5	Academy of Economic Studies from Bucharest
Partner 6	„Alexandru Ioan Cuza" University of Iași
Partner 7	„Constantin Brâncuși" University of Târgu-Jiu

The paper will focus on the Lucian Blaga University involvement into the counseling and guidance of students, together with the partners from private sector. The project took place under the name: "Today's students, tomorrow's professionals”. This project aims to increase access to labor market opportunities for 800 students, from the target group of 1,650,000 persons.

Students involved into the project came from different specialization fields, the biggest percentage came from Engineering sector, being followed closely by the Business and Economics sector. The distribution of students on different domains is exposed in figure 1.

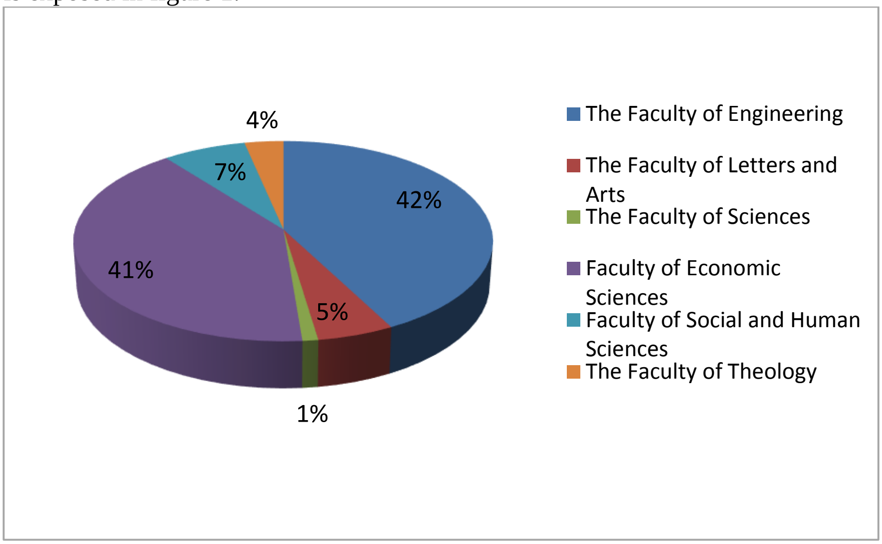

Figure 1. Distribution of students in Faculties

The indicators of project are:

- 800 beneficiaries students career counseling services;
- 16 Career Management Conferences;
- 35 companies study visit;
- 15 partnerships with employers, to share experience and best practices;

During the project the students had the opportunity to visit the companies and discuss with employees of the company, to gain some knowledge on the companies and the work itself.

Private sector has a major contribution on the knowledge mobilization in this project through the company visits, organizations speaches etc. The number of students that experienced a study company visit is presented in figure 2.

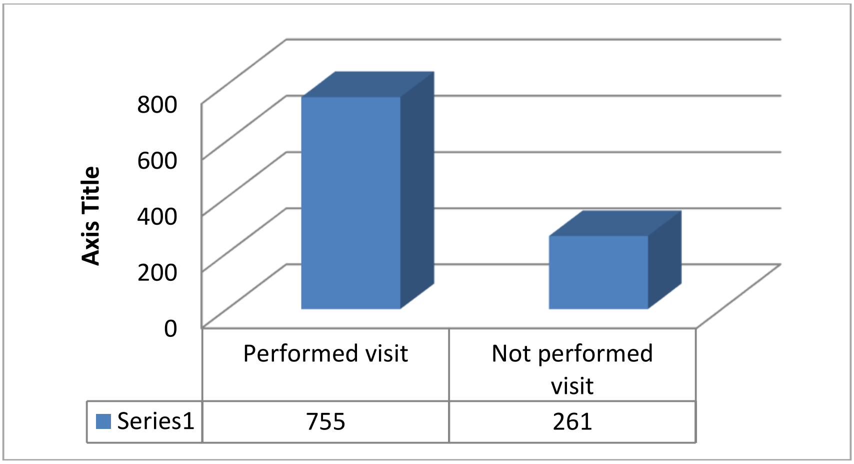

Figure 2. Company visit

Project components are detailed into table below:

Table 2. Project Stucture[17]

No.	Component of the project	Short describe
1	Career management conference	- Documents are signed and informational materials related to the project are received; - Participation in a chat session related careers and labor market, with speakers selected from the private sector; - Receiving informational materials on the preparation CV, a letter cover and how can go to a job interview;
2	Evaluation of generic skills (General Counsel)	- Participation in a computerized testing, 1 to 1, under the supervision and guidance of a professional counselor; - Getting results and making requests of personalized interpretations or advice.
3	Companies study visit	- Visit a number of employers relevant to your area of specialization to gain more practical knowledge on the organization and functioning of economic entities.
4	Specific assessment of skills and building professional development plan	- Go through an application process and selection criteria to qualify for this activity; - Participating in a thorough evaluation, both with computerized tests and expert interpretations and interventions;

	(specific counseling)	
5	Conferences on horizontal objectives	- Attractive and actual topics: sustainable development; Innovation and information and communications technology.

The targets of the "Lucian Blaga" University project were reached, until this stage 815 students received career counseling services, 20 Career Management conferences were conducted and 36 visits to companies were organized. The number of private companies involved into project was bigger then the one planned, between them being counted: Continental Automotive Systems Sibiu, Ropardo Sibiu Business Center, Hirschmann Târgu Mureș, REEA Târgu Mureș, Danubius Sovata, Greiner Sibiu, CEC Bank, Gedeon Richter Târgu Mureș, Marquart Sibiu, Boromir, Al-Ko, Keep Calling, Visma, Am Ring.

PROPOSED CARRER PATH MODEL

Carrer Path model is designed for the education of students regarding their way into the work stage. Students carrer management awareness needs to be exposed, the carrer being one of the most important objectives of education. A mandatory factors in a good career is the know-how owned by the person in that field of work.

In this fight for bringing more students in the workplaces, the key is Knowledge Mobilization which has influences from private sector, academic sector and government. The government has a financial involvement because the project was started with co-financed from the European Social Fund Operational Programme "Human Resources Development".

The influencing sectors: private-academic-government, have an impact in the growth and development on career for each person. To satisfy the requirements from private sector is necessary the government support to the academic sector. The influence depending on the amount of knowledge transferred.

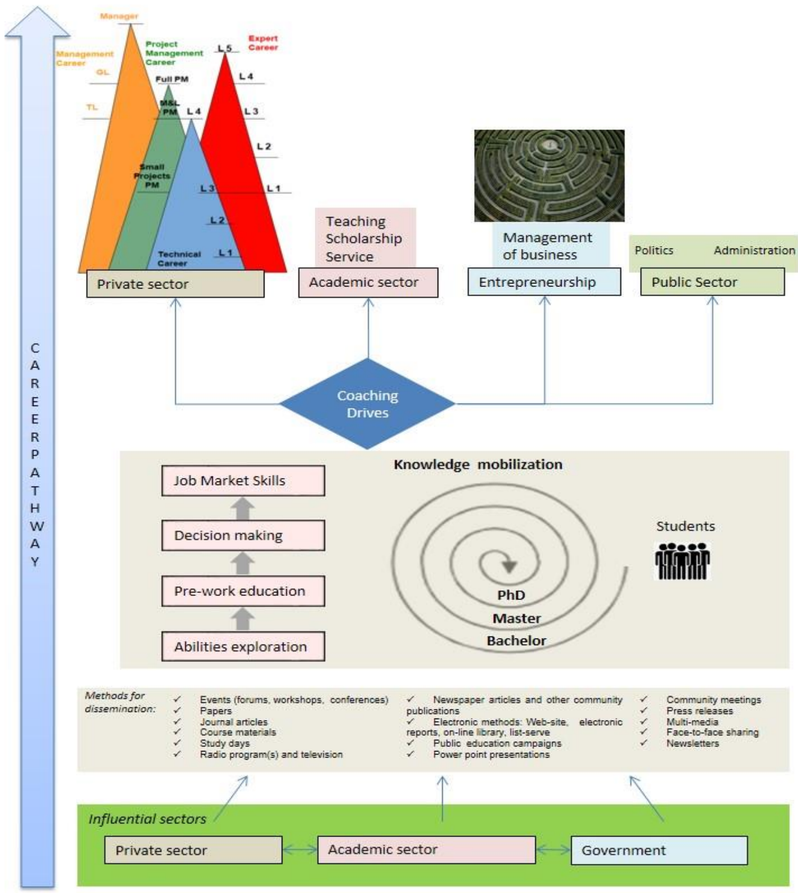

Figure 3. Creation of the Career PathWay

The project used formal and informal knowledge mobilization plans. The dissemination methods are: events (forums, workshops, conferences); papers; journal articles; course materials; study days; newspaper articles and other community publications; radio program(s) and television; public education campaigns; community meetings; press releases; multi-media; electronic methods: Web-site, electronic reports, on-line library, list-serve; face-to-face sharing; newsletters; power point presentations.

The knowledge mobilization is starting with general knowledge in a wide domain through the bachelor education phase. In will continue with enhance of specific knowledge in a narrow domain during the master program and will reach the final stage of education with the PhD phase, in which the specific knowledge in a chosen narrow sector is assimilated. The students of the superior level (master / PhD) are easily integrated on the private sector (industry / entrepreneurship) if their professional expertise is in the same filed as the research.

There are four phases that must be followed in order to enhance the chance of a good career:

- ➔ *Personal exploration* includes skills, personality, interests, values. In first phase before creation of the career pathway it's mandatory to perform a self - discover.
- ➔ *Pre-work education* is divided into research and experimental education.
  Research side: Job market trends, employers, work environment, informational interview. This step is necessary to create a picture of what happens outside and what others do.
  Experimental side: Internships, volunteering, part time jobs, and company study visits.
- ➔ *Decision making* processes involve the accumulated knowledge, the abilities and the intuition drives their future. In this project, all students have support on their decision regarding their career choices through the coaching sessions. In these sessions they can ask the industry experts, they make plans and they try to understand the risks of the decisions that they will make.
- ➔ *Job search Market Skills*: networking, resume, cover letter, interviews, negotiations, research on job field and research on company background. The last step is needed in order to outline the career pathway, being necessary to know how to sell the skills and the acquired knowledge.

CONCLUSION AND FURTHER APPLICABLE WORK

The original contribution on this paper is the model of career pathway consists into knowledge mobilization for students in order to get the desired and right job for them; the model was validated in a project for Romanian students. It was highlighted the importance of the concerned sectors (public – private – government sectors) and the high effectiveness of carrying out the career management project for students.

In this moment "Lucian Blaga" University is in the KPI targets, was reached 815 counseled students, 20 conferences (target was 16 conferences), company visits is ongoing, in this moment the status is 36 visits, but are scheduled for autumn 2015 approximately 5 visits.

It is considered that the student career management reaches a new revolutionary phase, a phase in which the students are guided and advised by the private sector experts.

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Talking the Talk and Walking the Walk: Designing an Online Admissions Process in an Elearning Training Project

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ABSTRACT

This paper presents a case study of the design and implementation of the admissions process in a large teachers elearning training project that took place in Romania. From a theoretical viewpoint we aim at contributing to a rather understudied area at the intersection between project and process management literature. We show that project management could borrow some process management tools and techniques in designing highly repetitive activities. From a practical viewpoint, the case presented could serve as a good practice for other training projects and support them in simplifying admissions procedures by systematic process design and the use of accessible Web technologies.
***Keywords**: process management; project management; elearning; training project; registration-admission process; Romania*

INTRODUCTION: LINKS BETWEEN PROJECT AND PROCESS MANAGEMENT

Both project management and process management disciplines have developed substantially over the past decades. The two areas of study and practice have similarities; however the need to distinguish them has also been often heralded. By definition, the resemblance between the two is that they are both sets of activities oriented toward achieving goals. The main difference however is that processes are repetitive, recurrent sets of activities, that take place over and over again in an organization as part of its core activity (production of products or services) or as part of support activities (e.g. payroll, administrative services, etc.), while projects are unique, one-off sets of activities (Nokes & Kelly, 2007; Project Management Institute, 2013). Whether activities are organized as projects or processes "depends on whether the organization repeats an activity often enough so that it becomes routine" (Nokes & Kelly, 2007, p. 9) more than on the nature of the activities themselves.

Aside from this legitimate semantic concern of the management literature for distinguishing between processes, and projects and consequently between project management and process management, the two fields have grown rather separately from one another with rather few links being drawn between them. One way the two have been related has been by trying to systematize project management and program management in organizations such that it becomes more process like and becomes embedded in broader organizational, strategic and performance management. For example Fernandes et al. (2015) argue that organizations differ in the extent to which project management is used as a tool for achieving certain goals, versus situations where project management principles and practices become *embedded* into organizational practices and processes. Thus in the former case, projects may be approached in a more informal and *ad hoc* manner, while in the later organizations may have formally defined methodologies and a systematic approach to career paths or certification systems in project management. Adler and colleagues (1995) have argued that often product development projects are not that unique as theory may lead us to believe. Rather they have substantial similarities of in activities and flow to allow for a process approach to their management allowing simultaneously for closer monitoring and performance management.

Another link that can be established between process and project management is that the project management literature does make many references to "project management processes", these including *initiating processes, planning processes, executing processes, monitoring and controlling processes, closing, etc* (Nokes & Kelly, 2007; Project Management Institute, 2013). However what can be observed is that in these cases, the term *process* is used, not in the rather specific meaning of the project management literature, but in a broader sense of sequence of actions.

An additional link between project management and process management is that process improvements and process design (in new product development) usually take place within projects with this purpose in mind. The literature in this area abounds with many research pieces discussing mainly the issue of business process improvement, various methodologies and results (e.g. Ittner & Larcker, 1997; Nair, Malhotra, & Ahire, 2011; Rohleder & Silver, 1997; Swink & Jacobs, 2012), however we cannot but observe that in these cases the link between the two literatures is rather spurious: it is rather a co-occurrence of two areas of management where projects have as purpose process improvement (which tend to be one-off operations, although sometimes reoccurring after a while within renewed projects).

To summarize, process and project management have tended to be linked in a substantive way when projects have been proposed to be subsumed in broader organizational processes or when projects have as objective process management improvement. There has been little use of process management knowledge in project management especially in the area of project activity design, execution, monitoring and control. This aspect is particularly surprising especially since project management literature tends to be somewhat less informative especially on activities design. The Project Management Institute's (PMI) *PMBOK Guide* offers a rather reduced set (albeit useful) of tools and techniques by which the project designer/manager can design activities. Such techniques include: *decomposition* (splitting work packages into smaller and smaller units) with variants like *rolling wave planning* (where near term activities are defined in more detail while longer term in higher detail) or *expert judgment* (where pre-existing expert knowledge is used to define activities) (Project Management Institute, 2013, pp. 151–2).

What seems to be missing is exactly what project management could be borrowing from process management, more systematic ways of analyzing and designing activities that address simultaneously issues such as: who has to act, what action needs to be done, in what order and with which dependencies (the later one admittedly is given much attention in project management).

PURPOSE AND ANALYTIC FRAMEWORK

This paper has a twofold aim. From a theoretical viewpoint it explores an area where project management activity design could borrow tools and techniques from process management analytical and design methodology, especially in the area of highly repetitive activities. Particularly we make use of the widely used book in the field, Sharp and McDermott's *Workflow Modelling…* (2009). We show how this analytical framework can be used in approaching process analysis and design especially for highly repetitive activities within projects.

From a more empirical point of view we present a case study of a large technology (ICT/ elearning) training project that took place in Romania between 2010 and 2013 emphasizing one aspect that we believe may represent a good practice that other similar projects may apply. Specifically, we show how the project not only talked about technology use in teaching others about it but made full use of it in order to make a highly bureaucratic process more manageable by both applicants and admissions administrators. We did so by exclusively using open source tools that were relatively easy to implement.

In describing and explaining the process under review we make use of Sharp and McDermott's analytical framework. They proceed from a very simple (and probably incomplete at first) definition of what a process is, that is "a process is a collection of activities (or steps or tasks, or whatever) that is a way to get something done". However Sharp and McDermott insist on several definitional features of processes in the context of process management. We summarize them in what follows:

1. A process "involves work" that is it is a "set of activities or (…) a sequence of steps and decisions, and can be completed by a person or a machine or both" (Sharp & McDermott, 2009, p. 39)
2. A process, propose Sharp and McDermott, should (be able to) be named in a verb-noun form where the verb is transitive and expresses an action that is being done upon an object represented by the noun. For example *acquire new customer* could be a process. In the participle form the verb expresses the result of the process, e.g. *customer acquired* (pp. 39-40).
3. Delivers a specific and essential result:
    a. The result is *discrete and identifiable* such that individual instances of the result can be differentiated.

b. The result is *countable*: the various instances, since they are discrete and identifiable can be counted.
c. The result is *essential* in that “it is fundamentally necessary for the operation of the enterprise, not just a consequence of current implementation” (pp. 40-41).

4. It is initiated by a specific *triggering event* which can be:
   a. *Action event* – when a person or organization does something;
   b. *Temporal event* – when a predetermined time is reached;
   c. *Condition or rule event* – when a monitoring activity detects an exception condition (p. 44).

Additional business process characteristics:

1. Business processes are measurable, possibly in multiple ways relevant for different stakeholders;
2. Automation: various tasks can be manual or automatic;
3. Levels of detail: processes can be described in different levels of detail as needed. Usually a progression is followed from higher level to lower level descriptions.
4. Customers of processes can be internal or external (pp. 59-60).

In the following section we use the analytic framework provided by Sharp and McDermott in order to present the process that was used for admissions in an eLearning training project.

CASE PRESENTATION

Context, Scope and Goals

Our case is represented by the admissions process in a teachers eLearning training project that took place in Romania between August 2010 and July 2013. The project, named shortly *eProf*[1] was financed by the European Social Fund and the Romanian Government through the Sectoral Operational Program Development of Human Resources (SOP HRD). Its objectives (now fulfilled) were to train at least 2000 secondary education teachers (of various subjects) in using ICT and specialized eLearning tools in their teaching activity. A secondary objective of the project was to create a Web portal of the project that would serve as: project website, elearning platform, document repository and a media outlet contributing to a digital culture in teaching in Romania. The project was implemented in a partnership made of four organizations: two leading technical universities in Romania, University Politehnica of Bucharest (Parnership leader) and University Gh. Asachi in Iasi (Partner 1), and two IT and management services and consultancy companies Pythia International (Bucharest, Romania, Partner 2) and CSI Piemonte (Torino, Italy, Partner 3). The project admitted secondary education teachers from all regions of Romania and had two training centers in Bucharest (where at least 1400 teachers were to be trained) and Iasi (where at least 600 teachers were trained). Training took place by means of *blended learning* where part of the teaching/learning was done

[1] The project’s complete name in Romanian was: *eProf: Formarea personalului didactic din învăţământul secundar (ISCED 2-3) în vederea utilizării tehnologiei informaţiei si a instrumentelor e-learning în activitatea didactică*”. See www.eprof.ro.

from a distance using an eLearning platform and part of it was done with presence at the training centers in fully computer endowed classrooms).[2]

The issue of designing an admissions process came up as a practical issue to be solved within project implementation. To achieve the main goal of the project, that of training teachers, an essential precondition was that such trainees were first registered and admitted for participation in the training (as such the admission process satisfies the essentiality condition stated by Sharp and McDermott). The admissions process faced several regulatory constraints:

1. It had to follow the data and document requirements issued by the project financing authority, the Management Authority of the SOP HRD, a notoriously highly bureaucratic agency.
2. It had to follow the data and document requirements of the training accreditation authority (the National Council for Professional Training of teachers in Romania, a department within the Ministry of Education).
3. It had to follow regulations concerning the use of personal information.

The data and document requirements imposed especially by the financing authority were significant a multitude of paper forms and documents were required as well as reporting in electronic format in complex Excel files about the target group. By following an approach where each document and form were filled separately with a lot of redundant information between forms, the process of applying for course participation the application process would have been highly complicated for both applicant and project operational personnel in charge of admissions. There was thus a desire to simplify as much as possible the admissions process from both the management and operational personnel.

In addition to making the application process easier for those involved there was an explicit concern with project's consistency with its own goals and values. The project was built around promoting digital tools and showing their usefulness in teaching. Teaching state of the art eLearning courses while at the same time having a cumbersome paper based registration/admission process would have been highly inconsistent, and management was concerned that this would negatively impact project's reputation and capacity to attract applicants.

Consequently the goal of designing the admissions process was:

1. Designing a functional admissions process that satisfies project's practical requirements and legal regulatory requirements from multiple regulation agencies;
2. That is simple enough such that it is as easy as possible to follow by applicants, following to the extent possible the principle *collect once, use multiple times* regarding information gathered.
3. As well as simple for admissions operational personnel;
4. And which is consistent with the technological goals of the project in making full use of information technology where useful.

[2] For additional information about the project see the project website, www.eprof.ro, as well as (Ogrezeanu, Ogrezeanu, & Niculescu, 2015)

Process Automation: Web Application for Managing Admissions

In order to achieve the goals listed above, it became clear that the admissions process had to be assisted to the extent possible by Information Technology (IT) particularly by means of Web technology. The project portal thus acquired an additional purpose, that of being a management and operational instrument for the project. The portal component (on top of which management and operational functionalities were built) was based on Joomla technology specifically building various forms and reports that allowed for data entry, checking and manipulation.

The following Web functionalities were developed to support the admissions process:

1. Online registration form.

To open the registration form, a website visitor (initially as unregistered guest) had to first create a website user account by simply providing a set of general data such as name, username, County, Town/City, and password. Once registered on the website the user could begin course registration by opening the registration form. Due to the multitude of data and forms required by different regulatory agencies, the online registration form was made of the union of all data fields required by the financing and training accreditation authorities. The result was a rather complex form which was split in several sections: personal information, contact information, professional information, data about teaching school of the applicant, options regarding course participation (training center and preferred sessions). The form contained both open fields filled by typing the answer as well as combo boxes and drop boxes. Some fields were checked for format consistency (for example the Romanian ID Number, CNP). Due to its size, there wasn't any expectation that the applicant would finish filling the form in one session, therefore the partially completed form could be saved and continued later. The completion and submission of the registration form was the *triggering event* for the admissions process.

2. Application administration form

This form was very similar to the registration form, allowing the admissions operator to visualize and edit registration data. In addition it contained several data fields corresponding to a few decisions:

a) Candidate status (admitted, rejected, withdrawn, etc.)
b) Check marking of a series where the candidate was allocated;
c) Complete file (yes, no)
d) Message sent with completed documents (yes, no)
e) Course participation and completion (graduated, gave up before course start, gave up during course);
f) Observations (open text field).

3. Automated generation of registration documents.

Based on the complete and validated online registration form a set of printable (PDF) registration documents were generated including:

a) Registration form;
b) Training contract
c) Certificate of being employed at a school (signed by school directorate);
d) Agreement for granting access to personal information;

e) A checklist of all documents needed (in addition to the above a CV, a copy of ID card, were required)

The applicant had to sign documents a, b and c and obtain signature on d, while the ones at D had to be sent on paper. All printed documents were to be sent physically by the postal service to the selected training center.

4. A series of tables and reports with candidates sorted or filtered by status, training center.
5. Automated generation of confirmation messages and message with documents generated (see 3 above) attached.
6. General administration interface from which the various forms, tables and reports were being accessed.

Process design and description

Process design took place at the same time as the Web based admissions functionalities were designed. While the Web functionalities described above were meant to support most steps in the process they were designed as a set of discrete functionalities that further needed to be integrated into a process. The wider process was based on a decomposition of the activity of admissions. While the Sharp and McDermott methodology was not directly used in its design, a similar (yet more classic) one was used with classical process diagrams illustrating each step (task), arrow links between them and decision points. The Sharp and McDermott suggested swim lane diagram is more useful in this post factum description and analysis as it provides an easy view of both the steps and who is supposed to fulfill them while at the same time not adding much more detail, not needed in this medium level of detail description.

Figure **7**, below, presents the swimlane diagram of the admissions process. One can see that the triggering event was the submission of the registration form by applicants while the end result was a complete file and a candidate committed at least formally to begin a training course session. On can also see that the admissions process interacted with other processes for example it was the management process that established when, where and the type of training sessions and the admissions process needed this as an input. Its output was that the list of admitted candidates and some information about them could be used in the process of physical organization of training sessions (including hotel reservations, catering services, communication with applicants before sessions, etc.) as well as the process of online course creation on the eLearning platform.

Assessment

The process and web portal functionalities were implemented as described above. They were successfully used during project implementation. More than 6000 registrations were made (most valid) but unfortunately only a little over 2000 could be covered by the project (one a first in first out basis) due to limited financing available (for more information on project's outcome see Ogrezeanu, Ogrezeanu,

& Niculescu, 2015). The process and Web functionalities did indeed help a lot with simplifying the admissions bureaucracy for both applicants and admissions operators, making their overall experience of the project more positive.

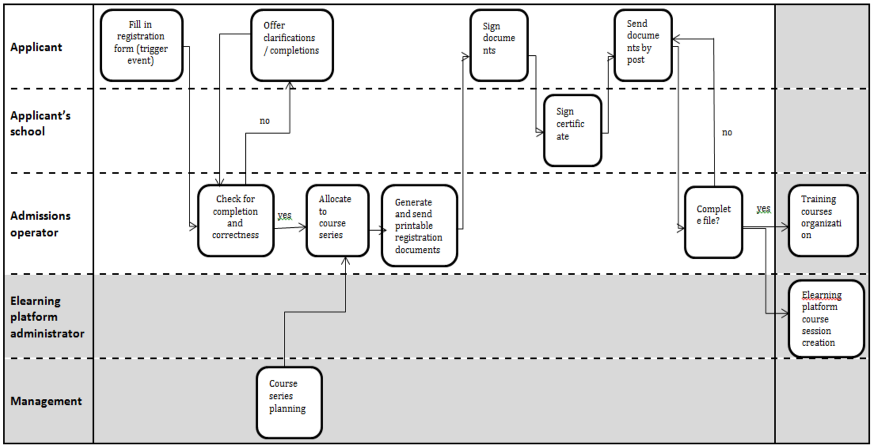

Figure 7: Swimlane diagram of the eProf project admissions process

In addition to the benefits related to the process of admission of candidates itself, there were broader project benefits of using an ICT (Web) supported process. Because the data was introduced non redundantly in electronic format and processed in that form, it could be easily used within the project for other activities and processes. For example, the elearning platform could easily import the data from the Joomla portal's database of applicants depending on how they were allocated to different course series. Also various lists of course participants and relevant data were produced to support the logistics of training series organizations. Finally, and very importantly, the Web portal also supported the automatic production of tables and reports that were highly necessary for project monitoring as well as reporting to the management authority.

CONCLUSION

This paper has presented a case of the admissions process design within a teachers' eLearning training project that took place in Romania between 2010 and 2013. The need for an approach of systematic process design arose from several requirements:

1. The project's need to have a functional admissions process that could take in thousands of applicants that was as simple and manageable as possible for both applicants and admissions operators;
2. Multiple requirements in terms of necessary data and documents from multiple regulatory agencies;
3. The need to make the process and the experience of applicants and admissions operators consistent with project's goals and values.

The paper illustrates how a systematic approach borrowed from process management can be used in activity design and implementation in project management, especially for highly repetitive activities within projects. From a theoretical viewpoint this shows that there is a clear area of intersection between project and process management where the former could borrow some of the tools of the later. While projects as a whole are indeed unique, not all of their activities are. Some of their activities are highly repetitive and require a process management approach.

From a practical point of view we presented a tried and tested admissions process that could be used with modifications in other large training projects. We have shown that with a partly automated process supported by simple open source Web tools what could have been a nightmarishly bureaucratic process of admissions could be simplified to a manageable level of complexity.

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Instrument for the visualization and evaluation of the intellectual property assets in the knowledge based economy

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ABSTRACT

The intellectual property is a concept of whose content and materialization find themselves more and more in the attention of the researchers and practitioners. The increased number of the works that approach such an issue is the argument that supports the previous affirmation. The intellectual property assets attract the interest of all the organizations from the local to the global level. The important pillars of the European Strategy 2020 formulated by the European Commission are based on the capitalization of the innovation knowledge and of the intellectual property. The increased interest towards innovation and intangible assets is given to the awareness of their economic potential. This is the reason why the evaluation and the valuation of the intellectual property capitalization propose an evaluation methodology unanimously accepted. The aim of this article is to present a visualization and evaluation instrument for the intellectual property assets, realized in a framework of a European research project with 15 partners from countries that are situated in the South Eastern Europe.

Keywords: *evaluation for the intellectual property assets, knowledge based economy, intellectual property.*

INTRODUCTION

The economy, the organization and the knowledge based management are common used concepts when we talk about the new economic tendencies. This fact is given mainly because of the knowledge revolution from the XXI century, which brought to the attention the “knowledge”, seen as a main element in the assurance of functionality and the efficiency of the organizations.

In the new conditions imposed by the accelerated changes and by the more and more complex changes in the business environment, the economic restructuring comes as a necessity in the global level.

The study of the historical evolution regarding the different types of societies emphasizes the fact that at the level of high societies reach and maintain those societies that invest in their innovation activities (Slătineanu, 2015).
The knowledge based economy is a new type of economy that works out in the developed countries for the last decades. This is totally different compared to the type of the industrial economy or its postindustrial version.

According to the OCDE, the knowledge based economy is “the economy directly based on the production, distribution and usage of the knowledge and of the information”. This definition was rapidly taken in numerous developed countries and used for prefigure the economic future. An apogee of it was represented by the summit of the European Union from Lisbon, where was established as fundamental purpose for the countries that form this organization, the constitution of the knowledge based economy.

The main features of the knowledge based economy are presented in figure no 1. These give a broad view, accurate enough for seizing the specificity of the knowledge based economy and the essential differences in what concerns the economy from the current times.

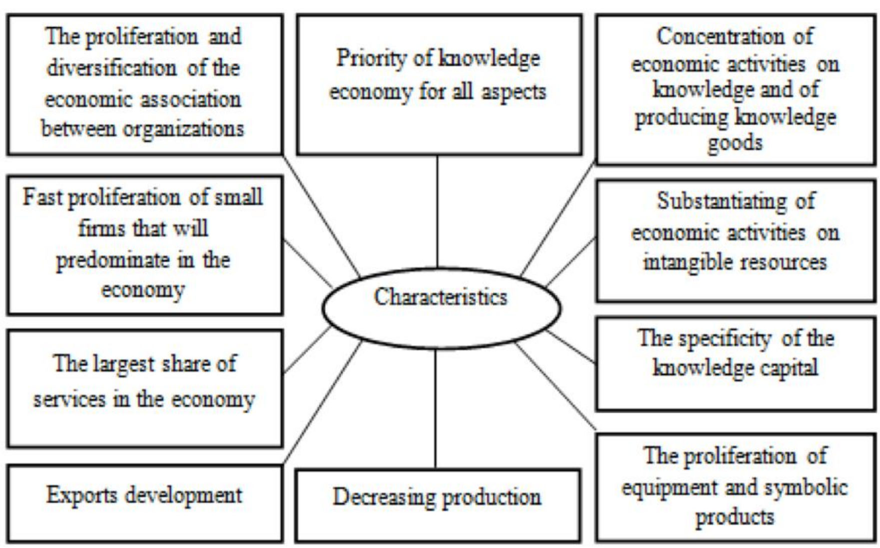

Figure 1: The main features of the knowledge based economy.

The passage to the knowledge based economy, to the building and to the functioning of the knowledge based economy can't be realized without a knowledge based management (Oprean, 2011). To the level of the organizations, the knowledge is found to the level of the human capital, in the requests and the preferences of the clients, more precisely the clients capital, in the products, the processes, the capabilities and the systems of it, all these that form the structural capital.

As a result, the value of the knowledge assets can significant overcome the value of the assets (Oprean, 2011).

In the framework of every organization there takes place three major processes linked to the knowledge (Oprean, 2011):

- The acquiring or achieving of knowledge that is realized through the processes of learning by the organization's employees;
- The creation of knowledge in the form of inventions, innovations, etc.;
- The use of knowledge, through all the actions and the decisions that are being shaped later in products, services, new information, that are traded in profitable circumstances.

The conditioning in the terms of acquiring economic performances represents a branch of a revolution that has a foreground the knowledge. Moreover, the knowledge will become a priceless resource in the provision with management examples and valuation of the economic potential for the intangible assets of the innovators and researchers (Manus, 2012).

THEORETICAL CONSIDERATIONS THAT ARE APPLIED IN THE INTELLECTUAL PROPERTY MANAGEMENT

The intellectual property, especially the patents seem to bring a significant contribution to the value of the organizations market. The need of an improved evaluation is strongly linked to the expansion of the use of the intellectual property. The evaluation and the exploit evolve together over the time. The need for an adequate evaluation of the intellectual property is motivated even more by the expansion of its use in the application that expand out of the organizations.

The need of financial evaluations of the intellectual property becomes relevant especially when these are used as instruments of financing by the organizations and as investment assets assured by the financial institutions. The analysts and the financial investors consider more often the intellectual property as a key element in the value of the organization and a sign of its technological capacities.

In the case of the organizations, especially in the small and medium enterprises that do not own internal sources of financing and a necessary portfolio of success for attracting the external investors, the patents are considered a manner of attracting and assuring from a financial point of view. Owning a strong portfolio of intellectual properties can signal to the investors that the company has a technological advantage against its competitors- one that can be protected by the patent law (Weltz, Fichtinger & Kerschbaum, 2013).

The basis methods for evaluation are very much alike, fact that reduces the complexity and helps in the finding the key- issues of the management. Any evaluation exercise can be seen as a pyramid, where each level supports the analysis generated by the superior level.

To the highest level of the pyramid is approached the important problem of the way that the evaluation analysis solves a business problem or generates a recommendation to a specific business issue (Weltz, Fichtinger & Kerschbaum, 2013).

The purpose of the evaluation defines the regulation and legal statuses, the judiciary court of resolution, the accepted methodologies and the basic rules that have been developed in that domain.

The companies can value their intangible assets by selling, dismissing or through a variation or combination of these. This thing has stimulated the selling a dismissing transactions between the medium and small companies and between the non-practicing entities, using various business models for the capitalization of the intellectual property assets.

The biggest obstacle in stimulating the interest and the activities in the financial sector by intangible assets is the uncertainty that surrounds the evaluation of the intangible assets.

The business evaluation is seen more like an art than as a science in many places. For example, the evaluation of a patents or trademarks portfolio of a brand is an even bigger challenge because of its inherent unique of the intangible assets and of the preoccupations linked to their possibility of transfer.

The companies are exploring more and more the intellectual property as a way of accessing the external resources of financing. The intellectual properties can play the role of facilitating the attraction of investments with risk capital, being also used as goods on the traditional financial markets, banking debts and the markets of securities (Weltz, Fichtinger & Kerschbaum, 2013). For example the banks begin to accept patents as a guarantee for the bank loans and to develop securities guaranteed by the intellectual property that the owners of the patents can use in obtaining the financing.

EVLIA METHOD FOR THE IDENTIFICATION AND DESCRIPTION OF THE COMPETITIVE RELEVANT ASSETS

The intellectual property represents an important resource in the processes of innovation and it is a part of the intangible assets portfolio of an organization. Even so, there aren’t enough evaluated and treated as real assets in the bookkeeping by the experts of the financial market, like the majority of the other assets. There is still missing a global approach that should be standard, of the valuation at the European level and also to the global level. So, nowadays the experts in investments apply traditional methods combined with additional information of the market, according to the specific circumstances.

The leading point of the global study regarding the emergent standards for the capitalization of the intangible assets is the current national development of the valuation instruments of the rights for the intellectual property in Europe towards other regions of the world. (Fichtinger, Mösenbacher & Weltzl, 2013).

So, these developments must be analyzed according to the supranational programs and of negotiation at the level of The Cooperation and Economic Development Organization, The Global Organization for the Intellectual Property and to the level of The Global Organization of Trade.

In some European countries there already are some projects and pilot experiences regarding the valuation of the intangible assets that the European project EVLIA used as an advantage (Fichtinger, Mösenbacher & Weltzl, 2013). In what concerns the acceptance of the capitalization of the patents and the use of them on the market it is very important to understand how the banks and other financial institutions handle the assets as intellectual property in the framework of their internal procedures and how they use this category in their businesses.

Any method of evaluation of the intangible assets at the European level will encounter difficulties because of the national bookkeeping standards differences regarding the treatment of the patents (Fichtinger, Mösenbacher & Weltzl, 2013). The main purpose of every bookkeeping standard is to give a complete vision, accurate and equitable over the financial situation of an organization. Even so, the bookkeeping standards failed to adapt entirely to this continuous process where de business become more and more dependent of the value of their intangible assets.

The EVLIA project – Making full value of good ideas by leveraging intellectual assets for financing SMEs in SEE, implemented and tested a standard methodology by the implication of the financial organizations. According to this methodology, any organization that wishes to evaluate and value their intangible assets and to complete a preliminary questionnaire for the analysis of the intangible assets must realize a business plan with a special section dedicated to the intangible assets and must evaluate the brand and the patents.

This methodology is the result of some researches and analyses of all the existent practices, and has been identified signs of great importance in the valuation and evaluation of the intangible assets. So, has been identified four groups of intangible assets which are relevant from the competitive point of view, more exactly: human resources, intellectual property, organizational capital and relational capital. Each group of intangible assets can be defined as we can see in the table 1.

Table 1: Intangible assets structure.

Intangible assets	Intellectual capital	Human resources	Entrepreneurial experience
			Staff competences
			Tacit knowledge
			Staff motivation and loyalty
		Intellectual property	Codified knowledge
			Business information and proprietary technologies. Trade and business secret and their management
			Inventions: awareness and protection
			Trademarks and brands
			Designs and models
			Copyrights and related rights
	Capital Structural	Organizational capital	Methods/procedures for production/supply of services
			Certifications
			Project management tools and systems
			Administrative System
		Relational capital	Customer attraction
			Customers portfolio management
			Suppliers management
			Cooperation and networks

Each intangible asset is analyzed after it model of creation, function, programming and transferability (table 2).

Table 2: Types of analysis indicators of the intangible asset.

Creation	Functioning	Programming	Transferability
- the modality through which the asset is obtained.	- the modality of using the asset and how it contributes to the business model.	- the modality through which the regeneration of the assets is managed.	- the relevance of the asset for the third parties and the way they can be charged for the using of the asset.

So, depending on the availability and the relevance of those indicators, can be found four situations as we may see in figure no 2. There must be mentioned that each organization must adapt to this list at the dimensions the capacity, the activity field and the market where it operates. We can sustain that there is not a completed, standard list that would function for all the organizations.

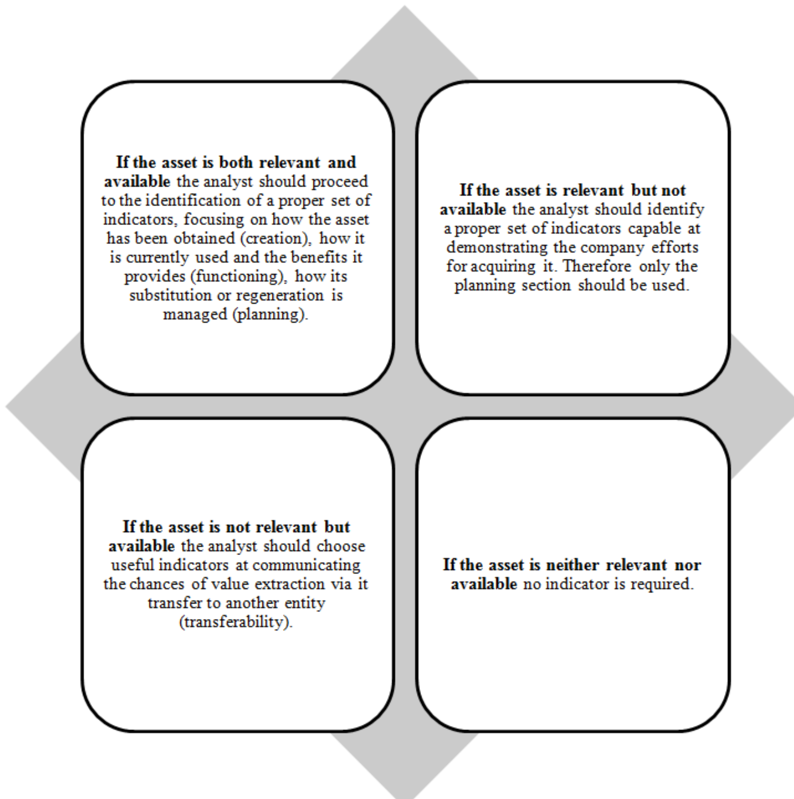

Figure 2: The relevance and availability of the intangible assets.

FINAL APPRECIATIONS REGARDING THE APPLIANCE AND IMPLEMENTATION OF THE EVLIA INSTRUMENT IN THE KNOWLEDGE BASED ECONOMY

The importance of the valuation for the intellectual property assets is indisputable, especially when we talk about an economy found in a continuous change, when the information gives power and the innovation is a must.

Taking into consideration the economic instability of the markets where the nowadays organizations are activating, the protection and valuation of the intangible assets make the difference between failure and success. So, the organizations must manage the most accurate possible these assets for identification of the additional modalities of capitalization.

The applicability of the EVLIA instrument will be proven in time but for the moment the first steps were made and the SMEs that responded to the preliminary questionnaire of analysis, have provided the business plans and evaluated their brand and patents, has been already put in touch with the financial institutions for being given solution in order to develop solutions for businesses based on their intellectual property assets they own.

Of course this demarche is at the beginning of its road but it is a good sign the fact that the first step has been realized, that at the European level has been proposed a draft of law that sustains the demarche we are talking about and the fact that the capitalization of the intangible assets is not just a simple idea anymore.

In the new economy the intangible assets become the new nucleus of the competences. That is the reason for what we must become aware that we live in a world that focuses on the economic value of the intangible assets. We deal with a period of time where the ideas value billions, while the products cost less and less. In this sense, the EVLIA method represents the foundation stone in a process that no longer ahead will become the equivalent of the way the tangible assets are seen now.

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The Sustainability In A Quality Improvement Model

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ABSTRACT

Purpose: The purpose of this paper is to promote the integration of sustainable development concepts and conceptual models in engineering research, and therefore, to enhance sustainability of research models. Particularly, the concepts are integrated with an integrated theoretical model of knowledge management and DMAIC (Define-Measure-Analysis-Improve-Control) process.

Methodology: Based on literature, the key concepts of sustainable development, knowledge management, Ontology and DMAIC methodology have been reviewed. A theoretical combination of knowledge management, ontology engineering, and DMAIC methodology is to aim at accumulating and reusing a potential economic resource, knowledge resource. An analysis of sustainable aspects of a proposed model is presented.

Important findings: As literature expressed that knowledge created by every step of a DMAIC process can be accumulated and reused by using Ontology in a conceptual model. Furthermore, sustainable aspects of the model such as economy, environment and society are identified.

Conclusion: DMAIC knowledge is a potential economic resource that should be shared and reused using Ontology engineering in order to archive sustainable development of DMAIC process. Theoretical integration of seven sustainable measures with activities of knowledge management is possible and realizable.

Keywords: *Sustainable development, knowledge management, DMAIC, ontology.*

INTRODUCTION

Concept of sustainable development

In 1987, the term of "Sustainable Development" is used to refer a long-term development, and stated in a Brundtland report titled "Our Common Future" that: *"Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (Brundtland, 1987). This conception is useful for organizations and society in order to aim at a sustainable development. Sustainable development is represented as a deep transformation about how to utilize natural resources, choose investment criterions, propose advanced technologies applied, and change administrative mechanism that accord with current and future needs (Harris, 2000).

However, notion of Sustainable development is very neutral (Hallstedt, 2008). It needs to be concretized into principles or measures for business and society. It is recognized that three essential factors impacting on sustainable development are Economy, Environment, and Society (Harris, 2000) (Aparna & Keren, 2007). Basing on the factors, several sustainable measures and criteria have been presented in literature. Ritzen Rofia proposes five proactive measures for integrating environmental aspects into product development. (Ritzen, 2000). Ansari *el at* have mentioned seven sustainable measures for knowledge management (Ansari, Holland, & Fathi, 2010). Harris have pointed out principles for sustainable development in the three essential aspects or pillars. In particular, goods and services need to be continuously developed without damaging agricultural or industrial production. A resource base need to be retained stably by preventing over-exploitation of renewable resource system and eliminating non-renewable resource. Biodiversity, stability of atmospheric, and other ecosystem function must be maintained. Social equity, adequate provision of social services, gender equity, and political accountability and participation must be assured. More importantly, a harmonious combination of sustainable aspects of development would guide products towards a greener, clearer and more equitable growth (Bleischwitz, Giljum, Kuhndt, & Schmidt-Bleek, 2009), (Roblek, Meško, Bach, & Bertoncelj, 2014). However, this is one of primary challenges for sustainable development of products nowadays.

Products in sustainable development

The term of product is defined as the physical artefact, software, services, processes, or combinations of these in systems (Hallstedt, 2008). Product development is an indispensable part of sustainable development. Each product has positive and negative impacts on environment and society during its life-cycle through the activities such as energy or material consumption for production and delivery, emission to land, water or air, resource exploitation, and use and elimination of products (Ritzen, 2000).

The traditional approach for products designers is to meet preference of customers based on functions, efficiency, and aesthetic elements of products. Hence, the designers become embarrassed with considering the sustainable aspect of environment (such as resource usage) during their product design (Nambiar, 2010). One of the intelligent choices for sustainable development of products is to apply technology systems into monitoring continuously resource usage of products (Nambiar, 2010), (Nagel, M.H., & Tomiyama, 2004). By utilizing the supporting tools, a products can be minimized its negative impacts on the aspect of environment during its life-cycle.

In this paper, we focus our intention on applying techniques in Information Technology (IT) sector to enhance sustainability of a quality improvement process used to improve business processes, and the realization of resource management of the process. In the next section of this paper, a review of DMAIC process as well as the problem of its knowledge resource is presented. Afterwards, a model for accumulating and reusing the knowledge resource created by DMAIC is discussed in the third section. The fourth section explains the sustainable aspects of the proposed model. The final section is to conclude the paper.

RELATED WORKS

Sustainability of an organization can be affected by quality of a manufacturing process that produces its products. A manufacturing process with many defects can creates faulty products affecting negatively on customers, environment, and business's sales. The customers do not satisfy with the products, spend a lot of time to contact with providers for correcting or changing the faulty products, even quickly throw them into environment, and eventually lost their belief in an organization. Hence, more and more organizations utilizes quality improvement tools to enhance their manufacturing processes. One of the most interesting solutions is to execute DMAIC process in a Six Sigma project to eliminate defects from the manufacturing processes.

In Six Sigma system, DMAIC (Define-Measure-Analysis-Improve-Control) (Park, 2003) is a problem-solving process. Its ultimate aim is to produce 99.9996% defect-free products, in order to improve business profits, and business excellence (Yang, 2005), (Pande, Neuman, & Cavanagh, 2000). DMAIC deployment creates a favorable environment for managers, working teams, suppliers and customers to communicate, discuss, and propose ideas and insights with each other (Wu & Chinho, 2009). Consequence, new knowledge can be created in discussions such as gate review sections (Stevens, 2006) (Kifor & Baral, 2013) and improvement solutions (Zou & Lee, 2010).

Ritzen Rofia wrote that knowledge need to be developed for the purpose of reaching environmentally sustainable development (Ritzen, 2000). However knowledge produced during DMAIC execution is often easy to be lost or difficult to reuse (Stevens, 2006). While implicit knowledge is often resident in minds or brain of individuals that is difficult to be queried again after DMAIC execution, explicit knowledge is documented into text-based document and reports that may be permanently secreted in filing cabinets. Thus, a potential resource of knowledge economy which is considered as the key for sustainable competitive advantage (Roblek, Meško, Bach, & Bertoncelj, 2014) meets challenges. It is not reused and renewed efficiently.

In IT techniques, three typical approaches for organizing and representing knowledge are to base on Documents, Ontology, and Artificial Intelligence (Ribino, Oliveri, Lo Re, & Gaglio, 2009). These approaches aims at making a converting from tacit knowledge to explicit knowledge, and sharing the expertise and information resource of an organization. In case of the Ontology-based approach, both of tacit and explicit knowledge are represented and hierarchically structured. In the case, knowledge is described and defined as a set of concepts and their relationships. This approach is suitable to share DMAIC knowledge because Ontology supports a specification of conceptualizations, and helps programs and humans to share knowledge (Gruber T. R, 1993). It also can be used to *"share and reuse among different applications"* (Benjamins, Fensel, & Gomez Perez, 1998).

THE PROPOSED OKMD MODEL

Overview

The proposed OKMD (Ontology-based Knowledge Management process for DMAIC) model (Figure 2.) is an integrated conceptual model that combines activities of DMAIC process, knowledge management and ontology engineering.

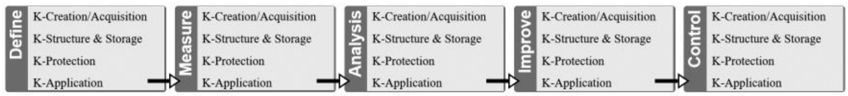

Figure 1: Integration of KM and DMAIC process

The ultimate goal of OKMD model is to construct a knowledge base to accumulate and share knowledge created by DMAIC improvement process. Knowledge available should be represented by existing Ontologies. Thereby, knowledge resource of DMAIC improvement process will be preserved and reused sustainably. Activities of DMAIC process are planned and deployed step by step according to the recommended Six Sigma guideline (Kifor & Baral, 2013), Gate Review sessions are arranged by the project participants recommended in (ISO13053-1, 2011) and tools and techniques proposed in (ISO13053-2, 2011). These activities provide opportunities to generate new knowledge that is then accumulated and reused in the during DMAIC process execution. The activities of knowledge management (Figure 1, section 3.2) involving Knowledge Creation/Acquisition, Knowledge Structure & Storage, Knowledge Protection, and Knowledge Application (Gold, Albert, & Arvind, 2001) are executed continuously within each of five DMAIC steps consisting of Define, Measure, Analysis, Improve, and Control. DMAIC knowledge is structured and stored by using Ontology engineering into sub-knowledge bases. Ontologies are built by using supported tools in IT area such as Ontology editor tools, programming languages, and natural language processing techniques. Moreover, activities of knowledge accumulation and reuse are fulfilled by knowledge workers (Mikael, Ioana, & Sachin, 2003) through Knowledge Portal where various information sources such as reports, plans, and text-based documents are collected. It provides activities of knowledge management with the functionalities: Content presentation, user account, chat room, forums, news module, and online quiz, questionnaire with multiple choices, file uploader, file downloader, search/query generator, and Knowledge Reasoner/inference engine.

Accumulating and reusing DMAIC knowledge

In OKMD model, a knowledge management process typically consists of four stages videlicet K-Creation/Acquisition, K-Structure & Storage, K-Protection, and K-Application. Figure 2 depicts the typical activities executed by working teams who participate a Six Sigma project, experts, specialists of Information technology, and web users.

The activities of **K-Creation/Acquisition stage** (arrow path 1 in Figure 2) is to obtain new knowledge (Gold, Albert, & Arvind, 2001). The stage should be started at the Gate review section of every DMAIC step where members of project team such as Black Belt, Green Belt, domain experts discuss and review problem-solving solutions or improvement plans basing on reports and documents created. The support of Knowledge Portal allows them to submit or upload their reports, documents, writings, and relevant files to Knowledge Portal. Data collected at the Gate review section is used to extract potentially valuable knowledge (King, 2009) for reusing in the next stages. Domain experts can be interviewed in case tacit knowledge need to be supplemented. **K-Structure & Storage** (arrow path 2) aims at cumulating new knowledge into sub-knowledge bases based on Ontology Engineering. As Figure 2 shown that data collected on Knowledge Portal is extracted to explicit knowledge under the support of Ontologies available, Ontology building tools (such as Protégé), natural language processing techniques, and programing languages. Concepts of new knowledge as well as their relationship are defined and updated by the support of IT specialists into each of DMAIC stages correspondently.

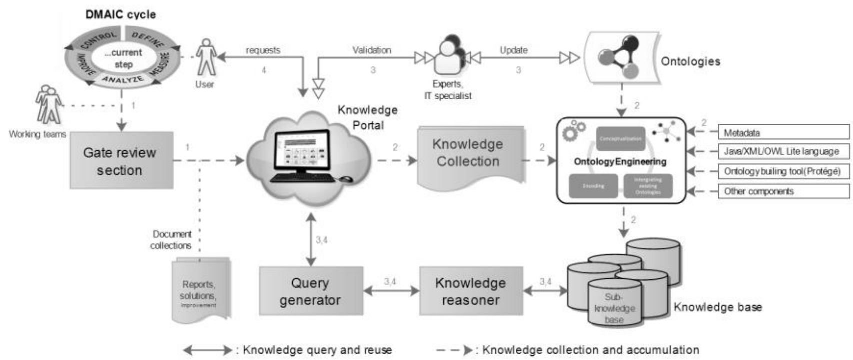

Figure 2: KM process in OKMD model.

K-Protection (arrow path 3) plays an important role in protecting crucial knowledge before it would be distributed to the next stages. This stage is proposed in order to prevent illegal or inappropriate behaviors of web users who are querying knowledge available on Knowledge Portal. It provides security mechanism for web users and supporting tools for maintaining and validating knowledge. The knowledge access and activities of web users are monitored and controlled through their accounts. Experts are required to validate knowledge available, and their opinions are helpful to contribute to making created valuable knowledge and eliminating outmoded knowledge. Ontologies are updated by expert's opinion and IT specialists. **K-Application** (arrow path 4) is necessary to share and reuse created knowledge. Activities found in Figure 2 consist of querying knowledge, and applying valuable knowledge. Knowledge found can support improvement activities of the next steps of DMAIC. A knowledge request of a web user is sent to the query generator where a command of knowledge query is generated. Intelligent results of the query are then responded by Knowledge Reasoner after appropriate knowledge is reasoned from a knowledge base.

SUSTAINABILITY OF OKMD MODEL

In various fields, there are different points of view to make sustainability. Hence, there is not unique criteria for sustainability (Ansari, Holland, & Fathi, 2010). In this article, sustainability of the conceptual OKMD model is achieved by effectively managing and exploiting knowledge resource. Sustainable aspects of the proposed model are discussed through criteria presented by (Harris, 2000), (Brundtland, 1987) and seven sustainable measures presented by the authors in (Mahesh, Henrietta, Laszlo, & Jozsef, 2008) (Ansari, Holland, & Fathi, 2010).

The essential goals of sustainability are economic growth, environmental conservation, and social equity (Aparna & Keren, 2007). For economically sustainable aspect, OKMD is a healthy business model. DMAIC focuses on a continuous improvement cycle that benefits organizations in several years (Kwak & Anbarib, 2006). Increasingly, OKMD improves economic sustainability of DMAIC process when more knowledge is provided to people. Valuable knowledge is queried online for the purpose of applying into improvement activities. Knowledge accumulation is useful for the share and renewal. This would "*create greater willingness to share global resources equitably*" (Brundtland, 1987). The socially sustainability of OKMD can be attained when it creates easier knowledge access and opportunities to enhance skills of employees. The Knowledge Portal would support organizations to improve working conditions as well.

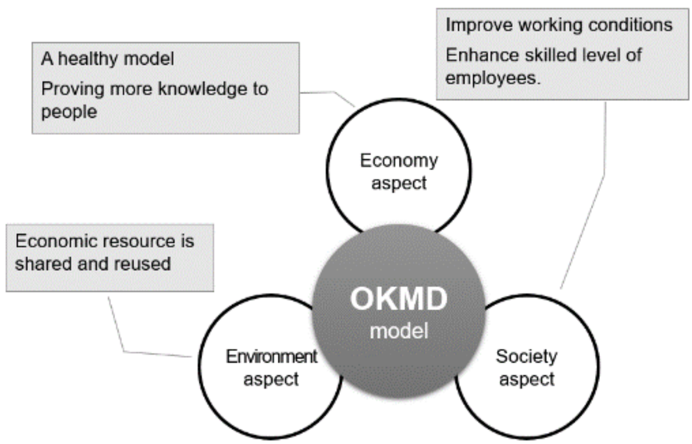

Figure 3. Sustainability of OKMD

Moreover, sustainability of knowledge resource can be attained by KM process in OKMD model and seven sustainable measures.

- *Converting economic goals to knowledge goals*
- *Discharging obsolete knowledge*
- *Protecting and preserving of sensitive knowledge*
- *Identification and retention of human knowledge hosts*
- *Optimizing "Use of knowledge" infrastructure*
- *Externalization of tacit knowledge*
- *Offering incentives for knowledge sharing*

In modern economy, products are often produced by improving and innovating previous ones. Contribution of valuable knowledge is necessary for the improving processes. OKMD model creates opportunities to target the valuable knowledge in order to preserve and renew it. Yet, during knowledge accumulation, outmoded knowledge is not useful and conducive to improvement activities. It does not provide breakthrough insights but cause problems in term of processing data and making decision. Besides, valuable or sensitive knowledge is just strategic assets of an organization that can create the competitive advantage in business (Roblek, Meško, Bach, & Bertoncelj, 2014). Hence, the outmoded knowledge should be eliminated and sensitive knowledge must be protected through implementation of the K-Protection phase. Another sustainable measure to discuss is knowledge sources. DMAIC knowledge can be found in various kinds of document. This causes troubles to knowledge identification and storage. Fortunately, Knowledge Portal and Ontology Engineering are helpful to optimize exploiting knowledge and overcome the problem. They are used to collect, structure, maintain, and share DMAIC knowledge. Nonetheless, not all kinds of knowledge can be collected easily, particularly tacit knowledge. Using Ontologies and other techniques, KM process of OKMD model creates a conversation from tacit knowledge to explicit knowledge. Therefore, valuable experience and knowledge of experts will be accumulated and shared equitably. Far more than that, it encourages employees and managers participation in the knowledge sharing, and impulse the development of knowledge (Ritzen, 2000).

CONCLUSION AND FUTURE WORKS

In this research, the necessity for integrating concepts of sustainable development with a quality improvement model has been pointed out. A harmonious combination of three economic, social, environment aspects is essential to archive sustainably a quality improvement model. In case of the proposed conceptual model, crucial knowledge is created to improve business processes and enhance quality of products. Hence, accumulation and reuse of knowledge, a potential economic resource (Roblek, Meško, Bach, & Bertoncelj, 2014), is necessary. Effective managing and exploiting this resource of knowledge contribute innovation of products towards sustainable development of the DMAIC process. Finally, sustainable measures for knowledge management have been analyzed theoretically. For future work, the conceptual model can be validated by using data collected from a Six Sigma project in practice and applied into IT operations management.

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Lean Innovation of Course Unit Contents

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ABSTRACT

Designing courses for emerging areas of study is subject to clear challenges. If the envisaged courses are directly paid by the students – as it is the case of this research – they are actually the customers whose requirements have to be satisfied. Traditional approaches for collecting student requirements are not feasible for building up very novel topics. For such cases, an approach for course unit design that respects the lean philosophy is introduced in this paper. Lean is about creation of more value for students with fewer resources; or maximizing value while minimizing waste. The approach is based on the paradigm that, in highly dynamic and strong competitive educational markets, top quality courses must be designed from the very early stages. A hypothesis-based process defines the "content-prototype" of the course, which is further tested via web-based surveys that are directed to potential students. Results are statistically interpreted and a refined course content is formulated. The prototype for the most delicate module of the course is elaborated to test the level of delight of potential students (also called the WOW effect). Lessons learned are then considered to design the "promoter-prototype" of the course. A focus group is then used to test if potential students will feel a special experience interacting with the course content (also known as the KANDO effect). The methodology was experimented to design a master course unit on digital entrepreneurship. Empirical researches reveal the viability of the methodology to extract the appropriate topics of a course in emerging areas of study. Researches also show that a well-piloted strategy for course delivery should be in place to achieve the desired market impact.

Keywords: *course prototyping, lean innovation, digital entrepreneurship*

INTRODUCTION

Various published sources highlight the fact that economic environment faces with rapid changes (Drucker, 2015). The scientific and technological advances, together with other factors like business globalization make a lot of completely new professions to emerge onto the labor market (Durkheim, 2014). Just with an indicative role, an article in Forbes from 2012 was entitled "10 Jobs that Didn't Exist 10 Years Ago" (Casserly, 2012). Various foresight studies envisage for the future new needs in the labor market (Frey, 2011; Nusca, 2010; Penserini, 2012). In this context, universities must rapidly adapt, at high quality standards, their educational offers, too. New academic study programs need to be designed and operationalized to face with labor market evolution. Proactive actions to define high quality course units, starting with their 1.0 versions, are also necessary. This is because, in the new socio-economic world, there is not very much space for trial-and-error approaches. Traditional mechanisms of quality assurance in designing and delivery academic course units are based on the premises that stakeholders (e.g. students, employees, faculty staff) know very well the problem and express this by means of specific requirements (Brad, 2014). In the transforming educational environment, where a plenty of means and sources of information and education exist, universities should create "blue ocean" spaces to differentiate their offers with respect to other educational offers on the free markets. A strength of universities, which is still poorly exploited, is the capacity of the academic staff to think visionary and to formulate emerging courses and topics for study. Thus, by analyzing foresight studies and futurologists' opinions, universities can launch emergent study programs, capable to provide qualified graduates in due time. For example, emerging jobs in the years to come, highlighted on the "My_Future" portal, are: alternative vehicle developer, vertical farm engineer, avatar manager, social networking officer, old age wellness manager, etc. (Emerging Occupations, 2015). In this line we also find the job digital business entrepreneur. For such opportunities, universities can adopt courageous actions and initiate visionary study programs.

It is the purpose of this paper to introduce the results from a research project aimed to formulate a reliable methodology for ideation and construction of high quality course units related to emerging topics, where traditional tools of market investigation do not properly work. The methodology is called "lean innovation of course units" and it is the main subject of the subsequent section of the present work. Its experimentation on the emerging topic "e-Entrepreneur", also known as "Digital Entrepreneur", which is going to run from 2016 at the Technical University of Cluj-Napoca in the framework of a private fee-based MSc study program on "e-Businesses" is presented in the section 3. It is shown that, by means of smart approaches, impacting themes can be formulated in this incipient phase of course unit development, even if the target market is not quite familiar with the topic. The challenge is similar to the breakthrough or radical technology-push innovations in the industrial world. Section 4 of the paper is dedicated to conclusions.

LEAN INNOVATION FOR COURSE UNIT DESIGN

Innovation in this paper is about the whole process of bringing a new course idea to life. It includes the complete phases, from course ideation to course writing and course launching. Lean, in this paper, is seen as the conglomerate of steps and tools considered to avoid any non-value added work in course writing and non-value added topic, information or activity included in the course contents. Both perspectives are in line with the definitions of traditional innovation concept (Dias, 2014) and lean concept (Jasti & Kodali, 2015), particularized for the case of course unit design.

The methodological toolbox for lean innovation is introduced in the next paragraphs of this section. It is based on the preventive action paradigm, presented in Figure 1 (original authors' contribution), with the belief that a better planning will diminish later insurmountable or costly risks.

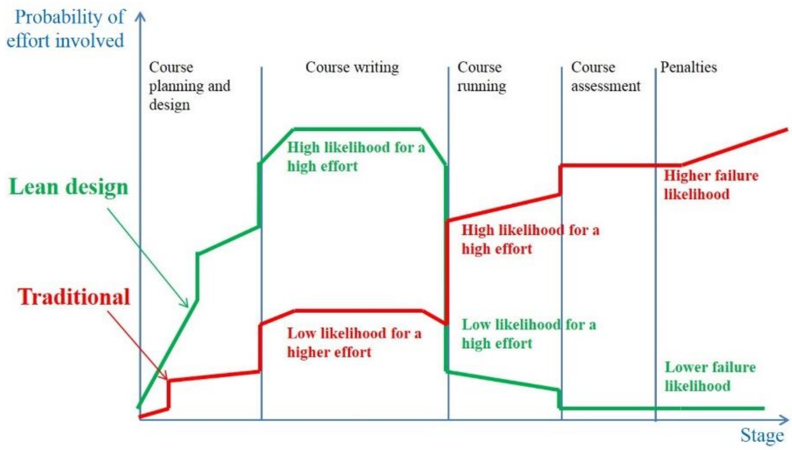

Figure 1: Preventive action strategy vs. traditional strategy.

Step 1: Ideation and impact understanding. Before starting to think around the structure and contents of any module of the course unit, a good understanding of the generic customer (e.g. various "personas" of potential students) is necessary. Academia and industry are not considered customers because they do not pay for the course. To sell something onto the market you need to know the needs and expectations of the buyers. Quality is judged here in restrictive borders – as the perceived value-for-money the buyer is paying. This involves some informal meetings (e.g. in a coffee shop, in an excursion) with people from the target segments to understand their values, priorities, wishes, fears, needs, ways of problem solving, behaviors, etc. Based on these empirical information, various topics that would be of interest for the target market in relation with the course unit are thought. This work has to be supported with information gathered from Internet, magazines and journals. Mind-Mapping, LOTUS, and 9W (e.g. in this order) are powerful tools to support the ideation process. All ideas must be immediately shared and discussed with few "personas" from the target market. Criteria to define the target market include: age (e.g. 23-35), BSc degree profile (e.g. for a course on E-entrepreneurship the BSc profile includes: informatics, computer science, telecommunications, economic informatics, automation, robotics, business, economic engineering), interest on entrepreneurship. In order to see the impact, the "smoke" test is applied. This means, about 10 people from the target market are contacted via email to provide a rapid feedback to your ideas. Ideas must be electronically available, either as attachments to email or in a web page. If 50% of the contacted persons reply to your request, the conclusion is that the topic might be of real interest. Viable ideas are then selected for further developments. It is also necessary to profoundly meditate from the very beginning on how each topic will be useful in practice for the graduates.

Step 2: Testing and refinement of the content prototype. A prototype of the course unit is elaborated at this step. This means, for each module, a summary of the issues included in the course, as well as elements of practical utility are considered. This must be done both for the lecture classes and applicative classes. Information is introduced in a web form for electronic surveying. Tools like Google Forms or Monkey Survey are adequate to support this process. Information about utility (e.g. reduced, medium, and high) of the topics is required. The survey is submitted to a representative sample from the target group. Email addresses are obtained from university or faculty secretariats, alumni offices, study program tutors and student associations. Results from the survey are statistically analyzed and interpreted. Recommendations and conclusions from the survey are sources of inspiration for course content refinement. If the work from the step 1 and step 2 of the methodology is properly done, over 80% of the respondents in the survey have to appreciate all topics of high utility, otherwise the main streams of the course must be radically reengineered.

Step 3: Prototyping, testing and refinement of the weakest link. For the module with the worst feedback in the survey, two or three representative topics are elaborated into more details. Email opinions from 3 to 5 personas are required. They are selected from the pool of respondents to the survey in step 2; in principles those that responded with high promptness. The "WOW" effect (Munoz, 2013) is tested. "WOW" is an acronym that expresses a very pleasant surprise. It is important to organize an informal meeting with the selected respondents in advance; for example, by inviting them to a coffee in the downtown. Feedback is used to refine the material and to generalize the main lessons learned to the other modules of the course unit.

Step 4: Testing and refinement of the promoter prototype. At this stage, a key topic from each module is elaborated into detail. The occasioned set of topics represents the "promoter prototype" of the course. It is introduced to 10 personas in the target group by organizing a 4-hours workshop. If more than 6 people in the workshop give the maximum appreciation to the content, the chances that the final course to be promoted in the community by word-of-mouth are reasonable high. If this does not happen, content must be revisited, revised and an additional workshop, with other guest participants, has to be very soon organized.

Step 5: Testing and refinement of the prototype for special topics. In order to have a high impact course, every module must include at least one topic that is thought to create a special experience to the audience in the class (the "KANDO" effect). Delighting topics do not necessarily need to be highly elaborated in the prototyping phase. Generation of the "KANDO" effect (Corporate Philosophy, 2014), which determines students to meditate long-time-after to a certain or some key aspects, is not an easy task and this requires creativity and hard work done by the lecturer. "KANDO" is a Japanese word that does not have a precise equivalent in English. "KANDO" is something that inspires the heart and spirit.

Step 6: Testing and refinement of the delivery strategy. A course can be delivered to students in multiple ways. Modern technologies used in education provide many alternatives to deliver information and knowledge. Strategy should consider the best possible schedule of the face-to-face meetings between students and lecturer. Because each participant in the course has a particular daily program, there is no optimal solution in terms of scheduling face-to-face meetings. Therefore, flexible solutions have to be considered like, for example, the record of the lecture. For a good traceability, the use of multimedia technologies to enhance the course modules with short movies, animations and simulations (where appropriate), is very much welcome. MOOCs-inspired courses (Massive Open Online Courses) and supporting web platforms meet todays' expectations of most students. Value-for-money should be also tested at this stage. A high quality course unit must be self-sustainable, even if it is independently delivered, not necessarily as part of a study program. A course unit is, in principle viable, if a group of 10 students agrees to attend the course and each student is happy to pay 10% of the overall course costs. This step also includes a systematic work around a cost-effective strategy to educate the wider market about the usefulness and opportunity of the course and around the effective actions to honestly persuade potential students to attend the course. Thus, a delivery strategy requires resources (time, money, technology, skills), which have to be allocated in due time.

Step 7: Guidelines for development. Once the new course is designed, a lot of work is necessary to develop it. This effort involves time, money, documentation work in the library and documentation in the field, interviews with practitioners, ingenuity, and skills for formatting knowledge on digital means (e.g. text, sketches, drawings, graphics, movies, simulations, and animations), as well as other resources (e.g. server, e-learning platform, recording camera, multimedia projector, etc.). All these things need a careful planning. An important aspect at this stage is the cost-benefit analysis over the course life-cycle. Net Present Value (NPV) and Return on Investment (ROI) are useful indicators to limit the level of investment in the development phase of the course unit.

CASE STUDY

The origin of the lean innovation methodology was actually caused by a real situation with which the authors have confronted in 2014. The university has initiated a private fee-based new master program in e-Activities, with a line of specialization on e-Businesses that is going to start in autumn 2015. A course unit on e-Entrepreneurship was included by the program coordinator in the curricula of this study program and the authors of this paper have been invited to run this course unit starting with autumn 2016. Despite the fact that digital businesses are not necessarily new in the market and the discipline of entrepreneurship is already a consolidated one, the combination of the two fields is seen as an emerging study area because of the specific particularities in the business models and skills necessary for e-entrepreneurs.

The course unit includes 56 h, organized into 14 class modules (28 h), 7 seminars (14 h) and 7 meetings for project tutoring (14 h). There are plenty of possibilities to fill this course with information about entrepreneurship and digital businesses, but because of the novelty of the study program in the market, not very many consolidated references exist (e.g. in other universities) to get some clues on the best topics and their weighting within the course structure. Thus, the lean innovation methodology was considered to solve this problem. Because of space constrains, in the following paragraphs of the paper only fragments from the step 2 will be illustrated. The content prototype from step 2 is presented in Table 1. The survey was done using a Google Form worksheet. Invitations were sent to 380 students from several universities in the city that study in the field of informatics, computer science, telecommunications, automation, robotics, electronics, business, and management.

Table 1: Content prototype (fragments).

Module 1: Foundation of entrepreneurship, the entrepreneur, and entrepreneurial profile: understand the key elements of an entrepreneur; entrepreneurship dimensions; major challenges; business life-cycle; entrepreneurial activity; entrepreneurial strategies; entrepreneurial practices; characteristics and qualities of an entrepreneur
……….
Module 7: e-technologies for e-entrepreneurship: brief presentation and examples of Web 2.0; Web 3.0; IoT/IoE; IaaS; PaaS; SaaS; big data; cloud computing; augmented reality; data analytics; open source; collaborative innovation
……….
Module 9: Organizational processes in e-enterprises: basic structure of an e-organization; basic organizational functions; roles and attributes; quality management in e-enterprises; process flows; orientation on continuous innovation
Module 10: e-product management for e-businesses: e-product manager attributes; human resource evaluation on innovation; competitive development of e-products; quality planning of e-products; development strategies for e-PSS
………..
Module 14: e-technologies for e-engineering: examples of information systems that support product design and development; key functionalities for collaboration in distributed systems
Seminar 1: The entrepreneurial plan for e-businesses: structure and case study
Seminar 2: Generation of new business ideas in the Net-Economy: methods and exercises
…………
Seminar 5: Business models in e-commerce/e-intermediation/e-service/e-sales: roundtable; case studies collected by students; invited speaker
…………
Project 1: Entrepreneurial plan for e-business X
Project 2: Financial plan for e-business X
Project 3: Marketing plan for e-business X

A number of 90 persons responded to the electronic survey, which falls into a statistical analysis with ± 10% error, at a level of certainty of 90%. Results in the survey show the followings:

- Majority of the future students (approx.. 75%) will appreciate all “step 2”-proposed topics as being of “high utility”
- Respondents that marked some “step 2”-proposed topics with “low utility” or “medium utility” did not recommend alternatives – this meaning they have no clear idea what they would like to see in this course
- Approx. 20% from the future students would consider 50% of the “step 2”-proposed topics of “medium utility” and 50% of “high utility”
- Approx. 5% of the future students would consider 20% of the “step 2”-proposed topics of “low utility”
- Approx. 90% of the future students would appreciate all “step 2”-proposed topics of the seminar of “high utility”
- Approx. 5% of the future students would consider 30% of the “step 2”-proposed topics in the seminar of “medium utility”
- Approx. 5% of the future students would see 40% of the “step 2”-proposed topics in the seminar of “low utility”
- Approx. 95% of the future students would see all “step 2”-proposed topics of the project of “high utility”
- Approx. 5% of the future students would see 30% of the “step 2”-proposed topics of the project of “medium utility”.

Lessons learned from the survey are:

- All topics will be kept, but with some additions to module 14 (i.e. high performance computing technologies to assist e-businesses) and to project 3 (i.e. cases for the marketing plan on e-businesses)
- To increase the impact of module 1 for potential disinterested students on the topic “basics about entrepreneurship” (e.g. because they already know this), an appendix to the course will be included, consisting of a test for self-assessment of personal entrepreneurial qualities
- To increase the impact of module 7 for potential disinterested students on the topic “e-technologies for e-entrepreneurship”, real case studies on IoT/IoE will be expanded
- To increase the impact of module 14 for potential disinterested students on the topic “e-technologies for e-engineering”, module will be expanded with examples on “e-technologies for product innovation”
- To increase the impact of module 9 for potential disinterested students on the topic related to “organizational processes in e-enterprises”, the module will include an appendix with ISO standards on quality management (ISO 9001) and innovation management (ISO/TC 279), as well as with examples of procedures, instructions and records, plus collaborative web platforms.

From the survey, module 1 and module 14 look to be the weakest links of the course. Thus, the step 3 of the lean innovation methodology was concentrated on these two modules. The WOW effect was tested on the following topics: “entrepreneurial practices, characteristics and qualities” (module 1) and “collaboration in distributed systems” (module 14). The contents of these topics have no space for being displayed in this paper.

CONCLUSIONS

The main contribution of this paper is the proposal of a lean innovation methodology to design course unit contents for emerging topics in the university private fee-based study programs. Following a “Probe-Test-Evaluate-Learn-Refine” cycle, the methodology is able to unveil the key issues from the very early phases of the course life-cycle, to focus development on WOW and KANDO effects by means of a series of evolving, well-targeted prototypes of the course.

The case study that complements the theory shows that the lean innovation methodology works properly. It allows course developers to know from the early phases of course life-cycle its potential impact and leads the work to converge towards the formulation of a high quality solution.

Some important findings have been also revealed from the experimental research. The most important one is that if the WOW and KANDO effects are achieved on a single topic from each module the high positive impact of that module is ensured. However, to achieve these goals, a lot of creativity and information from real cases is necessary to put in place.

The second important finding is that experts, academics and industry are useful to deliver ideas for course content, but the result should be tested on those stakeholders that are going to pay the course – the potential students.

The third finding is that respondents are capable to express what they want and do not want once they have in front of them a proposal. This means a starting prototype must be in place – even if it is based on hypotheses – such as respondents can analyze their needs with respect to something and can provide feedbacks that are helpful for refining the content.

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Internship and Private Fellowship: Why is it Difficult for Companies to Find Suitable Candidates?

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ABSTRACT

This exploratory study aims to identify the factors that prevent companies to find suitable candidates for private fellowships and internships: what students believe to be the causes, how would they explain these and which stakeholders should be involved to eliminate them. Data collection based on a sample of 18 engineering students that attended a company presentation inviting applications for private fellowship and student practice. Opinions were expressed in writing prior to structured interviews and group discussions. Limitations to this study are the relatively small sample size (n =18) and reliance on self-report measures. Information related causes were perceived by the students to lead their decisions, followed by lack of self-confidence of successful application for the grant. Respondents were classified in „Doers", „Wishers "and „Lagers". Universities must reinvent themselves in order to provide students with better knowledge and confidence on the job market, measured through a larger number of doers, which could become role models for wishers. Such process may generate a "critical mass" or tipping point in the transformation of a significant number of "wishers and lagers". Whilst some of the students' opinions are subjective, cooperation between universities and companies must continue to improve in order to enhance learning and better prepare students for their future careers.

Keywords: *student fellowship, self-confidence, qualitative research*

INTRODUCTION

Economic crisis hit hard many organizations and companies. Forced to restructure and reduce their activity the firms had to lay down personnel leading to high unemployment rates, especially among youth. Even in harsh economic conditions, some companies sustained their efforts to provide students with internships, practice placements and private funded grants. The author noticed the discontent of the representatives of such a company with the reluctance of students to apply for such grants, based on a job fare event for students.

This qualitative research aims to gather data regarding student's perceptions on the causes why companies do not find suitable candidates for private fellowships and internships, how the students explain such causes and analyse the stakeholders that should be involved to eliminate them. Thus, the paper aims to contribute to the debate in the wider academic community on issues of preparing students to successfully enter the Romanian labour market.

Context

There are three kinds of grants provided by State Universities during term-time: "Study" of about 40 Euros/ month, "Merit" of about 55 Euro/ month and "Social" for students with financial difficulties of about 30 Euro/ month.

The company, a multinational from the steel industry, is located about 500 Km from researcher's university and provides 650 scholarships across 17 countries distributed to over 80 Universities. Bursaries are particularised for each country.

In Romania, the bursaries consist of nearly 200 Euros/month for 12 months and targets engineering students from several Technical Universities/ Faculties.

Applicants must have good grades for the whole year, pass most of the exams and attend at least one meeting with the company providing the grant. There were no other specific requirements for the recipient "*no strings attached*", as expressed by the representative of the company such as compulsory practice/ summer work or employment after graduation. She provided a contact data for a student, which was the recipient of the grant for three consecutive years and declined twice a contract to work for the company after graduation. The student confirmed the information. Analysis of a copy of the contract from another grant's recipient revealed that there were no conditions stipulated for the grand beneficiary except from keeping up the hard work and continue to receive good grades.

In Romania, technical universities' students must do "student practice". Therefore, for the recipients of the grant the company would facilitate practical training (i.e. internship, part time employment or practice).

LITERATURE REVIEW

Since 2005, in United State occurred a shift from Need Based to Merit-Based grants (Doyle, 2006) to provide a better use of the money. A study of the impact of financial aid on student dropout from or the completion of higher education (Arendt, 2013) revealed that impact on dropout rates was higher for students from a lower socio-economic background. Grants lowered the number of work hours while studying. Persistence in college and college graduation likelihood of low-income students may be enhanced through financial aid that lowers economic barriers for low-income students (Alon 2011, Gentry 2014).

Scholars researched student's belief in themselves through optimism (Tschannen-Moran, Bankole, Mitchell, & Moore Jr., 2013) as a composite measure of student trust in teachers, academic press and student identification with school related with student achievements. Work experience through student practice, employment and internships has a direct impact on student's acquired "soft" skills (Cord, Sykes, & Clements, 2011) and self-confidence (Hynie, Jensen, Johnny, Wedlock, & Phipps, 2011).

There are mixed reports of the benefits of part-time work during academic studies. Discouraged university students are reluctant to work during term-time and combine studies and work (Mihail & Karaliopoulou, 2005). Whilst part-time work not necessarily degree related represents a source of income, some of these experience provides rich learning experiences for students (Shaw & Ogilvie, 2010). Thus, students become aware of the recruitment process, challenges and issues that occur in real organizations, develop self-marketing, and job search skills (McCorkle, Alexander, Reardon, & Kling, 2003).

Across industries, faculties are seeking to improve job placement rates for their graduates (Chi & Gursoy, 2009).

METHODOLOGY

This research is an exploratory, qualitative study of the perceptions of private fellowships and internships among engineering students and the causes that prevents companies to find suitable candidates. Semi structured interviews and an "informal" focus group were used for data collection. The sample consists of 18 students, plus 5 others that were there by chance and only attended for 15 minutes. All had been exposed to the presentation of the Company's representative that complained of the lack of interest from the students for their grant program.

In order to stimulate individual answers and avoid "borrowing" other's ideas from the group, the participants were required to fill in some forms as semi-structured questionnaire prior to discussions. Thus was enhanced the expression of their own perceptions and ideas, limiting the influence of the group where they could "hide" and say that they agree with their colleagues.

Participants agreed for the discussions to be voice-recorded to enable later evaluation and to free the flux of ideas and emotions flow uninterrupted.

RESULTS

Student perceptions regarding the „Causes why" the company do not find suitable candidates

Analysis of the written forms and interviews revealed 6 categories of causes perceived by the students (Information; Experience (professional); Lack of self-confidence; Faculty; Students ; Company), depicted in table 1.

Table 1. Factors and their influence for each category of causes

CAUSE	FACTORS	EXPLANATION
1. INFORMATION **"No *strings attached*"**	LACK OF / INSUFFICIENT planning and preparation of the promotion campaign	• Students are not informed or it / Arrives too late to the students • It is INCOMPLETE • Therefore Students DO NOT TRY AT ALL

	GRANT ALLOCATION CRITERIA	• There are NOT presented the CONDITIONS or • Those conditions are NOT CLEAR for Grant ALLOCATION • Criteria are perceived or presented with ERRORS
	RARITY of such PRIVATE GRANTS	• Not promoted on a WEB SITE • No Web site dedicated/ specialized on private fellowship/ internship
2. **EXPERIENCE** (professional)	LACK OF or INCOMPLETE NOT RELEVANT (as perceived by the student)	FEAR TO APPLY for both private fellowship and internship
3. LACK of SELF-CONFIDENCE	Personal perception of LACK OF CREDIBILITY	WHY do they GIVE THE GRANT with NO STRINGS ATTACHED "***IT MUST BE A CATCH***"
4. FACULTY	Academic staff should put on less theory and made it better applied More PRACTICAL WORK	Courses and seminars to be more practical oriented To do practice in a company for the equivalent of 1 day a week
5. STUDENTS	GRADES too small Distance too great between Co. location and student residence	Do not learn enough "Laziness" – just a reason to justify why did not apply. What about holidays on the sea-side.
	Lack of interest	Social life in the campus Large group of students that are not interested Lack of belief that would pursue a career in their field of study
	Incompatibility (as perceived by the student)	For the job after graduation in their field of study
	Do not REALLY want to high grades in Faculty	Just want to go by using the "minimum resistance" and got the Degree
	Do not wish to assume RESPONSIBILITY (be RESPONSIBLE)	Did not discuss this issue, but I presume the influence of the SUPPORT (or LACK of IT) received from own FAMILY and personal VALUES

	Would like to BUT CANNOT learn enough Doing work for charity or NGOs	Does not have good grades because have to work to support themselves May believe that would get a job in a different specialty after graduation
	Do not know a foreign language	Great barrier if the company requires them to (and they have to use it)
	See their future in other countries	Not explored and could not explain this observation
6. **COMPANY`**	TO BE INVOLVED	In and with the Faculty

Students' perceptions regarding stakeholders that should be involved to eliminate causes

De difficulties faced by the companies in finding suitable candidates are generated by a complex interaction of factors. A sustainable solution requires a new set of rules and interactions among the four key stakeholders as perceived by the students from the sample:

- COMPANY (and the person responsible for this issue) and
- UNIVERSITY (Top Management and Academic Staff).
- STUDENTS (as perceived that *have to* play a role)
- FAMILY(not really referred to and therefore not discussed and analysed)

Table 2. Finding better candidates: stakeholders that should be involved

STAKEHOLDER	FACTORS	EXPLANATION
1. COMPANY (The person **assigned to be responsible** for the project **and** The company's **top management)**	Explains the situation	- Explicit presentation of the working conditions and the procedures/ process to gain the fellowship - HAS the Authority and responsibility - Knows the situation and has faith - Convince you to apply
	Provides Support, resources and celebrates results as well as acknowledges the partnership with the University	- Active promotions of the private fellowships/ Internships and Practice within the company - Ensures appropriate level of resources and support - Appropriate access and use of media during promotion campaigns (TV/ Web/ Radio, Events, etc.)
	Bring in Proofs that program works (such as students that already have the grant)	- Brings credibility to the Fellowship and the way it is allocated - Better Understanding of the way the system works - Positive Examples for the students - Credibility

2. UNIVERSITY	Top Management Rector/ Deans Academic Staff	- Students to be well prepared and "In Great Demand from Companies" - Vision, Support, Resources, Results - Acknowledges and Celebrate achievements - Promote the Private Fellowships and Internships and support open competition - Important role in Influencing and Motivating Students - Coaching and Mentoring

3. STUDENTS	OWN RESPONSIBILITY was barely mentioned at this stage	- Required support and encouragement from academic staff to improve learning and receive the grant
		- Better use of theory in practice
		- Did not assume responsibility for not applying; ALL motives are "outside of their control"
		  o *somebody else (…) should help and*
		  o *Should lower their criteria*

4. FAMILY	Only one occurrence	- No reference or explanation regarding involvement of parents

DISCUSSION

Information related causes (including lack of it) are perceived by the student to have the greatest impact on the scarcity of suitable candidates reported by the company. Promotion activity should provide clear, concise and verifiable (trustworthy) information, including appropriate means that would make applicants believe that "no strings are attached" to such offer.

Whilst during job fare event there were former grand recipients on the company's stand that could provide details regarding the grand and confirm that the contract did not include any conditions for the recipient, none of the 18 students from the sample asked for further information or made an application.

Second important factor that deters students to apply relates to Lack of SELF – CONFIDENCE. It roots both in limited personal experience, as he/she knows that did not work and believes that has no credibility (proved by grades, knowledge of a foreign language, knowledge of theory and practical application). Such negative self-perception fuels fears of rejection and pain of seeing reality which determines the student not to try. The researcher was told by some students that whilst being invited to interviews they decided not to go because they may not get the job, or leave the comfort of his/her present emotional life.

For most of the students from the sample, there is no *self-reflection* and career planning and therefore very limited desire to actively work toward finding an internship position or a private fellowship. Few respondents reported self-awareness and acknowledgment of the importance of practical experience (for internship) and good grades (no work during term-time based on private fellowship). However, there was no evidence of application forms towards companies that could enable such experiences.

Further research should include qualitative and quantitative study of the students' life goals, aspirations and preparation for employment.

Data analysis revealed three categories of students, based on their specific behaviour: DOERS, WISHERS and LAGERS

1. DOERS are very rare, they have well established aims and objectives regarding their career and had already engaged in actions in order to achieve them and have excellent grades. There are some doers that are engaged, know where they are going but do not have good grades because they work or value more their „practice" for what they will do after graduation.
2. WISHERS constitute a small group, larger than doers. They ask themselves some problems (in terms of aims and objectives) but there are few concrete actions to reflect on their learning and assuming responsibility for their life.
3. LAGERS does not have aims, objectives and do not acknowledge the importance and impact of their actions. They seek motives for their actions that are outside of their control and therefore justify their lifestyle and achievements.

Whilst not proven, the author presumes that there were at least a critical event in DOER's life that forced them to assume responsibility, or they had a harsh life. Such opinion bases on some informal private discussions with students that acknowledged that they had no parents or single parent that had to support 5 brothers. They needed the university bursary and therefore had excellent performance in the University.

Not all single parent students focused on learning. Some other student reported that her mother and sister over protected her by sending money during a time when she was also receiving government help for her deceased father.

Subsequent interviews with company's representative and academic staff with managerial positions from the university confirmed that in each year there were some recipients of this private grant, without clearly identifying the persons, the number of bursaries awarded or a brief video presentation of the recipients stating their specific achievements due to receiving this grant.

CONCLUSIONS AND RECOMMENDATIONS

This paper aims to contribute to debates in the wider academic community on the issue of preparing young, well-educated people to be better prepared to enter the Romanian labour market.

Whilst may be an isolated case where students did not enrol for private fellowship, the qualitative research revealed strong perception of students that they were "not provided" with enough information, encouragement, support in order to apply. Many students from the sample also perceived themselves as not having enough theoretical and practical knowledge, which generated lack of self-esteem leading to abstinence in applying for the grant. Informal discussions with some 3rd and 4th year students revealed that many either did not apply or received no feedback to their application from the companies.

The solution requires joint efforts of University and Private enterprises (Gault, Leach, & Duey, 2010). All faculties already had taken significant steps to improve the quality and quantity of applications through organizing student practice in companies, improved communication through web site and exhibiting the calls for applications from interested firms. They should continue to adapt and improve the curriculum in order to meet the continuously changing industry needs (Chi & Gursoy, 2009). Such actions would gradually improve students' self-confidence and determine a larger number to apply and be accepted by the companies.

Some students were reluctant to involve their family and/or stated that even if the family would be involved, they would not change present attitudes and behaviours. There were no references to spiritual life that may also play a role in influencing decisions.

Limitations of the study

The main limitation is due to a relatively small sample size (n = 18) and reliance on self-report measures by respondents.

Whilst there may be other companies to offer grants and internships, the paper only focuses on this firm. The study should be extended to include cohorts of students attending other company's presentations from both engineering and non-engineering students and universities, and compare data with company's information on the number of applicants and successful candidates.

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Discrimination of various vulnerable groups - perception among the students of the Faculty of Engineering ("Lucian Blaga" University of Sibiu)

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ABSTRACT

The purpose of this article is to highlight students' perception of the Faculty of Engineering concerning discrimination, particularly discrimination against certain vulnerable groups. This issue is part of a broader research that aims to assess the attitude of students towards discrimination.
The method used in the study is questionnaire-based survey. The questionnaire includes scales and subscales for measuring the attitudes of subjects, their emotions, cognitions and behaviors in relation to discrimination in general, and specifically in relation to certain vulnerable groups such as the Roma population, people with HIV/AIDS, people with a different sexual orientation or people with disabilities and mental illness.
The main results of our research have demonstrated that the students from engineering believe that there is discrimination within society, including at the level of educational institutions; the most discriminated category is Roma population.
These results reflect the importance of training engineering students in the field of ethics and non-discrimination. We conclude that there is a need of such courses in the context of promoting inclusive societies and of the rebirth of business ethics education at an international level.

Keywords: *business ethics, engineering students, discrimination, vulnerable groups*

CONTEXT

The study presented in this paper was conducted within the project POSDRU/156/1.2/G/142145 "Medical higher education oriented towards a non-discriminatory treatment of patients", developed in partnership between the "Lucian Blaga" University of Sibiu, as beneficiary, and the Association for Development and Social Inclusion (ADIS), as partner, during the period May 14th, 2014 - November 13th, 2015.

The project takes into account the fact that discrimination is one of the current issues in Romania and also that there are signs of aggravation of this phenomenon (according to the report "Perceptions and attitudes concerning discrimination in Romania", realized in 2012 and 2013 by TNS CSOP Romania, at the request of the National Council for Combating Discrimination). The phenomenon has also an impact in the economic field, in the context of social issues such as numerous corporate scandals and malpractice cases at international level (Jagger & Volkman, 2014), growing lack of confidence in the correctness of business (Wankel & Stanusch-Stachowicz, 2011) etc.

Business organizations are an integral part of economic, social and environmental systems. Therefore, the activities, structure and processes of these organizations must assume responsibility for the impact they have on those systems and the society that supports their existence (Sharma et al, 2010, Lauring and Bjerregaard, 2013, Goela and Ramanathan, 2014).

Activism in the business world also involves awareness of social problems. Business professionals should pursue profit, but at the same time must strive to achieve a balance between profit and responsibility, between variety and equality. People always exist as individuals in space and time. They are neither omnipotent nor omniscient, therefore are prone to making mistakes. On the other hand, they must take responsibility for their actions. No man can live outside the sphere of morality (Kacetl, 2014).

Ethics is even more important nowadays, as we live in an existential chaos, marked by different traditions, customs, cultures, religions, commercial interests which must be brought into harmony. The Romanian business environment needs a range of values and standards in making everyday decisions and in the elaboration of strategies for long-term development (Georgescu, 2012).

Today, ethics has an important place in all areas of life. Education is a fundamental process of each individual’s becoming, therefore ethics in the educational system must occupy a very important place (Gülcan, 2015). The results of our study also suggest the need for and the importance of the introduction of ethics and non-discrimination courses in the curricula of future engineers.

People generally tend to follow social rules, except when it becomes too costly to do so (Engelen, 2011). In many cases existing institutional models of private business structures are proving to be expensive for the community, and thus there is a growing pressure for a change in the structure of these rules. Strategic corporate social responsibility measures (Corporate Social Responsibility) are potential ways of updating these rules. Other processes such as corporate governance, corporate and political mobilization (Corporate Outreach and Politics), rebuilding of the business (Business Process Redesign) and corporate business strategy are also tools and strategies that must be adopted by companies to comply with the ethical principles in business (Goela and Ramanathan, 2014).

Regardless of the numbers and the issues addressed by studies in the field, there is a research gap addressing some moral and social issues like attitude of discrimination among the groups of students. Business ethics has become an important part of study programs. Among the topics to be addressed are those related to cultural and linguistic diversity, different approaches to the ethical and moral principles in different cultures, ethical dilemmas (Kacetl, 2014).

In this article we intend to analyze the manner in which the students of the Faculty of Engineering ("Lucian Blaga" University of Sibiu) perceive discrimination in general, and in particular the discrimination against certain vulnerable groups, bearing in mind that "now more than ever the universities are called upon to prepare students who will raise ethical standards in the business world" (Kurpis, Beqiri & Helgeson, 2008; Jagger & Volkman, 2014).

The present paper addresses the main problem of perceiving discrimination against vulnerable groups, but also the possible intervention, among students, by designing courses about these issues.

THE CONCEPT OF DISCRIMINATION

Traditionally, discrimination has been defined as a negative and unjustifiable action which denies equal treatment of individuals or groups of individuals (Dipboye and Colella, 2004). Discrimination can occur on many levels: cultural, social, institutional, individual. There are two important concepts for the understanding of the process that generates discrimination. These are prejudice and stereotype (Dipboye and Colella, 2004).

Prejudice is defined most often as a negative and unfair attitude towards a social group or one person in that group. Like other attitudes, it provides a set-up for the interpretation of the environment by the attributes of good guy-bad guy, thus preparing the individual to take appropriate action. Prejudice can be generally reflected in assessments, and may include emotional reactions such as anxiety or contempt (Dipboye and Collela, 2004).

The stereotype is a generalization of beliefs about a group or its members, which is not justified because it reflects faulty or over-generalized thinking processes, impropriety, excessive rigidity, erroneous assignments, attitudes of prejudice, discriminatory behaviors (Dipboye and Collela, 2004). A stereotype represents a specific constellation of traits and roles associated with a group.

Because stereotypes function as coherent cognitive schemes, they influence how information about a group or a group member is acquired, processed, stored and recalled. Activating the stereotypes usually produces a processing of information which is an advantage for the stereotyped traits or other associations (Dipboye and Collela, 2004). In addition, people do not typically call the perceptual information that might refute the stereotype, but tend to view the group members that are outside the stereotype as exceptions or as a representative of a subtype of that group. As a result of these processes, stereotypes are resistant to change.

As far as the specific content of the stereotypes guides the praising of group members and defines appropriate roles and behaviors, stereotypes can determine how people respond in affective and behavioral manner towards the members of a group. Aside from their obvious expression in discrimination, stereotypes and prejudices can model interpersonal interactions in subtle but significant ways.

METHOD

In order to assess different aspects of the perception of discrimination among the students, we used a questionnaire with four scales: a scale for the perception about people with HIV/AIDS, a scale for the perception about people with different sexual orientation, a scale concerning perceived discrimination of people with mental illness and/or disabilities and a scale regarding discrimination of Roma population. The first three are Likert scales, with the answers ranging from 1 (total disagreement) to 4 (total agreement).

The HIV/AIDS discrimination scale contains three subscales. The first has 27 items, with a score from 27 to 108. The higher the score, the higher the declared discriminative attitude towards people with HIV/AIDS (e.g.: “I do not use the swimming pool at the same time with a person with AIDS/HIV”). The second one is a social distance scale, with 12 items, ranging from 1 to 10. A higher score means a low social distance, thus represents a low discrimination (e.g.: “Rate from 1 to 10 - with 1 representing I DO NOT ACCEPT and 10 representing I TOTALLY ACCEPT - the extent of acceptation that a person with HIV/AIDS is your neighbor”). The third subscale evaluates knowledge about the HIV/AIDS disease. There are 16 items and the answers are true or false (e.g.: “HIV is transmitted by coughing and sneezing”). The score ranges from 0 to 16; a higher score indicates better knowledge about HIV/AIDS.

The “other sexual orientation” discrimination scale contains 29 items, with a score ranging from 29 to 116. A higher score means a higher tendency to discriminate people with other sexual orientation. (e.g.: “A person with other sexual orientation should be isolated from other people”).

The mental illness discrimination scale and the disabilities discrimination scale evaluate the declared attitudes towards people with mental illness and with disabilities. The first one is a Likert scale, ranging from 1 (total disagreement) to 4 (total agreement), with 22 items. The score is ranging from 22 to 88; a higher score shows a higher tendency to discriminate people suffering from mental illness. The scale measuring the attitudes towards people with disabilities has 20 items. The respondent has to range from 1 (total disagreement) to 6 (total agreement).

The scale evaluating the attitudes towards Roma population has three subscales and it based on a vignette. A situation is described and afterwards emotions, cognitions and behaviors regarding this situation are assessed.

The questionnaire was applied to 142 students from the Faculty of Engineering - "Lucian Blaga" University of Sibiu. Statistical processing was done using SPSS - version 22.

RESULTS

The comprehensive study conducted within the project in order to measure the attitude of discrimination of students from "Lucian Blaga" University of Sibiu included 1135 students, aged between 18 and 48 years; 372 male and 763 female. The number of participants allow comparative and correlational analysis between students from different faculties, revealing the problematic of discrimination in different fields of sciences, education and levels, helping to understand the phenomena of discrimination and to intervene adequately.

The structure of the respondents according to the faculties of belonging is as follows:

Table 1: Respondents in relation to the faculty of belonging

Faculty	Frequency	Percent
Law	245	21.6
Letters and Arts	52	4.6
Social And Human Sciences	310	27.2
Engineering	142	12.5
Sciences	10	0.9
Medicine	343	30.2
Agricultural Sciences, Food Industry and Environmental Protection	10	0.9
Economics	22	2
Theology	1	0.1
Total	**1135**	**100.0**

As Table 1 shows, 142 of the respondents were students within the Faculty of Engineering, and the results that we will further analyze will refer only to them.

Amid the economic and social impact of the economic crisis, both business people and scientists have argued the importance of ethical education in business and the need to increase social responsibility (Blasco, 2012; Jagger & Volkman, 2014). Starting from this necessity, the instrument of data collection (the questionnaire) included questions about discrimination in general, as well as questions concerning discrimination of certain vulnerable groups.

When asked about the extent to which they themselves discriminate, engineering students responded as follows:
- 35% considered that they discriminate to a very little extent;
- 62% felt that they discriminate to a small extent;
- only 3% considered that they discriminate to a large extent.

Therefore, most respondents (97%) believe that they discriminate to a small and very small extent.

On the other hand, however, the students considered in significant percentages that discrimination exists within the Romanian educational system:
- in school - to a very large extent (38%), to a large extent (42%), to a small extent (16%), to a very low extent (4%);
- in universities - to a very large extent (9%), to a large extent (40%), to a small extent (43%), to a very low extent (8%).

Thus, a total of 49 percent of the respondents considered that discrimination exists in universities. This result comes to emphasize the imperative need for courses on ethics and nondiscrimination, both for students and teaching staff. The educational establishments (and in particular universities) can and must have a pivotal role in providing ethical and non-discriminatory education and in promoting the importance of moral, ethical and non-discriminatory behaviors and attitudes, according to their own values, principles, traditions and experiences (Levy & Rakovski, 2006; Caldwell, 2010; Blasco, 2012; Jagger & Volkman, 2014). This is the best way to prepare the future professionals for a correct approach at their workplaces.

In fact, 62% of the students in Engineering believe that, in Romania, there is discrimination at work to a large and very large extent (43% and 19% respectively). Thus, a holistic approach in the teaching of ethics is recommended, in which students are encouraged to improve their knowledge and to develop skills in their own personal values framework (Jagger & Volkman, 2014). Several methods and models of training in this area were proposed and analyzed, in order to increase dialogue, social justice and non-discrimination (Wang, Zhang & Zhu, 2015).

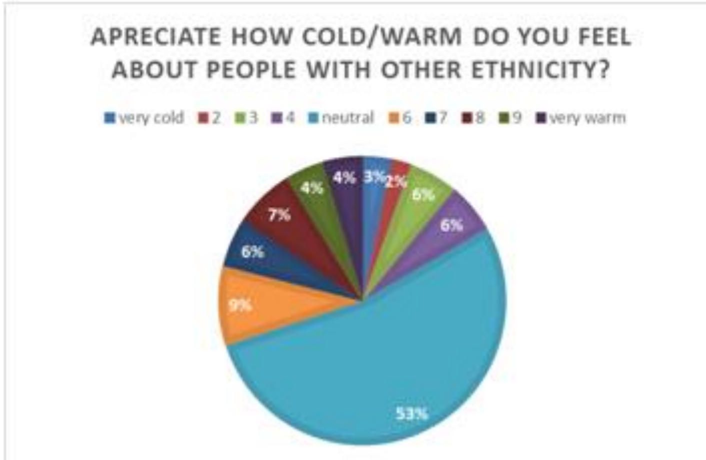

Figure 1: Hot or cold appreciation of students of the Faculty of Engineering in relation to persons of other ethnicity

In relation to persons of other ethnicity, over 15% of engineering students felt "cold" and 53% declared themselves neutral in relation to persons of other ethnicity. At the same time, the percentage of those who feel "cold" drops (to 8%, 5% and 7% respectively) when it comes to disabled people, children, or those terminally ill.

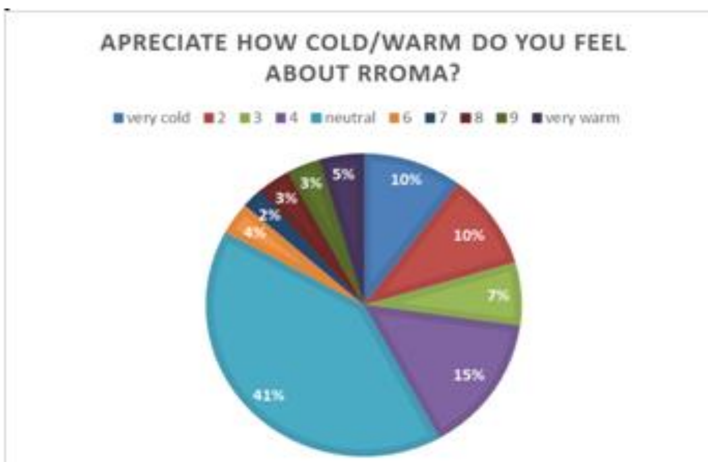

Figure 2: Hot or cold appreciation of students of the Faculty of Engineering in relation to the Roma people

Regarding the attitudes towards Roma population, results show that there is a significant relation between the emotions and cognitions subscales, but none significant relations between these components and the behavioral one. Interesting is the fact that there is a relation between what the students think and feel about

Roma people, but the emotions and cognitions (thoughts, beliefs) are not reflected in the behavior.

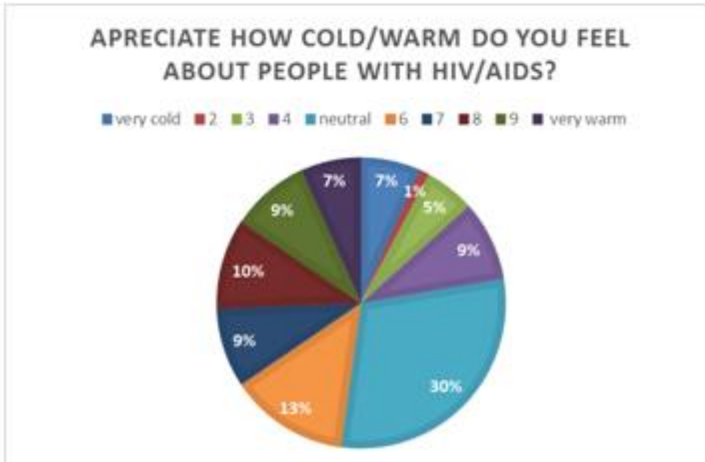

Figure 3: Hot or cold appreciation of students of the Faculty of Engineering in relation to people with HIV/AIDS

Regarding the attitude towards people infected with HIV/AIDS, the mean of this student group was 55.29, around the middle of the range. The social distance score was 77.38 in the high area, meaning an appropriate distance to the most vulnerable groups. The result about the knowledge regarding the HIV/AIDS disease was 11.37, out of a maximum score of 16.

CONCLUSION

The paper outlines the Engineering Faculty students' perception on discrimination in general and on discrimination against certain vulnerable groups in particular, in the context of promoting inclusive societies and of the rebirth of business ethics education at an international level.

The students of the Faculty of Engineering consider that discrimination exists both in school and in universities, even if these institutions must have a primary role in ethics and non-discrimination education. Discrimination is also perceived to be present to a large and very large extent at work, as well as in society as a whole; hence the need for training human resources for the purposes of development of social responsibility of enterprises. Some vulnerable groups (especially the Roma population) are perceived as being more prone to unfair treatment (including in the economic environment), and this justifies furthermore the need to study and prevent discrimination.

As an integral part of social, economic and environmental systems, business organizations should assume responsibility for the impact that they have on these systems and on the society that supports their very existence. The necessity for training in ethics and non-discrimination is also emphasized by the need to balance their goals of obtaining a profit with responsibility for social issues.

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TRENDS AND INFLUENCES

Innovative Methods for Business Education using Isotope Linking on Anonymous Readers' Comments

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ABSTRACT

The paper presents the importance of analysis isotopes on anonymous readers' comments as an important part of deep interpretation of texts. Furthermore, we describe a classification methodology of the anonymous readers' comments on online articles, through the overlapping of isotopes, which completed the traditional analytical methods. Automatic recognition of isotopes is an important topic in Natural Language Processing (NLP), especially in the semantic disambiguation. The aim of this article is the automatic comparative analysis of the identified isotopes in articles and comments, which reveals an important part of online behavior. Moreover, we present a new tool that classifies the online commentators based on existing resources, open-source or freely available for research purposes. This study is intend to help direct beneficiaries (journalists, business, education, managers, PR specialists), but also specialists and researchers in the field of natural language processing, linguists, psychologists, etc.

Keywords: *isotopes, natural language processing, online commentators' classes, anonymous readers' comments, education, business*

INTRODUCTION

In our context, isotopes in writing refer to how public consumers express a personal opinion of their experience about different subjects proposed by journalists. The motivation for this topic is to clarify and describe the civic online profiles (Cioca et al., 2013), (Gîfu & Cioca, 2013), (Gîfu, Stoica, & Cristea, 2013) by comparing isotopes, found in texts on different *platforms* (articles and comments). These isotopes are influenced by the amount of media texts regardless of their nature and purpose. We considered this as an important point of view to understand the media consumer behavior. The isotopy[3] concept was introduced by A.J. Greimas (Greimas, 1970), in structural semantics, describing the coherence and homogeneity of texts. The isotopy had a major impact on the field of semiotics, and was redefined multiple times (Rastier, 1972) (Ricœur, 1995) (Plett, 1983).

[3] The concept was borrowed the term from nuclear physics.

This paper considers the fact the discursive isotopy can disclose an important part of the online civic behavior.

The paper is structured in five sections. After a brief introduction about the importance of this study, the section 2 mentions some important works focused on discursive isotopy. The section 3 shortly describes a new tool for automatic recognition of isotopes and the classification of the online commentators, and section 4 presents a case study on Romanian print press and the statistical results. The last section highlights conclusions and mentions for the future work, in order to improve the automatically isotopes recognizing.

BACKGROUND

If we understand the text as a manifestation of freedom of expression, assuming the constitutive ambivalence of the sign-text, it can be treated as eminentely verbal entity and also as a part of a complex semiotic process (Vlad, 2000, p. 22). The isotopy is an essence of the text, and because of that it was long time a subject of debate involving the critical literature in the age of reproducibility (Riva, 2011). Furthermore, by using a computational technology (Ciotti & Crupi, 2015) we can rethink the methods in textual hermeneutics, observing the macrostructural and microstructural results (styles, lexemes, isotopes) of critical analysis. The authors propose a hermeneutic template that allows semantic indexing of isotopes.

The emergence of a large and increasingly number of increasingly large tools and technologies - which allow the textual data storage and the electronic editions in different formats (RTF, PDF, etc.) and thus their analysis (quantitative, mostly) - decreases the computerized hermeneutical potential, when the text is divided into atoms with the same meaning (Trevisan, 2008). Moreover, the textual criticism often has no historical dimension, a solution being TEI (*Text Encoding Initiative*), which encodes some semantic features in the modern texts. For instance, the Crilet Laboratory of the Faculty of Arts of the "Sapienza" University of Rome, proposes the interpretation of documents extending (Mordenti, 2007), using digital transcription and reformulation through semantic markup. In other words, it is possible that a narrative corpus to belong to several semantic families. Thus, it could be analyzed: *vertical*, by studying the lexical sorting at maximum frequency hapax-legomena; *semantic*, by analyzing frequency and position of the isotopes selected in text (Greimas, 1983); *alphabetically*, by generating an alphabetical order to identify meanings of families. Having built a system based on text, it is useful to start the critical thinking adding marking XML for links to sites with historical references. TEI model explains the text coding principles (Cummings, 2007) (Romary, 2009) (Vanhoutte & Van den Branden, 2010).

This study aims to demonstrate the potentiality of textual analysis, highlighting the interdisciplinary nature of the methodological approach which that will be described below.

IARC TOOL DESCRIPTION

IARC (*Izotopes of Anonymous Readers' Comments*) is an application implemented recently at the Faculty of Computer Science of the "Alexandru Ioan Cuza" University of Iași (UAIC) which has a simple functionality, but very useful, given the huge volume of comments on online newspapers forums.

This tool is able to automatically detect and to compare the isotopes from texts (article vs. comment) and to classify the online commentators taking into account these. This tool is based on information like labelling of parts of speech, extracting of isotopes and classify the anonymous readers' comments as we describe below:

1. We access the newspaper website which has a section for anonymous readers' comments. The tool extracts only the text (article and comments). Each text is passed through an extraction module keyword (*topical extraction*), which consists in the automatic pre-processing chain applied on our corpus and includes the following tasks, executed in sequence:

- Segmentation (splitting the text in sentences);
- Part-of-speech tagging (identifies morpho-syntactic information of tokens);
- Noun phrase chunking (Simionescu, 2012) (recognizing the chunks that consist of noun phrases (NPs)).

2. The words found are passed through a filter cleaning (*cleaning*) being eliminated the connecting words (conjunction and preposition), and adverbs and pronouns. Each keyword (isotopy) found in article is checked with other keywords found in each comment individually (one-to-one). In case they are synonyms, their weights are aggregated, being retained only the keyword with the highest frequency.

3. In order to categorize the commentators, the formulas (3 in this moment) were made after some tests that can be improved as the corpus will increase.

a) Each isotopy from a comment is checked if it belongs to the isotopes list extracted from the article. If one of the isotopy is retained in the article list or is a synonym with this -> is added to the final result.

We defined five commentators' classes: *none*, *low*, *medium*, *high* and *expert* and they have the weights assigned to the following intervals:

1 ->[0-4] -> none
2 ->(4-10] -> low
3 ->(10-14] -> medium
4 ->(14-20] -> high
5->(20-100] -> expert

b) Check the number of isotopes that appear in both lists (article and comment), then the weight 100% will be the total number of words in the article. Ex.: in a comment we identify x, y, z isotopes, and in article x, y, z, t. The result will be:

$$3*100/4=75\% \qquad (1)$$

The new intervals for commentators' classes:

1 ->[0-20] -> none
2 ->(20-30] -> low
3 ->(30-50] -> medium
4 ->(50-75] -> high
5 ->(75-100] -> expert

c) For each isotopy that appears in both lists (article and comment), we added the article weight, the 100% weight is given by the sum of the weights of the article.
Ex: If we have the weights: x = 5%, y = 6%, z = 10%, t = 3% and in comment the isotopes y, z, t its weight will be calculated with the formula:

$$(6+10+3)*100/5+6+10+3) = 86\% \quad (2)$$

In this case, the intervals for commentators' classes:

1 ->[0-20] -> none
2 ->(20-30] -> low
3 ->(30-50] -> medium
4 ->(50-75] -> high
5 ->(75-100] -> expert

The final result will be the average of these formulas[4].

CASE STUDY AND STATISTICAL METHODES

We present a short case study and its results, starting from a communication crisis between the Prime Minister and President about the Silvic Code to show the tool's utility for the signatures'' article (journalists, in this case).

In this sense, we monitored stored and pre-processed all articles from the newspaper *Adevărul* in the period 13-15 May 2015, structured as follows (see Fig. 1):

- 13 May (3 before) – 12 comments (720 words) and 2 articles (1248 words);
- 14 May (the crisis in course) - 233 comments (32296 words) and 11 article (6451 words);
- 15 May (after) – 197 comments (4746 words) and 3 article, one without comments (859 words).

Like we said, the work corpus was automatically and manually annotating (75%, training corpus, and 25%, testing corpus). All automatic results were checked manually (Table 1) in order to calculate the statistical parameters (Table 2): Precision, Recall and F-measure, important to improve our formulas for the classification of online commentators.

With these values, the Precision (3), Recall (4) and F-measure (5) could be computed, for categorization and classification of online commentators (CCi) using isotopes.

$$R = \frac{\#correctly\_identified\_CCi}{\#manually\_annotated\_CCi} \quad (3)$$

[4] Note that these calculations have resulted from a few tests (manual annotation vs. automatic annotation) that disadvantage the short and very short comments.

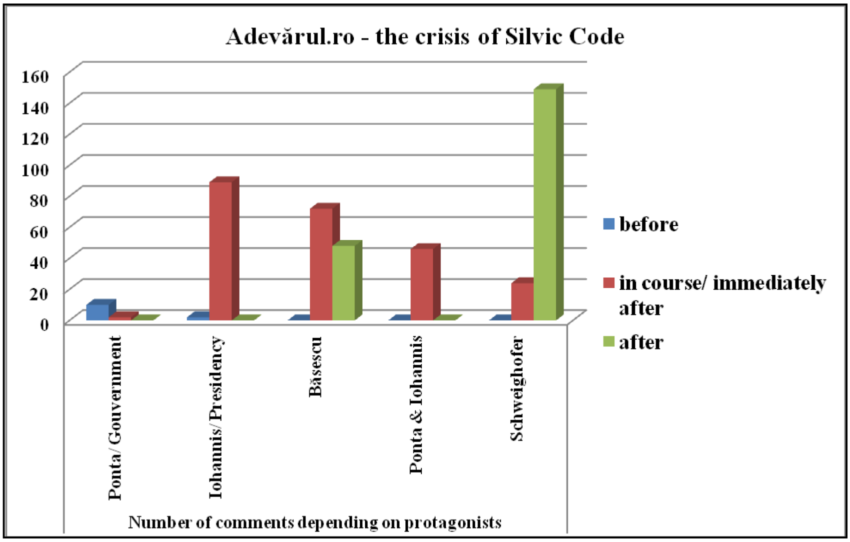

Figure 1: The number of online comments depending on protagonists

Table 1: Automatic and manual annotation results

Total Number of Isotopes	478
manual isotopes for commentator class *None* (mICN)	271
automatic isotopes for commentator class *None* (aICN)	366
manual isotopes for commentator class *Low* (mICL)	83
automatic isotopes for commentator class *Low* (aICL)	49
manual isotopes for commentator class *Medium* (mICM)	67
automatic isotopes for commentator class *Medium* (aICM)	38
manual isotopes for commentator class *High* (mICM)	32
automatic isotopes for commentator class *High* (aICM)	11
manual isotopes for commentator class *Expert* (mICM)	25
automatic isotopes for commentator class *Expert* (aICM)	14

$$R = \frac{\#correctly\_identified\_CCi}{\#manually\_annotated\_CCi} \qquad (4)$$

$$F - measure = \frac{2 * P * R}{P + R} \qquad (5)$$

The values are given in Table 2.

Table 2: Statistical results for the detection commentator class

Commentator class by isotopy	Recall	Precision	F-measure
None	74,04%	42,54%	54,03%

Low	70,94%	62,87%	66,66%
Medium	69,79%	63,80%	66,66%
High	60,37%	74,41%	66,65%
Expert	69,44%	64,10%	66,66%

As shown in Table 2 the results for the automatic detection of isotopes online commentators classes, which could be better. For instance, the fact that the High class is scored better than the None class, could be due to the special attention that we paid on annotating isotopes.

CONCLUSIONS AND FUTURE WORK

This paper presents an automatic method able to detect the discursive isotopies and online commentators' classes. Although the statistics are satisfactory, it is premature to advance some firm conclusions about the accuracy of the data obtained. We intend to consider more than syntactic threshold (the frequency of words) and to pass to the discursive semantic registers. Actually we talk about the syntactic and semantic isotopes. We believe the results will be better if we will analyse the semantic isotopes (synonyms, the words / phrases that are part of the same semantic register). For instance: Forester Code includes forester, trees, silviculture, logs, etc.

ACKNOWLEDGMENTS

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Teaching Natural Language Processing (NLP) Using Ontology Based Education Design

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ABSTRACT

It often happens in teaching that due to complexity of a subject or unavailability of an expert instructor the subject undergoes in a situation that not only affects its outcome but the involvement and learning development of students also. Although contents are covered even in such a situation but their inadequate explanation leaves many question marks in students' mind. Artificial Intelligence helps represent knowledge graphically and symbolically which can be logically inferred. Visual and symbolic representation of knowledge is easy to understand for both teachers and students. To facilitate students understanding teachers often structure domain knowledge in a visual form where all important contents of a subject can be seen along with their relation to each other. These structures are called ontology which is an important aspect of knowledge engineering. Teaching via ontology is in practice since last two decades. Natural Language Processing (NLP) is a combination of computation and linguistic and is often hard to teach. Its contents are apparently not tied together in a reasonable way which makes it difficult for a teacher that where to start with. In this article we will discuss the design of ontology to support rational learning and efficient teaching of NLP at introductory level.

Keywords: *NLP, Ontology, Protégé, Knowledge engineering, knowledge modeling*

INTRODUCTION

"Seeing is believing". A problem is half solved if we are able to see it, analyze its components, and can identify a relation among its components. Same applies on the complex subjects which have been a challenge for many students in the past but as soon as Artificial Intelligence (AI) evolved and knowledge modeling came into practice this challenge seemed to be vanished for many subjects. Through knowledge modeling knowledge engineers can acquire the knowledge of a specific domain from its experts, break down it in a structure and represent it graphically using symbols and logic. A knowledge model makes it easy and interesting to understand and communicate a difficult idea.

An instructor often thinks about the different learning approaches that can make learning experience interesting and easy for learners. Conceptual and logical structures have ever been an ideal approach in different fields of education especially in Engineering and Technology where semantic networks, logic frames, concept maps, brain maps, and taxonomies are becoming norms of coherent teaching. A teacher as a knowledge engineer acquires knowledge from text books, manuals, and web; works on the refinement and visual presentation of knowledge by structuring it, breaks down the domain concepts into semantic and syntactic networks by using his own heuristics and experiences of others. A formal representation of domain knowledge by its entities and relationship between those entities is known as ontology. Major purpose of ontology and ontology engineering is to make knowledge explicit by acquiring, structuring and representing domain knowledge formally.

Ontology based teaching approaches are in practice since last two decades. In this period many teaching ontologies have been seen for different domains say Mathematics, Business, Biomedical, Engineering and Technology (Boeker, et al., 2012) (Baker, 2012). Emerging of knowledge representation tools has made all this even more interesting. Protégé-OWL, OntoEdit, OilEdit, Ontolingua, Top Braid Composer, and Neon (Abburu & Babu, Survey on Ontology Construction Tools, 2013) are different tools being used to represent domain knowledge in visual sharable form and Hermit, FaCT++, Pellet, and Racer are some other tools that help infer through ontology (Abburu, A Survey on Ontology Reasoners and Comparison, 2012).

In this article we will design and discuss a teaching ontology for introductory level Natural Language Processing. In following sections we will discuss teaching turbulences of NLP, ontology and ontology development tools, teaching ontology, and the design for proposed ontology.

TEACHING TRIBULATIONS OF NLP

Natural Language Processing (NLP) is a very hard subject to teach even at introductory level. The very first reason for that is the combination of computation and linguistic that NLP is based on. This course is a collection of problems, techniques, ideas, and frameworks but they are not apparently tied together (natural language processing blog). It often confuses an NLP instructor where to start with, which tools should be preferred, and how to deal with linguistic, computational, and technological parts together in one class. Apart from all these issues an instructor has to make some room in his lectures for programming as the NLP friendly Python (a programming language) is always new to students. If there would be a visual logical representation of course contents it will certainly help instructor and students.

ONTOLOGY

In AI ontology is defined as domain knowledge representation that facilitates common understanding of that domain (Baker, 2012). It is a logical combination of a domain concepts and their relationship. It is a good way to represent knowledge graphically. Ontology to represent domain knowledge in a graphical network would consist of some nodes and connections between nodes. Nodes would represent concepts of that domain whereas connections would represent relationship between concepts. This type of knowledge representation is valuable as it facilitates communication among people by visually representing core concepts of a domain and relationship between them and it makes knowledge representation standard by structuring it in a network. This natural language representation of knowledge is not only human friendly but equally easy to implement in computer for further applications (Baker, 2012). Ontology can be defined as machine readable design of a shared conceptualization, which uses explicitly defined type of concepts and constraints applied on the use of those concepts. It captures and represents the knowledge which is accepted by a group of masses, it uses a vocabulary in order to represent knowledge in terms of objects and their relationship, this vocabulary makes it easy for an intelligent system to understand the knowledge represented on another (Studer, Benjamins, & Fensel, 1998).

RELATED WORK

Ontology makes domain knowledge transparent. In teaching ontology, instruction patterns can be derived from the understanding of connections. These connections connect main concepts of the domain. Teaching ontology is a synthesized collection of the core concepts of a domain that presents the crux of whole subject in one graph. On one hand these structures help instructors to elaborate concepts more clearly on the other hand they make it easy for them to assess students' understanding because students can better express their learning by drawing mind maps.

In (Baker, 2012) authors developed a basic ontology for sharing domain knowledge, teaching content, and evaluation task for an online remediation system for USMC rifle marksmanship. They accumulated domain knowledge from domain experts and available instruction material. Using Bayesian network they mapped that knowledge, which was further converted to a visual ontology in Protégé. Further they adopted the same strategy to develop a teaching ontology for pre-algebra taught at middle school.

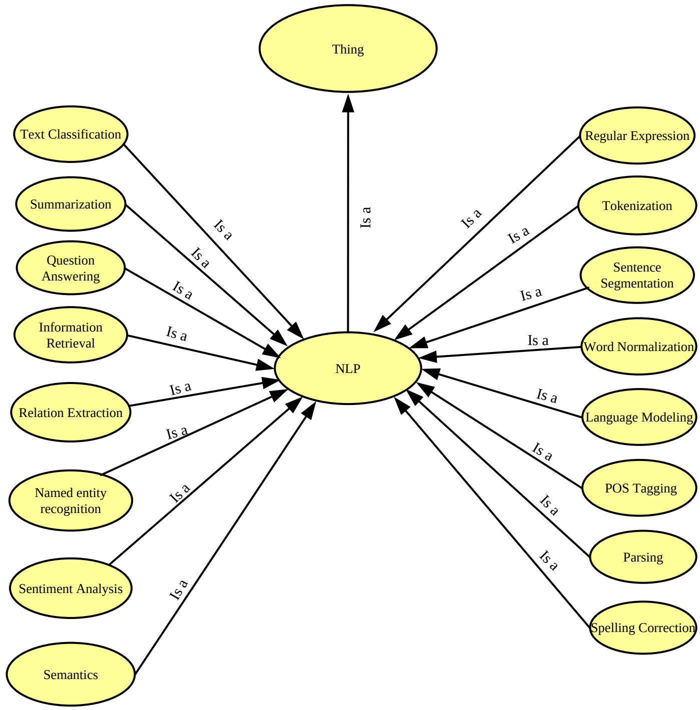

Figure 1: Class NLP along with its subclasses

In last two decades, ontology development has been remarkable for teaching different subjects of engineering and technology. Author in (Gavrilova, 2003) presented a teaching ontology to support e-learning of artificial intelligence. Authors in (Sosnovsky & Gavrilova, 2006) developed ontology for teaching introductory C programming language. They formulated a practical algorithm to design ontology with strong emphasis on visual representation of knowledge as a learning mind tool. Authors in (Ganapathi, Lourdusamy, & Rajaram, 2011) developed ontology to teach Java programming language, using ontology development guidelines presented by (Sosnovsky & Gavrilova, 2006). Authors in (Lee, Ye, & Wang, 2005) presented a framework known as Java Learning Object Ontology (JLOO) based on classifications described in computing curricula CC2001 of the ACM and IEEE/CS. In (John, 2014) author presents an educational ontology for teaching and learning Java programming language. He proposed a hybrid methodology based on conventional software engineering methods.

DESIGNING TEACHING ONTOLOGY FOR NLP

While designing ontology for NLP we followed very common norms of ontology development (we chose some of them according to the scope of this article) (Brusa, Caliusco, & Chiotti, 2006) as given below.

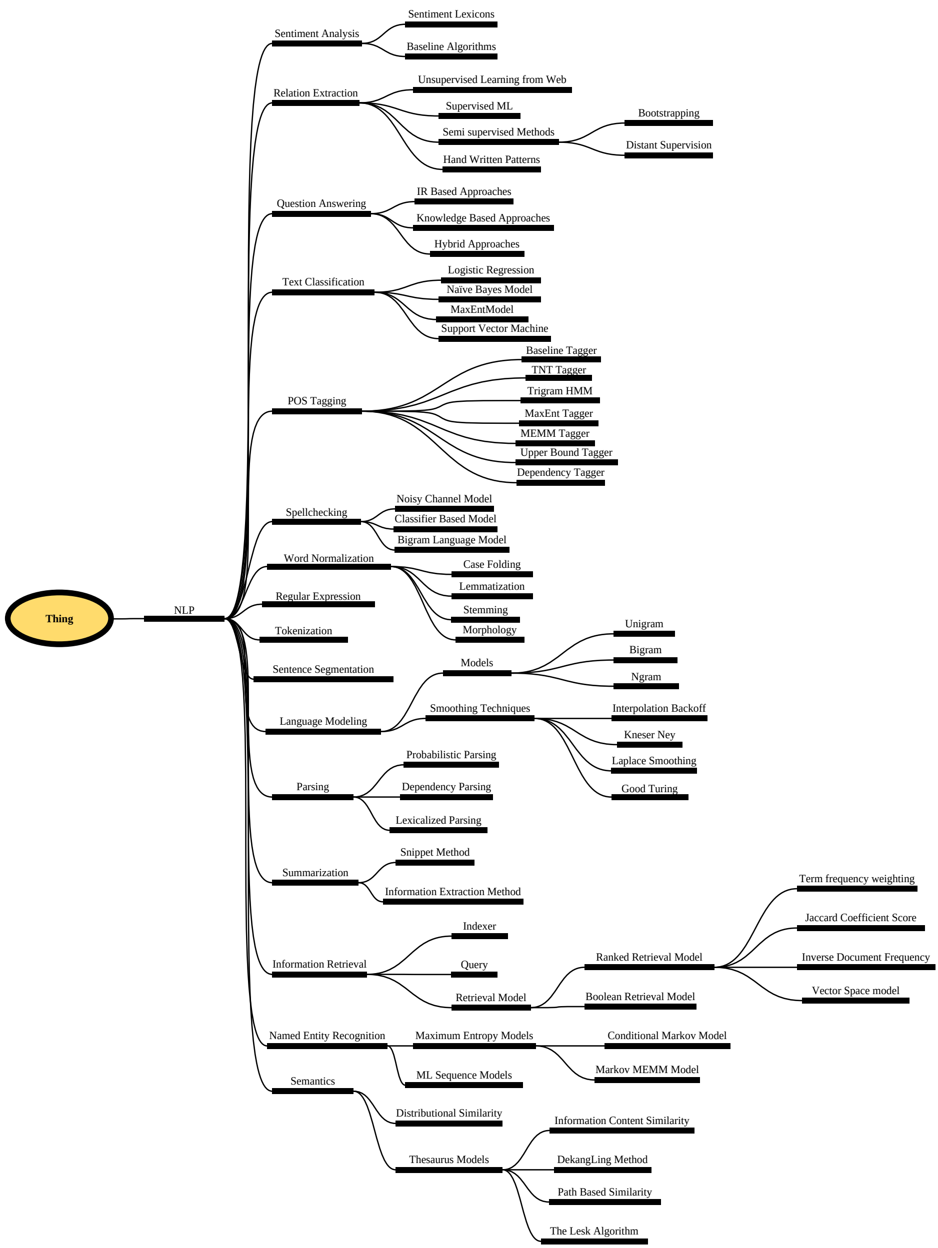

Figure 2: Concept Map to represent concepts in NLP

1. Determine the ontology, its goal and scope
2. Describe the domain

3. Determine core concepts of the domain
4. Breakdown the concepts to desired level of granularity
5. Identify classes and sub-classes in determined concepts
6. Determine relationship of classes

Our purpose is to design an educational ontology to facilitate teaching and learning of NLP at introductory level. We gathered core contents of this domain from books, online lecture notes, and blogs (developed to discuss NLP teaching issues) (Jurafsky & Manning) (natural language processing blog) (Hearst, 2005) (Manning & Schütze, 1999). We defined the main class NLP (subclass of universal class Thing) and all other important concepts (introductory) are considered its subclasses as shown in Figure 1. Further we considered each subclass of NLP for finer details and prepared a concept map to represent this as shown in Figure 2. In next phase we converted this concept map into ontology using an ontology editor tool Protégé. Protégé is an open source ontology editor developed by Stanford and it is freely available. Its supports building of intelligent systems, ontology based applications and knowledge based solutions for different domains (Protege). The visual representation of our ontology is given in figure 3 that shows classes and subclasses of NLP ontology and object properties (relationship between classes). We defined relationships between classes on the bases of a sub-concept being the pre-requisite for a super-concept. For example almost all NLP activities need text divided into basic constituents (tokens) for further processing.

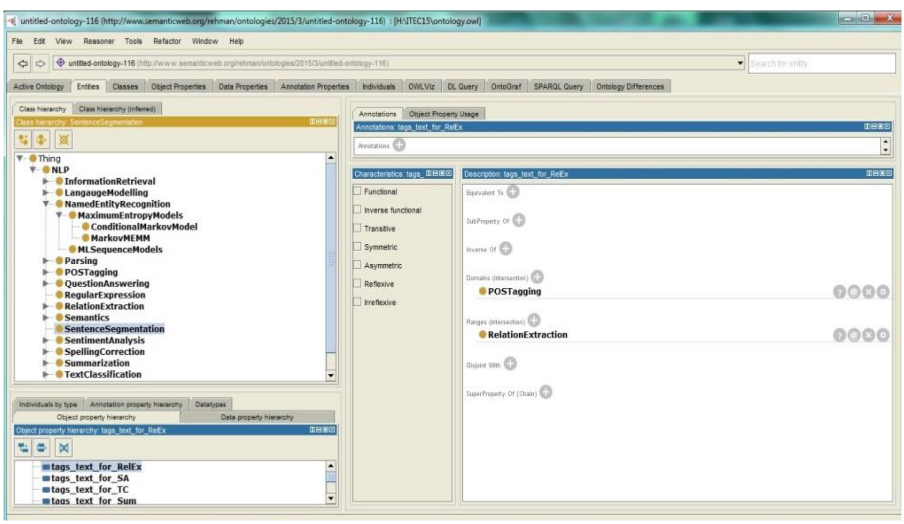

Figure 3: Snapshot of NLP ontology in Protégé with classes and subclasses and object properties

Part of Speech (POS) tagging is an activity in NLP that tags each token in the text with an appropriate part of speech tag, here POSTagging will be super-concept and Tokenization the sub- concept connected with a relation from sub-concept to super-concept (Tokenization tokenizes_text_for_POSTagging).

CONCLUSION AND FUTURE DIRECTIONS

This article describes the importance of ontology for teaching Natural Language Processing at introductory level. We also developed a mind map to represent important constituents of this course and their relationship to each other. We also used Protégé (an ontology editor) to aid visualization of our ontology. Knowledge structures and their visual prototypes are supportive for both teachers and students. They help teachers to concentrate on a specific problem, understand its granularity, and process and understand domain knowledge in great detail. They help students to syntactically analyze their knowledge, judge level of their understanding, compare knowledge contents, and generalize solutions and new ideas.

Ontology presented in this article can be further enhanced to develop E-learning system for NLP course. It can be joined with (Semantic Web Rule Language) SWRL (Ian, Peter, Harold, Said, Benjamin, & Mike, 2004) to find finer details of knowledge. We can also turn it to complete subject tutor by adding URL links for each concept in its visual design for their elaboration by means of power point presentations and video lectures. These concepts can also be linked with their implementation in Natural Language Tool Kit (NLTK 3.0 documentation) to understand their implementation details.

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A Transdisciplinary Approach on the Advanced Sustainable Knowledge Integration

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ABSTRACT

The paper presents a new, transdisciplinary approach on the DIKW (Data, Information, Knowledge, and Wisdom) hierarchy, offering arguments that the hierarchy is unsound and even methodologically undesirable. The purpose of the paper is to identify a new and more complete perspective on knowledge integration. This model is based on another scale, in a synergistic-generative transdisciplinary manner, in order to transfer and implement knowledge in the knowledge based society/economy context. The new knowledge pattern, named DIMLAK (Data, Information, Messages, Learning, and Advanced Knowledge) is reconfigured to explain the way the advanced knowledge is achieved as a top level of the transdisciplinary integrated and integrative knowledge system. The proposed model is working complementarily as breadth through depth approach, opening a new vision in the knowledge achieving process.

Keywords: *transdisciplinarity, advanced knowledge, sustainable all life learning, breadth through depth approach.*

THE ROOTS OF THE KNOWLEDGE AND THE WAY TOWARDS THE ADVANCED KNOWLEDGE

Knowledge became a very hot issue and knowledge management is the hottest subject of the day, the main question for the knowledge-based society/economy (KBS/E) being the way the advanced knowledge is produced, shared and implemented (Becera-Fernandez et al, 2004; Pop & Maties, 2011). Because knowledge refers to the state of knowing, acquaintance with facts, truths, or principles from study or investigation every level of the knowledge achievement has to be analyzed from a synergistic systemic approach with the 7 questions paradigm (where, when, who, with whom, what, how, and why), defining the context of the knowledge based society/economy (KBS/E) (Pop, 2011). The importance of the knowledge is linked with a tremendous increasing level of the economic growth correlated with a permanent threat for crisis, and unprecedented possibilities of producing and sharing the knowledge. For this goal it is very important to choose the best definition of the knowledge from a lot of existing possibilities making a net distinction between what does mean data, information, knowledge, wisdom and understanding (Zins, 2007). Even the knowledge is considered as *"the cumulative stock of information and skills derived from use of information by the recipient"*, with a consistent difference between data (signals which can be sent by an originator to a recipient), and information (data becoming intelligible to the recipient) (Burton-Jones, 1999), or as *"an organized body of facts, principles, procedures and information acquired over time"* (Blanchard & Thacker, 2009), knowledge is referring to what individuals or organizations (NGO, company, institutions, etc) know how to do (human and social knowledge), acting as rules, processes, tools and routines (structured knowledge) (Davenport & Prusak, 1998; Noe, 2008). All kind of knowledge could be attained, possessed and implemented by individuals in communitarian contexts, as productive knowledge, to get values, knowledge communities, knowledge being considered as culture in a historic context (McCarthy, 1996; Hildreth & Kimble, 2004). Especially the "communities of practice" are of a big interest in the context of the knowledge based society/economy (KBS/E) (Fotea et al, 2012). Another such of knowledge communities are Transdisciplinary places, industries, technologies, work and education (Hyun, 2011), some of them being: Transdisciplinary Technoplis Spaces as innovative open territories (Doignon & Falmagne, 1999; Hakkarainen et al, 2004; Pop, 2011), Teaching factory (Alptekin, et al, 2001), Mobile mechatronical platform (Papoutsidakis et al, 2008), Knowledge Intensive Firm (KIF) (Sveiby, 2000), Transdisciplinary Reform School Education 2000+ (Bertea, 2005), and others.

Knowledge is an activity not an object, so, it can be managed only as explicit knowledge (Collins, 2010). The explicit and tacit knowledge are different one to another, so explicit knowledge could be codified through information (know-what), and tacit knowledge is including skills such as insight, creativity and judgment (know-how). A more complete answer in this sense is given as follows: *„knowledge is the combination of data and information, to which is added expert opinion, skills and experience, to result in a valuable asset which can be used to aid decision making"* (Zeleny, 1988; Sveiby, 2001). The current concept about knowledge is that it *"proves itself in action"* being focused on results (Drucker, 1998). In the knowledge process there are different sequences, as acquisition, creation-production, dissemination-distribution-exchange, and use-implementation of knowledge with a possible depreciation and obsolescence of knowledge when it is used (Hildreth & Kimble, 2004; Hakkarainen et al, 2004; Bernstein, 2009; Helm Stevens et al, 2010). It is very important to know when and in what context the knowledge would be determined by information, deciding which information is relevant, and how it is to be used.

It is important to consider that knowledge has an intentional character, being strictly connected with human projects, as an exercise of the highest and defining capabilities of humans, a fulfillment of human nature, a transgenerational treasure, with a very important spiritual component (Nicolescu, 1996; Gitt, 1997; Pop, 2011). The existing models regarding knowledge are integrated transdisciplinary in a generative-synergistic way by the Synergistic Contextual Message Model, which is working with three spheres of the communicational process, ***Pathos*** with its specific rules: responsibility, credibility, and deference for Sender; ***Ethos*** with the rules: receptivity (choice), availability (accountability), and involvement (action), for Receptor; and ***Logos*** for Contextual Message, with the rules: quantity and quality of the message, the contextual relevance of the message, and manner of transmission (cod, channel), in a specific transdisciplinary way (Pop, 2011).

A TRANDISCIPLINARY PERSPECTIVE ON THE KNOWLEDGE INTEGRATION

Transdisciplinarity as understanding (top-down approach), learning and practicing (bottom-up approach) is based on an active process, occurring either intentionally or spontaneously, that enables to control information, thus to question, integrate, reconfigure, adapt or reject it (Nicolescu, 1996; Pop, 2011). The four pillars of the transdisciplinary knowledge: learning to know (creativity through adequateness and innovation), learning to do (action through competence and performance), learning to be (authenticity through integrity and excellence) and learning to live with other people (participation through communion and apprenticeship) are working in a new framework, for learning and achieving knowledge, as an objective rational extrinsic logical issue, and understanding as an ethic-semiotic issue, the subjective relational dimension of knowledge (Delors, 1996; Pop & Mătieş, 2011). Every pillar of transdisciplinary knowledge process can be integrated to explain the perspective of achieving knowledge in the knowledge based society/economy (KBS/E), with a new transdisciplinary epistemology, a new creative logic of the included middle, and a new ontology (Nicolescu, 1996; Soritau & Pop, 2014). It is very important to understand the new synergistic-generative transdisciplinary model about the perspective of the knowledge integration from the thematic-curricular disciplinary (predisciplinary, monodisciplinary or codisciplinary) level to the synergistic one, as structural (interdisciplinary), functional (crossdisciplinary) and generative (transdisciplinary) stages, passing through the methodological (multi and pluridisciplinary) level (Soritau & Pop, 2014).

The transdisciplinarity gives a better explanation then the existent models of the emergence of the epistemic teaching-learning paradigm, that of the synergistic identity of the informergic knowledge, as a new transthematic generative way of education, in order to have a better understanding of the knowledge integration process in a creative context (Bertea, 2005; Montuory, 2006; Pop & Mătieş, 2011). The transdisciplinary approach is based on the equilibrium between the outside (with its extrinsic active knowledge aspect) of the person and his inside (with its intrinsic reactive knowledge aspects), the transdisciplinary way of the knowledge being the only way to realize the integration of the rational knowledge of things (by doing) and relational understanding of the world (by being) (Nicolescu, 1996; Pop & Mătieş, 2011; Jashapara, 2011). The transdisciplinary approach is relevant to and contextualized within the full complexity of the real world, and seeks to identify, integrate, and act upon points of relationship among centers of knowledge-making, entailing an ontological perspective of the world integrated as a networking whole, in a needed balance between globally and locally tendencies, as well (Slaus, 2003; Hakkarainen et al, 2004).

There is a permanent questioning and crossing the boundaries, in order to bridge the gaps, to cancel the walls by trandisciplinary experts within a continuous knowledge process as a sustainable all life learning process (lifelong learning, wide life learning, learning for life) (Pop, 2011). Such a transdisciplinary work does imply a critique of the so named *'ivory tower'* conception (depth approach) (Nicolescu, 1996), building a *"global village"* as transdisciplinary spaces of knowledge (breadth approach) (Hyun, 2011).

TRANSDISCIPLINARY BREADTH THROUGH DEPTH APPROACH OF THE ADVANCED KNOWLEDGE INTEGRATION

The end of the DIKW hierarchic pyramid

The DIKW (data – information – knowledge – wisdom) model has ancient roots in the poem "The Rock" of T.S. Eliot (Zelenyi, 1987), becoming a great idea when it was first proposed, being determined by a very complex context put on the way through the very important aspects of the integrative process in the Knowledge based Economy/Society (Zelenyi, 1987; Pop, 2011). Because of the very strong connection between data and information, the knowledge was considered as a valuation of information, the way the information becomes knowledge being one of the most important problem. The biggest question is what does represent "knowledge" in the DIKW pyramid, and how is it correlated with data and information, in connection with the implication of the fact that knowledge would be derived by filtering information, considering some facts by combing through databases (Rowley, 2007). A very interesting definition considers that knowledge transforms *"information into instructions"*, being very closed to the necessity to achieve skills in an informational context of a sustainable education (Ackoff, 1989; Bertea, 2005; Montuori, 2006).

There is an apparent confusion about the role of knowledge, wisdom and understanding, processed as a controversy about the top position of the wisdom against the knowledge, considered not as *„the highest of the intellectual goods, of higher value is understanding and, beyond that, wisdom"* (Mortimer, 1985). Knowledge management has largely relied on the DIKW pyramid when "wisdom" was added as a guide of knowledge process (Ackoff, 1989; Rowley, 2007). There are some critiques on the DIKW Pyramid model of knowledge integration (fig.1), because the hierarchy proposed is focused only on specific modes of data, information, knowledge, and wisdom, neglecting important distinctions of them, including the path of the Knowledge Management, because in practice the DIKW pyramid tends to cause a number of problems for KM practitioners (Becerra-

Fernandez et al, 2004; Liew, 2007). One of these problems is that there is no agreement on the possible boundaries between the different elements involved in the DIKW pyramid model. More fundamentally, from a KM practitioner's point of view, the DIKW model offers no guidance as to where the KM work should be focused within an organization, to deliver business results, and to maximize them (Jashapara, 2011). The Knowledge and Wisdom can only be created by an efficient network of humans, but data can be generated with a little human intervention, as measuring process.

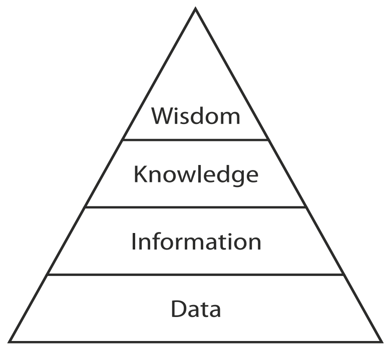

Figure 1: DIKW hierarchy pyramid (Rowley, 2007)

To become information data must be examined by humans, who have then disperse and convert into tacit and explicit forms in order to assure the creation of the knowledge, by repeating several times, and sometimes by different groups of humans, to achieve wisdom (Ackoff, 1989; Browning et al, 2002; Rowley, 2007). So, knowledge creation, necessary to develop wisdom, works best in an open and transparent human social network across which information moves rapidly. The faster information flows to individuals, the faster the process of knowledge creation and the easier it is to make appropriate decisions (Helm Stevens et al, 2010).

There are two disputed issues in the DIKW hierarchic knowledge pyramid, first of them being wisdom, as meaning and ability to see the long-term consequences of any act and evaluate them relative to the ideal of total control (global competence). The second issue under a controversy is understanding, connoting only an ability to assess and correct possible errors, different from "wisdom" as a top in the knowledge pyramid (Frické, 2009). The DIKW pyramid model widely used by many KM practitioners, vendors, consultants, and scholars, is suggesting that each of the four elements, Data (D), Information (I), Knowledge (K), and Wisdom (W) of DIKW Pyramid is working separated and distinctive from the others, in an existing hierarchical relationship, one of the elements being translated "upward", in a different state through some unknown process (fig.1) (Frické, 2009).

Because of the lack of possibilities to establish what kind of data, information or knowledge are processed, and how does that processing occur, to whom is delivered the Data, Information or Knowledge, and for what use, the siren is calling for the DIKW pyramid (Frické, 2009). The DIKW model does not help at all in the search for a way to make organizations smarter (Allee, 1997; Noe, 2008). So, there are very pertinent critical observations on the topic of the DIKW that consider this hierarchy as unsound and methodologically undesirable, the way through a new model being open, and the DIKW model must die (Frické, 2009; Vala Webb, 2014).

Transdisciplinary DIMLAK model for advanced knowledge integration

The arguments presented before have to be correlated with the fact that the knowledge is a human product, both individual and communitarian, being considered as a complex process, social, goal-driven, contextual, and culturally-bound more then a simple filtering process or algorithms (McCarthy, 1996; Helm Stevens et al, 2010; Hakkarainen et al, 2004). In order to make true connections between the components of the knowledge hierarchy, is necessary to introduce a new model for knowledge management (KM) that meets new transdisciplinary criteria introducing new necessary levels and finally reconfiguring the whole knowledge pyramid removing it by another approach.

A simple database and information become knowledge only when they are understood, manipulated and connected to a purpose or idea, so the KM must gain the ability to capture, share and manage knowledge, as process and as product, as well (Alavi & Leidner, 2001; Jashapara, 2011; Pop, 2011). If this is accepted the unique conclusion is that DIKW must die (Vala Webb, 2014), achieving the sunset of its existence, the reconfiguring and the improvement of the existent model should become a natural process. As consequence it is proposed a new type of knowledge integration, from a transdisciplinary perspective, through an integrative sustainable all life learning process, using the semiophysical synergistic contextual message model, as a synergistic-generative significant evolution of the knowledge process from the monodisciplinary to the transdisciplinary context of learning in the knowledge based society/economy (KBS/E), in order to achieve advanced knowledge (Bertea, 2005; Pop & Mătieş, 2011; Soritau & Pop, 2014).

The new DIMLAK proposed model is not a pyramid, but a heterarchic-hierarchic configuration with Data, Information, synergistic contextual Message, integrative sustainable all life Learning/teaching, Advanced Knowledge, as steps, with expertise as final goal, expressed through wisdom and skills, in order to integrate the knowledge with the truth. The stages of this model are presented in fig. 2 as waves of knowledge with different semiophysical processes (Helm Stevens et al, 2010; Soritau & Pop, 2014). Knowledge has to combine data and information, in order to connect expert opinion (top down approach) with skills and experience (bottom up approach), as a finally valuable asset useble for decision making.

Starting from data, as an abundant, vital and necessary resource, it is necessary to utilize new ways to channel them into meaningful information, which has to become knowledge by a specific filtering process through the synergistic communication sequence, as synergistic contextual message, through sustainable all life teaching/learning process, as advanced knowledge, in order to achieve the goal, the expertise as wisdom and skills (Pop, 2011). Data represents the bottom ground statistic level of knowledge process as a product of observations, measuring without no value until they are processed into a usable form to become information (Hey, 2004; Zins, 2007).

Information (syntactic level) is related with descriptions, definitions, or perspective on reality, contained in answers and questions by absorbing the sense from data as a transitional stage to knowledge passing through contextual message stage as subject by a learning process (Buckland, 1991; Bates, 2005). Synergistic Contextual Message (semantic) level is working by filtering the information, with attention focused on the meaning and truth, and other semiotic properties of the recorded marks (Pop & Maties, 2011; Soritau & Pop, 2014).

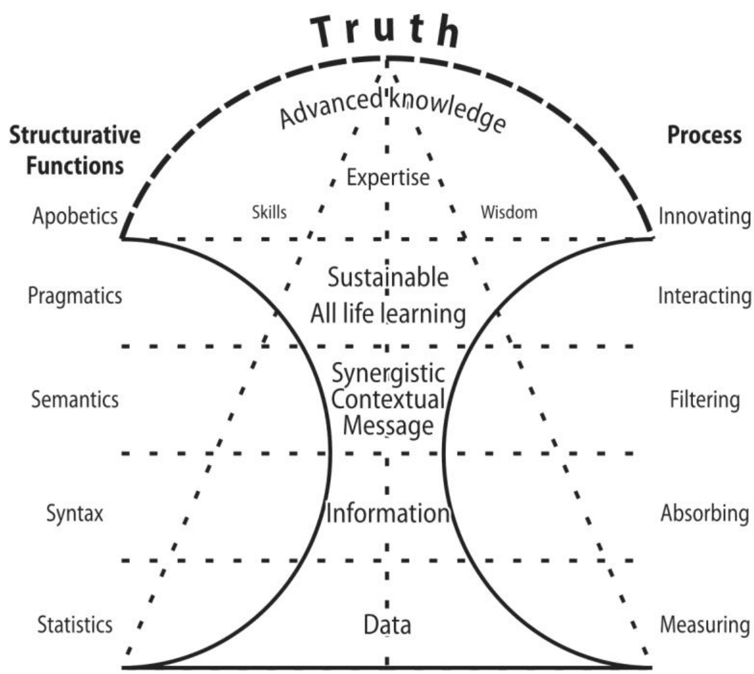

Figure 2: Transdisciplinary DIMLAK breadth through depth approach model

Information has a significant potential if it is properly managed, all knowledge being based on information but not all information becomes mandatory knowledge. The most important question is how knowledge management could help to transform information into trends, products and increased profitability for businesses (Fotea et al, 2012). Integrative sustainable all life learning (pragmatic level) is working in a teaching/learning process as a transdisciplinary multimedia theory, describing a movement toward integrated lessons in order to help people to make connections across curricula, using modern methods and tools, in order to help the actors of this process to make linkages across any borders, barriers (curricula, methodologies, tools of knowledge, or other kind of thresholds) (Lave & Wenger, 1991; Bertea, 2005), in a structural-functional-generative context comprising specific strategies, practices, methods, or approaches (Hyun, 2011; Pop, 2011). Advanced Knowledge (top/apobetic level) has as final goal the Expertise, as Wisdom and Skills (Gitt, 1997; Pop, 2011), by embodying principles, insights, or archetypes, in ethic/moral pattern to integrate the knowledge with the desired Truth. The main question is the way the advanced knowledge is produced, shared and implemented starting from data and information (Zeleny, 1987).

Knowledge and intellectual capital are considered as a primary source of production and value in an organization (Davenport & Prusak, 1998; Strathern, 2007), as collective value of the capabilities, knowledge, skills, life experiences and motivation of the workforce, reflecting the thinking, knowledge, creativity and decision making people to participate in organizations (Allee, 1997). The importance of human capital in the innovation process underlies the demand for increased skills, including teamwork and cognitive skills, in a sustainable all life learning process, in order to adapt to a continuous change (Nowotny et all, 2001; Hyun, 2011). Expertise is considered the top level in achieving integrated knowledge with two aspects, wisdom (top down approach) and skills (bottom up approach), both of them being integrated transdisciplinary through included middle (Nicolescu, 1996).

Wisdom represents an integrating experience arising when the foundational principles responsible for the patterns representing knowledge are understood as what they are, creating its own context even more so than knowledge does (Davenport & Prusak, 1998; Jashapara, 2011). As a top down level of the advanced knowledge, wisdom requires synthesis, bringing together a wide range of knowledge created from an important amount of information representing a tremendous quantity of data. Skills are considered to be a permanent objective of the knowing process, starting from the bottom, with a question about what is knowledge management, and why is it so important offering some emerging perspectives in response, as a part of the human capital in the innovation process, including teamwork and cognitive skills, and all life learning in order to adapt to continuous challenging changes.

The stock of the human capital, as potentiality, is reflected in the level of skills, competencies and knowledge of the members of society, being built up over time mainly through investment in education (public and private) (Düntsch & Gediga, 1995; Albert & Lukas, 1999; Rainey, 2002; Bertea, 2005; Hyun, 2011). From the transdisciplinary point of view the Truth, as final goal of the knowledge integration process, can be achieved as *hidden third* integrating the fundamentals through every stage of the proposed DIMLAK model (Nicolescu, 1996; Nonaka, 1996; Pop, 2011).

CONCLUSIONS

Transdisciplinarity perspective on knowledge integration introduces interpretive approaches, critical science and grounded theory, exploring the values in a new synergistic generative context to create a new praxis through a holistic breadth through depth inquiry. The new proposed transdisciplinary model is working pragmatically by a sustainable all life learning, using integrative learning concepts, as a movement toward integrated lessons helping people to make connections across curricula, putting together skills and knowledge from multiple sources and experiences; applying skills and practices in various settings; utilizing diverse and even contradictory points of view; and, understanding issues and positions contextually.

The result of this inquiry is the DIMLAK model, as a holistic way of the knowledge integration, instead of that is known as DIKW Hierarchic Pyramid of Knowledge. The different heterarchic-hierarchic stages of knowledge integration are represented as a transdisciplinary chain, as follows: Data (D, statistics approach) → Information (I), as syntactic way to relate descriptions, definitions, or perspectives → Synergistic Contextual Message (M), as semantics → Sustainable integrative all life Learning (L), as pragmatics pattern comprising strategy, practice, method, or approach → Advanced Knowledge (AK), as apobetics embodying principle, insight, moral, or archetype, to attend the desired level of Expertise (Wisdom as top-down perspective, and Skills as bottom-up perspective), in order to achieve its final goal, the Truth, representing an emergent continuum flow. In this way the new perspective of the knowledge management creates a better understanding, a transdisciplinary one, about the knowledge as dynamic synergistic integrative process.

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Can Women be Successful Managers in Technology Business? four Romanian Examples

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ABSTRACT

Purpose of the work: This research is meant to outline the contribution brought by women in technology management and identify how business environment, especially from the Romanian market, welcome females who lead in this men dominated industry.

Methodology: The paper has been built upon analyzing the connection between world's female leaders and technological advance. The sources were articles, books and interviews. To outline the Romanian situation, an interviewing phase followed, with four women who currently lead in the IT industry.

Important finding: Gender disparity has been and is wide-reaching in most of technology's industries. Nevertheless, women reaching a certain career level, are more eager to embrace tech management. They have proven to be extremely open to the challenges brought by this new technologized working environment, worldwide in general and narrowed down to Romania as well.

Conclusions and key "Take Home Messages": The primary message transmitted by this research is that women can indeed add value to the technology business and their main contribution is bringing IT closer to people. Women's potential reaches beyond having gender diversity, and should be exploited at its maximum. Women have the understanding that technology is created for people, and their entire work revolves around it.

Keywords: *women, management, technology, success*

WHY IS THE ROLE OF WOMEN IN TECH LEADERSHIP IMPORTANT?

The global carousel revolves nowadays around technology. We are facing outstanding innovations which have as main goal bringing people together. This new world of networking, socializing and access to information has been driven in the recent years by the business leaders of technology market. And there is one crucial aspect to be taken into account: women are considerably less present among IT leaders.

Why are we not making more progress with our women? Is not that we do not have great women. We do, we have amazing women. Why are they not coming all the way through the pipeline?
There are two major reasons why studying and understanding gender disparity in companies' management, especially in the technological domain, is critical.

First, women represent half of the talent pool, globally speaking (European Commission, 2012). And isn't it essential for companies to have the best brains, especially in times of great evolution?
Second, one must find answers to the following: does it really matter for corporations to have women in leading positions?

The answer lies in the steps forward taken by all large companies which embraced personnel diversity. Having employees with the same profile sitting at a negotiation table leads to a fast, yet poor conclusion. It also lies in the success of women CEOs around the globe, running some of the most profitable tech companies. Sustainable economies understand the equilibrium brought by women professionals and embrace it as a natural contribution to long term profit. In the same way, a healthy sustainable society will treat both men and women based on worth, not gender. Yes, they are different, but this is nothing but a positive aspect in both business and day to day life. So if women's presence deserves a boost, why are they still not as present as men? Broadly because mind-sets need to adjust.

Women in management still face difficulties in their advance, women in IT are often labeled. They themselves seldom restrain from doing what they are passionate about, due to the external context.
The great side is that women leaders around the world prove that boundaries can be surpassed. They serve as models of perseverance and success. Either one speaks about business, technology or politics, the contribution of women is more and more visible, even outstanding. And their traces show that women belong in the current global scene.

This article aims an emphasis on women's value added in IT, by bringing in front four of Romania's managers and their special contribution. Its content will thus reveal the role of liaison that women have in tech business and how this market gains from the bridges women build.

HOW DOES THE WORLD SEE GENDER DISPARITY IN IT?

As companies transform, and human talent finds itself in a new geographical dispersion, human resource management ought to be approached in a brand new way. Societies' evolution helped acknowledging the female labor supply potential and the idea of them blending in for a plus of productivity. Still, as the technological slope began rising, this gender inequality strengthened and the world faced a mass association of IT scientists with man. How was this gender unbalance in IT reached? The answer comes from two primary drivers: society and women.

On one side, there are faults in the industry caused by ***people's general beliefs***. Most employers associate engineers with a male figure. They perceive men as more inclined towards fact, figures. They predict how inborn skills will make them more passionate and efficient. Also, women are seen as less reliable. An old, yet current idea still governs employment decisions: women do not build careers, they simply pursue casual works that take second place to familial concerns. The intermittency of their work has often been a reason of concern, and in technology business this concern has even a higher impact. Moreover, employers see men as more willing to take risks, whilst women are perceived as more reluctant to change (Johnson, Fox & Rosser, 2006). In an industry that requires permanent innovation, this perception is a huge downgrade for women.

On the other edge of this vicious circle, lays ***women self-perception of their abilities***: females rating themselves lower than males with similar abilities. They often fail to understand the importance of their work, the value added they could bring to the technological flow. Often, when faced with a male dominated context, women get really busy trying to figure out whether or not they belong there. It seems more welcoming and at ease for them to target jobs with a gender balanced ratio, or better female dominated ones.

This "belonging" need is a combination of social stereotypes and comfort of women worldwide. Thus the main drawback is that within tech business, women are treated as a special group. This phenomenon has been justified in the latest decade as an effect of "intersectionality" (Bystydzienski, Eisenhart & Bruning, 2015), a concept that explains how social divisions (e.g. gender, race, age) are directly connected to career choices. The attempt is to find main causes, cut them out, and create a framework that would welcome more women in IT as a natural process, not as a peculiar turn of events. Gladly, several iconic women have managed to break societies' categorization and are now among world's most successful IT leaders. They serve as role models for young girls willing to pursue a career in technology, as their contribution has changed the way society perceives women's leadership potential in this field.

Research on world's female managers has revealed optimistic patterns. Although the disparity between men and women in technology professions is still at high levels, studies show that most successful women in the world have majored in engineering. Also, the number of women leaders who brought their companies among the most successful firms in the world has been in continuous increase from

the end of 20th century. Moreover, despite of the widespread perception of women as “casual workers” due to involvement in family life, more than 80% of female CEOs have children (Saskia, 2014).
In order to bring empirical arguments to the table, the following lines shall introduce world’s most renowned female super achievers, who built their career in a male dominated framework.

One of the most present appearances on today’s global scene is undoubtedly ***Caroline Fiorina***. Her visibility is rooted both in outstanding tech management and political involvement, being one of the 2016 candidates for USA presidency. Technology and Politics have several common aspects, and one of the most important seems to be the gender discrepancy. Fiorina managed not only to rise herself as a female manager, but to reduce the male-female gap within HP, especially at managerial level. Within an interview for World News, Fiorina emphasized the gender disparity in the Silicon Valley and agreed that a change is stringently needed. In business, she says, when at a table you have similar people, people of same color, gender, of similar ages, you will reach a conclusion fast. But the impact of that decision will be low. And just as businesses need variety, so do country leaders.

The co-president of Oracle, ***Safra Catz***, proves once again the benefits of women in tech. Based on her and her team’s strategies, Oracle not only provides top quality services on the tech market, but also dominates the database field. Catz’s skill to oversee Merger and Acquisition opportunities combined with outstanding deal making attributes set the basis of success at Oracle.

This brief analysis of global tech leadership scene cannot end without mentioning the bright, outstanding ***Marissa Mayer***. Marissa has been a key player in the design of Google’s era-defining homepage; her logic and design sense are now woven into the daily lives of people at every corner of the globe. In an interview for Makers, Marissa calls her evolution as “gender oblivious”. She remembers how one day, while she was in the university, she found in the newspaper a brief article about “the blonde girl in computer science”. And it took her a while to understand that that blonde girl was herself, and that for others she is different. No one knew at that time how big programming will grow; but Marissa knew for sure that she wants to code. After years of coding, she continues to be impressed by the wonders a computer can do.

Female super achievers worldwide are risk takers and have vision. They embrace innovation and tech advance, and understand the benefit it brings to their professional activities. With respect to the belief that women do not feel comfortable in a male dominated industry, there has been a recent bias to a turn on perception. Both women and men should do whatever they feel passionate about, without worrying about how they fit in. Pursuant to this comprehensive approach of what happens to the women leaders around the globe, it is time to broaden the analysis and take it on the Romanian IT market.

THE ROMANIAN MODEL - FOUR WOMEN MANAGERS SUSTAINING INNOVATION

In order to identify how leader women feel in the Romanian technological framework and what is their special contribution, four amazing ladies, managers in software technology, have been involved in throughout discussion about their careers and what happens beyond it as well.

Their answers and reactions prove how Romania embraces female leadership in domains that were traditionally perceived as men’s fields. Moreover, their activity shows why female workforce is important for IT innovation and progress.

Research context

Within three months of primary research (February to April 2015) women who have chosen to lead in technology on the Romanian market have been identified and contacted. This revealed how the visibility gained by women managers lately increased. Gladly Romania appears to be making progress, which corresponds to the international ascending attention brought to women leaders.

The main sources have been awarding events, such as “Women in Tech” organized by Intel or “Women in Technology Awards”, held by Market Watch. Also a great starting point was represented by the online communities Girls in Tech Romania and Girls Who Code.
Four out of the contacted managers have given a positive feedback and all participated to a throughout discussion about their career in technology.

Interview guide

The following set of questions has been adapted upon the interviewee’s analysis (educational and professional background, marital status, position within the company). Furthermore, in the context of a face to face conversation, additional questions resulted along the way. Nevertheless, the below remain essential for drawing relevant conclusions:

(A) *How did the closeness to IT happen?*

(B) *Which is the pattern of your education and career?*

(C) *You are now a professional in a men-dominated field. How is the interaction with colleagues/ subordinates/ partners?*

(D) *What would be your particular role as a woman in IT? Do you find it different from a man’s contribution?*

(E) *Which would be the best part of being a female manager in IT?*

(F) *How about a downside of it? Which are the obstacles?*

(G) *Do your personal goals meet the professional ones? Do you believe that a woman's role in a family can compromise career?*

All interviews were conducted face to face, for a more at ease interaction.

The profile of the four young women managers (age range 25-35) who provided positive feedback to this initiative can be summarized as presented in *Table 1*.

Table 1. Profile of interviewed Romanian female managers in technology

Name	Position	Company	IT area
Sabina David *"As a woman in technology, you have to be prepared all the time"*	Project Manager	Iristel Canada	Telecom
Irina Oprea *"A lady should wear more than one hat"*	CEO	System Innovation	SAP - Business Consulting
Elena Bogasiu *"Coding is like writing. When you see your result serving million people, you get as thrilled as a writer seeing their book on bookstores shelves."*	Developing Team Leader	BRD	Cobol development
Alice Porosanu *"I do not remember being encouraged by parents or teachers to do science. It was the type of qualification that women were not identified with."*	CISCO Team Leader	Nobel	Telecom

Another relevant aspect is that two of the interviewees have children, aged between 1 and 2 years old.
The interviewing phase aimed mainly to determine the particular contribution that women managers bring to the Romanian technology market.

Additional results are related to women's development as IT professionals in Romania, their study and career path, how did they choose technology and how do they feel in this position. Furthermore, it has been interesting to observe the correlation between family and work, especially since the personal life of a woman is considered to get in front of her career.

Main deductions from the Interviewing Phase – Romania does nurture women's professional goals

The following lines will reveal how women feel as tech professionals in Romania. Questions of the interviews have been centralized and narrowed to the crucial topics, namely society's perception, self-awareness as well as personal goals versus professional advance.

(A) Feedback about Romania and IT possibilities for women

Sabina: *"At this point, I would not leave Romania. Here I had the chance to do all I wanted to, work related. I never hit unmanageable obstacles. I have got in touch even with the Western world; nothing motivated me enough to leave. Gender-wise they were even a bit more hostile, maybe more aware. I have noticed also how women in IT from other countries try hard to fit in. I never have to do so here. I have been myself and learned along the way."*

Irina: *"As a matter of fact, I was never keen on another country. Here is my home, and Romania is actually a great country to be in, especially at this level. I have worked in USA many years ago, for several months, I never returned. I have been to Asia with business. There it feels difficult to be a woman even on the streets. Professional-wise, I have grown so much in Romania that I know it suits a leading women perfectly."*

Elena: *"If I did leave the country, it would be solely for the education of my little girl, not for me working in a different environment. I experienced this for several months in Franca and Belgium; I couldn't wait to come back."*

Alice: *"World's best IT companies open branches here in Romania, why would someone passionate for software leave?"*

At this point, one may see how well integrated these women managers are in the Romanian business environment. They all see Romania as a welcoming environment, for IT professionals, women leaders in business and women involved in IT altogether.
Indeed, they all experienced at some point, either at the beginning of their career, or during their advance, a certain degree of reluctance gender related. Yet in the same time, while travelling in different countries, they understood that this same reluctance towards women leaders can be even more emphasized abroad. Consequently none of the interviewed women expressed any intention of leaving the country for better professional opportunities.

(B) External reaction to their involvement in technology management

Sabina: *"At the beginning of my managing experience, I did have the tendency to be too straight forward or too rough. Looking behind, I see it was a way of mine to compensate the fact that I was a young girl trying to be a manager in technology. So yes, I had various approaches, because you tend to be the pretty face if you make the slightest mistake. As a woman in technology, you have to be prepared all the time. You must be able to back up any idea you have, anything you say. Because at the smallest mistake, people can easily label you as the pretty face."*

Irina: *"I consider our product has always been more important than who delivered it. I have been abroad indeed, in more than 20 countries, and the solution always matters the most. I even believe that Romania is one of the many open-minded societies, where you can be whoever you want to, as long as you work for it. "*

Elena: *"As a matter of fact I was for a long time perfectly unaware of such differences between men and women in technology! The first time I heard about this, was when a French partner came on a business trip here in Bucharest and we went for lunch. He asked me if employers here differentiate between females and males professionals."*

Alice: *"We have unfortunately few role models in many scientific fields, including telecom and networking. This is probably why I do not remember being encouraged by parents or teachers to do science. It was the type of qualification that women were not identified with. More women should be seen doing science. Moreover, I believe that they should be less obvious about their gender. What I mean is that people should respect you for your achievements, not because you are a male or a female."*

(C) Personal goals versus professional advance

When asked if their personal goals could stand against career evolution, they all answered nearly the same. Family is not a drawback, not for women in IT and not for women activating in other fields.
On the contrary, having a fulfilling personal life is a huge motivating factor.
The two interviewees already having small children said that they were indeed somehow forced into returning faster from maternity leave. They sensed a pressure from their upper management. Nevertheless, their professional advance per say has not been affected in any way, as they do not consider the time spent with their children a career drawback, but a normal life decision, one that improved their lives.

In order to get this family discussion further, the topic of ovarian tissue freezing was brought into discussion and thus the possibility to postpone having children until the career path is settled. None of the interviewed women saw it as a necessity, being given their above stated perspective. Furthermore, they did not see it as a viable solution due to the very large age gap. As they saw it, having a child at 40 years old implies a crucial difference in understanding and complying with the changed ways of living. Societies evolve so fast, technology is launching in a tremendous advance, people live differently and new generations are already arising. Thus raising a small baby 20 years for now did seem like a great challenge for the interviewed women.

(D) Special contribution to technology business

The general conclusion with respect to this topic is the following: women bring technology closer to people. They have the empathic approach, and manage to find the human side of software.
Regarding leadership itself, the interviewed women impressed me through their ability to impose themselves in their working environment. They place their success on the high quality professional activity undertaken. As these ladies view it, gender becomes irrelevant when your results meet all expectations.

CONCLUSION:

IS THE WORLD READY FOR WOMEN LEADERS IN TECH?

Because women are for sure ready to lead in technology.

Gender disparity has of course been pervasive and wide-reaching in most of technology's industries. Yet with the rise of this information society, women are now given the opportunity to speak up, share their ideas and get credit for their contributions.

The respondents' views on external and internal attitude towards women in tech industries – as well as on family and particular contributions brought by women in technology industries – are presented in ***Appendix 1*** (*Table A1* and *Table A2* respectively).

The conducted interviews demonstrate how women have changed their perception on IT. They are aware of the degree in which technology impacts people. Even more, they see IT as the means to reach societies and change life-styles, which is nothing but true. Bold, talented, passionate women can be managers, despite the degree of uncertainty brought by these male dominated fields. And once they reach a certain level, they discover another layer of the society, a threshold of the courageous, inspiring people, having their minds open to variety.

This entire study leads to an encouraging conclusion: more and more women are aware of technology's potential, and in the same time IT benefits increasingly from these women's contribution. Female managers of today's technologized world bring software and hardware closer to the people these serve. Because after all machines and programs are built to serve people, and yet not the other way around.

RESEARCH LIMITATIONS AND POTENTIAL FURTHER ACTIONS

The main purpose of this research has been to identify how women managers contribute to the Romanian technological market, namely which is the value-added they bring, and how they feel in the leadership positions occupied.
Should the sample be enlarged, the conclusions of the study would become representative for the entire Romanian technology market. The research would then provide as a strong analysis of women' leaders in tech position towards their profession the business environment. It would draw a pattern of female managers' evolution in the IT industry and even the basis for prospects.

Appendix 1.

Table A1. Respondents' view on external and internal attitude towards women in technology industries

TOPIC	Societies' Perception on Women in Tech		Women Self Awareness	
Elena Bogasiu	*Positive*	Not aware of gender barriers to women in tech; evolution based on her objectives	*Positive*	Beginning: did not trust herself enough to aim very high; after having a job, she earned confidence
Irina Oprea	*Positive*	Unlike Asian societies, Romania proved to be rather welcoming and open-minded	*Positive*	Always confident, which lead to a rather smooth professional and personal evolution.
Sabina David	*Negative*	Met some external obstacles here and abroad: protective men, reluctant to her abilities or role	*Positive*	Gained trust along the way, based on her results and feedback
Alice Porosanu	*Negative*	Her family and friends did not support her career choices; tech field would not be associated with women	*Positive*	Passionate about the field, always focused on work and aware of her competencies

Table A2. Respondents' view on family and particular contributions brought by women in technology industries

TOPIC	Personal versus Professional Goals		Value Added to Tech Business (different from men)	
Elena Bogasiu	*Negative*	Although she has a fulfilled personal life, she met several obstacles along the way; believes it is difficult to have them both	*Negative*	Same contribution as men, does not perceive herself to be a different professional; communication may be different, yet not seen as a crucial aspect
Irina Oprea	*Positive*	Admits that it is hard to keep a balance, yet thinks it is normal and possible to explore every aspect of life	*Negative*	Although sees women as more emphatic, the general opinion is that both male and female contribution consists in results

Sabina David	*Positive*	Profession only cannot fulfill and personal plans do not affect job efficiency; on the contrary it can be motivating	*Positive*	Making IT more human, bringing hardware and software closer to people; building bridges through effective communication
Alice Porosan u	*Positive*	A husband, a child, friends do not make a woman less of a professional. It should not be about time spent at work, but about efficiency	*Positive*	Going beyond technicalities and experiencing the end-user approach

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The place and the role of the intellectual property assets in the knowledge based organization context

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ABSTRACT

In the nowadays society, when the access to data and information is made easier to accomplish grace to the development of the information and telecommunication technologies, the issue to discuss is the use of knowledge with the purpose of creating the competitive advantage by producing knowledge. For the accomplishment of this purpose the actual situation has been analyzed to the level of European Union in what concerns the manner of valuing the intellectual property assets. The analysis revealed a model realized in the framework of a European research project. The conclusions of this scientific measure are pointed towards the optimism of the fact that, in time, each organization, no matter the size, the field of activity or the structure will be conscious of the assets that it owns and the way that they can be valued.

Keywords: *intellectual property assets, knowledge based organization, the capitalization of the intangible assets.*

GENERAL CONSIDERATION REGARDING THE INTELLECTUAL PROPERTY ASSETS

The historical moment where we are found is one where no matter the place in the world we are, we are able to access a large amount of information that no human being or a group of people would be capable of processing and remember. But just the information is not enough. For example, to be able to access the data disposed by the internet, a connection to the internet is not enough, it must be known the way of using the computer, what means owning some knowledge. The characteristic of the knowledge based society is not that we have great amount of information but that in this framework we must find out more through the process of their transformation in knowledge (new products, technology, etc).

The contemporary economic landscape is shaped not only by physical waves of goods and material products, but also by intangible values and waves of data, images, and symbols. This situation develops the conditions for making a change in the organizations'' complexity order. Because perceiving the organizations out of the economy and out of the relationship between them is absurd, it seems that in fact we assist to the apparition of a new type of organization: knowledge based organization.

In the new economic reality, the change of knowledge at the tactic or strategic level, together with the change of intangible values and benefits become the main source of values creation. The change currency is not represented only by the money, but also by the knowledge or other intangible values such as the prestige or the loyalty of the clients. In such an environment, the old models used to describe the bookkeeping system, the organization and the economy can't capture the nowadays reality. This is the reason that leads to a new manner for reporting to the intellectual property assets that represent the competitive advantage which most of the organizations don't take knowledge of and even less values it.

The passage to the knowledge based economy, to the construction and functioning of the knowledge based organizations, it can't be accomplished without a knowledge based management (Oprean, 2011). To the organization level, the knowledge is found to the human capital level, in the requests and preferences of the clients, more specific the clients capital, in the products, processes, its capabilities and systems that builds the structural capital. As a result, the value of the knowledge assets can increase in great number the value of intangible assets.

The intellectual property assets and their value most of the times are not adequately appreciated. But in the knowledge based organizations, the intangible goods represent the major interest point when decisions are needed to be made. What must be taken into consideration by the organizations, generally speaking, is the speed by which the new products, brands, models and the results of creativity come out on the market as a result of innovation and of the daily process of creation, rightfully appreciated.

RESEARCH REGARDING THE IDENTIFICATION OF NEW VISUALIZATION METHODOLOGIES AND EVALUATION OF THE INTANGIBLE ASSETS STATUS QUO IN EU

The European capital market experts are found in the first line in what concerns the global developments. In 2008 the European Federation of Financial Analysts Societies- EFFAS, published "The principles for an Efficient Communication of the

Intellectual Capital, establishing an European standard in what concerns the recommendations for the bookkeeping principles of valuation and presentation of information for the corporative intellectual assets (South East Europe Transnational Cooperation Programme, Application Form, Document Reg. No.: INTRA – 5182931- Documentation European Research Project EVLIA, 2012). According to EFFAS (European Federation of Financial Analysts Societies), intangible goods are defined as a category of goods in the context of financial markets, and also in the corporative bookkeeping and reputation, classifying the intangible goods as follows: the competences of the employees and of the management, the human capital, software, the research-development, innovation and capacity of innovation, brands and licenses, strategies, processes, relationships with the suppliers and with clients.

Taking into consideration the fact that most of the patent transactions are realized based on some non-disclosure contracts is difficult to tell the size and the evolution of the patent's markets. But, analyzing the reports and the statistics available, we can conclude that the paten's markets are on an increasing. The patent's market represents a significant step of innovation because it facilitates the spreading of technologies and ideas by the actions of encouraging the circulation of patents between a great numbers of organizations.

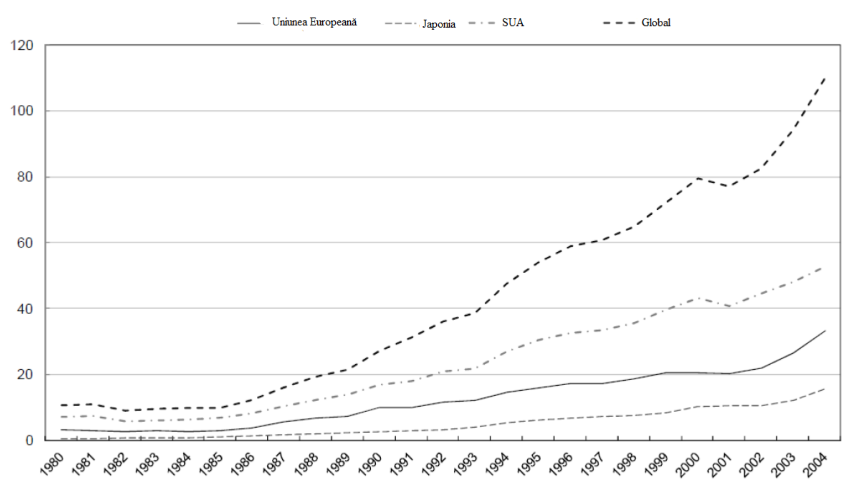

Figure 1: Encashment from the international licensing (billions of dollars). Source: WIPO.

The international licensing, for example, seems to be in a rising trend. The international encashment from intellectual property increased from 10 billion dollars in 2004, with more than 90% from the encashment for the three great areas: European Union, Japan and the United States.

Because of the apparition of new players whose business models are focused on the extraction of value from the intellectual property, the market of intellectual property has known significant changes. The way of action of the organizations that try to value the intangible goods that they own can be divided in various categories. On one hand the organizations try to value the patents by creating strategic portfolios of patents that they specialize. On the other hand, the organizations offer websites with the purpose of creating online markets where patents and ideas can be changed, and other organizations make cooperative structures that buy and license patents for their members in defensive purposes.

It is important to take into consideration that the intellectual property markets are rapidly developing by the apparition of new types of intellectual property transactions and new ways of development and supplement of intellectual property, which on their turn create new business models. This is the reason for which these must be carefully analyzed, for the purpose of creating transactions that may influence in a significant way the circulation of the patents and there can be created a favorable environment for the development of the knowledge based economy.

The way of action of these new players on the transactional markets for the patents and the evaluation approaches of the intellectual property used, are of a significant importance in the development of a framework for the valuation of the methodological set of tools which have a contribution to the making of a unique European market for the intellectual property.

Taking into consideration the fact that the intellectual property represents an important mean in the processes of innovation and a part in the intangible goods portfolio of an organization, we have the tendency to believe that is evaluated and treated equally with the tangible assets but, unfortunately, it hasn’t been enough valued and treated as a true asset in the bookkeeping by the experts of the financial market. The lack of an evaluation approach being generally standardized is the weak spot of the knowledge based economy.

Nowadays, investment experts combine traditional methods, as the approach based on income, the approach by market comparison or the approached by costs with additional information taken of the market, according to specific conditions.

In certain countries, for example Austria and China, they are in process to establish the standardized evaluation methods which include a qualitative and a quantitative approach. In Italy, in 2008 a methodological approach was established based on the agreement between the Economic Development Minister, Banks association, Industrial Association, And University Association. Also, in Hungary, new evaluation approaches are explored at the national level. The European unitary patent gives a new leafing point adequate for introducing the intellectual property as an asset, regarding its valuation and evaluation from accounting point of view. The current European patent system is complex, fragmentary and expensive.

In 2011, the European Commission begun to explore the options for establishing an evaluation instrument of the rights for the intellectual property to the European level. In this context “the valuation” refers to the valuation of the intangible assets in terms of bookkeeping and to an increase in the number of the opportunities for obtaining a better value from the rights of intellectual property and to find financing.

The valuation and exploit are two concepts inter-conditioned, in this context, the need for an improved evaluation is strongly tied to the expansion of the use of intellectual property. The necessity of financial evaluations of the intellectual property becomes relevant especially when they are used as financial tools by the organizations and as investment goods by the financial institutions and risqué capitalists.

For many organizations the professional management of the intellectual property is of an important critique. In fact, the intellectual property is the main good which determines value of an organization found at the beginning of its journey, and the decisions of investment are taken. (Manus, 2012). The intellectual property can be considered a key element in establishing the value of an organization. The basis evaluation methods are very much alike, fact that reduces in complexity and helps in determining the management key problems. The introduction of a national evaluation instrument or a standard of patents in the member states of the European Union must take into consideration the situation at a national level in what concerns innovation sector activity. Meanwhile the evaluation of patents or other forms of rights for the intellectual property and intangible goods present differences between the economic sectors, and these economic sectors are characterized by differences to the level of the use for the patents, the tools of evaluation must be adjusted to the level of countries regarding the activity that implies the rights for the intellectual activity and intangible goods.

VALUE MODEL FOR THE INTANGIBLE GOODS

In preventing the problems that the economic market for intangible goods confronts with, there comes the EVILA Project- Making full value of good ideas by leveraging intellectual assets for financing SMEs in South East Europe" whose main purpose is facilitating innovation, entrepreneurship and knowledge based economy, facilitating the SMEs' access and of the potential entrepreneurs towards the requested financial resources for the implementation of these actions. The main idea is to contribute to the creation of a unique market for good ideas and innovation in the South Eastern Europe (South East Europe Transnational Cooperation Programme, Application Form, 2012).

The specific objectives of the project are the developing and application of some commune valuation methods for the intangible assets in order to facilitate the financing from the intellectual property rights. The set of methods elaborated and summed during the EVLIA project, from the best case studies and business practices, gives the foundation for standard evaluation method of the intellectual property all over Europe. This would be a crucial step for accomplishing the European Commission's purpose to create the framework conditions for facilitating the appearance of a Unique Market of Intellectual Property. It is important to mention that this project tried to promote the cohesion and the equilibrium of the weak structural points of the regions that are less developed by the transfer of knowledge and of top practices of these regions.

During the European research project EVLIA, it was developed an approach on three levels with the purpose of grouping the evaluation approaches as a result of their relevance in what concerns the real current situation of the financial industry and of the supposed capacity of evolving and integrate new approaches in their internal procedures. The three level approach (Figure 2) has ne following structure (Weltz, Fichtinger & Kerschbaum, 2013).

Level 1	**Level 2**	**Level 3**
„Intellectual property in restrained sense”	”Intellectual proprerty in large sense”	„Intangible assets”
Valorification		

Figure 2: EVLIA valorification model on 3 levels.

Level 1 is the basis zone of the registered industrial rights, more specifically, the patents. In this area there are a great number of business cases together with instruments or valuation approaches.

Level 2 is named the middle evaluation zone and it follows the industrial property including the brands and the trademark. Here we have some proofs of transactions and business from the South Eastern Europe, United States and China.

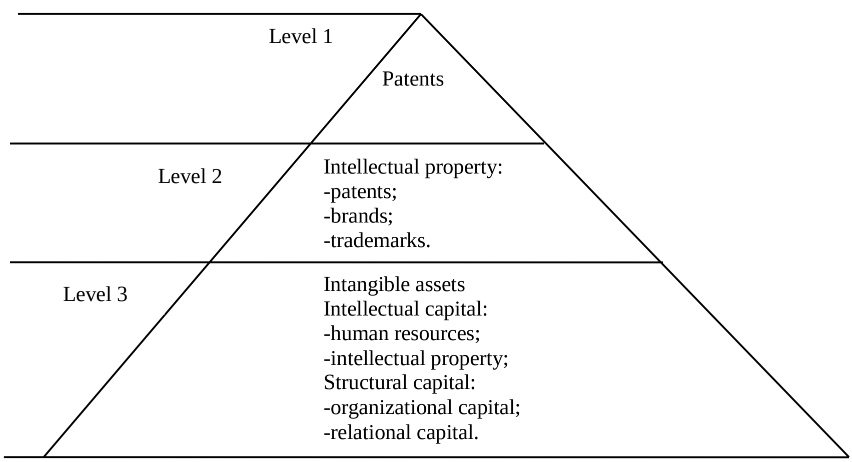

Figure 3: EVLIA valorification model - extended

Level 3 is the largest area of evaluation that includes all the intangible assets categories, for example: intellectual capital and the structure capital of structure. This level is considered to give a comprehensive image over the organization’s value of creation, based on intellectual assets and knowledge. An expanded representation of the EVLIA model is represented in figure no. 3.

Usually, the banks don't accept and don't implement any instrument of valuation in what concerns the knowledge based organizations. Even so, in what regards the bookkeeping practices and reporting, a number of European organizations and Asian organizations give substantial information about intangible assets to the interested persons.

For example, on behalf of the corporations, Infosys Technologies situated in Bangalore, registered to the market of New York - NYSE, gives the comprehensive divulgation of a great range of intellectual assets. Until now, from behalf of the banks there are no proofs regarding an implemented structural approach in practice.

Levels 1 and 2 reflect the current situation of a valuation and evaluation limited of the categories of intangible assets, individual selected as it shows the business transactions that implies corporations and financial industry of Europe, United States and Asia. For both levels, in practice is suggested valuation methods that would be relevant, based on standards of valuation published in Austria by the Austrian Institute of Standard, developed in partnership with all the relevant parts involved (Weltz, Fichtinger & Kerschbaum, 2013). Even so, we must understand that the financial experts, most of the times use a completely different set of approaches of practical evaluation. Level 3 is dedicated to the development on medium and long term and to the final purpose of valuation of the intangible assets in business transactions: the approach of the integrated valuation.

The described approaches can be seen as additions for developing a framework for working that is accepted in practice, more advanced, and a set of applied methodologies in the context of business transactions all over Europe. The European research project EVLIA, pretends to bring such a working frame in order to give a model and a plan for a standardized valuation procedure of the intangible assets.

CONCLUSIONS

The importance of the knowledge based organizations is irrefutable, especially when we talk about a continuous changing economy, where information gives power and innovation is always present, because in order to progress, adapting is not enough, you must innovate, think and act with a step ahead your competitors, but in the interest of the consumers and of the organization. In other words, innovation must be as a basis stone for any entrepreneur's support.

Any entrepreneur or manager must base his strategy on the intangible assets that represent unlimited and renewable resources. This fact gives strength to the idea that sustains that intangible assets have a higher utility than the tangible assets.

On the competitive markets from these days, the use and protection of these intellectual assets makes the difference between success and failure. Moreover, the intellectual property is an important means in the innovation processes and part of the intangible assets portfolio of an organization. Even so, it hasn't been enough evaluated like most of the assets, and treated right as a true asset in bookkeeping by the experts of the financial market. At the European level and also international level is still missing a general standard valuation approach. In the nowadays practice of the investment specialists , the traditional methods (the income approach, the comparison of market approach or the costs approach) are applied in combination with additional information of the market according to the specific circumstances.

Following, the organizations must manage the most correct possible the intangible assets for identifying additional modalities for valuing them. This subject has been approach by the EVLIA project that has as a main purpose the elaboration, the testing and transmitting a methodology that supports the creation of a unique market for innovation, in private the evaluation of the intellectual assets and of the intangible assets in the South Eastern Europe. The making of an unique market would mean a great progress for the European market and also for the global one taking into consideration the opportunities that result from this process.
What should be taking into view by the entrepreneurs and investors is to see beyond what they already know, beyond the static data or the prognostics of the markets. It is important that each of these categories to be aware of the role that they have in the context of the development of the economy and of the organizations based on knowledge. In the very moment when the awareness passes from individual to the collectivity we could talk about change to the level of mentalities and this will lead to the evolution of the collectivity and of the economy altogether.

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Redesign Subject to Support Group Work in Distance Education

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ABSTRACT

This paper is about a distance education subject redesign undertaken in School of Information Studies at Charles Sturt University. This paper presents a theoretical framework supporting a constructive alignment in subject redesign grounded on some valuable learning theories, namely social constructivism, cooperative learning and collaborative learning. The theoretical framework guided the redesign of a postgraduate subject INF441 Information Management in Organizations. In the subject redesign, constructive alignment for learning environment, intended learning outcomes, teaching and learning activities and assessment tasks were carefully checked. The paper reports the effects of the subject learning design after the subject was subsequently taught by the same designer in the role of a subject coordinator/lecturer. Group work tools in CSU Interact (a learning management system using Sakai) were able to create an appropriate learning environment for the successful running of the subject. The subject redesign created an effective beneficial learning environment in the presence of the affordance of the learning management system 'CSU Interact'.

Keywords: *Group work, Distance education, Subject Redesign, Educational Technology.*

INTRODUCTION

This paper particularly focuses on a redesign of a postgraduate subject 'INF441 Information Management in Organizations'. A head of school (HOS) in School of Information Studies (SIS) who was a former subject coordinator of it spoke to a new subject coordinator about conducting a postgraduate subject peer-review and its subsequent subject redesign. This postgraduate subject was a core subject in the Master of Information Architecture (MIA) and an elective in the final year subjects in Master of Applied Science (Library and Information Management) [MAS(LIM)] program. The past students in the subject complained that very highly librarian-focused study materials were used when these students would actually expect to be employed in information centers or information resource organizations with leadership or managerial roles after their graduations. As there were generally more students from the MIA program than the MAS(LIM) enrolled in the subject, the information management and knowledge management components of the subject were to be made much less librarian-focused, but more industrial-focused in a subject redesign in order to suit the particular student cohort.

In the same school, there was another undergraduate subject with very highly similar contents offered to Bachelor of Applied Science (Library and Information Management) [BAS(LIM)] students. All MAS(LIM) postgraduate students and BAS(LIM) undergraduate students who graduate from the programs would be granted an Australian Library and Information Association (ALIA) accredited librarian membership. In common, the two subjects clearly needed the librarian-focused study resources. As such, the HOS requested both the new MIA/MAS(LIM) subject coordinator and the BAS(LIM) subject coordinator to collaboratively review, discuss and redesign their subjects together. They were also assigned the subject coordination and teaching roles after the redesign. Being mindful of the different subject requirements and how the different requirements could affect the subject redesign and development, the two subject coordinators gathered different study resources and worked out different learning activities to suit the diverse needs of their own student cohorts. They helped and shared some common resources with each other. There were several types of frequent discussions e.g. on different learning objectives, assessments, group work learning, practice based learning, learning activities and learning environment issues in the subject redesign. They individually conducted a constructive alignment that considers the needs for the diverse cohorts. Both the subjects were redesigned with a rationale of how the subject could be constructively aligned with the learning objectives, group activities and assessments in the learning environment for the needs of different student cohorts. These tasks were paramount in the subject redesign. They discussed how the disparate types of learners could grasp the theoretical learning concepts and apply them in class activities and group work. The use of group work assessments was selected due to the student would become the future librarians and information resource staff and would need to work cooperatively with co-workers. They would need to interact with all types of stakeholders in a library. The same applied to many of the postgraduate students as prospective information center/resource managers.

During the session, the students made use of the study resources, took part in the learning activities, engaged in group activities and completed two assessments which were group work. Most of them enjoyed they group work tasks though a few students left the subjects and their groups. The students who completed the subject enjoyed the subjects. They commended their subject coordinators and left in group work forum messages about how much they enjoyed their group work and times spent in the subjects.

This paper is structured as follows. The next section is a literature review. It discusses the learning theory, learning design principles and considerations that support the postgraduate subject redesign. A section on methodology follows. The section afterwards reports the findings of the study. A subsequent section on discussion reflects on the implication of this study. The final section provides a conclusion.

LITERATURE REVIEW

The common terms educational design, subject design, learning design and instructional design are used interchangeably (Rogers & Graham, 2008; Pelham et al., 2008). The terms directly relate to a subject design or subject redesign. This literature review explores literature in educational design using principles and guidelines of various learning theories. The learning theories have a common theme supporting constructivism and constructivist learning design (Jonassen, 1999; Gagnon & Collay, 2006). Together, the learning theories present a theoretical framework that supports an educational design that facilitates constructivist learning. Using this framework, it guides the subject redesign. The theoretical framework highlights that the teachers and students can participate in teaching and learning activities aligned with intended learning outcomes in a monitored environment for collaborative group assessment tasks.

Constructive Alignment

A subject redesign involves making changes. Theories of education and theories of change need the support of each other (Fullan, 1993). Biggs and Tang (2007) explain reflective teaching happens whereby ‘expert teachers continually reflect on how they might teach even better’ (p.41) but transformative reflection ‘uses theory to enable the transformation from the unsatisfactory what-is to the more effective what-might-be’ (p.43). Constructive alignment also aims to facilitate constructivist learning on the premise of constructivism. Social constructivism emphasizes the needs for students to learn and gain knowledge of a subject through interactive learning activities like group work.

Learning Theories

Learning has always been the subject of research by psychologies and educators resulting in many theories of learning (Tusting & Barton, 2003; Forehand, 2005; Collinsa, Josephb & Bielaczycc, 2004; Howard, Carver & Lane, 1996; Biggs, 1996; Seongheea & Boryungb, 2008). The above-mentioned researchers who explore learning theories commonly view that teachers play an important role in creating a learning climate or learning environment to encourage and facilitate active learning and teachers also reflect, learn and make teaching improvements based on their teaching experience. Kolb learning cycle (Kolb, 1984; Howard, Carver, & Lane, 1996) suggests to adopt a reflective practice which is important to the development of teaching using teachers’ own experience, so that teaching can facilitate student learning. Reflection has been widely recognized as a central tenet in an effective teacher education program (Wang, Chen & Levy, 2010). This research adopts and endorses a few learning theories below.

Social Constructivism

Constructive alignment is grounded on constructivism which aims is to facilitate constructivist learning.

Constructivism is a philosophical view on how we come to understand or know (Savery & Duffy, 1996, p.135). Barab and Duffy (1998) comment that amongst the constructivists, they hold different perspectives and make different assumptions. Mayer (2004) argues that constructivism takes many forms. Piaget's constructivism (Leonard, Noh and Orey, 2007) is about what is learned and organized as mental representations of something tangible or intangible that can be applied to an object, situation or event. Cognitive constructivism sees that learners play an active role in assimilating objective knowledge in constructing new models by engaging in new experiences in active learning process (Tusting & Barton, 2003). Social constructivism, developed by Vygotsky in his activity theory (Chaiklin, Hedegaard & Jensen, 1999), is crucial for learning as it allows a different perspective through the interaction with other people and cultural artefacts (Berger & Luckmann, 1966; Loughland & Parkes, 2004). Engestrom (1987) articulate a computer-mediated communication or computer-mediated collaboration (CMC) model where technology is used as the artefacts in educational technology.

Nevertheless, constructivism has a basic premise that learning is an active process, in which learners actively seek to construct coherent and organized knowledge. Social constructivism critically means a need for social interaction amongst members in a same learning and teaching community to collectively construct the coherent knowledge. To construct collective knowledge, it is critical to encourage and facilitate collaborative learning and cooperative learning.

Collaborative Learning and Cooperative Learning

Bruffee (1995) clarifies that collaborative learning and cooperative learning are two versions of the same thing. The traditional form of collaborative learning is face-to-face group work (Ellis, 2001). Collaborative learning is an important pedagogy in higher education which restructures the traditional classroom lecture into small group work with intensive interactions between students and teachers for complex projects (Cabrera et al., 2002). Collaborative learning allows group members (learners) to analyze and interpret meanings as it unfolds the data at the group level (Dennen & Paulus, 2005). The modern world reaches out beyond the face-to-face collaborative or cooperative learning with the affordance of technology (Suthers, 2005; Teo & Gay, 2006). Dennen and Paulus (2005) further discuss computer-supported collaborative learning in Internet-based distance education. Cabrera et al (2002) remark that cooperative learning connects knowing, cooperative problem solving and socially based knowledge. Ledlow (1999) and Panitz (2000) explain that cooperative learning requires students to form groups and work on an assignment together formally in which teachers carefully design lessons and activities suitable for use. Cooperative learning allows students to work together (Jacobson, Davis & Licklider, 1998) to accomplish shared learning goals (Johnson, Johnson and Stanne, 2000). Computer-mediated collaboration is well adopted in education and training (Salmon, 2000). CMC offers the affordance of online socializing and networking (Salmon, 2000), i.e., technology creates the opportunity for social interaction in learning and teaching (Gabriel, 2004; Fullan, 1993). Educational technology like learning management systems (e.g. Blackboard, WebCT, Sakia, Moodle) are well adopted in the modern world (Grace & Butler, 2005; O'Neil, Singh & O'Donoghue, 2004). Sharples (2000) and McLoughlin and Lee (2007) discusses the use of mobile educational technology such as personal handheld or wearable computer systems and social software that support learning from any location. In essence, the researchers above hold highly similar views about people can interact collaboratively with work cooperation in different learning projects to accomplish tasks and achieve common goals.

Having explored a constructive alignment articulated through a theoretical framework of social constructivism back up with collaborative learning and cooperative learning, the subject redesign needs to adopt a methodology. The methodology will follow the direction of using the constructive alignment supported by the theoretical framework.

METHODOLOGY

To redesign the subject INF441 Information Management in Organizations, a methodology is formulated by aligning the subject's intended learning outcomes, teaching and learning activities, assessment and learning environment created for its distance education learners within the theoretical framework. It will be discussed below. The subject involved distant education students from the Master of Information Architecture [MIA] and Master of Applied Science (Library and Information Management) [MAS(LIM)] programs. Many students were students who were located in different parts of the world. Some were domestic Australian students.

Constructivist Learning and Constructive Alignment

It was planned that at the start of the teaching session, the students would be formed into groups by the postgraduate subject coordinator. Each group would be assigned a project site (online Sakai group work sites through CSU Interact) where all group members could interact together using communication tools like 'announcement', 'group emails', 'chat room' and 'forum'. They were given planning tools like 'calendar' to set timelines and meeting arrangements. They would also be provided with group work with collaboration tools like 'wikis' as well as 'resource' to add and share common work together (Okamoto, Kayama & Inoue, 2002).

In the learning modules, students would be encouraged to interact amongst the members in the group project site based on questions in the modules. Students would be taught how to use the tools and would be clearly provided with instructions to learn the tools at the start of the session. The subject coordinator would also facilitate the first few chat room meetings in groups and check the communication or progress patterns of all groups in the early weeks in the session. Teacher-learner interactions would need to be well maintained throughout the session to ensure effective learning continuously happened and group work would be steered into some fruitful directions.

Intended Learning Outcomes (ILO)

The subject has six ILO or learning objectives 1. Discuss the use of information in strategic management; 2. Outline information resources and processes in an organization; 3. Outline the key concepts underlying knowledge management; 3. Describe ways of establishing corporate information needs; 4. Explain methods of evaluating corporate information resources; 5. Assist in the development of a corporate information policy; and 6. Apply the above outcomes to a variety of information-related positions. These objectives are in alignment with CSU graduate attributes. The subject intended learning outcomes fulfils seven principles of good practice in education (Chicking & Gamson, 1987, Graham et al., 2001). In the subject delivery, it must be checked that there were frequent interaction between faculty members and learners, adequate cooperation amongst students, prompt feedback to all members, and clear communication of expectations. The subject coordinator must ensure that the whole class respected diverse talents and opinions of others. Learning would be well-supported by collaborative learning and cooperative learning. It was planned with an expectation that constructivist learning would be a form of active learning allowing each individual learner and the group workers to work towards the completion of all assessment tasks and learning activities.

Teaching and Learning Activities (TLA)

The importance of technology used in supporting education from a pedagogical point of view has been highlighted in different literature. Marra, Moore and Klimczak (2004), and Dennen and Paulus (2005) discuss the use of online forums in learning and teaching. Schellens and Valcke (2006) and Schellens, et al. (2005) focus on collaborative learning in asynchronous discussion groups which possibly links to enhancement of academic discourse and knowledge construction. The subject coordinator considered the use of CSU Interact tools like ‘resource’ as a multimedia reading material repository in the subject redesign to enhance interactive learning (Kennedy, Petrovic & Keppell, 1998; Kennedy, 2004; Mayer, 2001 & 2005) as well as resourced-based learning (Hill & Hannafin, 2001). To enable the discussions of various topic readings amongst students, forum discussions and chat room would be used. The use of covered readings and group forum discussions on their project sites will help achieve the learning outcome ‘the use of information in strategic management, information resources, information audit, information/knowledge policy, key concepts underlying knowledge management, corporate information needs, and all organizational information related issues’. By discussing the topic readings in groups, students could establish corporate information needs, query the readings or seek to clear doubts in subject contents. Students could share information resources and discuss organizational work processes on the project site. The student group activities were aligned with the six intended learning objectives.

Assessments

There were two assessments in the subject involving group work. The first assignment was grounded on problem-based learning that anchors the learning process in real-word or simulated cases (Hannafin & Land 2000; Savery & Duffy, 1996;). Assignment 1 was planned to involve students in a lot of group interaction to edit a group report using wikis on the group project websites in CSU Interact. Assignment 1 would test the students on their application of subject knowledge in a practiced-based case study. Group members identified their case in terms of user information/knowledge needs, information audit strategies, information resources required in the case, information policy, strategic management practices, and all subject related issues in their learning activities. The second assignment made use of their learning knowledge to perform annotated bibliographies. In assignment 2, all group members were required to not repeat the bibliographies used by any other members in the same group through their group interactions. As all students in all groups were distance education learners, all interaction, communications, activities and assessment tasks were done electronically.

Learning Environments

In the subject website (through Interact), tools like 'announcement', 'chat rooms', 'easts evaluation', 'forum', 'module', 'resource', 'subject outline' and 'wiki' were used. The subject redesign strategies made the ILOs explicit to the students which enable them to demonstrate to the teacher and their peers what they learned (Mann, 2004). As Kotzinos et al. (2005) and Karpova, Correia and Baran (2009) discussed, online learning allowed students, like the INF441 learners, to share resources, communicate messages to their group and teacher, integrate their learning into the individual contribution in group tasks on project website wikis and help each other in editing their completed tasks. They could share and enjoy their achievements in each group. The subject redesign fulfils its ILOs with its TLAs, and assessments are put in place in the learning environment. In both the subject and group project websites, 'home', 'site info' and 'help' options would provide the students with options to adjust their project site environment or seek help information about the use of each tool. In distance education where the INF441 students were required to collaborate for group assessment purposes, CSU Interact group project websites was design and set up to facilitate these TLAs and assessments task to achieve the ILOs.

The subject was taught by the head of school before the redesign took place in a final session of a year. It was redesigned with the HOS's direction and guidelines. The subject was taught as a redesigned subject in the first session the next year with an initial subject enrolment of up to 36 students. The number later dropped to 29 students after the university census date. The students were contacted by an educational designer in SIS for a separate distance education group assignment experience survey at the end of the session. Apart from observation, subject site and project sites documentations, the survey provided further data for analysis of the success of the redesigned subject and the student experiences.

DISCUSSIONS

The subject was delivered successfully as the way it was planned in the methodology section. In conducting this subject, the subject coordinator/lecturer closely monitored all group work, the student communication, frequencies of interaction, scheduling, individual task performance and group assessment completions. In the group project websites, it was found that tools like ‘announcements’, ‘calendar’, ‘chat room’, ‘group email’, ‘resource’, ‘wiki’ and ‘forum’ were well used by all groups. The subject coordinator/lecturer visited all project sites to check shared resources used, whether they used group emails, how they responded to forum/ chat room questions and their email enquiries, having the authority as a project site manager, and stepped in when any groups needed help and support.

While declarative knowledge was provided to students through the resources and modules developed in INF441 subject Interact website, it was found that their functioning knowledge was a gained through learning experience in self-centered self-directed learning, as well as group work learning. All students access a subject forum and a chat room to interact in the subject CSU Interact website. They could also access their group project sites created to help them share and communicate their learned declarative amongst the group members. As in Figure 1, the students’ group knowledge was used to produce their wiki assessment report with fulfilments of the six learning outcomes. It was observed that their collective functioning knowledge was applied in their group learning activities and group work assessment tasks. Their project sites showed that chat rooms, announcements and group emails were best utilized. Few groups with members who used high-end broadband Internet also used SKYPE for video chats. Students demonstrated their application of subject knowledge in their practiced based assessment and learning activities.

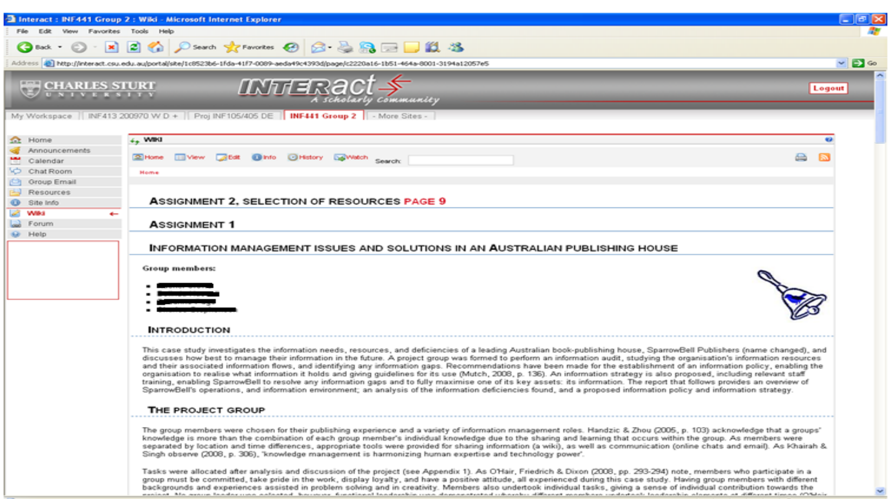

Figure 1: An Example of Wiki on a Project Site.

In the group work assessment reports on wikis, all groups provided a required section with their comments on group work progress and achievement. Surprisingly, all students reported positive learning experiences. It was discovered that Interact tools like ‘chat rooms’, ‘forums’, ‘group emails’, and ‘announcements’ help support collaboration learning or and cooperation learning by enabling in-depth discussion, brainstorming, prompt group member feedbacks and faculty-members-learners interactions for teacher feedbacks. Expectations of tasks were communicated over teacher-learner interactions in group emails, chat room and during consultation hours where students phoned the teacher. Calendar were scheduled with meeting appointments and beeping alarms that alerted the students and resultantly facilitated on time task completions. The ‘resource’ tool was helpful in groups where members shared their group task related resources. The Saika’s ability of generating project websites in CSU Interact enabled online group work. It helped achieve the ILOs by enabling the group interaction driven TLAs, facilitating the group work assessment tasks and providing the required interactive active learning environments.

On a whole, the students were provided with prompt feedbacks, guidance and support throughout entire teaching session in the redesigned subject. It is observed that many MAS (LIM) students found it hard to follow the text as it had more real-world information organization examples not in the library settings. In contrast, the MIA students enjoyed the text and all readings. Reading resources, especially the multimedia resources were highly commended on. It was observed that some MAS (LIM) students also could not understand some organizational issues as much as MIA students in the assessment task specification sheet. It was found that a few students did not like the second assessment on annotated bibliography, seeing it a waste of time as a higher education literacy test. As many student queries were answered in group project emails and as emails to the subject coordinator’s/lecturer’s work email account, the forum on the subject website appeared to have minimal forum activity. When questioned whether all groups had done well in their group work, a student pointed out that group work could be difficult if group members had different ways to undertake tasks or simply did not get on well. Cultural and language differences in learning (Melles, 2004) were also brought up as an issue. As close monitoring of class happened with the teacher facilitation throughout the teaching session, no group reported any dispute or disagreement throughout the entire session. Due to the facts that the second assessment involved group interaction but was submitted as an individual assessment, the members in group scored different total marks in the subjects.

RESULTS

Nevertheless, the redesign subject encouraged collaborative learning and cooperation learning in group interaction and co-working together. It allowed the construction of individual and collective group declarative and functioning knowledge. Using the combined collective group functioning knowledge (Zack, 1999), all members resolved the practiced based problem in their selected case study. Students were highly satisfied in this their learning, activities and assessments in this subject. The online evaluation results of core items were rated 5.41 on a 7 Likert scale by the overseas student cohort with 67% of responses and rated 5.56 by the domestic student cohort with 50% of responses. Using the feedbacks from an end of session online evaluation survey and a required section from all groups reporting their progress and achievement in group reports, Table 1 is developed.

There was no clear difference between the pace of learning and significant result difference between the MIA and MAS(LIM) students. Both the overseas and domestic student cohorts in general performed well and were satisfied. There was no failure occurred in this subject. In reflection, the distance education student challenges (student culture, country and time zone differences) have to be taken into account in a subject minor revision if the subject was to be conducted again. The revision would also need to consider making improvement for all group members understand the need for practiced-based learning before each member embarks on the task.

Table 1. Student Feedbacks on their Experience of Group Assessments

Category	Feedbacks
Sharing real life experience	• I enjoy sharing the group member knowledge and experience in this real life case study that relates directly to a real world problem. • My members have expertise that I get an opportunity to learn from them. It has been a great learning experience.
Ability to use technology supporting their collaboration	• It appeared worrying for me to use wikis and tools in the group project site at the beginning of our group work. As soon as I learnt and used it well, I was so glad to have developed this ability. • The assessment tasks in this subject were very well designed. They allowed students to communicate and use Web 2.0 technology for real activities. The annotated bibliography taught me to read critically. • Working in a group project and discovering the benefits and pitfalls of preparing a joint report was interesting. I enjoyed meeting my group online and working with them.
Group work experience	• For my team who live in various countries, we overcome the time and location difference to have worked collaboratively together. It was a rather different experience. • Working in a group project and discovering the benefits and pitfalls of preparing a joint report was interesting. I enjoyed meeting my group online and working with them.
Overall subject experience	• Questions to the lecturer were answered promptly as well as online forums that outlined questions that others had asked. This was very helpful. • Online resources were helpful. • Group assignment was helpful in facilitating communication with students • The first assignment is good exercise to think how I could improve my organization. • I enjoyed the group work for the first assessment item. A large choice of readings was given. • The group assessment task was a helpful learning experience. I'm glad I did it.

CONCLUSIONS

Constructive alignment adopted in the subject redesign has provided some effective teaching and learning outcomes. In the subject redesign, setting a group work project site using the affordance of educational technology actually helps facilitate individual and collective (group) knowledge construction. With the practiced-based learning assessments used in the subject redesign, functioning knowledge of students were collectively assessed. The paper explains a theoretical framework which strongly supports the constructive alignment of ILOs, TLAs, assessment tasks and learning environment creations. The learning environments encourage and facilitate collaborative learning and cooperative learning.

While group work is a graduate attribute and employer preference in graduates, doing group work together could be a nightmare to some students. Group work and group participations in an online learning environment poses different challenges when students in the face-to-face world dread this idea. However, the running of the redesigned subject prove it supports distance education group work as group assessment tasks in the presence of (or affordance of) educational technology.

On a whole, this paper reports a successful innovative learning and teaching owing to the subject redesign using an enabling educational technology of CSU Interact. This paper reports that educational technology clearly supports group work in distance education.

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Worldwide good practices in managing the orientation of technical education towards sustainable development

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ABSTRACT

Our study aims to provide a global picture of good sustainable practices and initiatives in the field of Technical and Vocational Education and Training (TVET). In order to outline the major positive practices worldwide, a document analysis was performed on international relevant documents (reports, academic studies, guides, rules and regulations, work papers). This method was complemented by discussions with local representatives of school administration, who provided specific evidence on curricular and extracurricular activities conducted locally. Our findings confirm that various sustainable initiatives in TVET took place at an international level, mostly involving multiple stakeholders in the public sector, private sector and civil society. However, it is difficult to assess the effectiveness of these initiatives due to the unequal cooperation of several countries in responding to the UNESCO questionnaires, and to the targets they address. Many of the initiatives outlined in our study appear to have a strong cultural and ethnical dimension. The organization of such examples of good practices according to the different types of learning systems (formal, non-formal and informal education) provides a large framework for different Education actors at international, national and local level, allowing them to inspire when making policies decisions to integrate Sustainable Development in Technical educational courses.

Keywords: *TVET, Sustainable Development, good practices, Education for Sustainable Development*

INTRODUCTION

The concepts of Sustainable Development (SD) and Education for Sustainable Development (ESD)

There is a general consensus that human beings and Earth are facing important environmental problems. Many scientists argue that resource scarcity, ecosystem degradation, biodiversity loss and climate change are threatening our modern way of life, and eventually life on Earth (Steffen et al., 2015). The environmental crisis is increasing poverty and health problems, particularly in a growing population context, with subsequent demands on prosperity and consumption (Heikkurinen and Bonnedahl, 2013).

The concept of sustainable development emerged as an alternative to help restore the world equilibrium. Among the 70 different definitions compiled (Pezzey, 1997), we retain a simple definition that became widely quoted worldwide. In the Brundtland Report, the WCED (World Commission for Environment and Development) defines SD as "...development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (1987). SD was conceptualized as occurring at the intersection of three key aspects (environmental, social and economic), with some authors adding a cultural (Barr, 2014, Knox-Hayes and Hayes, 2014) or a philanthropy dimension (Perrini, 2006, Porter and Kramer, 2006).

The concepts of SD and Education for Sustainable Development (ESD) are deeply related. The most effective way to achieve SD is by enhancing educational practices (Costache et al., 2015). The UNECE (United Nations Economic Commission for Europe) Strategy on ESD states that "education, in addition to being a human right, is a prerequisite for achieving sustainable development and an essential tool for good governance, informed decision-making and the promotion of democracy". In 2002, the UN General Assembly declared the DESD –the Decade of Education for Sustainable Development, to take place from 2005 to 2014 and designated UNESCO as the lead agency. The launch of the DESD in 2005 gave the start to 10 years of a global movement towards improving and reorienting education systems to achieve SD.

The role of technical and vocational education and training (TVET) in achieving Sustainable Development

At the end of the DESD, UNESCO released a final report (UNESCO, 2014) to summarize the progress with regard to the DESD goals. Accordingly, several major trends were identified by the United Nations experts regarding ESD during the Decade:1)ESD is an enabler for SD; 2)the engagement of Stakeholders for fostering ESD is crucial; 3)ESD is galvanizing pedagogical innovation; 4)ESD has spread across all levels and areas of education (formal, non-formal, informal, technical and vocation education and training).

The multi stakeholder approach (MSHA) is defined in the UN-DESD final report as a voluntary association between different stakeholders (public and non-public), in which all participants agree to work together to achieve a common purpose or undertake a specific task. Multi-stakeholders action related to ESD applies to all levels of education and occurs in a wide range of settings whether in a formal, non-formal or informal context. Formal education takes place in school, college and university systems and is based on an established curriculum and on approved teaching and assessment methods. Non-formal education is carried out outside the formal system, through other organized learning settings (e.g. Non-Governmental Organizations -NGOs, youth groups, women's associations, zoos and museums, community organizations and adult literacy classes). Informal education results from daily life activities related to work, family or leisure, and is provided within families, community and religious groups, and traditional culture, as well as by news organizations, social media and different forms of entertainment. Training involves organized activity aimed at imparting information and/ or instructions to improve the recipient's performance or to help him or her attain a required level of knowledge or skill.

Technical and vocational education and training (TVET) consists of formal and non-formal learning experiences that are relevant to the world of work. TVET encompasses more than formal TVET at the secondary level in schools, and includes higher skills training, apprenticeships and workplace skills development, small- and medium-sized enterprise needs, and community-level capacities. TVET for SD(Majumdar, 2011) provides not only the technical and scientific skills needed to implement sustainability solutions, but also the understanding and mindsets to propose and implement continuous changes and improvements in business, industry and community practices.

According to UNESCO final report, global drivers for advancing ESD in TVET include:

-changes in the physical environment, requiring more technologies and skills for remediation of degraded environments and adaptation to changes in the environment resulting from climate disruption;

-progress in international guidelines and government regulations, requiring more capacities for the management of waste, water, energy, building and transportation systems; and

-shifts in consumer demand for greener products and services.

It is also important to highlight the role of the cooperation between the business and industry sector and the TVET in order to allow young people and adults to start up green businesses or to join existing green projects. A three-year study performed on one thousand social and environmental small, micro and medium- sized enterprises (SMMEs) in developing countries showed that one of the most significant barriers to social and environmental enterprise sector success is the shortage of skills at the grassroot level, and carrying out their own training is a significant investment for these enterprises (Creech et al., 2014). The same researcher argues for additional efforts to be made in non-formal and informal TVET to facilitate transition to green growth. Entrepreneurship training and green business coaching are equally important, by reviewing current employment training programmes with respect to new, more environmentally friendly technologies and production processes. As a corollary, the provision of specific programmes for SMMEs may improve their own capacity to deliver a range of training and skills development on the ground.

The main outcome targeted when promoting ESD in TVET is that national TVET systems recognize the need for change to support greener economic development. Several academic studies outline the importance of re-directing technical education towards SD, with some examples of good practices in the field, generally focused on a specific country or on particular educational sector. The aim of our study is to provide a global picture of various examples to illustrate good practices in different countries and educational sectors, without being exhaustive due to their number and sometimes to their lack of publicity.

METHODS OF THE RESEARCH

In order to find relevant examples of good practices in the field of SD-oriented TVET, the main method performed is the document analysis. Initially, several documents were collected, based on the presence of one of the following key themes: SD, ESD, TVET. The document research was conducted in English and Romanian, within the time framework corresponding to the DESD (2005-2014). Online research was made with the help of scientific database searching engines EBSCO and Anelis, and Google for non academic papers. This first step resulted in the collection of reports, academic articles, work documents and laws and regulations.

Secondly, examples of good practices in the field were identified and organized based on the definition of the different types of Education provided by UNESCO in their DESD Final Report: formal, informal, non-formal education, technical and vocational education and training (TVET). Considering that TVET encompasses all forms of education transversally, we chose to present different useful TVET initiatives across the world in two main categories: formal and out-of-formal. The formal education analysis was conducted according to the four pillars of the operational TVET for SD scheme, proposed by academic researchers (Gu et al., 2011). Our work deliberately excluded examples linked to Higher Education Institutions (HEI), considering its particularities and the variety of practices worldwide.

At this stage, operationalizing the concept of “good practice” was possible based on two parameters: 1)what the academic authors considered to be a “good practice” in the field; 2)considering it as a method or technique that has shown good results or superior to those achieved with other means. The analysis of documents was complemented by a case study of Sibiu County, Romania. Data were collected by interviewing the Chief Education Inspector of the Sibiu County, who provided us with a list of extracurricular activities in the county for the two past years. The analysis of these activities allowed us to find several examples of good initiatives at a school level, which were studied according to their SD- content, following the UNECE criteria guide (Government of Romania, 2011).
The two methods combined resulted in a mapping of illustrative good practices in SD TVET, with examples both at an international level, and at a local, school level. Consequently, our study does not provide an exhaustive review of good practices, but rather provides selective examples of good practices within several types of education.

RESULTS AND DISCUSSION

TVET is the educational answer to the necessity of linking instruction and business. Our study highlights the major determinants for incorporating SD in TVET, such as the need of business and industry for technical education and low carbon design and production, full-cost accountancy and sustainability reporting. TVET occurs in all forms of education, from formal to out-of-formal and adult lifelong learning. We have organized accordingly the various examples of good initiatives concerning the inclusion of the SD principles into TVET practices.

Formal Education

An operational model for formal SD-TVET designed by Swedish researchers includes the following four pillars: curriculum that supports sustainable development attainments in knowledge, skills and attitudes; pedagogy; partnerships with stakeholders in business and community; and sustainability in operations and management of the TVET facility itself.

**Curriculum and Pedagogy

As far as the curriculum and pedagogy are concerned, they are presented in a different form in a whole-schools' guide for sustainable development in a guide of the Comenius-SEED network (Breitling et al., 2005). According to this guide, the curricular content and the pedagogy represent important criteria for evaluating ESD practices in schools ("Learning and Teaching Quality Criteria"). Recent research (Costache and Dumitrascu, 2015) points out the various criteria available for assessing the adoption of the ESD principles from the curricular and teaching methods point of view by schools and National Education systems. Most of the countries give schools a certain degree of autonomy for the choice of their curricular content; in Romania, for instance, the National Education Law (2011) allows school boards to decide the content of 20% of the curriculum (optional), the rest of 80% being mandatory and common to all schools.

In the case of TVET, curriculum enables pupils to acquire not only technical content and competences, but also skills and attitudes, presented by researchers as "transversal skills" (Brown, 1994). These transversal competences are classified by the UNECE in the following categories: learning to learn, learning to do, learning to be, learning to live and work together. As several researchers point out (Lotz-Sisitka and Raven, 2008), the technical "green skills" (sustainable design, green building, renewable energy, low carbon management, etc) are important for implementing SD through TVET, but transversal social and economic aspects of sustainability must not be neglected.

As far as the learning and teaching criteria for including SD in TVET are concerned, the efforts are different depending on the countries. Finland reported the incorporation of SD into all 52 vocational qualifications, as one of the key components of lifelong learning. Similarly, Kenya is reforming its vocational polytechnic schools' curriculum to develop skills training that supports sustainable livelihoods (Dubois et al., 2010).

Several relevant examples of technical education for SD in extracurricular activities can be found in the activities organized by local schools in Romania, during the "Different Week School". These activities, at the initiative of school boards, allow pupils to apply technical theoretical concepts from physics, chemistry and biology, in practical activities in the field: nature observation (Volosciuc et al., 2010) is followed by discussions on different recycling options and laboratory work (water quality and chemical composition analysis, soil analysis, etc). These activities are relevant both from the TVET- ESD-content point of view, and from the innovative teaching methods aspect. As far as their content is concerned, it is explicitly related to ESD, essentially to its environment aspect; soil, water pollution, waste collection, recycling issues are directly approached. Different methods are used to carry out these projects, some of them promoted by ESD: experiential and cooperative learning, applying learning in a variety of life-wide contexts. According to a recent study(Costache and Dumitrascu, 2015), the analysis of these activities from the Eco-school criteria's point of view reveals that most of the projects presented match all three categories of criteria.

**Sustainability in TVET operations and management, Educational partnerships These sustainability criteria are also present in the Comenius-SEED network guide for whole-institution approach, under the name of "School strategy and organization criteria" and "School external relations criteria" (Breitling et al., 2005). Regarding the sustainable TVET management, many countries are facing increasing costs for re-tooling training facilities to reorient TVET towards SD; thus, the investment effort in equipment and materials required for training in new technologies and more sustainable vocations can be significant: changing chemicals, using sustainably produced and certified wood, installing equipment for training in solar and wind technologies. These efforts can be assumed only by developed countries, therefore allowing them to meet more quickly the demand for green and sustainable technologies and services.

The educational partnerships for SD-TVET are multiple and may be illustrated by various examples. A capacity building example for TVET is the creation of the Duurzaam MBO Network in the Netherlands, in order to support TVET organizations, schools and teachers to integrate ESD as a whole-school approach through workshops, awards programmes, and enhanced cooperation in regional coalitions of schools, businesses and local government. The important of the link between curricular design and the needs of the private sector as a Stakeholder is suggested by the German experience(Pavlova, 2007): a large percentage of Germany's building stock was built before 1949 and was highly energy inefficient, therefore presenting both a challenge and a business opportunity. As a result, "sustainable development education for every apprentice, trainer, expert and company member" became mandatory in the curriculum of the Vocational Training Institute of the Construction Industry. Conventionally, it is now compulsory for all in the industry to learn how to identify, source and install new, more efficient materials to save energy.

These examples illustrate how all actors – government, industry and TVET educators – can conclude partnerships to reorient the curriculum relevant to specific industry sectors. As a consequence, these partnerships may be the key in advancing knowledge and skills into the TVET curriculum and workplace training for green jobs.

Non-formal and Informal Education

Learning outside the formal education sector is an area of growing importance, with particular reference to its relationship to capacity-building for sustainable livelihoods in the informal economy. Recent research (Langer, 2013) estimated that the informal sector is responsible for producing 50% of GNP worldwide and for more than half of all jobs (as much as 80% in some regions) in the non- agricultural sector (Jutting and de Laiglesia, 2009).

Several useful initiatives illustrate the understanding of the SD-TVET importance by informal actors: the Mokattam Recycling School in Cairo provides non-formal learning for out-of-the-school youth; this recycling centre combines technical skills for recycling with studies in literacy, numeracy, recreation, health and industrial safety (Baraka, 2012). The recycling containers are transformed into granulated plastic, which allows, when sold, young people to be paid for the collected plastic. Similarly, Columbia established a vocational training programme (UNESCO, 2014) to promote productive projects ranging from agribusiness to services and industry, called the Rural Youth Entrepreneurs. The beneficiaries of this programme are the rural unemployed people aged 16 to 25, with a particular focus on vulnerable groups. Between 2003 and 2009, the programme supported more than 257000 young people, with a higher probability of participants starting their own business compared with a control group non involved in the programme. Another relevant example that illustrates the incorporation of SD into TVET outside the formal education is provided by the Tostan NGO project "Solar Power!" in Africa (UNESCO, 2014). The aim of the project was to empower rural women to attend the Barefoot College, where they completed a training programme in solar electricity engineering. These women then returned training other women from close rural communities in solar engineering, thus spreading the impact of the programme and providing each engineer with a means of income. 452 solar panels were installed thanks to this project in 9 villages of Senegal.

In order to illustrate the technical learning in natural environment, Vietnam and Spain provide good examples, with their Man and Biosphere Programme as Learning Laboratory, and, respectively, Urdaibai Biosphere Reserve, that involved 13 schools in Spain. Likewise, a programme led by a NGO, WWF, "The Lake Victoria Catchment Environmental Education Programme", is raising awareness and understanding on the conservation of freshwater ecosystems.

Another example that is worth mentioning for TVET adult learning and practice comes from Africa and is called the "Namib Desert Environmental Education Trust" (NaDEET). Launched in 2010, the program helps adults learn to use solar ovens for cooking, thus avoiding wood burning (Shigwedha, 2012). A total of 200 community members have been trained this way.

CONCLUSIONS

The increasing awareness and experience regarding ESD allowed the emergence of positive initiatives and practices in the specific field of TVET. These actions were performed by multi stakeholders associations, with the public, private and civil society actors coming together to introduce a Sustainable dimension into TVET. Progress is recorded not only in formal education, but also in different forms of learning outside the formal system, often with the help of NGOs. The examples presented in our study are illustrative for various situations and forms of learning; nevertheless it is difficult to have a global picture of the progress accomplished in all countries, since not all of them responded to the UNESCO questionnaires with specific examples. Moreover, positive situations and initiatives in certain countries cannot be generalized, and the projects are often limited because of geographical boundaries, narrow categories of beneficiaries they address, etc. Furthermore, as far as the beneficiaries of lifelong adult education are concerned, academic studies admit that the "Matthews effect"(UNESCO-UIL, 2010b) may reduce the efficiency of educational programmes: according to this paradigm, those who are already well educated are more likely to participate in adult and continuing education than those who are most in need for further skills and competences.

Lastly, investment and action on public awareness rising is not only a matter for governments to address, but also a business issue for the customers of the private sector. As UNESCO point out, consumers must be guided through technical education campaigns in choosing green energy options, housing options, household goods and environmentally and socially responsible services in order to foster greener economies globally.

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SPECIAL TOPICS IN ENGINEERING/TECHNOLOGY AND BUSINESS EDUCATION

Model for improvement of fluxing process on selective soldering machines (model 6747)

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ABSTRACT

Selective soldering is the process of soldering components to printed circuit boards that could not be treated in a reflow oven in a traditional surface-mount technology process due to thermal shock and damaging. Process of flux appliance as a first step of the selective soldering process sets the baseline for achieving high quality and robustness of the soldered joints.
Purpose of this research is to identify the factors that directly influence the effectiveness of the fluxing process in selective soldering machines, using the design of experiment methodology with associated factors and levels used in the experiment. Final findings gives directions for set up of the optimal fluxing parameters that will enable appropriate flux appliance and to gain reduction of soldering quality issues which foundations are from this process.

Keywords: *selective soldering, fluxing, quality, improvement*

INTRODUCTION

The first demand for selective soldering is that the parts to be soldered are clean. Therefore is requirement for flux application on all components that need to be soldered. Often it is difficult to prove if the flux did penetrate sufficiently in capillaries between hole and lead. Especially if those holes are covered on the topside of the PCB by the component body.
The most common used flux-application-process for the multi wave-soldering is to use drop-jet fluxer. This type of fluxer makes application of small flux-drops with using of x/y-axis-system. Technical characteristics of the drop jet fluxer are:

- The drop jet is a small nozzle with a Piezo-element,
- The size of the nozzle is 100 1Jm, 130 1Jm or 270 1Jm.
- The most used nozzle-size is 130 IJm.

- The drop jets are mounted on a X-N-axis-system,
- The machine could have 1 or 2 drop jets,
- The Z axis is fixed.
- For each solder-joint the X-N-position, the drop-size and the number of dots can be programmed,
- For a row of solder-joints (for example connectors) it is possible to dispense a row of flux,
- Additional parameter for the amount of flux is here the axis-speed.
- The flux-application is done by opening the drop jet - nozzle with a defined opening-time and frequency. With the opening-time the drop-size can be influenced.
- Using the frequency the number of dots per time can be influenced.
- The flux is stored in a pressure-tank with a low pressure of 0,3 bar, with which the flux is pressed to the drop jet - nozzles. When the pressure of the flux-system is too high, the risk is to have flux splashes on the PCB outside the defined area.
- The flux-head shoot very small flux-dots onto the Bottom-side of the PCB at the programmed position. It is a selective fluxer.
- The amount of flux is programmable separately for each solder-joint.
- The machine must have a zero-position or a procedure to ensure a good indexing of the PCB.
- The nozzle of the flux-unit must be clean to get a homogeneous flux area on the board.
- The cleaning of the nozzle is done by using isopropyl - alcohol and a soft tissue.
- In case of too much flux, there are risks to have micro balls, pollution of PCB, components and carrier,
- In case of too low flux, we have bad wetting, bad through-hole-filling and residues from the solder process.

Parameters that need to be controlled:

- Drop-size (opening time),
- Frequency (number of drops per second),
- Axis-speed for lines,
- Calibration of axis-position (X,Y),
- Cleanliness of drop jet,
- Flux location and uniformity - visually check in the beginning of the shift and after change-over,
- Flux-area (quantity),
- Pressure in the flux-tank.

PROBLEM STATEMENT AND PROJECT OBJECTIVE

Problem statement for the research was a case study from SMD manufacturing plant. Problem was stated as a: excessive flux on test points around the connector of NCV product, see figure 1. Due to this issue all affected produced pcbs fail on the final station, Functional Tester with “Wrong Pin Check” defect reported.

Flux on the test points comes from Wave soldering machine - (Before FCT testing all affected pcbs pass wave soldering process - soldering of connector, stepper motors and relay components).

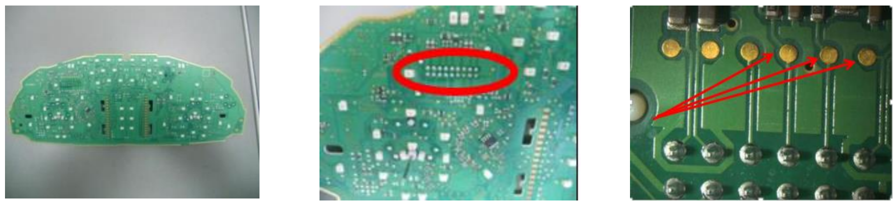

Figure 1: Printed circuit board with flux affected test point around connector area.

Project objective: Improve process of fluxing on wave soldering machine (model 6747). Target is to optimise main factors and appropriate levels of drop jet flux parameters due to achieve quality of the solder joints on wave soldered components and avoid flux appliance on test components around connector area, figure 2:

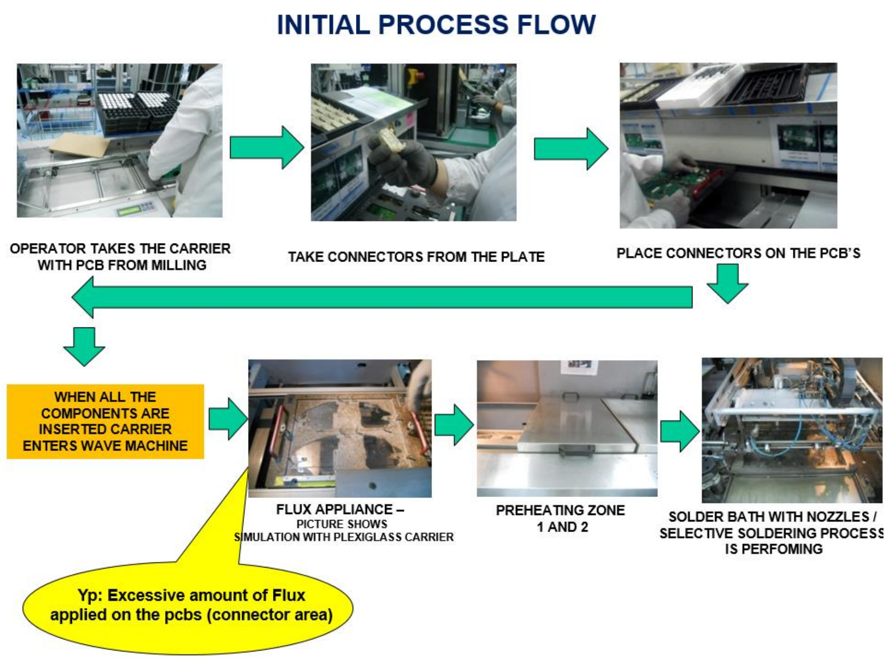

Figure 2: Initial process flow of wave soldering process (With highlighted fluxing process issue area)

DESIGN OF EXPERIMENT

Objective of the design of experiment was to consistently achieve a desired level of flux, with no test points affected and solder joint not to be weak.
Output measure is application of flux – not to exceed 5 mm from reception area on the pcb (where flux needs to be applied).

Factors Tested in Experiment	- 1	Levels 1
A. Speed of Drop Jet Movement.	20	30
B. Drop Size of flux applied.	1.3 ms	1.5 ms
C. Frequency of flux application	100 Hz	130 Hz

Figure 3: Factors and their levels tested in the experiment

X's verified through DOE, see Figure 3:
Factor A = Drop Jet speed,
Factor B = Flux drop size (mS),
Factor C = Frequency of flux application.

Using the assigned factors and levels, experiment was performed on 24 printed circuit boards using eight different combination of factors and levels, and this eight different combination was repeated three times. Table 1 below shows the design of experiment and achieved values:

Table 1: Design of Experiment guideline

Combination			Factors			Pcb No.	Left	Right
-1	-1	-1	30	1.3 ms	130 Hz	**1**	6,165	6,334
1	-1	-1	20	1.3 ms	130 Hz	**2**	5,491	5,311
-1	1	-1	30	1.5 ms	130 Hz	**3**	3,164	4,234
1	1	-1	20	1.5 ms	130 Hz	**4**	6,102	5,457
-1	-1	1	30	1.3 ms	100 Hz	**5**	3,302	4,442
1	-1	1	20	1.3 ms	100 Hz	**6**	5,442	5,008
-1	1	1	30	1.5 ms	100 Hz	**7**	5,684	3,175
1	1	1	20	1.5 ms	100 HZ	**8**	5,379	4,818
-1	-1	-1	30	1.3 ms	130 Hz	**9**	5,474	5,581
1	-1	-1	20	1.3 ms	130 Hz	**10**	5,25	5,997
-1	1	-1	30	1.5 ms	130 Hz	**11**	4,513	4,929
1	1	-1	20	1.5 ms	130 Hz	**12**	4,831	4,283
-1	-1	1	30	1.3 ms	100 Hz	**13**	5,062	5,062
1	-1	1	20	1.3 ms	100 Hz	**14**	5,063	5,366
-1	1	1	30	1.5 ms	100 Hz	**15**	5,176	3,057
1	1	1	20	1.5 ms	100 HZ	**16**	5,199	4,675
-1	-1	-1	30	1.3 ms	130 Hz	**17**	5,239	5,413
1	-1	-1	20	1.3 ms	130 Hz	**18**	5,32	4,594
-1	1	-1	30	1.5 ms	130 Hz	**19**	4,224	4,76
1	1	-1	20	1.5 ms	130 Hz	**20**	5,245	5,028
-1	-1	1	30	1.3 ms	100 Hz	**21**	5,148	5,423
1	-1	1	20	1.3 ms	100 Hz	**22**	5,076	5,278
-1	1	1	30	1.5 ms	100 Hz	**23**	5,306	5,829
1	1	1	20	1.5 ms	100 HZ	**24**	5,076	4,03

EXPERIMENT RESULTS

Achieved results from the experiment were processed in Minitab, to provide statistical evidence of the most influenced factors to the process variation.

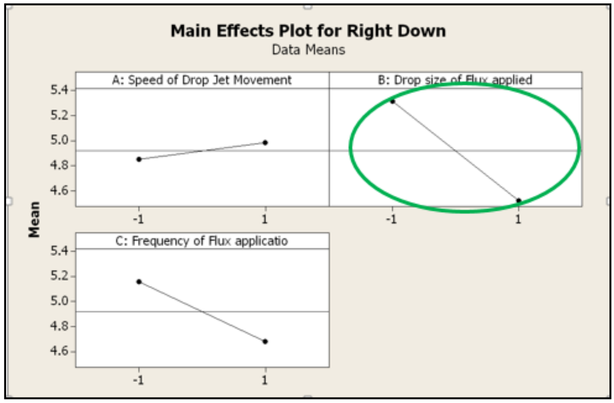

Figure 4: Main effect plot from the experiment

According the plot analyze shown on the picture, factors A and B interact differently in two cases. This gives direction to lower standard deviation of the process as a part of the improve phase. Target of the design of experiment is to lower standard deviation because in some case we have area affected with flux 6 mm (upper limit is 5 mm) and in some nominal value is 3,5 mm. According this we do not need to shift mean of the process because it did not affect the measurement.

For standard deviation to be on the lowest value, factors and levels should be:
A (1) = 30,
B (-1) = 1.3 mS,
C (1) = 130 Hz.

After implementation of this parameters, capability of the fluxing process was performed. We use 40 pcbs produced in different shift, and we measure flux appliance, test point around connector affection with flux and quality of the solder joint. From the chart below (Figure 5) we can see that capability factor Cpk =1,01 which is acceptable (>1.00). Decreased PPM of overall performance = 641.67. Process is capable. Which gives us direction forward to strive to continuously improve the process to achieve desired level of Cpk = 1,69.

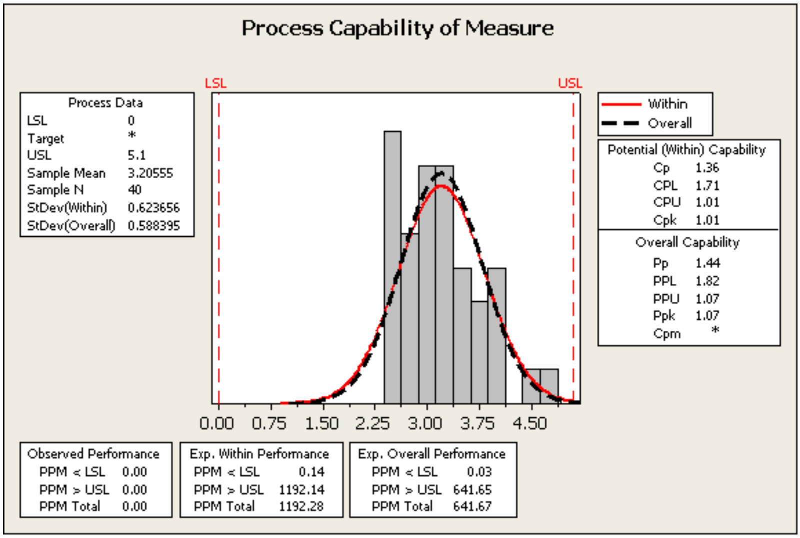

Figure 5: Capability of the fluxing process after implementation of new solution

CONCLUSION

Purpose of the flux in the wave soldering process has a primary and a secondary objective. The primary objective is to clean the components that are to be soldered, mainly any oxide layers that may have formed. Importance of the proper flux appliance is mandatory as a first step in the selective soldering process. Optimized settings of the main parameters and their levels for the flux drop jet is recommended considering the first requirement from the process: quality of the solder joint and the second requirement which is avoidance of flux application on the other components and test points around the solder area. Achieved optimized parameters and their correlation as a result of this experiment gives solid baseline for stable process set up with acceptable capability of process performance during time. As a further directions for research is optimization of a process when two drop jets are used in same machine and avoidance of constraints that appear when set up is done on all appropriate factors.

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The role of technology entrepreneurship education in encouraging to launch new ventures

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ABSTRACT

Technology entrepreneurship refers to processes by which entrepreneurs use resources, and technical systems through collaborative exploration and experimentation to pursue opportunities. The purpose of this study is to explore the role of technology entrepreneurship to increase the intention and motivation of engineering students to establish and manage sustainable new ventures and commercialization of technologies developed in university laboratories. Quantitative data were collected via a questionnaire-based by investigating whether engineering students have sufficient entrepreneurial skills to evaluate opportunity, developing new products, and recognizing potential market applications. Engineering students need to be able to exploit opportunities that rely on scientific and technical knowledge to create and capture value by launch new venture. Our important findings have a series of important practical implications for managers, engineering students, engineers, and scientists interested in encouraging economic growth. For example, technology entrepreneurship education increases the intention to start a business and stimulates the activities in a group setting and a network context because of increasing global competition based on agility, creativity and innovation. The findings of the study also provide practical implications suggest that increasing engineering students understanding and awareness of entrepreneurship lead to greater levels of interest in entrepreneurship careers.

Keywords: *technology entrepreneurship, education, engineering students, new ventures*

INTRODUCTION

Entrepreneurship is based on strategic thinking and risk-taking behaviour that results in the creation of new opportunities and economic growth (Schermerhorn, J.R., 2013). Practically, it is the process of discovering new ways of combining resources and capabilities to create value. Entrepreneurship is one of the major engines of economic growth through the creation of new venture. Entrepreneurial ventures also play a key role in developing the business environment through creation of new venture and encouraging entrepreneurship and the acquisition of business skills (Rasmussen and Roger, 2006).

The role of universities in society is changing quickly. They need to provide a collaborative and incentive atmosphere for technology development and business creation. Universities are expected to play a new role in society by the formation of human capital and economic transformations. They can contribute to develop the entrepreneurship through education of engineering students and commercialization of research because students receive knowledge and capabilities through an education process (Militaru, 2015).

Entrepreneurship education is a driver for future growth and it is becoming more accepted and applied in most European countries, including Romania. For example, in Romania, the entrepreneurial potential is not fully exploited yet. Entrepreneurship skills can be taught because business training is effective to start a new venture. They are essential for the formation, survival and growth of a new business. Advanced knowledge-intensive skills provide the basis for a business's dynamic capabilities (Militaru, 2015).

Despite the fact that many universities develop the entrepreneurship education programs, little is known about the impact on engineering students' entrepreneurial competences and intentions to launch new ventures. Indeed, previous research has focused on entrepreneurship education whereas a little attention has been given to technology entrepreneurship (Gross, 2005). Higher education organizations contribute to the development of entrepreneurial talent among young graduates.

The purpose of this study is to extend our understanding of the role of technology entrepreneurship education on the intention of engineering students to start new ventures. Technology entrepreneurship education plays a critical role in orienting and developing future engineering students and young entrepreneurs, by providing them the skills, knowledge and capabilities to lunch and manage new business ventures (Dutta et al., 2011). This research also aims to enhance our understanding of how engineering students may benefit from entrepreneurship education. The results of the study have important implications for academic staff, students, researchers, policy makers, as well as prospective entrepreneurs.

Next follows a literature review and hypotheses development. Then a section is dedicated to test our model and hypotheses on data collected from respondents. Next section provides details about the empirical results. Finally, a concluding section presents implications, limitations, and directions for future research.

THEORY DEVELOPMENT AND HYPOTHESES

Entrepreneurship is a disruptive process that sustains innovation efforts, redistribute the resources and bring greater efficiency for businesses (Chiles et al. 2007). For example, a technology entrepreneurship program needs to encourage initiative and develop in each engineering student a positive attitude to the creation of wealth. Fostering technology entrepreneurship generates wealth, job creation and local development.

The existing companies need to attract engineers with capabilities in developing innovative technologies as well as commercializing these technologies. Technology-intensive new ventures are more likely to be initiated by engineering graduates. They have knowledge and skills of technology in a specific field and should be able to identify, create, and exploit new business opportunities (Menzies and Paradi, 2002). Education program in engineering must provide students with diverse learning experiences tools and skills to identify and exploit opportunities, formulate problems, to think creatively and work collaboratively. They will learn how to identify and create new opportunity for new venture or helping to improve the existing businesses.

Technical universities can transform student's passion for technology into an ability to deliver inspired innovation. This type of university yields research results in market-oriented innovation processes and inspires an entrepreneurial spirit in all university areas. Engineering programs provides students a background in the fundamentals of engineering and give their engineering skills and technical ability to develop products, prepares and conducts experiments, or makes prototypes of newly designed equipment. Technical universities stimulate and facilitate technical entrepreneurial through excellence in engineering education. We thus propose:

H1: *Education program in engineering is positively related to the venturing rate of engineering students*

Technological skills increasingly need to be complemented by entrepreneurial competencies. Business and entrepreneurship skills, competencies and capability of engineering students need to become entrepreneurs for creating and running new business ventures or innovative projects in existing firms. Engineering students need to gain core knowledge of management, finance, marketing and entrepreneurship. Technology entrepreneurship involves taking a new technology development idea and finding a high-potential commercial opportunity to capitalize on it. Thus, engineering students or graduates can transform ideas into business for a particular technology by setting the resources and matching it to the right business model. Creating value requires vision and an ability to identify the customer needs, minimize the potential risks and maximize engineering students or graduates potential to launch new ventures. Therefore, it is hypothesized:

H2: *Education program in engineering is positively related to education program in technology entrepreneurship*

Technology entrepreneurship education is essential to provide the skills, knowledge and the individual's ability to turn ideas into action. It includes creativity, innovation and risk taking, as well as the ability to launch new ventures. Great ideas remain captive in the heads of students, and the ideas that are developed are not the best fit with business model (Anthony et al. 2014). Thus, students gain a solid core of business skills and given the opportunity to capitalize their technical skills. Engineering student who have taken a course in technology entrepreneurship have a higher determination to launch their own business or to do so more quickly after graduation (Menzies and Paradi, 2002). The technology entrepreneurship is an effective way to increase the venturing rate of engineering students or graduates. On the basis of the above discussion, the following hypothesis is proposed:

H3: *Education program in technology entrepreneurship is positively related to the venturing rate of engineering students*

To reduce the variance caused by other factors, we controlled for the age of respondents and their revenues. The conceptual framework is shown in Figure 1. Relationships among the constructs were empirically tested as follows.

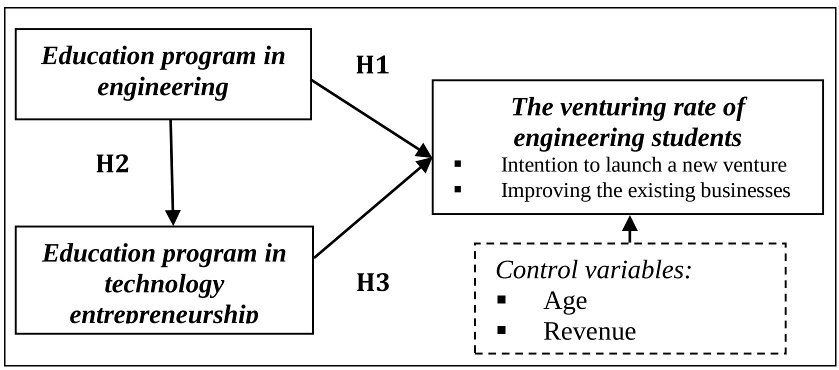

Figure 1: Conceptual framework

RESEARCH DESIGN

In this section the hypotheses formulated above will be tested about the constructions that influence the venturing rate of engineering students. It was used the regression analysis to test the hypothesized influence of technology education program and technology entrepreneurship on the venturing rate of engineering students.

Questionnaire design and data collection

For this study was used cross-sectional data from a survey on the venturing rate of engineering students to launch a new venture or to improve the existing business where they will work after graduation. It was generated a structured questionnaire based on observations, studies, ideas that were obtained both on literature and practice. This study is based on a survey administrated to a sample of 28 engineering students. The sample consisted of undergraduate and graduate students from the Faculty of Entrepreneurship, Business Engineering and Management, Politehnica University of Bucharest. The survey was carried out in 2014, and the response rate was 90 percent. No significant differences were found between early and late respondents on any of the variables from this study. The confidentiality of the respondents was maintained and no identification was requested from them in the survey.

Measurement

This study analyzes the causal relationships among the following constructs: education program in engineering, technology entrepreneurship and the venturing rate of engineering students. A rigorous study of literature for identifying existing measures to the related constructs was done to finalize questionnaire. Using questionnaire, students were asked about their technical and business skills gain in bachelor and master programs. Questions focused on determining whether they have knowledge and skills to generate a new technology idea, finding a higher-potential commercial opportunity of this idea, create and verify a business model for how to sell and market an entrepreneurial idea and create and verify a plan for gathering resources such as capital and talent to capitalize the technology opportunity. Student's perceptions in this study were measured with seven-point Likert-type scales with anchors of 1 to indicate "strongly disagree" and 7 to indicate "strongly agree". Seven-point Likert scales indicate the respondents' levels of agreement-disagreement with each statement.

The dependent variable is *the venturing rate of engineering students*. This variable was measured by using two items – intention to launch a new venture and contribution to improving the existing businesses. *Education program in engineering* is modelled as an independent variable formed by two factors that measures the ability of students to create knowledge and use of technology for engineering problem-solving, as well as the possibility that they develop their technical skills. *Education program in technology entrepreneurship* is measured by using five items that referred to create, identify, and evaluate new venture opportunities; defining target customer and value proposition; develop business plans; design a sound business model; start and building a successful company.
To collect the data, students were administrated the scales referring to the following aspects: *age of respondents* and *revenue*. Thus, the following control variables were considered age of respondent and students' revenue.

DATA ANALYSIS AND RESULTS

Table 1 presents the means, standard deviations, and correlation coefficients of all the variables used in this study. There are a few correlations with coefficients above 0.4. To ensure that these moderate correlations are no problem in our research, we calculated variance inflation factors (VIF) for a test of multicollinearity. It shows how much the variance of the estimated coefficient increases if the predictors are correlated. The results were below 5, which does not justify concerns about multicollinearity (Urbig et al. 2013).
Since Cronbach's alpha is an indicator of how well the individual items reflect a common, underlying construct, and it is an appropriate measure for validity of the scale items and assessing the reliability of the scale. Cronbach's alpha values were all above 0.7, indicating a high internal consistency of measure reliability.

Composite reliability for all constructs were above the suggest threshold of 0.7, indicating that our measurement was reliable (Nunnally, 1978).

Table 1: Descriptive statistics - correlation coefficients matrix

	Mean	S.D.	F1	F2	F3	F4	F5
The venturing rate of engineering students (F1)	2.76	0.49	1.00				
Education program in engineering (F2)	0.29	1.41	0.37	1.00			
Education program in technology entrepreneurship (F3)	1.26	0.54	0.45	0.41	1.00		
Age (F4)	21	2.1	0.32	0.38	0.07	1.00	
Revenue (F5)	0.86	0.5	0.18	0.36	0.23	0.17	1.00

In a hierarchical analysis, Model 1 estimates a baseline model of controls. Models 2 and 3 are designed to investigate direct and indirect (interaction) effects. Model 3 is a full model that includes all interactions effects. The standardized regression coefficients and results of regression analysis are reported in Table 2.

Table 2: Results of regression analysis (n=28)

Variable	**Model 1**	**Model 2**	**Model 3**
Control variables:			
▪ Age	-.02 (.06)	-.04 (.07)	-.09 (.14)
▪ Revenue	.09 (.16)	.09 (.11)	-.06 (.12)
Direct effects			
▪ Education program in engineering		.08 (.16)	.11 (.19)
▪ Education program in technology entrepreneurship		.89 (.52)**	.81 (.58)***
Interaction terms:			
▪ Education program in engineering **x** Education program in technology entrepreneurship			.89 (.54)**
R^2	.183	.251	.261
R^2 (Adjusted)	.96	.213	.381
ΔR^2	-	.11*	.062*

*p<.05; **p<.01 and ***p<.001 (two-tailed)

The individual reliability of the constructs was estimated with R square. R square is the multiple coefficient of determination and it indicates how well a model fits

the data. A significant R square change here indicates that education program in engineering and education program in technology entrepreneurship interact to influence the venturing rate of engineering students. The adjusted R square is used to compare models with different numbers of predictors as our case. To test Hypothesis 1, we examine whether education program in engineering has a positive and significant effect on the venturing rate of engineering students. Thus, Hypothesis 1 proposes that there is a direct relationship between education program in engineering and the venturing rate of engineering students. The results of the regression analysis show that Hypothesis 1 must be rejected. Therefore, we failed to find evidence that education program in engineering significantly affects the venturing rate of engineering students. Although the respondents of the education program in engineering had an average age of 21 years, they thought that entrepreneurship skills did not matter at all or that it was not closely related to the technical skills.
Hypothesis 2 propose that education program in engineering is a good driver for the engineering students to attend an education program in technology entrepreneurship. Thus, on the basis of our results we accept this hypothesis. As expected, education program in technology entrepreneurship offering complementary skills in business to engineering students to identify and create new opportunity for new venture or helping to improve the existing businesses.

Finally, on the basis of study results, Hypothesis 3 has been accepted, this states that the education program in technology entrepreneurship significantly affect the venturing rate of engineering students. This hypothesis implies that the education program in technology entrepreneurship catalyze engineering students to launch new ventures or improving the existing businesses. The confirmation of Hypothesis 3 is similar to give engineering students the opportunity to gain entrepreneurial skills by providing such an education program.

CONCLUSION

In this study we investigate the influence of education program in engineering and education program in technology entrepreneurship on the venturing rate of engineering students. In order to explore this influence, three hypotheses are formulated. Based on the survey results findings confirm hypotheses 2 and 3, and reject 1. The empirical results indicate that education program in engineering has neither a positive nor a significant influence on the venturing rate of engineering students. A possible explanation may reside in the lack of entrepreneurial skills. The interaction between education program in engineering and education program in technology entrepreneurship lead to improve significantly the engineering students' potential to launch a new venture using entrepreneurial skills gained in the education program in technology entrepreneurship. The technology entrepreneurship education plays an important role in a dynamic economy. It includes creativity, innovation and risk taking, as well as the ability of engineering students to launch new ventures. An integrated approach of these education programs is essential for technical universities.

Together, these results underscore the importance of education program in technology entrepreneurship for technical universities. They also extend prior research by including the simultaneous effects of education program in engineering and education program in technical entrepreneurship. Technical universities can transform student's passion for technology into an ability to deliver inspired innovation. The results support prior findings regarding the importance of technology entrepreneurship program to encourage initiative and develop in each engineering student a positive attitude to the creation of wealth. Technology entrepreneurship involves taking a technology idea and finding a high-potential commercial opportunity to capitalize on it.

This empirical study has several limitations that provide direction for future research. First, study focuses on a university from a single country and a single time period, as such the results should be generalized with caution. A second limitation of this study lies in the fact that it focuses exclusively on perception of students on the topics treated. Family environment from which the engineering student comes might also be investigated.

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“Internet of Things” contribution to Electrical Energy Efficiency and society eco-education.

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ABSTRACT

This paper aims at analyzing the place and possible contribution of “Internet of Things” (IoT) in the context of the EU’s ambitious climate and energy targets for 2020. Using qualitative methodology we are mainly focusing on Demand Side Management (DSM) as an effective method in balancing the load of Electrical Distribution Networks.
The role of IoT in DSM is to enable and enhance electrical energy peak demand reduction and its maximum uniform time-distribution achieved through society’s eco- education.Using computational tools such as Data Mining and Recommender System we can achieve results at the level of electrical energy distribution network reflected in peak reduction and its uniform time distribution.

Keywords: *Energy efficiency, Peak demand, Eco-education, Internet of Things.*

20-20-20 EU GOALS, OVERVIEW

“The climate and energy package is a set of binding legislation which aims to ensure the European Union meets its ambitious climate and energy targets for 2020.
The targets, known as “20-20-20” targets, set 3 key objectives for 2020:
- a 20% reduction in EU greenhouse gas emissions from 1990 levels;
- raising the share of EU energy consumption produced from renewable resources to 20%;
- 20% improvement in the EU’s energy efficiency.” (European Commission, n.d.)

At this point we can state that overall EU has already made big steps in achieving its goals and especially:
- So far EU is on track achieving 18% emission reduction in 2013. Also the first Kyoto commitment was over-achieved in the 2008-2012. (European Commission, 2015)

- 15% share of energy from renewable sources in gross final consumption of energy in 2013.(European Environment Agency, 2014)
- Energy efficiency is a delicate topic and requires a more detailed approach. First of all, an overview of actual energy consumption trend in EU:

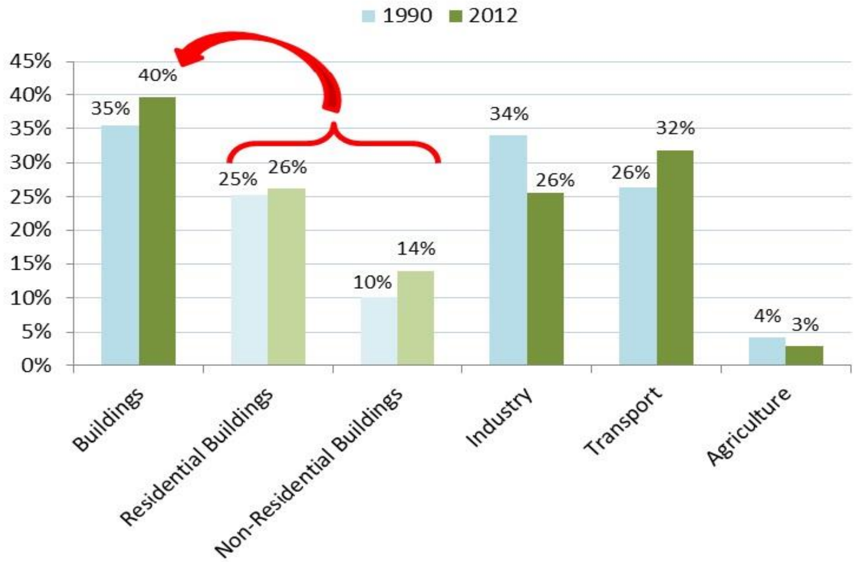

Figure 1: Share of buildings in final energy consumption in EU-28 (Peter, S., 2015).

A brief analysis leads us to the conclusion that buildings energy consumption share tends to grow and has the biggest impact on the overall consumption trend.
Following this idea, would suggest that electrical energy efficiency is mainly influenced by the optimization of energy consumption in this particular sector.
The measures that were actually taken to reduce the power consumption and increase energy efficiency of household appliances and office equipment gave good results at the level of electrical energy end-user/consumer, but analysing it at a higher level, when the number of electrical devices is in continuous growth, we have to face the network's problem of demand peaks.
Generally Electrical Distribution systems adjust to the changing demand by dispatching additional generation, which are usually supplied by less efficient sources during peak periods.

ENERGY DEMAND HANDLED BY SMART GRID, METERING AND FINANCIAL INCENTIVES

The idea behind Smart Grid is to monitor energy flows and adjust it to changes in energy supply and demand accordingly. Smart Metering aims to achieve monitoring of real-time consumption on the side of end-user (consumer) and it's estimated that will give an energy saving at 3% according to (EU Joint Research Center, 2014).

Having Smart Grid for energy monitoring and flow control on one side and Smart Metering with real-time consumption data on the other side, such a system will theoretically react to energy demand growth or fall, but demand itself will remain the same or even increase, if it maintains its actual growth rate.

To deal with demand peaks and specifically to reduce and spread it, Europe uses financial incentives and behavioral change through education. Further we'll call this specific type of education eco-education.

Education is meant to encourage the consumer to use less energy during peak hours. Financial incentives reinforce eco-education by offering different tariffs for energy, usually two tariffs "High" and "Low", so the consumer pays more for kWh during peaks and respectively less during "off-peaks".
In this paper will adopt the Polish electrical energy market model as a reference in further discussion on the topic of financial incentives and eco-education.
Having said all the above polish operator "Energa" offers following tariffs for kWh:

Table 1: Electrical energy price in PLN/kWh, Energa, Poland. (Energa, n.d.)

Name of tariff Group	Uniform price	Peak price	Off-peak price
G12	-	0.3625	0.2401

Table 2: Time schedule for G12 tariff group (Energa, n.d.)

Month	Peak time zone	Off-Peak time zone
From: January 1st To: December 31st	06:00-13:00 15:00-22:00	13:00-15:00 22:00-06:00

We can easily conclude that peak to off-peak ratio is 14/10 hours a day and price difference between High and Low tariff is 50% for this specific tariff group.
After more than two years since implementation of Smart metering in Kalisz region of Poland Energa operator made available report on effects of Smart Metering on network load and energy savings (see Figure 2 and Figure 3).

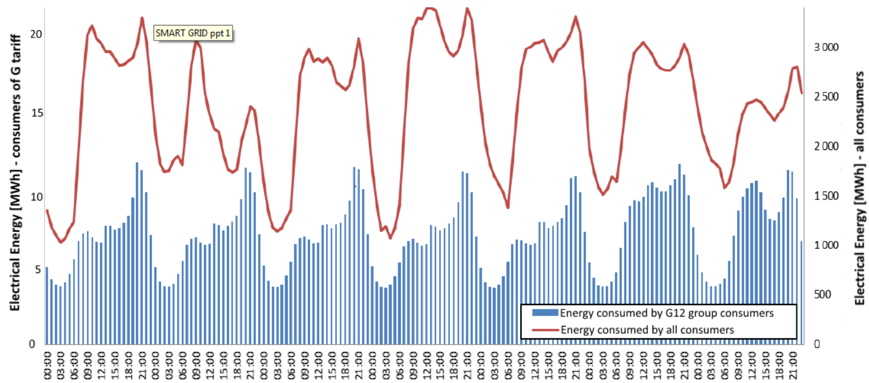

Figure 2: Network load profile of Kalisz region (Masiąg, R., 2014)

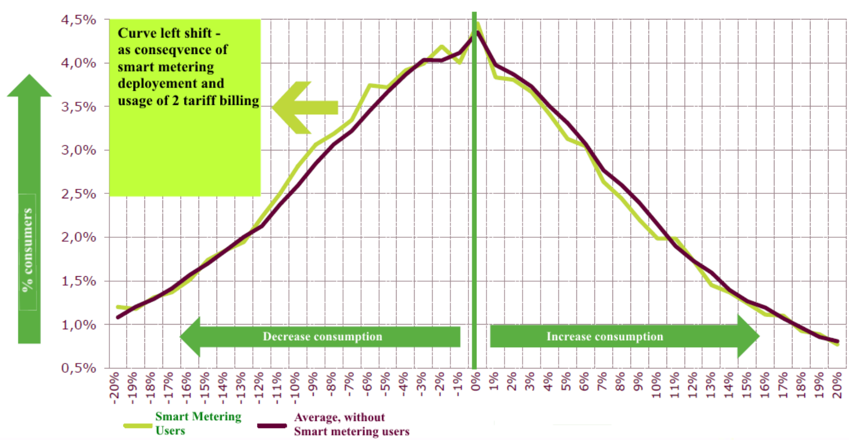

Figure 3: Energy savings of customers with Smart Metering compared to customers without. (Masiąg, R., 2014)

Energa operator (2014) concluded that overall network load profile curve follows consumer's demand from G tariff and the tendency of energy saving for consumers with Smart Metering compared to regular meter consumer is higher by 0,22%.

Analyzing network load graph we can conclude that there is room for more efficient load distribution and a simple financial incentive does not completely stimulate the consumer for both, savings and time usage.

We tried to identify a few possible reasons why a consumer follows the energy tariff time zones with such a low rate of interest:

- The number of appliances that would allow their scheduling is still low.
- Consumer has to manually adjust and follow G tariff schedule, which causes that in many cases schedule is ignored or followed poorly.
- The number of appliances is too high and physically difficult to track and manage.

- Consumer is poorly informed on effective bill savings that can be achieved by following G tariff schedule.

We want to propose Internet of Things (IoT) technologies as a possible solution in stimulating consumers toward eco-education.

IOT AND EXTENDED RECOMMENDER PLATFORM CONTRIBUTION TO CONSUMER'S ECO-EDUCATION.

The Internet of Things computing concept. The IoT is not an easy to define concept and there are many groups that define this term in their own way, so we'll use an approach that is closer to our actual topic. We'll adopt a business oriented approach to define the IoT concept seen at the macro level.

According to Burkit, F. (2014) IoT is divided in three strategic categories based on type of enterprise they are reflecting:

"Enablers", technology-oriented companies that develop and implement the underlying technology.

"Engagers", that design, create, integrate and deliver IoT services to customers.

"Enhancers" that devise their own value-added services, on top of the services provided by Engagers.

In our further analysis we'll focus mainly on Engagers and Enhancers to see their possible contribution to Energy Efficiency and society's eco-education. For this purpose we need to define some terms that latter will be extensively used.

Smart house- an acquisition system as a part of IoT that is delimited by the range of normal house, flat or similar area of living. Smart house has sufficiently granulated acquisition system, which means that all power outlets are measuring consumed Active Energy and centralizes this data on the platform offered by IoT Engagers.

Data HUB- a service offered by IoT Engagers, cloud storage platform, where the data from Smart House is stored and further interfaced. They are offering all afferent APIs and services to securely access and process this data.

Extended Recommender System – a tool that uses as input data offered by Data HUB, processes this data and offers to end-user recommendations regarding his behavior and possible benefits. This system is categorized as IoT Enhancer.

Extended Recommender System's (ERS) main functionality will be to offer to end-users (electrical energy consumers) recommendations to match their habits related to usage of electrical energy and maximize possible bill savings. In other words ERS will search for a solution with minimum behavior change required from user to best-suite energy time- zone tariffs so it can also estimate direct financial benefits from adjusting his behavior.

Such a system will naturally use some dedicated computational tools. We'll focus mainly on Data Mining as a key tool in processing such a big amount of data related to energy consumption.

Data mining on its turn can use a couple of algorithms to accomplish its job. We'll simply enumerate them and won't go in details because it is out of scope of this paper.

Cluster analysis-discovering groups and structures in the data that are in some way "similar" and can be used to indicate cohesive groups of consumers.
Regression analysis-the prediction of power consumption for a new consumer is a classical regression problem.
Anomaly detection- is applicable in our case in fault or event detection
Classification is the problem of identifying in which set/category a new observation belongs to.
Now returning to the subject of Energy demand, Smart Metering and financial incentives we can assume the following situation:
- Electrical distribution network with Smart Metering implemented and running;
- Financial incentives applied to stimulate consumers to more effective energy use;
- Smart House in the context of IoT with Data HUB and Extended Recommender System;

Such a system will contribute at solving problems identified in the previous chapter - consumer follows the energy tariff time zones with a low rate of interest.
It will offer solutions that otherwise consumers would be forced to investigate, calculate and manage manually. In this way such a system will naturally increase the level of consumer's eco-education.
The success rate of such a system would normally depend mainly on type of electrical devices consumer is using and especially on their grade of autonomy.
By grade of autonomy we mean devices that can be controlled without the need of user's confirmation and are less dependent on use-time. A good example of high-autonomy electrical consumer would be for instance an automated irrigation system that can run mainly during night; also an electric car charger can be easily scheduled according to the owner's preferences. This kind of electrical devices will have the biggest weight and will mostly influence the overall optimization effect.

The opposite extreme case would be electric stove or refrigerator, here the ERS effect is reduced only at recommendation level and the decision is fully taken by the user and the overall effect is not precisely predictable. The ERS can only inform the user of possible benefits if the user will adopt an alternative decision.
For example a brief report on how much money would save user in case of adaptation of alternative behavior.
Estimation of the benefit of such a system is not a trivial problem and will be the subject of the separate research.

CONCLUSION

In the context of European Union struggle to achieve its 20-20-20 goals the IoT can contribute in the field of electrical energy efficiency by offering an effective tool for:

- Learning consumer's habits related to electrical energy consumption profile;
- Offer an optimal solution to minimize interferences with already adopted behavior and maximize the follow-up of energy usage according to active tariff zones;
- Categorize types of appliances based on their energy consumption profile;

- Detect anomalies related to energy consumption;
- Manage electrical devices with a high decision-autonomy grade;

It's obvious that such a tool will achieve its maximum efficiency only in synchronization with Smart Metering system. Also it will naturally contribute to society eco-education. By "naturally" in this context we mean that a regular user does not need to know all the theory behind Smart Metering, Demand Side Management, IoT and so on, the only thing he will require to do is to follow advice of ERS and depending on his degree of compliance will achieve respective bill savings. As a consequence, also Distribution Network Load profile will also normalize with respect to energy demand peaks.

This model in our opinion can be adopted also in other fields such as heat energy efficiency and industrial energy consumption optimization.

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Traffic noise pollution in a historical city center - case study project within environmental engineering field of study

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ABSTRACT

Noise reduction for urban areas, especially noise generated by traffic is one of the major problems in today's European cities. This paper is focused on more aspects that are addressing to traffic noise, like pavement, driver's behavior, frequency of stops, pick hours, traffic agglomerations, etc. Research leading to this paper was conducted within the project "Adaptation to the Climate Change" developed in partnership with Environmental protection Agency Sibiu, focusing for this case study on traffic related pollution in a historical city center of Sibiu. Were considered three types of pavements (cobblestones, streets covered with dense asphalt, and graded asphalt road surfaces), three types of vehicles (small passenger car, family car and SUV), and testing's were done using 3M Quest SoundPro Sonometer. Higher noise levels were registered for cobblestone and dense asphalt surfaces. Acoustic measurements and maps emphasizing studied are presented, and the identified parameters considered to be related to the traffic noise are given.

Keywords: *Environment, noise, road, traffic, urban areas.*

INTRODUCTION

Transportation is one of the major sources of environmental pollution in urban areas according to noise map established for major cities. This work is in the collaboration with Environmental Agency Sibiu, within the project Adaptation to climate change. Environmental engineering is a key field regarding the environmental issues and is coming with practical solutions for undesirable effects reduction. One of the case studies performed during the research on the project is traffic related pollution – specially undesirable and disturbing effects of noise pollution. Is this respect were investigated the nature, sources and level of noise produced in the city of Sibiu.

Several studies focused on air, water, health pollution generated by transportation (Foraster et al., 2011; Stroe et al., 2014; Ciudin et al., 2014b; Schiavon et al., 2014; Rada 2014). Nowadays, traffic related noise is the major source of environmental pollution in most European countries. Traffic noise pollution studies have been carried out by researchers around the world and more focused on road surface type like porous asphalt and dense asphalt surfaces, (Sandberg and Ejsmont, 2002; Golebiewski et al., 2003; (Griefahn et al., 2008; Paunovic´ et al., 2009; Rada et al., 2010; Istrate et al., 2014; Kumar et al., 2014). The present paper reports results from a particular case-study regarding the traffic noise levels measured on different road surfaces in historical city center of Sibiu. The traffic noise is view as problem in the chosen case-study, and for this reason for example the new waste collection plan propose a system without road transport and alternative solution for its treatment (Petrescu et al., 2010; Ciudin et al., 2014).

PRACTICE TO LEARN -– ENVIRONMENTAL AND SOCIAL IMPACT OF ROAD SURFACES

Theoretical knowledge achieved at the university courses are a very good base to start practical activities and perform real measurements, conducting to palpable results. To practice and perform filed tests are crucial for students, this kind of activities are motivating them and rise their confidence, also preparing for the future jobs. Field measurements are key factors for environmental engineering field of study. Research conducted within research grant “Adaptation to the climate change” is one of many grants developed in partnership with the universities, and such opportunities has to be a continuous stream line, especially for applied science fields, as the collaboration with industry and governmental agencies are focused on emerging issues, legislation reinforcement and world wide data dissemination.

Road surfaces influence the generation of noise by tire / road interaction and the propagation of noise from the vehicle engine and transmission system. The relevant factors for noise emission are the texture of the surface, the texture pattern and the degree of porosity of the surface structure and the speed (Kloth et al., 2008; Rada et al., 2010; Iannone et al., 2013; Istrate et al., 2014). Low-noise road surfaces today are either thin layer surfaces or porous asphalts with one or two layers. Porous asphalt has an open structure with about 20-25% air void inbuilt. As a result, it absorbs noise and drains water, thus increasing road safety. The noise reduction potential of porous asphalt is higher than for thin layers. Paving stones normally cause increased noise levels of 3-5 dB because of their very uneven surface structure (Kloth et al., 2008).

Pavement properties are influencing the comfort, the safety, the road noise the aesthetic, the maintenance frequency and the maintenance. Each urban pavement types have various advantages and disadvantages, thus the selection of urban pavement types is a multi-attribute problem (Ogut and Kutluhan, 2004) Traffic noise is affected also by the pavement age the older the pavement, the higher the noise level. Traffic noise together with the particulate can be considered an environmental pollution because it lowers the standard of living (Licitra and Ascari, 2014; Ciudin et al., 2014b; Cao and Guan, 2013; Ionescu et al. 2013; Agarwal and Swami, 2012; Torretta et al., 2012). Research in Europe and in the United States has indicated that it is possible to build pavement surfaces that will reduce the level of noise generated on roadways (Hanson, 2004). The surface types measured in this study are cobblestones pavements, dense asphalt surface and graded asphalt road surfaces.

At certain speeds the noise produced by cars is dominated by the sound of the tires rolling on the road surface. At lower speeds, below 40-50 km/h, the engine noise also becomes important. The noise produced by the tyres depends on the road surface and the type of tyre. The most important factor is the roughness of the road surface (texture) and the tread of the tyre. Everyone is familiar with the effects of driving on paving stones, cement block paving or cobblestones. Average noise levels over 65 dB can lead to health problems (Leeuwen, 2003). Using a low-noise surface reduces traffic noise at the source. A reduction of 3 dB from 76 to 73 has the same effect as either reducing the traffic by half or doubling the distance from the source of the noise (Asphaltalliance, 2004).

Tire / road interaction noise can be described by different mechanisms: The aerodynamic noise generated by air pumping, when air is forced out (and sucked in) between the rubber blocks of the tire and the road surface as the tire rolls by: this source is typically the most important in the frequency range between 1000 and 3000 Hz. If the road surface is porous with a high built-in air void, the air can be pumped down into the pavement structure, and the noise generated from air pumping will be reduced. If the pavement has an open but not porous surface structure, the air pumping noise will also be reduced to some extent. Noise from vibrations of the tire surface: the aggregate at the top layer of the pavement forms the pavement texture. When the rubber blocks of the tire hit these stones, vibration is generated in the tire structure. These vibrations generate noise typically dominated by the frequency range between 300 and 2000 Hz. With a smoother pavement structure, the generation of vibrations and noise is reduced. The vibration generated noise can also be reduced if the pavement is elastic. In the driving direction, the pavement surface and the curved structure of the tire forms an acoustical horn which amplifies the noise generated by the tire /road interaction. If the pavement side of this horn is noise absorbing, the amplification by the horn is reduced. The most effective low noise surfaces are currently porous asphalt and thin-layer asphalt. Thin layer surfaces either can be open graded asphalt concrete, stone mastic asphalt or a combination pavement. The noise reduction potential is based upon a low aggregate size of the mixture (e.g. a maximum aggregate size of 6mm on urban roads and 8mm on highways).

The noise level near the road depends on the noise generated by the traffic but, also the characteristics of the pavement surface. The noise generated by the vehicle can be classified into three general categories: the power unit noise (engine, fan, exhaust and the transmission, etc.), the aerodynamic noise, which is related to the turbulent airflow around the vehicle, and the tire/pavement noise. The power unit noise and the tire/pavement noise are the important sources of noise levels for roadside noise. The speed of the vehicle also affects the noise level. Generally it is thought that tire/pavement noise can be described as two mechanisms: the mechanical vibrations of the tire, which includes the tread impact and adhesion mechanisms and the aerodynamic phenomenon (Hanson et al., 2004).

COBBLESTONE PAVEMENTS – ENVIRONMENTAL AND SOCIAL IMPACT

All citizens are at some point affected by noise, which can have a considerable impact on people's quality of life. As stated in WHO's Guidelines for Community Noise (Berglund et al 1999, p. iii), about half of the EU citizens (EU 15) are estimated to live in areas which do not ensure acoustical comfort for residents: 40% of the population is exposed to road traffic noise with an equivalent sound pressure level exceeding 55 dB(A) during daytime, and 20% to levels exceeding 65 dB(A). At night, more than 30% are exposed to sound levels that disturb sleep (exceeding 55 dB(A)).

In 2002, Directive 2002/49 relating to the assessment and management of environmental noise was adopted by the European Parliament and Council. This Directive will guide and steer activities on noise in Member States and large conurbations in the coming years. The directive describes environmental noise as "unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity" (Directive 2002/49/EC). Ambient or environmental noise covers long-term noise, from transport and industry sources, as distinct from noise caused by neighbors, construction sites, pubs, etc.

Many streets of historical city centers within Europe are paved with cobblestones, both car roads and pedestrian areas in order to keep the old look and historic appeal of the cities. Cobblestone pavements are also common pavements in Sibiu city center. This type of surface is not universally loved. While some studies prove that walking on cobblestones is healthy, others are reporting this kind of pavements as uncomfortable and noisy. In some cities of the world, cobblestone surfaces are also a hot topic. At the same time cobblestone surfaces can be pedestrian-friendly – when they are used on the road. Firstly, because this type of surface naturally reduces vehicle speeds, decreasing the risk of pedestrian accidents. Driving on this kind of surfaces is also very noisy, which may be annoying for car passengers, but it helps to keep pedestrians alert for the proximity of vehicles. Around the world, the attitude of urban planners regarding cobblestone pavements is variable. In some places, there are plans for substituting cobblestones with asphalt. But in many cities, cobblestone surfaces are also the first choice for the pavement of newly pedestrian areas. The main problem actually is the condition of cobblestone pavements, which often have holes and irregular surfaces. But when the pavement is well-maintained, it is a good strategy for controlling traffic speeds and enhancing pedestrian safety, especially in residential areas. In a foreseeable future we might expect a significant reduction of road traffic noise both through the use of more efficient pavements and because of the growing popularity of hybrid and full electric vehicles.

CASE STUDY

Investigated area presented in figure 1 is composed from 3 types of pavements: streets covered with cobblestones, streets covered with dense asphalt, and graded asphalt road surfaces. Table 1 bellow presents testing parameters and experimental results. Vehicles used in this study were selected as being the most representative cars for the region: family car - Dacia Logan, small passenger car - Volkswagen Polo and SUV - Dacia Duster. Road noise was recorded by 3M Quest SoundPro Sonometer at 7.5 m from the road center and at a height of 1.7 m. For each testing cars, the noise level was registered separately and later while driving in the traffic.

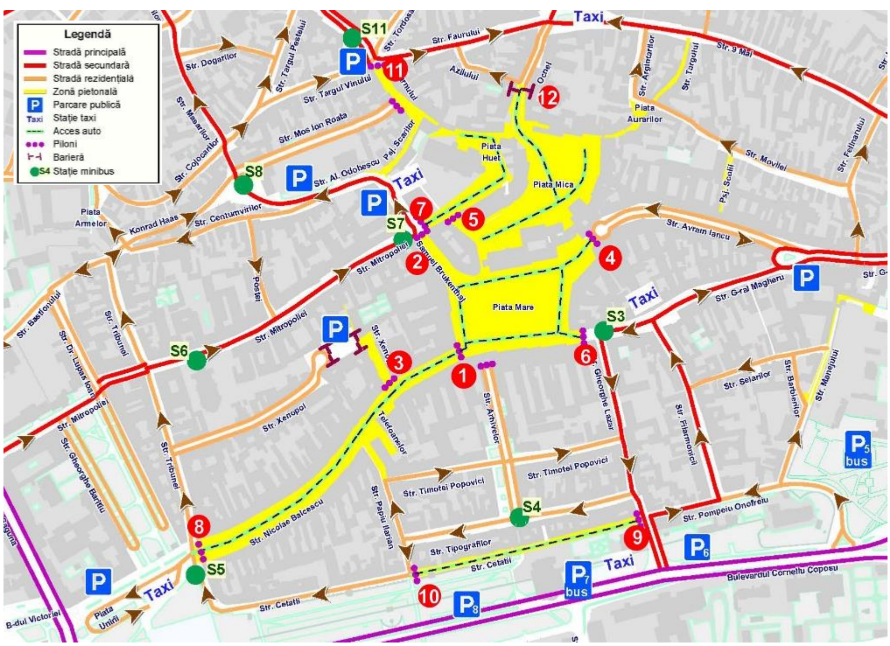

Figure 1: Map of historical city center of Sibiu, Romania

Vehicle speeds for each car used in the study were of 30, 50 and 70 km/h, and recorded with variable speed profiles as shown in figure 2. Records were performed according to ISO Standard 11819-1:1997: dry pavements, wind speed < 5 m/s, air temperature between 5°C and 30°C, and pavement temperature between

5°C and 50°C. The fact that cobblestones pavement generate more noise can be explained by the fact that the age of stones roads are relatively high, around 100 years, the resonance of narrow and crowded houses in the historical center contribute significantly to sound amplification. The results of this study confirm the fact that several parameters should be taken into account while measuring noise level for each street in particularly.

Table 1: Representative types of the road surfaces and testing parameters

Aggregate type	Aggregate size	Air / Surface temperature	Car speed km/h	Noise dB(A) Polo	Noise dB(A) Logan	Noise dB(A) Duster
graded asphalt	10 mm	22 ^{0}C /20 ^{0}C	30	52	53	62
			50	54	54	64
			70	56	57	66
dense asphalt	16 mm	20 ^{0}C /20 ^{0}C	30	53	55	58
			50	55	57	67
			70	58	59	70
cobblestones	100 x 100 mm^2	21 ^{0}C /19 ^{0}C	30	59	60	89
			50	62	62	93
			70	63	64	96

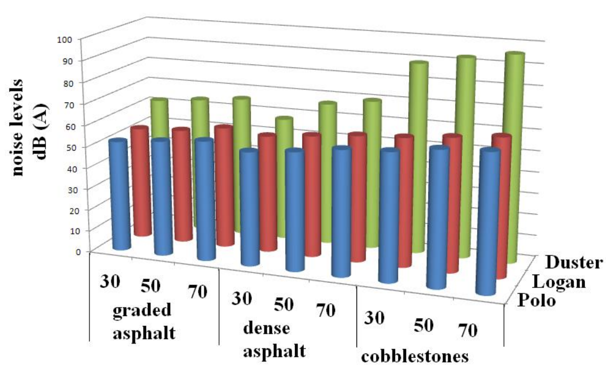

Figure 2: Noise levels for different aggregate types

It was observed that sound is absorbed in the pores of the pavement, while converted in heat energy, which is influenced by the pavement material's absorption coefficient and frequency and angle of incidence. Until recently, traffic noise was remediated through construction of noise wall barriers or purchase of right-of-way buffer zones where feasible. Recently, researchers are looking at source control issues. A major contributor of highway noise is at the tire/pavement interface, which means that quieter tires or quieter pavements could lead to substantial reductions in traffic-generated noise (Gibbs et al., 2005). Based on the testing's done with the 3M Quest SoundPro Sonometer the typical noise levels are: cobblestones is approximately 72 dB(A); dense asphalt is approximately 59 dB(A); graded asphalt is approximately 57 dB(A).

CONCLUSION

Road surface physical characteristics influence traffic-generated noise. Higher noise levels were registered for dense asphalt surfaces if compare to graded asphalt. The highest noise levels were recorded for cobblestones pavements. The authors believe that high noise level for cobblestones pavement are also due to the building resonance, being influenced by the street morphology and also by the buildings of historical center. It have been identified that a low noise road surface can be built at the same time considering safety, durability and cost using one of the following approaches (Hanson et al., 2004): a surface with a smooth surface texture using small maximum size aggregate; a porous surface, such as an open graded friction course (OGFC) with a high air void content; a pavement-wearing surface with an inherent low stiffness at the tire/pavement interface.

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Driving Simulators for Human Vehicle Interaction Design

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ABSTRACT

The interaction human-vehicle, as well as driver's behavior are subject long debated in the automotive engineering domain. Driving simulators have an extraordinary important role allowing research that would not be possible to study in real world scenarios.
A driver uses his sensory inputs to obtain the required input to base his decision on. The bandwidth of the required input signal should be in accordance to the driver's task. For simple tasks, like turning on the screen wipers or direction indicator, low frequency information is sufficient. High frequency information is required when cornering on a busy road or when driving in relatively limit situations.
The optimal configuration of each sub-system remains a significant cause for debate and still poses a major challenge when considering the ability of simulators to extract realistic driver behavior. If a difference is observed between real and virtual conditions, the factors specifically cause these differences are very difficult to be explained.
***Keywords**: human vehicle interaction, driver behavior, vehicle control design, virtual vehicle environment.*

INTRODUCTION: MOTION SIMULATION AND THE NEED FOR MOTION

Simulation is defined as the imitation of reality. Motion simulation is all about perception. Motion perception for the human body has two inputs: inertial stimulants on the body and environmental motion with respect to the body. The vestibular system located in the inner ear is the prominent sense that provides the perceptual system with the information about linear and angular inertial acceleration of the body. The speed prominent sense for the human body is provided through the visual system.

There are several reasons why a motion system is important in simulation, the main reason being to prevent driving simulator sickness. Symptoms of simulator sickness come from the differences between the latency of the visual and motion system and false cues.

The driver uses his/her sensory inputs to obtain the required input to base his/her decision on. The bandwidth of the required input signal should be in accordance to the driver's task. For simple tasks, like turning on the screen wipers or direction indicator, low frequency information is sufficient. High frequency information is required when cornering on a busy road or when driving in relatively limit situations.

DRIVING SIMULATORS PERFORMANCES

Versatility and Development

The main advantage of research simulators is the versatility. They can be easily and economically configured to simulate a variety of human factors research problems. They allow evaluation and optimization of human performance within system constraints and indicate problem areas in system design and functioning. They are particularly useful in selecting a viable system approach from numerous alternatives and evaluating system performance before field testing. Different simulation scenarios can be created to match the requirements of the particular experiment. Environmental effects such as foggy roads, snowy or slippery roads or night time driving conditions can be created. Vehicle characteristics can be altered quickly - steering rations, spring rates, damping factors, driven wheels. New roadways or infrastructure can be created in the driving simulator where the test situation is difficult to be reproduced on the road. They can often represent the most cost-effective approach in a given application. Complete instrumentation and recording systems for in-vehicle tests can be expensive to set up and maintain. Contriving typical traffic situations, including interactive vehicles and signal controls, on special driving courses can also be costly. On the other hand, it is often less expensive to set up and operate simulations in a controlled laboratory environment than it is to conduct field tests that are designed to achieve given experimental objectives. In particular, stimuli and events external to the driver's vehicle are substantially cheaper to implement, control and vary in a simulator that they are on a test track.

Experimental Control and Measurement

Driving simulators are able to control experimental conditions over a wider range than field tests and can be easily changed from one condition to another. This capability can be important in terms of experimental design characteristics, such as allowing back-to-back comparisons of disparate experimental conditions. Every driver can drive the exactly same testing situation where systematic variation in road, vehicle or traffic situations conditions is difficult to achieve in real world. Criterion variables can easily be made available in a driving simulator. Performance measures can be easily mechanized. Digital computer systems can further provide on-line data processing, formatting and storage and the reduction and compact arrangement of data.

Safety

Driving simulators provide an inherently safe environment for driving research. There is no endangerment to the driver or other road users under critical driving conditions or when testing innovative in-vehicle devices. They can be used where approval for an on-road experiment is unlikely to be forthcoming from the relevant authorities without some prior evidence on behavioral and safety issues.

Validity

The major disadvantage of driving simulators used for research is represented by the fact that the real world will never be replicated in all its complexity. There will always be the issue of validity, of to what extent behavior in a simulator corresponds to real life.

Costs

Driving simulators have a high initial acquisition cost. In addition, operating and maintenance costs are slightly higher than for training simulators because research simulators are more complex.

Simulation Sickness

Simulation sickness can vary widely among individuals who experience it among simulators that induce it. Effects may range from mild disorientation and queasiness to sever ataxia and full emesis. The most critical variables are the visual horizontal field of the view and the level of moving scene detail. The potential simulator design etiological factors summarized by Casali and Wierwille (1986) can be:

a. Control loop lags and delays. Inappropriate control-feedback lags are known to degrade controllability and stability of vehicular systems, as demonstrated may introduce symptoms of sickness;
b. Dynamic characteristics like proper modelling of the full-scale vehicle in the simulator's computational systems and accurate correspondence between the simulator's dynamics and those of the actual vehicle (both for low-speed manoeuvres and more complex high-speed kinematics);
c. Control load factors like damping;
d. Motion system factors. Barrett and Thornton (1968) suggested that fixed base simulators are likely to induce sickness because a cue conflict arises when the operator visually sense the appearance of incident vehicular

motion but never receives corresponding physical acceleration or positional cues. On the other hand, the addition of motion cueing systems to some simulators has greatly reduced the sickness problem;

e. Visual system factors such the display type, the field-of-view and scene detail, the display rate and the display distortions;
f. Cockpit environment factors such as temperature regulation and humidity control when the simulator cab is enclosed.

SIMULATION OF THE ROAD ENVIRONMENT AND REALISM

The simulation of the road environment is very complicated because the more details are provided the more slowly the simulator will run. However, since a certain driving pattern may not be replicated perfectly within a driving condition, the consistency in the driving pattern between different trials within each of the driving conditions (simulator vs. real world) has to be estimated first. In several studies, the question "How realistic do you think the driving in the simulator was?" has been asked. Comparing the results from different studies, the lowest realism and also some "not at all realistic" ratings appear in the studies of anti-collision and vision enhancement systems. These systems are not in common use yet and may add unrealism to the situation. Also, the fact that 5% of the elderly estimated the driving to be "not at all realistic" in a study concerning the effects of mobile phone use on elderly drivers may very well reflects that using a mobile phone is an unrealistic task for this section of population.

SYSTEM ARCHITECTURE

The architecture contains the vehicle mock-up and its platform, the haxapod including the hydraulic system, the hydraulic power unit and the steel plated needed for the load distribution, the video and the audio systems and the computer cabinet. All the components are part of two different global systems: the control system and the mock-up system (Figure1).

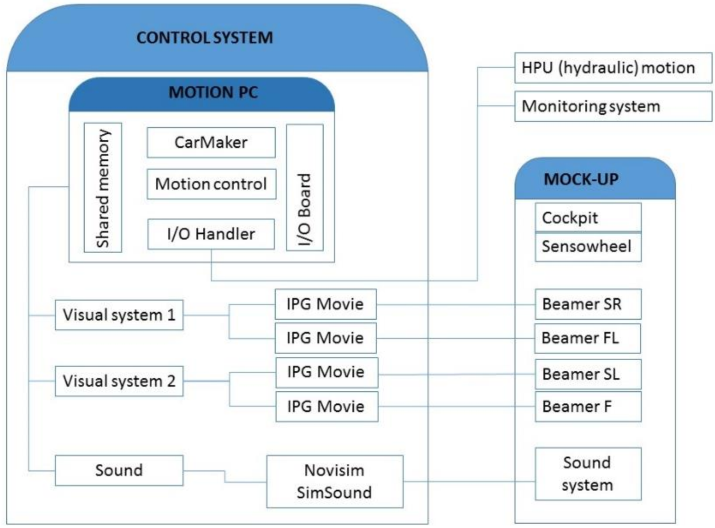

Figure 1: System architecture

The vehicle mock-up is an actual vehicled modified to have the same characteritics and parameters with the real vehicle, in respect with the task requirements. The platform is used to fix the vehicle with the haxapod. The motion system consists of a classical Steward hexapod with 6 hydraulic actuators that make the motion possible on 6 degrees of freedom. The actuators receive the motion comands via the hydraulic system that is operated from the motion unit. The steel plates for the load distribution are the contact with the ground that assures the stability of the motion platform.

The visual system consist in several projectors: placed in front and 2 in lateral views that displays different resolution images. The audio system is incorporated in the simulator cabin: in front side speakers are mounted below the instrument panel in the footwell of the driver / passenger, while the subwoofer, center speaker and two rear speakers are located in the rear cabin section. The audio and the video systems have to reproduce with high fidelity the real environment while vehicle is running.

KEY SYSTEMS OF A RESEARCH DRIVING SIMULATOR

Scenario Control

The scenario control refers to the process of choreographing particular traffic scenarios or events within the virtual driving environment. It achieves this through a modification of the scene-graph to add all the real-time agents based on a model of their behavior, such as other vehicles, pedestrians or traffic lights. Fundamental to scenario control is the underlying description of the roadway, the Logical Road Network - LRN. The scenario control uses the LRN to provide information in order to support the behavior and the interaction of the real-time agents. For example, intelligent virtual traffic effectively uses the LRN to "perceive" the road as a human driver in order to make intelligent decisions such as intersection priorities and overtaking.

Driver/Vehicle Data Processing

One of the fundamental reasons for using a research driving simulator is the abundance of driver behavioral and performance measures that can be easily recorded. These data may refer to the driver's use of the vehicle controls, the corresponding behavior of the vehicle or specific behavioral metrics that are commonly used to quantify driver behavior, such as coherence in a car following task (Brookhuis, de Vries, & de Waard, 1991), steering reversal rate (McLean & Hoffmann, 1975) or time- to-line crossing (Godthelp & Konnings, 1981).

Control Loading

The "feeling" for a simulated drive helps to create a sense of realism in a driving simulator; therefore, it would be convenient that the vehicle controls have the same characteristics as the actual vehicle that the simulator is mimicking. The main feedback to a simulator driver is through the steering emanating from those generated at the tyre-road interface as modeled by the vehicle dynamics. Control feedback through the foot pedals is also significant.

Motion System

A motion system is designed to artificially recreate the dynamic cues of both longitudinal (braking and ride) and lateral (cornering and stability) vehicle accelerations. Dynamic cueing in a driving simulator is possible using motion platforms which were initially developed for flight simulation applications, progressively used more frequently in the automotive field. Developments in vehicle simulation applications started relatively recently (Nordmark, Lidström & Palmkvist, 1984; Drosdol & Panik, 1985) compared to the initial hexapod design used in early flight simulators (Stewart, 1965).

EFFECTS OF THE MAIN SYSTEMS ON DRIVING SIMULATOR VALIDITY

Three main modalities through which drivers sense their movement within the virtual environment are contained into a research driving simulator: stimulation of the visual system, the vestibular system and via auditory information (Kemeny & Panerai, 2003). It has been for some time commonly regarded that the visual, and to a lesser extent the vestibular feedback are the most important with regard to the perception of vection. Recently the accuracy of audio rendering has been shown to influence such vection. Although, its effect is much weaker and typically only occurs in between 25% and 60% of people (Sakamoto, Osada, Suzuki & Gyoba, 2004).

Effects of the Visual System

Under natural conditions, visual cues provide a significant contribution to allow an observer to form a perception of their environment space. However, under simulated conditions, the inferior display characteristics (e.g. image resolution, update frequency and field of view) bring a quality reduction of these cues. The driver's use of these cues is important for the estimation of: vehicle speed, the distance to objects and vehicle heading and lateral control.

The evaluation of vehicle speed and the estimation of inter-vehicle distance are essential skills in safe and controlled driving. Maneuvers such as overtaking and collision avoidance require such abilities. These skills require the accurate representation of self-motion from both optic flow and egocentric direction – the direction of an object in space relative to the observer (Gogel & Tietz, 1979). Optic flow can give information about either absolute speed or distance and also exploited to compare relative spatial intervals, central to the accurate estimation of time-to-contact (Lee, 1976). A significant number of studies into speed perception have shown that observers tend to underestimate their velocity in simulated environments (Alicandri, Roberts & Walker, 1986; Riesmersma, van der Horst & Hoekstra, 1990; Duncan, 1995; Groeger, Blana, Carsten & Jamson, 1999).

Distance estimation is also based on a number of reliable cues, such as optic flow (Bremmer & Lappe, 1999), disparity (Howard & Rogers, 1995) and motion parallax (Rogers & Graham, 1979). Motion parallax describes the differential motion of pairs of points as a result of their different depths relative to the fixation point and to the motion of the observer. It provides robust estimation of absolute egocentric distance when combined with additional visual information describing an observer's self-motion.

Effects of the Motion System

The vection usually takes several seconds to establish itself (Melcher & Henn, 1981) in a stationary observer. The latency of this vection can be reduced by the addition of inertial motion cues (Groen, Howard & Cheung, 1999). Furthermore, from a steady condition of stabilized speed and lane position, drivers are experiencing a disturbance to such conditions. They exhibit a significantly shorter response time in simulators with motion as opposed to without (Wierwille, Casali & Repa, 1983).

Greater variation in lane position has been observed in drivers of fixed-base simulators compared to those experiencing similar but real-life conditions (Duncan, 1995; Blana & Golias, 2002). The addition of motion cues reduces this variation (Alm, 1995; van Winsum & Godthelp, 1996; Reymond, Kemeny, Droulez & Berthoz, 2001; Greenberg, Artz and Cathey, 2002). Moreover, drivers perform wider turns when lateral cues are present compared to those when only visual information is available (Siegler, Reymond, Kemeny & Berthoz, 2001).

Effects of the Sound System

Compared to the visual inducement of self-motion, audio cues are much less compelling. Auditory vection is influenced by the realism of the acoustic simulation and the number of sound sources.

Sound cues are so frequently represented in driving simulation that unearthing a driving simulator without the provision of a sound system would be quite a discovery. However, the effect of audio cues on the fidelity of simulator driver behavior in comparison to real conditions has not been shown so clearly. McLane and Wierwille (1975) investigated the effects of presence or absence of speed-related sounds and vibrations in a driving simulator. The results indicated that the performance measures of yaw, lateral and velocity deviation were significantly affected by the deletion of vibration. The authors reported that the existence of audio had no significant effect on either driving speed or lane control. However, they acknowledged that the audio rendering had the advantage that irrelevant sounds emanating from the various simulator sub-systems were effectively masked, improving the simulator's face validity. Similarly, some twenty years later, Davis and Green (1995) confirmed the lack of an effect of sound in a simple fixed-base simulator, demonstrated by unchanged drivers' rating of realism with and without audio cues, a result replicated by Capustiac, Hesse, Schramm & Banabic (2010).

CONCLUSION

The present study highlights the important role of driving simulators in multiple research areas. Furthermore, this study indicates that there are benefits to providing drivers with the opportunity to practice improving upon their driving techniques in a driving simulator.

The presented approach and aspects regarding the driving simulation have high importance in terms of the motion system, preliminary results before field testing, developing new very hard to be reproduced in real world scenarios, safety environment while entire driving simulation process, high fidelity while reproducing real world, very close to all its complexity, and last, but not least, the costs effective by using driving simulators than field testing.

The human-vehicle interfaces are trying to find the optimal configuration of each sub-system. But it remains a significant cause for debate and still poses a major challenge when considering the ability of simulators to extract realistic driver behavior. The effects from the main key systems are very important on evaluating the human-vehicle communications. If a difference is observed between real and virtual conditions, the factors specifically cause these differences are very difficult to be explained.

This study leads to ideas on how to optimize the driving simulator behavior and the human to vehicle communications. The interaction between users and vehicles will be long debated subject. New further researches are needed in order to achieve the control measures for the gaps between the level based functioning and the level specific to each user demands.

ACKNOWLEDGEMENT

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Marketing Management: Realities and Requirements in the Context of Business Globalization and Internationalization of Companies

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ABSTRACT

Romanian organizations must open their doors to the outside, and for that managers must perceive and interpret all incoming signals to withstand competitive pressure to attract and retain customers, to be competent, to achieve maximum efficiency in their business processes.
The purpose of the selective scientific research aims the knowledge of certain issues within the organization, such as: current state of marketing management and customer orientation; specific business marketing management in conditions of business globalization and internationalization of companies; specific customer orientation;
Depending on the objectives pursued, the investigation carried out included two successive researches: an exploratory qualitative research and a descriptive quantitative research.
The general conclusion about the state of knowledge on marketing management in the context of business globalization and internationalization of companies is that the majority of respondents are aware of the importance of marketing management to support them when they face the daunting penetration option of global markets;
"Take Home Messages": The research has shown that the most important measure that organizations are considering in order to improve marketing management and make the organization's management efficient is to increase the place and role of marketing management in the overall management of the organization.

Keywords: *global markets, client orientation, marketing management, internationalization*

PURPOSE OF WORK

We chose this primary objective in the construction of our work to identify the extent to which, at present, both the literature and practice of marketing management is prepared to implement and manage a new type of marketing management. The analysis of the extent to which the concepts that this management subsystem operates with are known, is the starting point of any scientific attempt.

Double focusing the company's efforts on superior products and services – therefore on quality and total services - as a source of consumer satisfaction and as a means of establishing lasting relationships with them, signifies, according to Ph. Kotler – the essence of specific approach of marketing management. To be successfully used, marketing must be fully integrated into the organizational structures of the third millennium entities. Trends in the development of marketing management process identified and addressed in conjunction with the manner in which they currently operate and depending on marketing environmental factors influencing the organization.

Obtaining competitive advantages is foreshadowed to be increasingly difficult. Former competitive concepts that were once successful, such as product differentiation, technological supremacy or lower costs are no longer sufficient in the current market conditions, to ensure long-term profitable, economically advantageous position of the company.

More and more organizations are in a position to offer products for specific target groups at the required quality and at competitive prices. Thus, taking into account their objective quality, they have become interchangeable to the customer. Because of this it was necessary to seek new sources of differentiation, that would be appreciated by the client and allow the organization to maintain a harder edge to match by the competition, for a longer period of time.

Both specialty literature and practice consider customer satisfaction a central indicator in assessing an organization in providing quality services. Customer satisfaction shows to what extent the offerer’s promises and achievements overlap with customer expectations. We can say that an organization that has only satisfied customers is a customer-oriented enterprise.

For these reasons and others, we considered it absolutely necessary to believe customer orientation and its role in marketing management as a major research objective, both documentary and applied to our paper.

The starting point of the study conducted was the consultation of literature in the field (Anon, A.& Perry, C. 2002, Bogdan, I. 2007, Buttle, F. 2004, Charlesworth A., Gay R. Esen R. 2009, Dumitru, I. 2004).

METHODOLOGY OF RESEARCH

Depending on the objectives, the investigation carried out included two successive researches: an exploratory qualitative research and a descriptive quantitative research.

Identifying the problem and purpose is one of the most important phases of a research. The purpose of the selective scientific research is closely related to the problems and issues raised in substantiating the study. Thus, it aims to highlight, describe the characteristics of marketing management and customer orientation at universities, PhD students and researchers, managers and customers of companies in Sibiu county and to determine the extent of the differences in terms of needs, attitudes or opinions between the different categories of respondents, between theory and practice, between what should be done and what is being done.

To operationalize the research the following objectives and hypotheses have been established:

Table 1: Objectives and hypotheses of the research

	OBJECTIVES OF THE RESEARCH	HYPOTHESES
Q1	Analysis of the current state of knowledge on marketing management: realities and requirements in the context of business globalization and internationalization of companies	***H_1***- Marketing management is largely influenced by change, business globalization and internationalization of companies ***H_2*** – Most respondents consider that marketing management can adapt to contemporary world's changes
Q2	Determination of the degree in which customer orientation is considered an essential component of marketing management	***H3*** – The majority of respondents believes that customer orientation is crucial to the success of organizations. ***H_4*** – Most respondents believe that the organization successfully applies methods and techniques of customer orientation.

The research was conducted through four questionnaires with a relatively high degree of structuring, distributed directly to the four categories of respondents (academics, PhD students/researchers, managers, clients). These questionnaires are structured relatively the same, with the top five common questions and the last, and the rest covering the same goals, but adapted to the typology of the respondent.

Therefore, dichotomous and multiple choice closed questions and were used, open questions, mixed questions.
To measure the variables under the study (baseline variables, descriptive variables, organizational variables, situational variables) the most suitable type of scaling and

the scaling method should be used. As a method of scaling, the Likert scale was used.

The selective scientific research carried out for a confidence level of 95% and a margin of error of 10%, the sample will be of:

$$n = \frac{1{,}96 \times 0{,}5 \times (1 - 0{,}5)}{0{,}1^2} = 96$$

Therefore, the minimum number of duly completed questionnaires, which should be collected and processed, is 96. Maintaining the confidence level of 95%, and given that a number of 200 questionnaires was collected and validated, we determined the maximum margin of error ($\Delta_{\omega \max}$):

$$\Delta_{\omega \max} = t\sqrt{\frac{p \times (1-p)}{n}} = 1{,}96\sqrt{\frac{0{,}50(1-0{,}50)}{110}} = 9{,}4\%$$

From the category of organizational restrictions that have arisen in determining the sample size, we mention: the financial availability of the researcher (actually, it was the most important, all expenses being borne by the researcher), the time given to the research, the lack of reliable operators etc.
We believe that the most important limitation of the research carried out is due to the sample size (200 respondents) and fairly high margin of error (10%) for a confidence level of 95.

RESULTS OF THE RESEARCH AND TAKE HOME MESSAGES

In order to operationalize the research a series of questions were formulated common to all categories of respondents, in order to achieve a series of comparative studies in the research. These comparative studies have allowed us to get extra information and motivation regarding the interdependence of the various aspects of marketing management and the training and the background of respondents. (Marcu, 2011)

The first question addressed to all categories of respondents concerns the fundamental concepts with impact on marketing management: change, business globalization and internationalization of companies. The data obtained in question v1 are shown in table 2 and graphically described in figure 1:

Table 2: State of knowledge of marketing management in the context of change, business globalization and internationalization of companies

		Frequency	Percentage	Valid percentage
Valid	200			
	Unimportant	8	4	4

	Less important	16	8	8
	Neutral	33	16,5	16,5
	Important	41	20,5	20,5
	Very important	102	51	51
Total		200	100	100
Mean	**4.06**			

Processing responses leads us to conclude that most respondents (51%) attached great importance to the concepts of change, business globalization and internationalization of companies and to the impact that these concepts have in marketing management. This result leads us to note the awareness of the respondents of the need to know and operationalize these concepts in organizations' management, and especially in marketing management. A neutral opinion on these concepts have 16,5% of respondents, 8% of respondents gave little importance, while only 2 respondents representing 4% consider the concepts of change, business globalization and internationalization of companies in the current economic context unimportant.

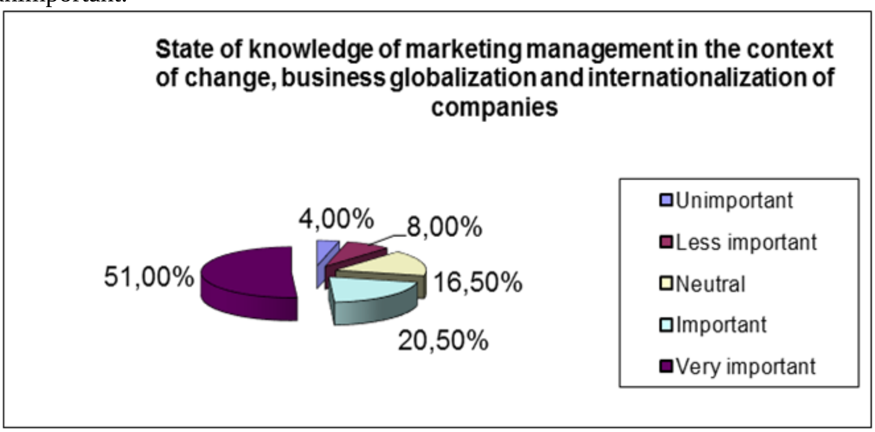

Figure 1: State of knowledge of marketing management in the context of change, business globalization and internationalization of companies

The average of responses (5- very important, 4- important, 3- neutral, 2- little important, 1- unimportant) is of 4,06 and are within the "important" area, so that the hypothesis launched before the research (*H1- Marketing management is largely influenced by change, business globalization and internationalization of companies*) is confirmed.

The formulated question was mixed and therefore measures to adapt the marketing management to the listed changes were formulated. Among those listed by respondents include: the identification of new markets and consumer segments, better training for managers in marketing management, finding new sources of

competitive advantage in international markets, reconfiguring and rethinking organizational objectives, thorough research of global environmental conditions, increasing structural and dimensional flexibility.
In conclusion, given that 84% of respondents listed at least one solution to adapt the marketing management to business globalization and internationalization of companies, we can say that our hypothesis (*H2 - Most respondents find that marketing management can adapt to contemporary world's changes*) is confirmed.

For details, v1 question pairing with the category of respondents was carried out (State of knowledge of marketing management in the context of change, business globalization and internationalization of companies/category of respondent), the information obtained being presented in table 3 and graphically described in figure 2.

Table 3: State of knowledge of marketing management in the context of change, business globalization and internationalization of companies depending on the category of respondents

	Category of respondents				**Total**
	Academics	**PhD students/researchers**	**Managers**	**Clients**	
Unimportant	-	-	2	6	8
%	-	-	4%	12%	4%
Less important	1	1	4	10	16
%	2%	2%	8%	20%	8%
Neutral	4	7	9	13	33
%	8%	14%	18%	26%	16,5%
Important	18	16	4	3	41
%	36%	32%	8%	6%	20,5%
Very important	27	26	31	18	102
%	54%	52%	62%	36%	51%
Total	50	50	50	50	200
%	100%	100%	100%	100%	100%

It thus appears from the information provided that the two categories engaged in practical activity, namely managers (4%) and customers (12%) are those with answers which consider unimportant the concepts of change, business globalization and internationalization of companies, especially in marketing management. Customers are the ones who feel in the greatest proportion (20%) of these concepts as being less important, while a neutral view is found in all categories of respondents, the highest percentage is thus again found at the customers.

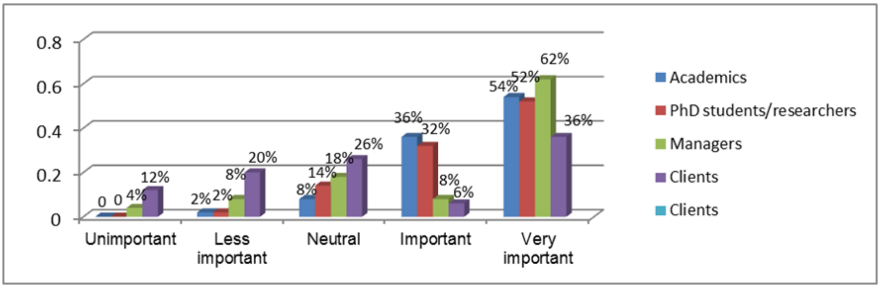

Figure 2. State of knowledge of marketing management in the context of change, business globalization and internationalization of companies depending on the category of respondents

Academics and PhD students considered in significant percentages (36% and 32% respectively) these concepts as important, and they also consider them as very important in a proportion of 54% and 52%. What is noteworthy, however, is the highest percentage of the category that considers as very important these concepts is that of managers and the lowest percentage, of customers. This shows the diametrically opposed views of the two categories directly involved in practical activity.

In order to achieve the second objective the v2 question was formulated, seeking **to determine whether customer orientation is considered an essential component of marketing management.** The information obtained after processing the data are shown in table 4 and graphically described in figure 3.

Table 4: The degree to which customer orientation is considered an essential component of marketing management

		Frequency	Percentage	Valid percentage
Valid	200			
	Unimportant	3	1%	1%
	Less important	7	3%	3%
	Neutral	12	6%	6%
	Important	47	24%	24%
	Very important	131	66%	66%
Total		200	100	100
Media	**4.48**			

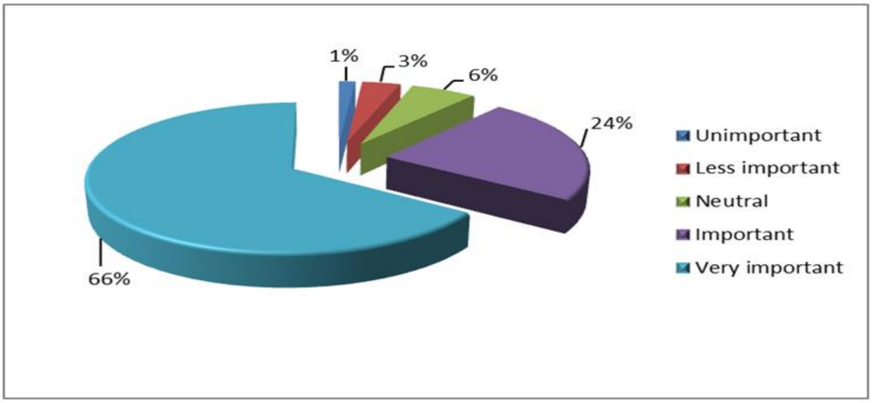

Figure 3. Degree to which customer orientation is considered an essential component of marketing management

From the above information we could conclude that most respondents (65,5%) believe that customer orientation is a strong component in marketing management while 23,50% consider it important. 6% of respondents show a neutral opinion while 3,5% consider it less important. Only 3 respondents (1,5%) consider this concept as totally unimportant. The score of responses is 4,48 (on the scale 5- very important, 4- important, 3- neutral, 2- least, 1- unimportant) and in conclusion, the hypothesis (*H3- The majority of respondents believes that customer orientation is crucial to the success of organizations*) is confirmed, which leads us to conclude that the majority of respondents are aware that the organization's activities should be conditional on the customer's requirements.

From the replies we could not identify specific methods and techniques of customer orientation listed by the respondents, and thus we can say that H4 (*H4 - Most respondents believe that the organization successfully applies methods and techniques of customer orientation*) is invalidated.

FINAL CONCLUSION

Our scientific approach, along with its special place that it holds within the modern organizations in the frame of business globalization and companies internationalization, can be considered as of a certain complexity and difficulty that must be evaluated, handled and approaches with a certain amount of attention.
One of the conclusions of the research refers to the concept of change, although widely accepted and debated in the academic environment, still very less accepted by managers and clients.

Of the four hypotheses, the fourth is invalid, resulting that the respondent organizations did not apply successful methods and techniques of customer orientation.

From the answers given by respondents to our request to advance solutions for the marketing management to get closer to customers, the most significant are:

- the intensification of marketing research;
- the formation of interdisciplinary teams to analyse the needs and demands of customers;
- using previous experience for assortment diversification, transfer of knowledge and know-how;
- networking and outsourcing of certain services, use of experts, external benchmarking.

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A Model for Nonlinear Dynamic Systems with Application Potential in Management

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ABSTRACT

Systems' modeling represents a valuable management instrument.
The paper proposes a possible modeling method for the behavior of economic (or other type of) non-linear dynamic systems.
To this end, it uses a particular (input-state-output) vector sample based function to approximate the n-dimensional vector field describing the modeled system.
The paper presents the approximation algorithm that was developed and further tested with good results on a limited (yet) set of data.
The approach enables the development of future trainable models, convergent to the "to be modeled" systems, task considered the next step to be done.
The main benefit resides in the possibility to develop models in order to simulate and predict evolutions, may it be the evolution of a product in a market, of an institution/company in its environment or of another economic sub-system of interest.

Keywords: *model, non-linear dynamic systems, systems management*

INTRODUCTION

Few if any of the large and complex economic systems are indeed predictable [1]. In many cases, predictions are based on qualitative considerations. Insights regarding the "actual" model of a system and the way it works are frequently empirical.

The huge interest for the subject[5] [2] should be enough to justify the effort of developing a model and an algorithm that should converge to the approximated system based on accumulation of information regarding the states the system proves to find itself in its evolution. Each such state becomes information to be used in adapting / training the approximating model to better reflect the behavior of the approximated system.

[5] Around 2 450 000 hits on Google for "conferences on economic modeling"

Hypotheses

H1. The approximated system is describable by a continuous function. Even if not true in many cases, the approximation through an analytical function that is continuous is beneficial. The impact of this hypothesis has not yet been evaluated but it is part of the further research plan.

H2. Any kind of model built is supposed to be fully described (a full set of input values, parameters and output values is available). Of course, in the absence of a part of the necessary data the model could either decrease its precision in making predictions or could even become unable make any predictions.

Limits of the model

The theoretical limits of this model are the following:

L1. The approximated function is "known" only through a limited number of values corresponding to a finite number of points (T points). There is infinity of functions that pass exactly through those points. When developing the approximating function, only the smoother functions will be well approximated.

L2. Having only information regarding T points, the convergence can be discussed only in relationship with those points and not with a given continuous function.

L3. Determining the trajectory of the non-linear dynamic system is as well subject to approximations, on top of limits discussed above.

APPROXIMATING THE NONLINEAR SYSTEM FUNCTION

We consider a general form for a dynamic system [3]:

$$\dot{\boldsymbol{x}} = \boldsymbol{F}(\boldsymbol{x}) \quad \textbf{(1)}$$

where x, F(x) $\in \mathbf{R}^n$. The non-linearity of the above system supposes that

$$F(a * x + b * y) <> aF(x) + bF(y)$$

but the proposed method would be applicable both to non-linear and linear systems (for which a much richer range of methods exists).

Comment: the chosen representation of the dynamic system covers the entire relationship between inputs, state parameters and outputs of the system (which would be the traditional representation of a system, as in Figure 1).

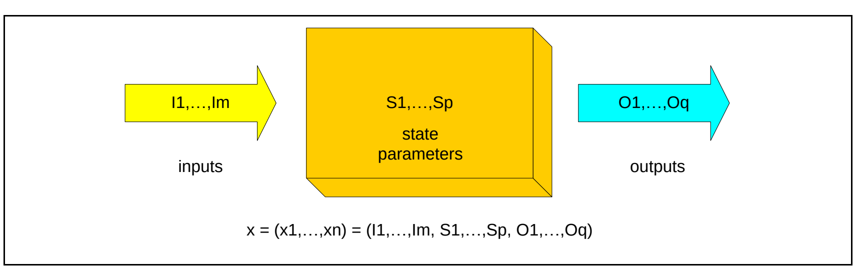

Figure 1: Dynamic system input-state-output representation

Once the function F is known, the evolution of the system itself could be determined with any of the known integration (numerical) methods [4]. A transformation of (1) into a discrete dynamical system leads to a difference equation:

$$\boldsymbol{x_{i+1} - x_i = F(x_i) * (t_{i+1} - t_i),} \qquad \textbf{(2)}$$

which could serve as well in determining approximated future states of the system. Thus, the first step in determining the future evolution of a system is to determine its function F(x).

The approximating function

Let's consider that the observation of the approximated system has led to the following set of data:

$x_1, \dots, x_T$, where, $x_t \in \mathbf{R}^n$ – called the approximation points (3)

and $x_{t+1} = F(x_t) * (t_{t+1} - t_t)$

with $F = (f_1, \dots, f_n)$,

that represent successive states of "to be" approximated system.

The task is to build an approximating function for F based on this data. A wide variety of methods exist already [5]. In order to choose the right solution (existing or new method), the following design specifications have been drawn (S1 … S4).

S1. The approximating function should converge to the "to be approximated" – called from now on "approximated" function in the above T points of $\mathbf{R}^n$;

S2. For each component f_i of F, the approximating function should be built as a sum of simple functions φ_t that each of them have relevant value in the vicinity of one of the approximation points and are tending to zero the farther we are from that vicinity; in this case, we will have **T** simple functions, one for each approximation point and for each component f_i of F;

S3. As the approximated function is supposed to be continuous, we should choose a continuous approximating function;

S4. The **T** approximating simple functions φ_t for each component f_i of F should have more than one parameter in their expression, allowing in this case the imposition of additional conditions.

Based on the above considerations (especially S2), a new method has been developed and the chosen expression for the scalar simple functions φ_t is:

$$\varphi_t \stackrel{\text{def}}{=} \frac{a_t}{(b_t * (x - x_t)^2 + 1)} \qquad (4)$$

where

a_t, b_t *are parameters while* x_t *is one of* T *approximating points in* $\boldsymbol{R}^n$

and $(x - x_t)^2$ is the scalar product of the difference vector $x - x_t$ with itself, x_t is an approximation point and x is another point in $\mathbf{R}^n$ where the approximated value of F is to be calculated.

The chosen function meets the above design specifications. The component f_i of F will have thus the form:

$$f_i = \sum_{t=1}^{T} \varphi_t, \text{ with } f_i, \varphi_t \in \mathbf{R}. \tag{5}$$

Since the approximation of the vector function F is reduced to the approximation of its components, further, we shall discuss the approximation of the scalar function f_i.

The approximation algorithm

Corresponding to each component f_i of F, we extract from the given set of data the relevant components that specify for each $x_t \in \mathbf{R}^n$ the y_t values f_i should have for each approximating point ($f_i(x_t) = x_{t+1}^i \stackrel{\text{def}}{=} y_t$).

The first iteration of the approximating function is defined as follows:

1. Determine the minimum and maximum values of y_t, y_{mn} and y_{mx} and their corresponding approximating points x_{mn} and x_{mx}.
2. Determine the parameters for the first iteration of the approximating function, corresponding to x_{mn} and x_{mx}:

$$f_i^1(x) = \varphi_{mn} + \varphi_{mx} = \frac{a_{mn}}{(b_{mn} * (x - x_{mn})^2 + 1)} + \frac{a_{mx}}{(b_{mx} * (x - x_{mx})^2 + 1)} \tag{6}$$

by imposing the following conditions:

$$f_i^1(x_{mn}) = y_{mn} \tag{7}$$

$$f_i^1(x_{mx}) = y_{mx} \tag{8}$$

and,

$$f_i^1\left(\frac{x_{mn} + x_{mx}}{2}\right) = \frac{y_{mn} + y_{mx}}{2} \tag{9}$$

3. Determine the next-iteration-to-approximate-values :

$$y_t^2 = y_t - f_i^1(x_t) \tag{10}$$

by substracting the approximated through f_i values of y_t from the actual values of y_t.

For a certain iteration “k”, the steps would be similar (Figure 2):

1. Determine the minimum and maximum values of $y_t^k, y_{mn}^k \; and \; y_{mx}^k$, and their corresponding approximating points $x_{mn}^k \; and \; x_{mx}^k$.
2. Determine the parameters for the k-th iteration of the approximating function, corresponding to $x_{mn}^k \; and \; x_{mx}^k$
3. Decide if the stop criterion is met or determine the (k+1)-iteration-to-approximate-values.

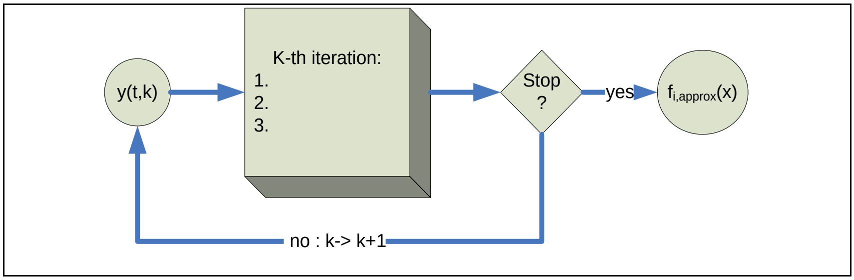

Figure 2: Approximation algorithm representation

The following questions need answer:

- How to calculate the parameters $a_{mn}, a_{mx}, b_{mn}, b_{mx}$?
- Which could be the Stop criterion?

The parameters' expressions are determined by conditions (7), (8) and (9). In addition, as we have three conditions and 4 parameters, we may add the supplementary condition

$$b_{mn} = b_{mx} = b. \tag{11}$$

The results are the following:

$$a_{mn} = \frac{9}{8} * (y_{mn} + \frac{y_{mx}}{3}) \tag{12}$$

$$a_{mx} = \frac{9}{8} * (y_{mx} + \frac{y_{mn}}{3}) \tag{13}$$

$$b = \frac{2}{(x_{mx} - x_{mn})^2} \tag{14}$$

The stop criterion could be given (not the only conceivable one) by the following inequation:

$$\frac{\sum_{t=1}^{T}(y_t - y_t^k)^2}{\sum_{t=1}^{T} y_t^2} < \varepsilon \tag{15}$$

where ε is small enaugh to satisfy the approximation precision neeeds.

The stop criterion is based on the idea that the

- distance between the
    - approximating values and the
    - approximated ones

becomes after k iterations sufficiently (relatively) small as compared to the approximated values (supposing that the approximation method is convergent).

The φ function

As defined in (4), $\varphi_t \stackrel{\text{def}}{=} \frac{a}{(b \;\; *(x-x_t)^2+1)}$; this function has a maximum value of a_t in x_t and tends to zero as x tends to $\pm\infty$. Depending on b_t, it's value becomes

$\frac{a_t}{2}$ when $x = \pm\frac{1}{\sqrt{b}}$ and becomes $\frac{a_t}{10}$ when $x = \pm\frac{3}{\sqrt{b}}$. For simplicity, a=1 and b=1 leads to the graphic presented in Figure 3.

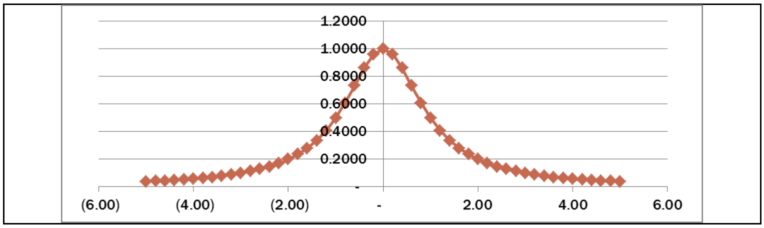

Figure 3: One-dimensional *φ* function function representation

The convergence of the approximation to the approximated function

As the approximated function is known only through its T values (approximation points and their corresponding values) the convergence could be discussed only *within the limits of the convergence of the approximating function to the corresponding known values in the approximation points*.
The degree of convergence is measured by the STOP criterion (15). At the moment of the submittance of this article, no formal demonstration of the convergence was available. However, beyond the intuitive convergence due to the fact that for each iteration the next approximation is made for the previous approximated difference, strong experimental data presented in the next chapter supports this hypothesis. One of the author's objectives is to further formally prove the convergence.

Testing the proposed approximation method

For simplicity reasons and without losing the generality, the testing was done for 1-dimensional functions.
The to-be approximated values were generated using ***52 types of functions***, for which values were calculated in randomly generated points and with randomly generated coefficients for a total of ***1000 cases***.

The Distance between the approximating function and the approximated one has been defined through the following function – see (15):

$$D = \frac{\sum_{t=1}^{T}(y_t - y_t^k)^2}{\sum_{t=1}^{T} y_t^2} \tag{16}$$

The smaller D (the approximation error), the higher the degree of convergence. D was calculated after 10 approximation iterations.

The Figure 4 displays the distribution of D after the 10 approximation iterations.

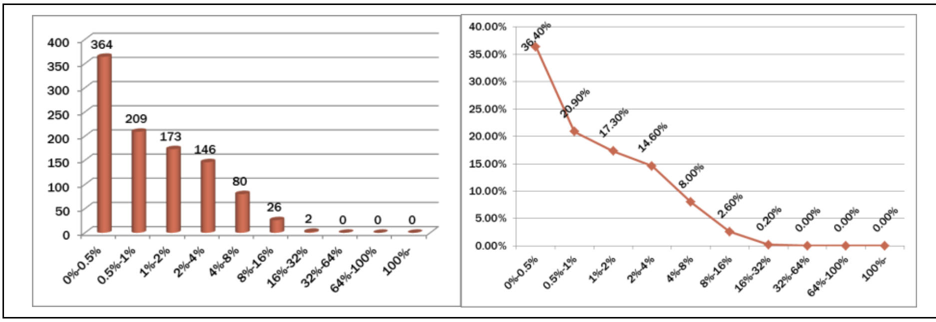

Figure 4: D (approximation error) distribution for 1000 randomly generated cases (left); the same, percentage representation (right)

This shows that after not more than 10 iterations, only:

- 2.8% of the cases had a lower convergence corresponding to D between 8% and 32%.
- About 8% of the cases had a convergence corresponding to D between 4% and 8% and
- the rest of 89.2% of cases had a convergence corresponding to D between 0% and 4%.

Table 1 shows the convergence depending on the type of function approximated.

Table 1: Approximation errors for the 52 types of functions after 10 iterations

	Function Shape Code	Count	Approximation error D
1	-2,0,2,0,-1,1,0	1	21.495%
2	2,-1,0,0,1,-2,0	1	10.683%
3…8	6 different types of functions representing 60 cases out of 1000 have D between 5% and 7%	2	5%-7%
9…28	20 different types of functions, representing 674 cases of the 1000	19	1% - 5%
29…52	24 different types of functions representing 264 cases of the 1000	5	< 1%

With the exception of the first two types of functions having the shape presented sketch-like in Figure 5 – which present a lower degree of convergence (a higher approximation error - D=21,495% and D= 10,683) – the average approximation error for the other types of graphics is below 8%.

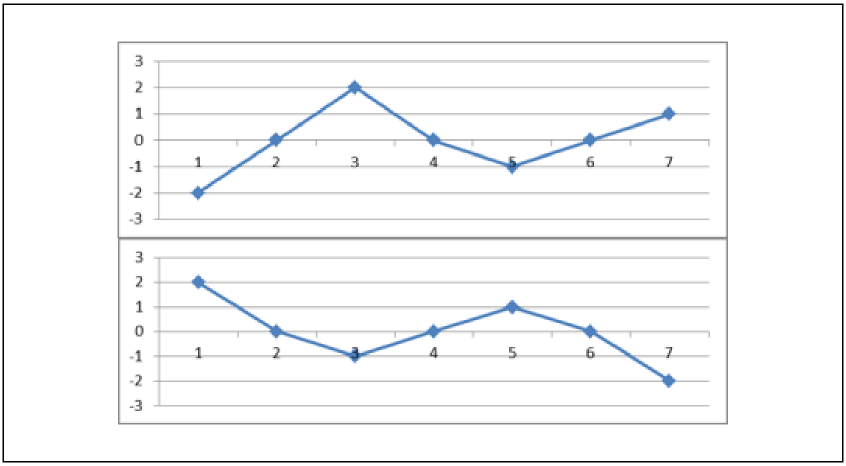

Figure 5: Lower convergence function shapes.

Figure 6 exhibits a number of examples where the approximated and the approximating functions (after 10 iterations) are represented together on the same graphic. Although the Function Shape Codes (FSC) are quite different, the approximations after 10 iterations (which use a maximum of 20 of 30 approximated points as input information) are quite good.

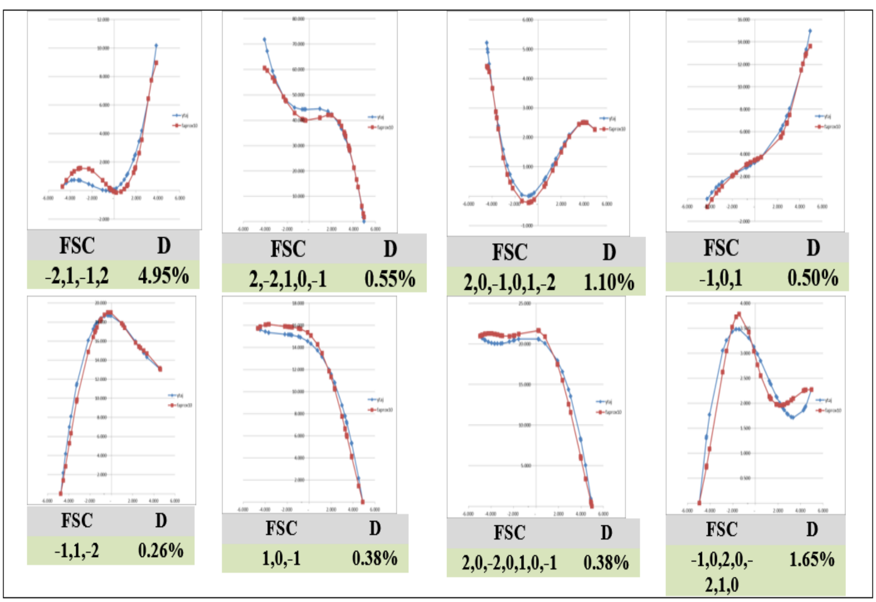

Figure 6: Eight examples of 1-dimensional function approximation

The Development of a Trainable Model [6]

A trainable model should be based on the gradual accumulation of as-much-as-possible non-redundant data, by using (2):

$$\boldsymbol{x_{i+1} - x_i = F(x_i) * (t_{i+1} - t_i)} \qquad \textbf{(2)}$$

Each new input-state-output vector x (called reference vector) should be tested against the model's capability to predict the state based on the previous state.

If the prediction error is below an acceptable threshold, no learning based on this vector should take place.

If the model's capability to predict is affected by an error above the chosen threshold, the new vector should be learned and added to the existing set of reference vectors and the model (the function F – in fact each of its components f_i of F) should be re-approximated through the φ functions associated to each reference vectors **x.**

If associated to a vector x we find two different successor vectors x_{s1} *and* x_{s2} , the interpretation would be that we cannot decide if the prediction should be x_{s1} *or* x_{s2}.

In order to discriminate and choose correctly, additional information is needed and such information should take the form of a "hidden" parameter that would increase the dimension of the input-state-output space by one. Further system evolution should include the values of the new parameter. So inability to predict is a good clue that the system's model is based on an incomplete set of parameters.

Applications in management. Further research

From a management point of view, the main benefit of developing such a system based on the proposed approximation method resides in the possibility to create models, simulate and predict the evolution of the modeled systems, may it be the evolution of a product in a market, of a company in its environment or of another economic sub-system of interest.

Examples of candidate subjects for using the proposed modeling method could be:

(i) market reaction (adoption curve) when introducing a new product based on former experience for similar products (not disruptive ones)

(ii) a company, considering its input-status-output main indicators; possible results: short term predictions on evolution in case of input changes and no additional control loop

(iii) the subsystem formed by a node in a national economy (all the companies having the same activity code), in connection with its neighbouring nodes (suppliers, customers, authorities). The node would be described through a set of parameters such as: input vector from its supplier nodes, performance indicators, output vector for its customers, output to authorities. Possible results would include: short-term predictions regarding the evolution of the node when input vector values are changing.

(iv) the subsystem of currencies and main merchandises quoted by a national bank and corresponding exchanges and its evolution.

The list is scarcely scratching the surface of possible applications.

The next research steps would include:
(i) Improving the existing model and increasing convergence speed
(ii) Evaluate the impact of using a continuous approximating model for maybe discontinuous or even discrete approximated realities
(iii) Formally demonstrating convergence
(iv) Extending experimental trials for n-dimensional data
(v) Developing a trainable model for n-dimensional data that should allow the confrontation of real-life economic sub-systems and their models. Success in this case would bring the benefit of a certain degree of predictability.

CONCLUSIONS

The proposed approximation method provides good results after a small number of iterations and based on around only 2/3 of the approximated points information (not all points' coordinates are used in the formulas – and of course this shows that some approximated points bring redundant information). So it seems to have a fast convergent approximating function that uses a reduced set of data (an efficient use of existing information).

Although no formal demonstration of convergence is available, there is strong experimental (randomly generated cases based) evidence that supports the intuitive hypothesis that the proposed approximation is convergent.

The model presented has appealing managerial implications by simulate and predict the evolution of the modeled systems: may it be the evolution of a product in a market, a company in its environment or another organization of interest.

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Designing a hardware platform for training operators of critical infrastructures

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ABSTRACT

Critical infrastructures could endanger the trainees' lives and/or the environment. The nature of these infrastructures often does not allow staff training in real situations. This paper presents the processes involved in designing a virtual reality platform (hardware and software) to provide a safe training environment, which is believed to be able to better support in the training of staff involved in critical infrastructures. The design of this training platform includes the considerations and adoption of an innovation algorithm based on the TRIZ method. The paper addresses the training process of personnel who operate offshore drilling facilities. The platform is in the physical development stage within the CREVIS project and it will allow personnel training from critical infrastructures in a mixed environment: real / virtual.

Keywords: *training using virtual reality, virtual reality cave system, critical infrastructure training*

INTRODUCTION

Critical infrastructures are those facilities that have an important role in ensuring the security of systems in their functioning and in the flow of economic, social, political, informational and military processes. According to [1], critical infrastructures in Europe include: highway systems, ports, etc., that provide the functioning fundamentals for an economy, physical networks used to connect computers and users and power, water and gas supply systems. These systems cannot be used effectively in the training of personnel without seriously disrupting the normal activities of their operation. Thus, staff training is done mostly in a theoretical way and in some cases on replicas of real systems, in which case the costs are high. Using virtual reality for training operators that work in critical infrastructures is already put into practice by several prestigious institutions such as: New York City Office of Emergency Management (Advanced Disaster Management Simulator – ADMS, the system is concentrated on the simulation of command elements and allows the trainee to navigate within the virtual city with the help of a joystick [2]) or the Los Angeles Police Department (Hydra simulation system for training command officers for disaster category incidents [3]). In the field of training operators for offshore drilling platforms there are a number of training providers who already use complex virtual reality systems and simulation software. Among these we mention: Worldviz [4], that uses a CAVE-like projection system with 5 walls, built by Christie Digital; CM Labs, that uses the Vortex system (Figure 1 – left [5]); and Ari Marine, that includes also a virtual bridge with a 360° projection (Figure 1 – right [6]).

Figure 1: Vortex Master left [5], and Ari Marine [6]

WORK METHODOLOGY

The platform development was done using the methodology presented in Figure 2, based on a QFD – TRIZ combination and with the help of support instruments specific to competitive development.

The methodology (Figure 2) starts with the **Need Analysis**, where using instruments like Brainstorming, Affinity Diagram and Tree Diagram requirements are identified, which refer to the training system. The two diagram-type instruments are used to group and identify stakeholder requirements related to the training process: the employer of the trainee, the trainee, the trainer and the training supplier.
In the second, the **Benchmark Needs** stage, the main competitors are identified, the needs are prioritized using the AHP (Analytical Hierarchy Process) method, the Main Sales Points are established and the Competitor's Performance Levels is determined. Based on the information gathered until this point the training system’s Target Performance Level will be established.

The third phase of the work methodology is the **Analyze CTQs** (Critical-to-Quality), in which classic analysis methods (Brainstorming, Affinity Diagram and Tree Diagram) are used to identify the CTQ elements. These elements will constitute as inputs for the **QFD Matrix**, the fourth stage. After completing the QFD matrix, the correlations between CTQs, the strength of the relationships and the optimization directions will be identified for each requirement related characteristic.

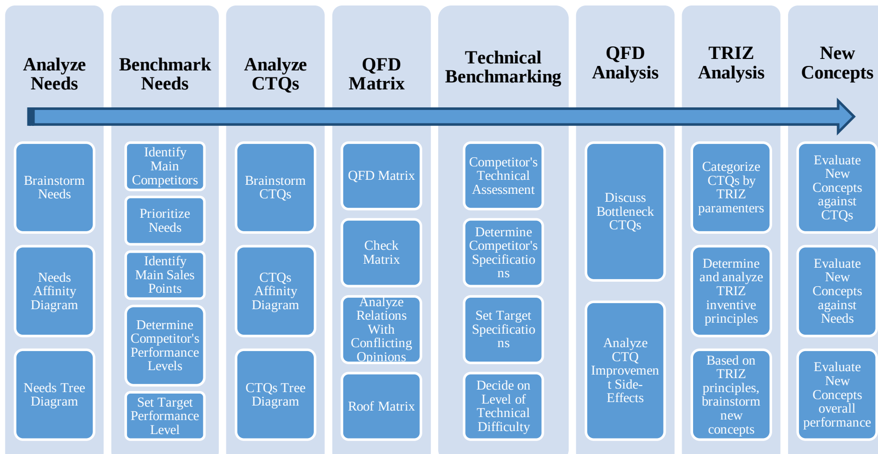


Figure 2: Work methodology

In the next stage (the fifth), called **Technical Benchmarking** a technical evaluation will be carried out following which the important technical specifications are determined. These are grouped into a targeted technical specification set for the training system, which are later analyzed from the difficulty-in-implementation point of view.

In the sixth stage (**QFD Analysis**) Bottlenecks and CTQ Improvement Side-Effects are analyzed (technical impact analysis) and the obtained CTQs represent inputs for the TRIZ method.

The seventh phase implies the use of the **TRIZ Analysis** for generating innovative technical solutions. Thus, each CTQ is equated with a TRIZ method parameter, the main conflicts and the applicable inventive principles are determined and then generic solutions are searched, based on previously known solutions. In the final step of the TRIZ method the generic solutions are interpreted and technical solutions are established in the form of new concepts.

In the final point of the work methodology (**New Concepts**) the concepts are evaluated in comparison with the Needs and the CTQs for determining the extent to which these fulfill the initial needs and requirements.

RESULTS

For efficiently managing the algorithm implementation the Qualica QFD software solution was used as support instrument for deploying the TRIZ, QFD and AHP methods. In the Need Analysis stage a set of 44 requirements was identified for the training system. Using the Affinity Diagram these were grouped and concentrated into 21, which were finally considered as inputs for the Benchmark Needs stage. The main identified competitors are: Ari Simulation, Oiltec Solution, Cubic, QinetiQ, Ksim, Ploaris and Plexsys. The hierarchy of the first five needs resulted from the Benchmark Needs is the following:

1. The ability to create dynamic scenarios
2. To allow the creation of test scenarios
3. Allow the introduction of random elements in scenarios
4. Smart equipment can use for interaction
5. The ability to create or import 3D models

The graphic representation of the entire Benchmark Needs is presented in Figure 3.

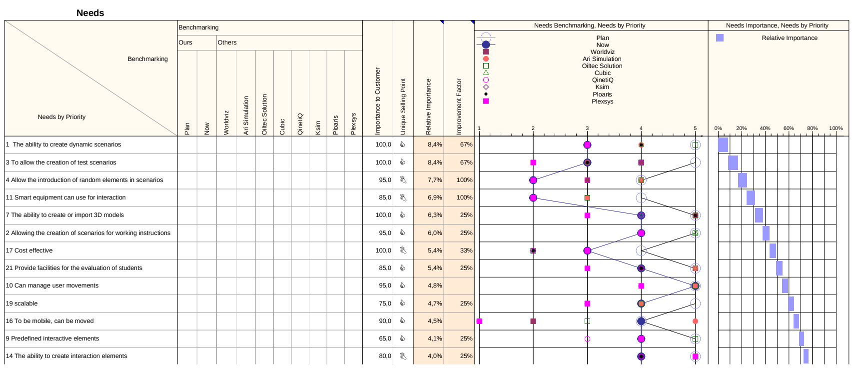


Figure 3: Benchmark Needs results

The prioritization matrix (Figure 4) offers an overview of the correlations between the needs and CTQs and allows the realization of a rigorous implementation plan, based on the importance and influence of the CTQs upon the needs.

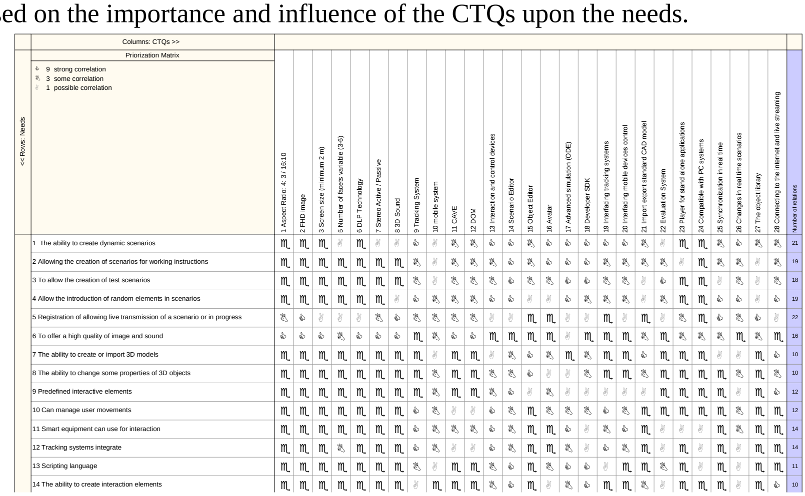


Figure 4: Prioritization Matrix (extract)

In the Technical Benchmarking stage (Figure 5) the following bottlenecks were identified for which solutions have to be found in the innovation phase:

- Tracking System – the necessity of integrating one or more tracking systems (for example, tracking system for the entire body and tracking system only for the hands)
- Scenario Editor – the possibility of creating independent or correlated scenarios
- Advanced simulation – simulating natural phenomena in a realistic way
- Changes in real time scenarios – dynamic modification of a predefined scenario
- Connecting to the internet and live streaming – transmitting and recording a training event

After establishing and prioritizing the CTQs in the QFD stage, within the first step of the TRIZ method they are attributed a TRIZ parameter. The attribution is done based on the similarities between the elements; the association is presented in Table 1.

After attributing the TRIZ parameter the calculation of the contradiction matrix follows; this is done automatically in the Qualica QFD software. The first step in using the above mentioned matrix consists in selecting a parameter that is to be improved (rows). The second step consists in identifying the intersection of the selected parameter with one or more parameters that are in conflict (columns).

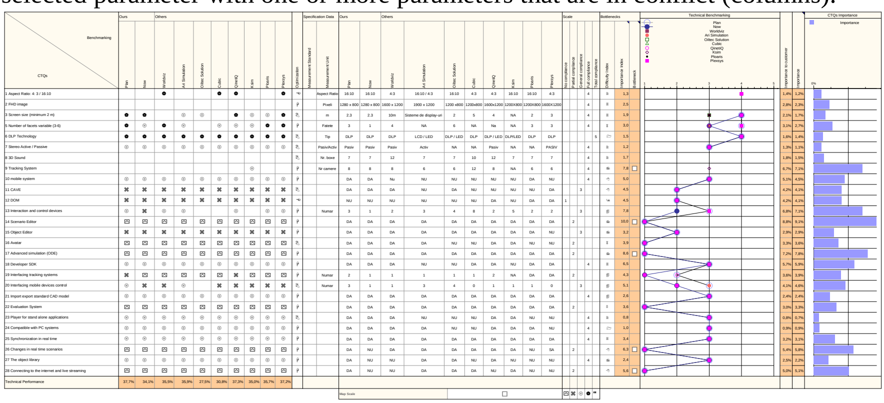


Figure 5: Technical Benchmarking

Table 1: Corespondence between CTQ and TRIZ parameter (Extract)

Aspect Ratio: 4: 3 / 4:10 p.m.	The brilliance / Clarity
FHD image	Strength
Screen size (minimum 2 m)	The ease of being manufactured
Number of facets variable (3-6)	The complexity of device / your system's
DLP Technology	The complexity of device / your system's
Stereo Active / Passive	The brilliance / Clarity
3D Sound	Power
Tracking System	Speed
mobile system	Volume object in motion
CAVE	The complexity of device / your system's
DOM	The complexity of device / your system's

Using Qualica QFD the number of conflicts and solutions are automatically identified with the help of the tables specific to the method. The extracted inventive principles do not represent the solution or solutions for the problem.

They simply indicate a few directions where specialists must look for innovative solutions that can resolve the conflict without compromise. For example, in the case of the Aspect Ratio 4:3 / 16:10 CTQ 23 conflicts were identified. This CTQ recorded conflicts with: Screen Size (min. 2 m), Number of facets variable (3-6), Tracking System, Interaction and control devices, Interfacing mobile devices control, Synchronization in real time, etc.

For the conflict between Aspect Ration 4:3 / 16:10 and Screen size (min. 2 m) the TRIZ Manufacturability parameter was attributed and the following inventive principles were found (see Table 2): Periodic action, Copying, Replacement of a mechanical system and Transformation of the physical and chemical states of an object.

Table 2: Details about Inventive principle.

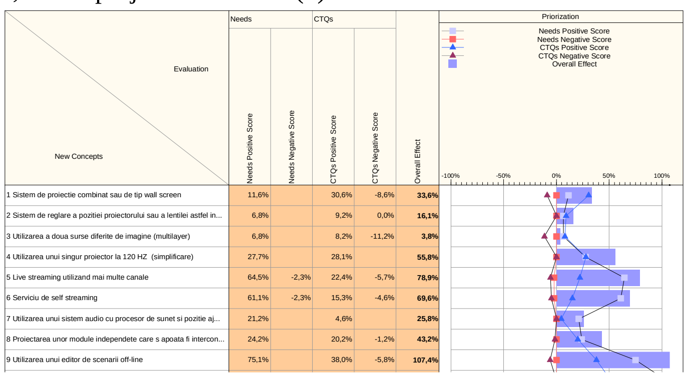
Periodic action	Replace a continuous action with a periodic (pulsed) one. If an action is already periodic, change its frequency. Use pulsed between impulses to provide additional action
Copying	Use a simple and inexpensive copy instead of an object that is complex, expensive, fragile or inconvenient to operate. Replace an object by its optical copy or image. A scale can be used to reduce or enlarge the image. If visible optical copies are used, replace them with infrared or ultraviolet copies
Replacement of a mechanical system	Replace a mechanical system by an optical, acoustical or olfactory (odor) system. Use an electrical, magnetic or electromagnetic field for interaction with the object. Replace fields: Stationary fields with moving fields; Fixed fields with those which change in time; Random fields with structured fields. Use a field in conjunction with ferromagnetic particles
Transformation of the physical and chemical states of an object	Change an object's aggregate state, density distribution, and degree of flexibility, temperature

One of the new developed concepts was based on the following elements: Use a simple and inexpensive copy instead of an object that is complex + Replace a continuous action with a periodic (pulsed) one. If an action is already periodic, change its frequency – the use of a single projector with a minimum frequency of 120 Hz (instead of two projectors) as a source for the stereoscopic image.
After using the TRIZ method a set of new concepts was identified, applicable to system development for training operators of critical infrastructures. In the final step of this methodology they were analyzed from the identified needs and CTQs point

of view, such that by putting them into practice the development of the desired system will be ensured. In Figure 6 the result of this analysis is shown.

After analyzing the concepts presented above these have been grouped into three distinct systems: the software simulation and 3D projection system, the hardware projection and interaction system and the online database with predefined 3D objects and scenarios.

After defining the three systems a market research was carried out for identifying a customizable software solution, that can be used in such a way that the software development part will not start from scratch. This study answers to the identified need of integrating an existing technical solution. After identifying this solution (Eon Studio) the focus was shifted to the design of the projection system (Figure 7). This is composed out of a removable metallic frame (1) shaped as a cube, upon which 3, 4, 5 or 6 projection screens (2) are mounted.



Evaluation / New Concepts	Needs: Needs Positive Score	Needs: Needs Negative Score	CTQs: CTQs Positive Score	CTQs: CTQs Negative Score	Overall Effect
1 Sistem de proiectie combinat sau de tip wall screen	11,6%		30,6%	-8,6%	**33,6%**
2 Sistem de reglare a pozitiei proiectorului sau a lentilei astfel in...	6,8%		9,2%	0,0%	**16,1%**
3 Utilizarea a doua surse diferite de imagine (multilayer)	6,8%		8,2%	-11,2%	**3,8%**
4 Utilizarea unui singur proiector la 120 HZ (simplificare)	27,7%		28,1%		**55,8%**
5 Live streaming utilizand mai multe canale	64,5%	-2,3%	22,4%	-5,7%	**78,9%**
6 Serviciu de self streaming	61,1%	-2,3%	15,3%	-4,6%	**69,6%**
7 Utilizarea unui sistem audio cu procesor de sunet si pozitie aj...	21,2%		4,6%		**25,8%**
8 Proiectarea unor module independete care s apoata fi intercon...	24,2%		20,2%	-1,2%	**43,2%**
9 Utilizarea unui editor de scenarii off-line	75,1%		38,0%	-5,8%	**107,4%**

Figure 6: New concepts evaluation (extract)

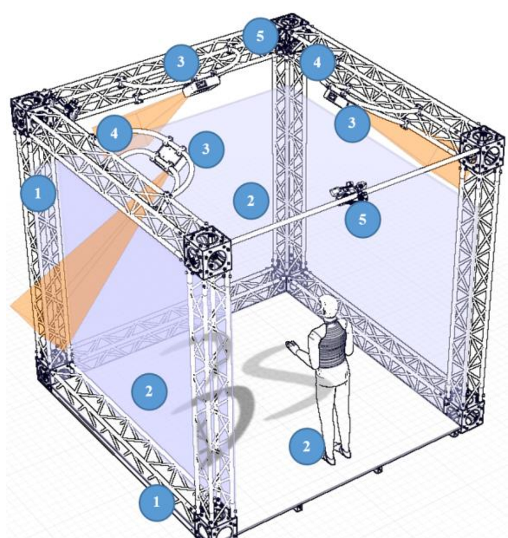


Figure 7: 3D model of the training system

On each side of the cube a 3D projector (3) is mounted that will project on each screen a part of the 3D environment, used in the software simulation of a scenario. The projectors can be fixed on the support beams of the cube with the help of adjustable systems (4), inside or out, depending on the number of used screens. On the metallic structure the sound system and the cameras of the tracking system (5) are mounted.

Because a requirement was identified related to the design of reconfigurable modules that can be connected to the training system for allowing the trainee to enter commands in the simulation using real actuating elements familiar to him from his workplace, a multi-functional panel was designed. This is mounted within the projection system and allows direct interaction with the virtual environment through the command elements placed on it. Other than these, the user can interact with a range of virtual command instruments placed on one of the screens used for the 3D projection. The virtual instruments are actuated by gestures recorded by the tracking system.

CONCLUSION

Using the presented algorithm led to the detailed design of a complex training system, that is in the physical development stage. Every electronic component of the projection system is standardized; the metallic support structure of the projectors and of the other systems (sound tracking, etc.) is customized and was built out of standardized aluminum profiles. The approximate cost of the system is 350,000 EUR for the 4-wall version.

ACKNOWLEDGEMENT

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New Skills in Education for Biodiversity Conservation in Romania

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ABSTRACT

The purpose of this article is to analyse political and regulatory frameworks for connecting education and environment authorities in order to reveal opportunities for introducing new activities based on living organisms into the biology curriculum. The article is also proposing a conceptual framework for capacity building based on the analysis of relevant results at the international level, regarding the experiential learning process. Based on the results of this analysis Romania has the capacity to implement new activities under the public curricula for biology in order to support the development of new skills for ensuring biodiversity conservation as a whole. Moreover, at least three native species, domesticated or wild, may become subjects for next activities development under the existing curricula.

Keywords: *education, new skills, biodiversity conservation, living organisms.*

INTRODUCTION

The current catalyst for socio-economic development worldwide is generally represented by political commitments taken by a State or Government (Robinson, 2004). To know and understand the access to and use of natural resources is a pre-requirement imposed by the country's economic future (Jones, 2005; Tilford and Whyte, 2010). The European Summit in Lisbon set new standards for the EU economy based on sustainable development principles (Jones, 2005) and it is recognized for more than ten years the need to raise the education threshold in the European context (Tessaring and Wannan, 2010). Also these authors pointed out that training and vocational education, are integral parts of the complex process of implementing the Lisbon strategy and may have a contribution to consolidate new competencies undoubtedly supporting this process. In this context the education in classical natural science should make their contributions for this scope. As an example, biodiversity conservation activities, related to tourism in nature, can support new skills development (Lordkipanidze et al 2005). Among the new skills that can support our economic development for 2020 and 2050 respectively, it may include those related to the ability to quickly engage for the balance between production and consumption and the causes that govern the study of living organisms. For biodiversity conservation issues only understanding the principles governing the organization of trophic levels, relationships between them, the logic of top down ecological balances in the trophic pyramid, relationships established into the trophic networks, all are arguments in supporting the development of new skills in the social context as a concept developed in the early '80 by Bill Drayton and Ed Skloot (Light, 2006). Thus, it was long time ago recognized that biology, as a natural science discipline, must find new models for supporting the development of new skills under the same competencies (Mair et al., 2006; Dees, 2007). A series of studies supports the transfer opportunity of ecological models into socio-economic life, through the development of specific entrepreneurial skills and not only, based on developing new skills up to those required for top managers (Westley et al., 2013; Koe and Majid, 2014). Tiere live project implemented in Germany between 2008 and 2010 is a positive example for experiential learning which was defined for more than 50 years ago based on pedagogical experience which now is developed as ELENA project (Sturm et al., 2014). The scope of this article is to analyse political and regulatory frameworks for introducing new activities based on living organisms into the public classes of biology considering the results of Tiere live project from Bavaria as well as of ELENA project and by taking into account our country peculiarities. The article is proposing a conceptual framework based on the analysis of relevant results at the international level regarding the introduction of new activities with living organisms as plants animals and microorganisms, into the public class.

MATERIAL AND METHODS

The study it is applied the SWOT approach to evaluate the political and regulatory frameworks for opportunities related to the introduction of new activities implying living organisms in the current curriculum of biology. The conceptual framework for capacity building is developed based on principles applied for social impact (Vanclay, 2003) and based on the reports of the Comenius Project entitled ELENA or Experiential Learning and Education for Nature Awareness no. 539561-LLP-1-2013-1-DE-COMENIUS-CMP which is a trans-European cooperative project of partners from Germany, Hungary, Romania and Georgia with the aim to promote the awareness of nature and the responsibility for nature.

RESULTS AND DISCUSSION

The implementing process of the classical and theoretical biology curriculum, in public gymnasium or high schools, needs to adapt different practical activities including that supporting biodiversity conservation, based on which new skills may further be developed according to the evolution of our society (Clark, 2001). In many countries scientists and educators signalled that the public and theoretical biology curriculum, among the natural sciences curricula, is not coupled with the progress of society and this may become a real burden for the future conservation of biodiversity (Rosenthal, 1989), mainly due to gaps into education.

Political and regulatory frameworks

Biodiversity conservation as a concept has to be introduced into all appropriate activities supporting the implementation of biology curriculum and not only, due to the commitments taken by every country under any Multilateral Environmental Agreements (MEAs) dealing with the subjects regarding education, communication, information and awareness. The first relevant MEA is the Convention on biological diversity (CBD, 1992) ratified at the global level in 1993. The signatory Parties have assumed political commitments for the development of Communication Education and Participatory Approach tools and methods in synergy with those treaties aiming biodiversity conservation. Under the current national strategy for biodiversity conservation which also aims the implementation of Habitats Directive (92/43/EEC) and Birds Directive (409/79/EEC) there is no goal for coupling biodiversity conservation with public education system (Antofie et al., 2014). Still, to implement environmental policy commitments, Romanian authorities supported the implementation of environmental projects with external funding related to education only as extracurricular activities (Hesselink et al., 2007). However no nature restauration projects are in place and the gaps in implementing the international commitments for biodiversity conservation may be due also to the gaps in the public education (Antofie, 2012). Considering this disjunction between authorities belonging to education and environment, the Aichi Targets of the CBD's strategy are not reachable on *long term* if the current public education system will not adapt to news and will not include new activities in order to support the development of new skills for biodiversity conservation (Antofie et al., 2014). On the other hand the Romanian legislative framework for education is harmonized at the Community level to all Member States. If the simple institutional framework is only involving a voluntary cooperation from the schools side under the Education Law no.1/2011, the implementation of new activities under the same curriculum still needs to develop the long-term institutional framework and mostly cooperation with experts on biodiversity conservation (Antofie et al., 2014). The main form of inter-institutional cooperation in education is the partnership referred to in Art. 14, paragraph 2 of the Law no. 1/2011. Regarding the regulatory framework the schools need to comply also with the European Convention for the protection of vertebrate animals used in experimental and other scientific purposes and transposed the Directive 86/609/EEC which is specifically regulating animal species welfare (Antofie and Stettmer, 2015). Based on this set of regulatory acts, it is possible to orient specific indoor activities, which need new study kits adaptation. Milvus is the non-governmental organization which is deeply involved in the extra-curricular education on ecology, developing education kits for outdoor activities also using living organisms and the pupil proved in time to be more careful and aware about nature. And still there is no experience in implementing new activities in the existing biology curriculum to support the development of new positive emotions and skills for biodiversity conservation (Antofie et al., 2014). Based on ELENA project Romania may have the chance to pilot for the first time new activities within the classical lessons of biology following the Tiere live model, where new skills may be acquired for the protection of biodiversity. However, teachers need training for acquiring new competencies to introduce new activities in close cooperation with experts in biodiversity conservation which will be part of capacity building.

New skills development process

In the last 20 years lot of education studies involved living organisms for teaching students and further more for exploring the competency framework starting with emotion variable, knowledge generation and the development of ethical concerns applied for ecology. Educators, pedagogues, psychologists, teachers and officials hardly contributed during time for introducing living organisms into the indoor classes. Currently an interesting approach for developing new skills based on the same curriculum for biology it is recognized to be already tested experiential learning in which the learner is directly in touch with the realities being studied (Keeton and Tate, 1978). Experiential learning is defined as the generation and/or creation of knowledge through the transformation of experience (Kolb, 1984), or furthermore as the experience involving students in doing things and in thinking about they are doing (Bonwell and Eison, 1991). The scope of developing new skills for biodiversity conservation through experiential learning is closely related to the chosen species: domestic or wild. Thus, working with domestic animals Marshall and collaborators (1998) suggested that experiential learning was effective in addressing at least two skills: hands on experience with livestock and subject cattle competence. These authors' defined cattle handling as the skill perceived to be the most important for the subject of their research or ability to handle cattle which may become important in the biodiversity conservation. It is long time recognized that effective working with living species supports the development of new skills such as understanding their behaviour and needs (Kiley-Worthington, 1990). The generation of positive emotions (e.g. interest, well-being, enjoy and satisfactions) as well as negative emotions (e.g. anxiety, anger and boredom) are part of learning process as well as cognition and motivation (Gläser-Zikuda et al., 2005). These principles were applied in one study the ECOLE-approach (Emotional and Cognitive Aspects of Learning) based on a specific combination of both student-centred and direct instruction also for biodiversity conservation. According to these authors attributions and self-concept are related to emotions generation that should be the subject of research. Moreover, these authors are reminding that internal attributions of success (e.g., having adequate ability) are related to positive achievement-related emotions being in agreement with Weiner (1985). In this regard they underlined that a negative self-concept and negative expectancies of achievements may play a relevant role in generating negative emotions such as anxiety or hopelessness. Emotions, such as interest, facilitate the implementation of activities that provide novelty or challenge, and are closely linked to all self-determined activities relevant for biodiversity conservation. Moreover, animals as healers are supported by the example given by dr. Boris Levinson using for the first time animals in the child psychotherapy and discovering by accident their positive effect in the mental process of the child cited by Kruger and Serpell in 2006. In 2010 Hummel and Randler (2010) are publishing the results for a study conducted in the Primary School and proved that the use of living animals in teaching activities are highly motivating pupils. Thus, emotional variables may have a strong impact on learning and mostly positive emotions play a key-role in the process of knowledge generation. On long term teaching it was proved that positive emotions such as well-being and interest were higher in the pupil with animal treatment where boredom was lower and scientists suggested that living animals should be used in the classroom for long-run teaching lessons. In Germany have been implemented new activities in physics for gymnasium where they investigated cognitive variables, cognitive-emotional variables and emotional variables related to the learning process (Laukenmann et al., 2003). They applied quantitative and qualitative methods and proved that positive emotions are more important in the acquisition phase than in the practice phase in physics supporting in this way the results of Hummel and Randler published in 2010. On contrary, it appears that anxiety plays an ambiguous role in the practice phase. Additionally, it appears that joy about learning in particular and interest are frequently linked to successful learning processes, and not merely to the nature of the subject matter. Randler and co-workers studied in 2005 in Germany the effect of living amphibians in teaching. According to these authors students who participated in the biodiversity conservation activity performed significantly better on achievement tests, and the 4th graders performed better than the 3rd graders, even when controlling for prior knowledge as a covariate, which also showed a significant influence. Moreover, pupils expressed high interest and well-being and low anger. In this case boredom and anxiety correlated negatively with low scores. It should be relevant to consider in this way that for biology classes in case of biodiversity conservation these authors recommend that it is relevant to focus on a small number of species, to start in primary schools to go outdoors and to be linked with common classroom teaching. Continuing this analysis it can be added that the review of Randler and co-workers (2005) describes the results of Kellert from 1985 which identified important changes in the development of children's perceptions towards animals and found distinct responses according to three age stages. Thus in the first stage (i.e. 6-9 years old) they observed changes in affective and emotional variables, in the second stage (i.e. 10-13 years old) they observed a major increase in cognitive abilities and for the last stage (i.e. 13-16 years old) it was observed a dramatic broadening of ethical concerns and ecological applications. However, the evolution of the conceptual framework for capacity building is related to the age group of students. If in the small age classes curiosity and positive emotions are essential for exploring new activities, later they are generating knowledge related to the subject within activities and in the end they develop cognitive connections to solve problems which may be considered as an asset for developing new skills under the same curriculum but implementing new activities. On the other hand it is relevant the site of learning or implementing activities became relevant for the conceptual framework. In 1998 Tunnicliffe, showed that the site where the animal specimens were observed and the manner in which they were 'available for viewing' had an important influence on the content of the conversations. The scientists are considering that farm animals, which were not exhibited elicited predominantly affective, including emotive, responses from the school groups. Later, a study published in 2003, considers that animal-based instruction is still heavily tied to traditional curricular content even from psychological point of view there it is recognized that the animal use in education may have positive effects (Cunningham, 2003). In 2008 Hammann and co-workers revealed that living plant experimentation skills may also be achieved using a germination test. Among the tested skills it can be cited: developing hypotheses, designing experiments and analysing experimental data. Thus, living organisms handling may provide almost all competencies for forming hypothesis for the next activity, designing experiment for how to handle better and analysing data directly based on direct experience. Therefore, it is relevant that the involved teacher to receive appropriate training for implementing new activities under the existing curriculum of biology.

Proposed conceptual framework

As a conceptual framework for capacity building at the school level it is proposed to start with the safer and easier activities, maximum three species, on the small age groups of students for being able to apply a monitoring system for the next two levels. The same lesson may be implemented for three different level of complexity according to the age stage of pupils as described above. The teachers need specialized training to implement new activities and furthermore to work together with species' experts at least in the first stage. The education system needs to support this type of cooperation also to adapt to local level needs. Based on this cooperation all activities will be developed based on the local peculiarities related to the chosen species (i.e. wolf, dog, reptiles and ants) for creating the specific learning environment. The process is not possible to be realized directly at the national level but at a small scale to pilot different activities related to living organisms according to Tiere live model can be (Sturm et al., 2014). The piloting process may be realized but not as a compulsory activity and the teacher needs the signed agreements of parents for ensuring the safety of the pupils. Also, teachers need to know each pupil for their existing phobia in order to avoid the expression of negative emotions. The successful implementation of the results of new activities into the indoor class involving living animals may be used as a threshold for ensuring their further implementation in the public schools. In case of wild native species, it is relevant that the teacher to provide first scientific movies presenting their natural habitats and after that they may implement other activities. In terms of human resources the county inspectorates will become a pivotal element for ensuring the monitoring system of the process.

CONCLUSIONS

Based on this study it is possible in Romania with the support of ELENA project to further develop the education conceptual framework for capacity building at the public school level for implementing new activities implying living organisms under the biology curriculum. Indoor activities involving at least three species may be sufficient for connecting biology and ecology for ensuring the achievement of new skills for pupils that will be involved in the future in biodiversity conservation. Teachers will need training for implementing new activities and for communicate with biodiversity conservation experts.

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The hierarchy of urban transport networks

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ABSTRACT

At the level of premise, most experts agree that, in urban, traveling public wants so-called ex-ante demand do not get to be fulfilled by transmission system exploit, so-called ex post demand level is lower desires the reasons are complex, but the general idea is the network that descends satisfied offer between the two categories of demand. In this material is presented a mathematical model for evaluating the quality of urban transport networks, the proposed hierarchy is determinate by the post central level approach of ex- ante demand of ex -post ideal. The exploitation of urban passenger transport has led to a custom on improving service: It is believed that multiplying the number of routes or vehicles number will bring the ex post level to ex-ante levels. In this paper is demonstrated that this desideratum is impossible to achieve. Like conclusions: numerical values for ex-ante demand near to ex-post demand; a relatively simple instrument, but consistent, to prioritize urban transport networks; a procedure for determining the profitability of "breakthroughs" in constructive structure that would reduce the distance by setting the limit up to which may increase the fare.

Keywords: *ex - ante, ex -post, gravitational model, transport network*

INTRODUCTION

Project assessments in public administration is a very useful step in any action of planning and management, a research technique and an instrument to support public policies , successfully used by officials of the institutions and organizations: project coordinators using evaluation models for notify, in due time, the effects of interventions that they implement or intend to implement
The plain purpose is to apprehend and timely counter undesirable effects on groups of people, communities and society. The purpose of evaluation is thus systematically collect information on outcomes, outputs and project management to improve implementation and the generation of future performance decisions. Summarily, different valuation models are used to minimize losses and maximize the benefits of interventions.

Throughout its evolution, the assessment has received many definitions. A synthesis of given the definitions by different dictionaries reveals key terms: character, value, social price, etc. The evaluation of projects or programs is closely linked to the meaning of these terms, but without summarizing them. In his book "Analysis and research in public administration", Dan Sandor describes synthetic that "for a project involving a systematic evaluation in order to determine if and to what extent the project was implemented according intentions and achieved their objectives "; and further, in the above study are remembered the 5 criteria of assessment proposed by the European Commission: relevance, effectiveness, efficiency, impact, sustainability.

Based on this platform, evaluation is the process by which, using methods and specific instruments can measure the degree to which projects have goals and significant results, resources are economically justified if the project has chance to continue after implementation phase, the measure in which the activities "satisfy their" target group and their impact is felt long term.

Specifying - but customizing the criteria and proposed goal that material namely HIERARCHY OF TRANSPORT Passenger Network in urban area - based on the schedule below can consider the following:
Relevance refers to the extent to which the targeted network fails to meet the real needs of the lead actor = the passengers. A network is relevant if it has throughout its operation flexibility needed to expand / reposition them whenever necessary to meet that aims to answer: a network becomes inconsistent when, during its existence, fails to cover the needs that propose to cover or cover them incorrectly, based on the original plan.

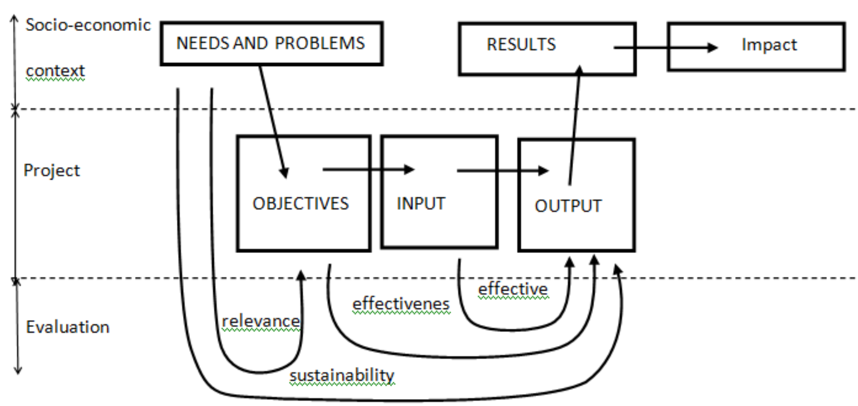

Figure 1: The main criteria for evaluation

Efficacy is the extent to which the network achieves its objectives: transportation demand ex-ante.
EX-ante demand = the crowds of trip that concern the member of the city and which cover the collective   needs. It can be determined by performing surveys to the city population.
Ex-post demand = number of effective registered trips on passenger transport network. It is determinate from profits.

Efficiency considers a further aspect, essential in the operation of a network: how expensive it is to satisfy demand ex-ante and how far it can go down; i.e. ex-ante demand can be financially justified?

Impact represents the net effect of a project produces. Because external variables, the distorting impact of a project is difficult to calculate accurately: it is difficult to differentiate the effect of a project implemented in a socio-economic context, usually extremely complex. However using appropriate methods possible, with a margin of error assumed to obtain answers to the following questions:

- What changes resulted from the project?
- How many of the benefits achievable considered perfect were reached?
- There are other benefits of the project, along with the expected?

Sustainability refers to perpetuate the exploitation of certain networks, validating the date of certainty of covering ex-post application envisaged for implementation, namely the achievement level of revenues which allows decent subsidy request.
In the same sense:

- Network benefits from quality feature? = Access to services provided by the network provides the same treatment regardless of age, gender, social and material conditions.
- Organizational context of the carrier allows, if not community participation, at least consulting them?

The starting point of this material is found in the last sentence: how to consult the community if there is not objective evaluation which allows a hierarchy of two networks?

Summarizing, the analyst can call the following essential elements of an evaluation

a. Evaluation is a process explanatory: starts from formulating pertinent questions to which answers must be found lucrative;
b. It involves judgments based on criteria;
c. Evaluation is a systematic activity and claims scientific analysis (data collection, their analysis, their comparison based on certain criteria);
d. The evaluation is useful in every step of development of a project:

- In the design stage;
- Before implementation-ex-ante evaluation ;
- During implementation – simultaneously evaluation
- After implementation –ex- post evaluation

e. Evaluation underlies decision making in relation to the evaluated project: changing the design or implementation mode and decisions may relate to the continuation, modification or even stop the project

Next statement at explaining - with the authors' opinion – unwares interest, but now that we have the passengers: "What makes me mood overlaps my needs "? In other words, the difference between ex-ante and ex-post is even decent?
Ex-ante evaluation is the result of a type made in the first step that may lead to the establishment of a network of public transportation (planning and design phase), before being taken to implement the decision. Ex-ante evaluation involves an

analysis which will be considered defining characteristics of the population and the location where the project is implemented, respective an analysis of the socio-economic needs of the type identified. This type of evaluation HOME NEEDS TO BE A FUTURE NETWORK answer is the number of trips that will satisfy the "wishes" CITIZENS (at least mostly). Ex Post is the result of a project type of analysis solution, mainly from the supply concrete compared with estimated demand. In addition to assessment methods and analysis of results and impact, ex-post evaluation methods can also be used as: cost-benefit analysis, cost-effectiveness and multi-attribute analysis. The purpose of ex-post evaluation is multiple: to quantify the results and effects of the project intentional or not, qualitative and quantitative performance analysis, benchmarking project evaluated the

CONCRET: ENOUGH TO BE A FUNCTIONAL NETWORK TO COVER THE NUMBER OF TRIPS IS EFFECTIVE SATISFIED BEING SITUATED WITHIN ACCEPTABLE ERROR NEAR TO CITIZENS DESIRES.

THE MATHEMATICAL MODEL

Question: How can be compared intrinsically two networks of public transportation lines for one and the same city? The key word of the question is 'intrinsic' to our own side is something essential. Intrinsic is the antonym of "extrinsic" which comes from outside, from sensory reflection on work; in the latter context can be considered:

- The number of lines that form networks;
- Accumulation km. route
- Number of transshipment - on average - the traveler is obliged to do to get to the destination;
- The number of boarding-landing stations; etc.

But only elements that are extrinsic origin.

In contrast, intrinsic analysis should provide the opportunity to compare two networks to their usefulness, their value of use.

The authors consider that, in the highest degree, share - ex-post - which provides ex-ante demand networks is an inherently very strong indicator.

Either situation „benchmark” areas where distances between centroids can be considered completed „bird in flight” which translates into is why the movement is straight or nothing prevents the easiest journey - in topological limit provided by town.

Most of the models for determining the number of trips made "in exchange" between each two parts of an urban localities, starting from Newton's formula - adapted situation - having a single parameter set (k):

$$N_{ij} = k \frac{P_i P_j}{d_{ij}^2}$$

(Where P is the number of inhabitants, d is the distance between the two centroids areas).

Some of the designs presented admit and power denominator above relationship may become constant, a parameter.
Finally, there is a model - Taylor - who admits the hypothesis that each of the areas - home some other destination - have their own specific, such as parameter k replaced by a product of two parameters (A and B) custom each area separately.
More detailed analysis of the model shows that the distance between centroids Taylor is in fact a matter of "choice" available to researchers, because there is no accepted principle that indicates how detailed should be split surfaces - even equip these areas with densities different population, with economic centers more or less active bias points of interest, etc .; or by dividing itself in areas introduce a hypothesis which predetermine the results (eg the number of trips is completely another mathematical obtained if Bucharest is divided into 6 zones according to sectors or areas 160 according neighborhoods).
In other words: it is relatively easy to prove that mathematically determined number of trips depends on the details of zoning and model Taylor can be reached due to be dominated by more than 4 parameters:

a. A - to characterize the influence area of origin.
b. B - to characterize the influence zone of destination
c. d_{ii} - to characterize the expansion areas.
d. p - weighting distance d (corresponding to "impedance" attached distance)

but also the need of transshipments (the authors consider this material as simple recording of the number of km. that separate the two centroids is not sufficiently relevant, as the distance d may be encumbered and a number of transshipments which would translate into a number km. additional (which simply record the number of km. physical might to "hide" immediately visible).
Mathematical relationships (and notations) Taylor generalized model are:

$$T_{ij} = A_i B_j \frac{Q_i D_j}{d_{ij}^p}$$

T_{ij} – is the number of trips from i to j
A_i – origin parameter
B_j – parameter destination

Q_i – the total number of trips that originate in
D_j – total number of trips that destination in j
d_{ij} – distance between centroids respectively origin destination
p – distance modulator (impedance)
considering:

$$\sum_{i=1}^{n} Q_i = \sum_{j=1}^{n} D_j = \sum_{i=1}^{n}\sum_{j=1}^{n} T_{ij}$$

$$Q_i = \sum_{i=1}^{n} T_{ij}$$

$$D_j = \sum_{j=1}^{n} T_{ij}$$

$$A_i^k = \frac{1}{\sum_{j=1}^{n} \frac{B_j^k D_j}{d_{ij}^k}}$$

$$B_j^k = \frac{1}{\sum_{i=1}^{n} \frac{A_i^k Q_i}{d_{ij}^k}}$$

As a parameter cannot be determined only knowing the parameter B and reverse appears to be a logical vicious circle; in fact determination is made from an initial value (e.g. $A_i^0 = 1$) and a simple routine allows obtaining concrete values for the two parameters by tolerant (alpha):

$$\alpha_1 < \frac{A_i^k}{A_i^{k-1}} < \alpha_2$$

$$\alpha_1 < \frac{B_j^k}{B_j^{k-1}} < \alpha_2$$

exemplification

To obtain numerical results was established several sites EXCEL sheet with which they were able to give consideration on the interactions between parameters that make up the mathematical relations above.

Thus:

- parameter "transshipment simple" = 1 km.
- parameter "double transshipment" = 2 km.
- parameter that represents impedance ("exponent") = 1.5
- parameter that represents the area stretching generates dimensions withdrawn unserviced of 2 km.

They were obtained:

1. for a simple network (lines connecting two nodes only fig. 2) ex-post value of travel reaches 55.96% of the ex-ante trips
2. for the most complex network (lines connecting two nodes only fig. 3) ex-ante value of travel reaches 59.06% of the ex-post trips
3. for IDEAL IN TERMS network topology (consisting of lines "bird in flight" fig. 4) the ex-post touches to travel 64.07% of the ex-ante trips.

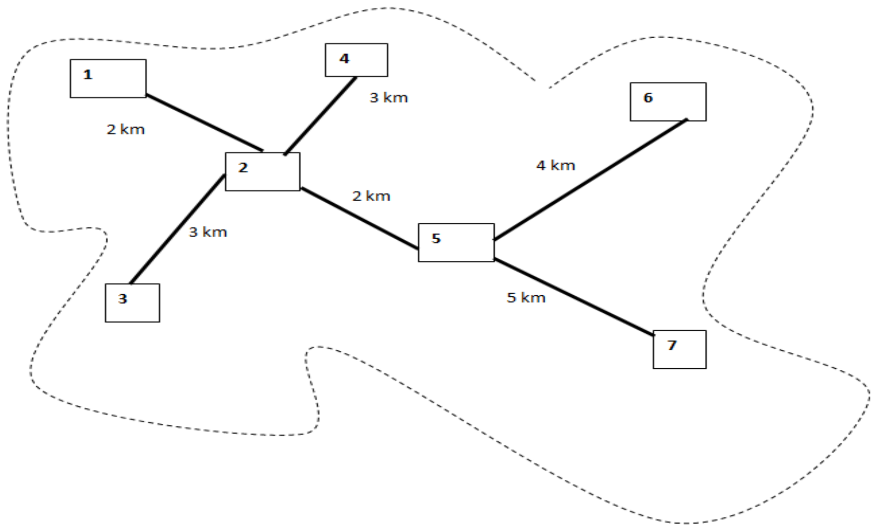

Figure 2: Example for the lowest network

Note 1: Where is the difference to 100%? Answer: Trips that people prefer to walk or perform its own due to impedance - unsatisfactory - to travel. Particularly, the difference of 36% compared to ex-ante demand would be satisfied Network "ideal" demonstrates that distances itself does not possess utmost importance in view of the passengers and the price, duration, convenience, etc. the citizens have greater importance than a kilometer.

Note 1: how significant are the few achievements percent difference between the most simple transport networks and the most complex network? Answer: at one year, plus the number of trips attracted by network omnipotence is 24-25 million in the context of daily trips 3810000 revealed by surveys before applying the model

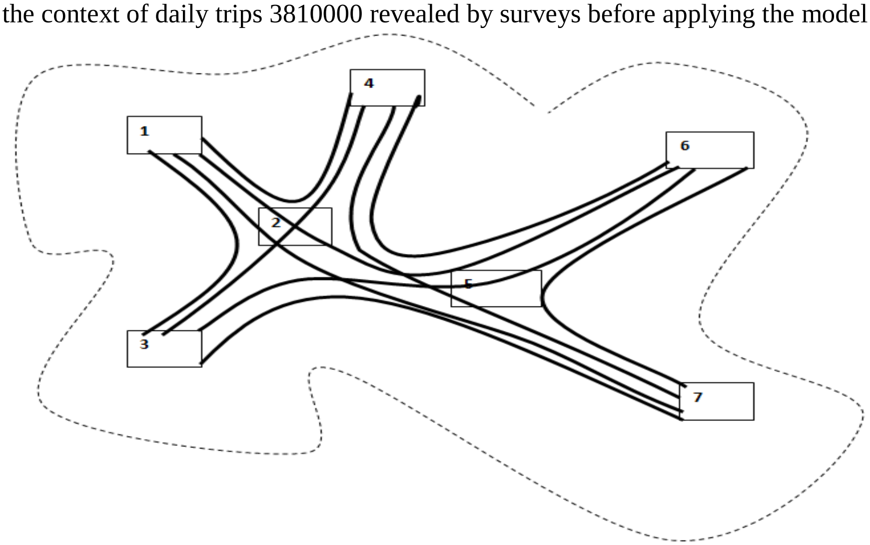

Figure 3: Example of the most comprehensive network

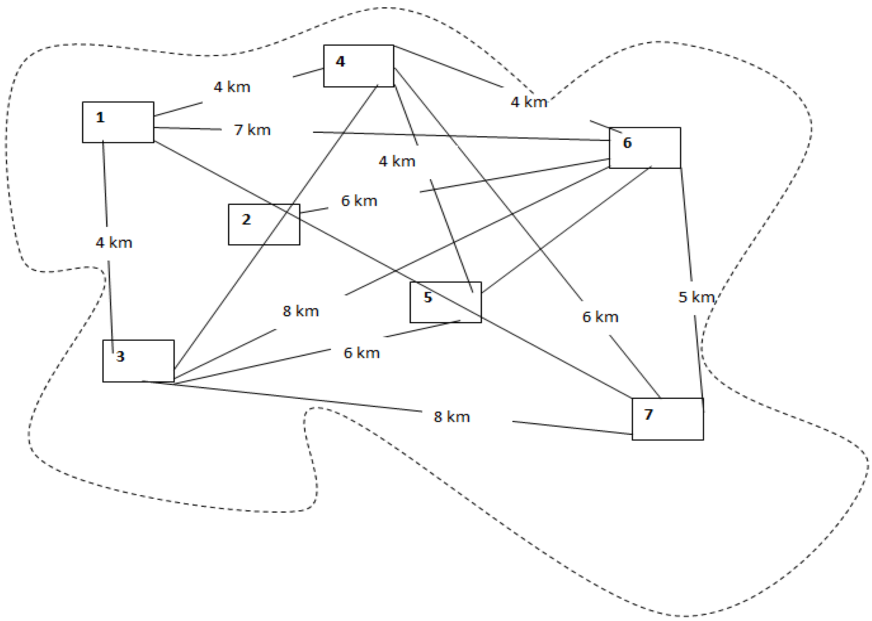

Figure 4: Example of network "ideal": all the nodes are connected by the smallest distance possible (the topology locality)

Case study

Determining the ratio between supply and demand ex post ex-ante was the main objective of the material; the secondary objective is to obtain relations "evidence" in the light carrier which may be the limit up to which would justify a price increase for example, given that through constructive measures and / or organizational reduce the distance between the origin and destination of a journey?

In the present paper, impedance is considered as a whole "difficulties" encountered in action movement; which is expressed impedance value is proportional to:

- distance to go (walk to the station from the station boarding or landing, but not in the middle distance transport)
- traveling term
- due to the financial cost carrier
- Other costs depend on convenience, hygiene, ease of buying IDs, etc ..

Heterogeneity space and time consuming imposed analysts to resort to mathematical models that take into account the impedance of the driving equip every "elementary unit of length" belonging continuous space with more attributes than simple mileage. A relative term the usefulness of the concept of impedance is shown below. The relationship mathematics required is:

$$(d - \Delta d)_{ij}^{p+\Delta p} = d_{ij}^{p}$$

That is: if diminishes with distance Δd is permissible for keeping balance growth with Δp impedance. Deep explanation: decent growth is lower threshold impedance value calculated above corresponding relationship:

- increasing the impedance which is similar to a consideration "deserved" the carrier for the effort to minimize the distance
  the remainder of the limit determined in accordance mathematics being developed is similar to a big improvement in terms of the traveling public- who wins in the characteristic of the "miles in the transport system" but not lose all the other features of impedance- to the extent that would allow cold mathematical judgment.

Logarithming and grouping last relations obtain appropriate terms:

$$\Delta p = \frac{\ln(d)}{\ln(d - \Delta d)} - 1$$

Mutual chart depicting functionality, demonstrating: with as reducing the distance between the ends of the journey is higher, so the justification is stronger magnification supported Mathematical price.

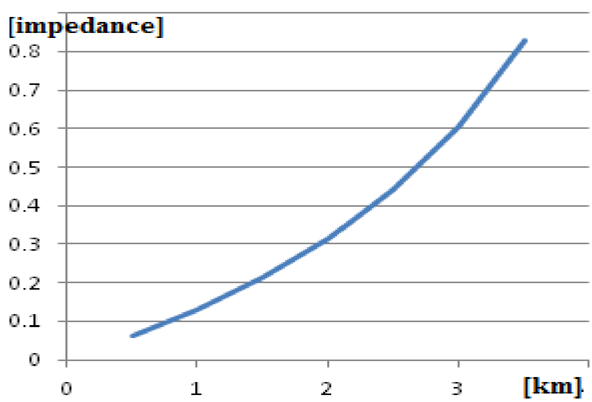

Figure 5: THE CHART Δp = fct(Δd), where OX= [KM] and OY=[IMPEDANCE]. Curve increasing variation in impedance for care situation is completely justified mathematically.

CONCLUSION

This material offers:

- numerical values for ex-ante demand near to ex-post demand;
- a relatively simple instrument, but consistent, to prioritize urban transport networks;
- the possibility of "equivalence" between measurable elements (distance = km.) and hardly measurable elements (e.g. transshipment);

- a procedure for determining the profitability of "breakthroughs" in constructive structure that would reduce the distance by setting the limit up to which may increase the fare.

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