



Project Title: Innovating Education of Talents in Chemistry for Business Success in SMEs' Innovations - InnoChem

Output Title: Road Map – Czech Republic 2017

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Introduction - characterization of the chemical industry in the Czech Republic and innovative trends

Characterization of the chemical sector in the Czech Republic

Chemical industry in the Czech Republic has a tradition and good scientific and research background.

Currently, there is a large space for highly innovative small and medium businesses in new fields - nanotechnology, nanomaterials, chemicals based on natural substances, etc. The chemical industry in the Czech Republic comprise of a wide range of technologies and supplies variety of products.

High volume technologies produce inorganic chemicals, monomers and other petrochemical products, fertilizers, food additives etc. However, the chemical industry in the Czech Republic has a negative trade (export/ import) balance.

Chemical industry in the Czech Republic takes a share of 4.2 percent of employees in the labor market (4Q 2015 data).

Product innovation trends and their perspectives in the country

The overall dynamics of innovation activity is rather low, technologically demanding and specialized products are often imported from abroad.

Innovations aim at the area of new materials (nanotechnology, nanomaterials and biotechnology) and streamlining of chemical processes in the Czech chemical industry. In addition to the research of new chemical compounds, it is also the area of energy savings.

The main philosophy of innovation in the chemical industry is to maintain competitiveness and sustainability, as well as increase environmental responsibility.

0. Summary of the key findings of SQA - the critical skills needed for innovations

A set of critical skills (scientific, technical, business/ economical, and personal/ soft) was defined for evaluation of interest from potential employees (Czech Republic), especially SMEs.

Five most important criteria – the most commonly rated

Set of scientific and technical skills

Engineers

- Inorganic chemistry
- Organic chemistry
- Polymer chemistry
- Process control and optimization
- Production logistics

Scientists

- Inorganic chemistry
- Organic chemistry
- Polymer chemistry
- Analytical chemistry (incl. Spectroscopic techniques)
- Process design
- Product development

Set of business skills

Engineers

- Quality Management
- Understanding suppliers & customers
- Project Management skills
- Cost Optimization
- Innovation Management Skills

Scientists

- Intellectual Property Law
- Understanding suppliers & customers
- Project Management skills
- Innovation Management Skills

Set of personal skills

Engineers

- Communication skills (verbal/ written)
- Problem solving skills (analytical, reasoning)
- Decision making skills
- Ability to work independently (self-management)
- Teamwork
- Organizational skills

Scientists

- Language / intercultural skills
- Creative thinking skills
- Problem solving skills (analytical, reasoning)
- Ability to work independently (self-management)
- Teamwork

1. Educational strategy, key and supporting objectives

1.1. Overall strategy of tertiary education

An important point of improvement in the system of tertiary technical education is a closer cooperation between universities and industry:

- Involvement of practitioners
- More space for student internship, optimization of its activities to be attractive for students and beneficial for industrial partners
- Support the research programs in the industry
- Deepening the scientific and research cooperation between universities and industry (joint research projects, resolving of actual problems of industrial partners)
- Increasing the attractiveness of the study.

1.2. Key objectives and supporting objectives

- Closer cooperation with industry
- Higher degree of communication from major employers to graduates and students → web portal/sites „CHEMJOBS“
- Increase students' knowledge about their own expert fields
- Student internships should be compulsory part of study
- Involvement of practitioners in teaching (special lectures in the framework of regular subject)
- Innovating curricula for tertiary education
- Support of industry needed → create a study program structure according to the requirements of chemical companies

- Actualization, supplementation and modification of current curricula
- Creation of a new curricula
- Support for further education – creation of professional qualifications
- Creation of criteria and evaluation standards for obtaining of professional qualifications

2. Enlargement of communication with students and industrial partners

2.11. Discussion of university representatives with students

Students of Bachelor, Master and Doctoral study programs are interested in all news and events on the Faculty of Environmental Technology (further “Faculty”), thus it would be helpful to support and develop communication between university officials and the students in the form of discussion meetings at round table. The first such meeting was already held in December 2016. Many students of all year groups took part as well as academics, namely the Dean of the Faculty Vladimír Kočí, the chairman of Faculty Academic Senate Eva Mištová, the member of Academic Senate assoc. Jan Bartáček and the representative of the department of education Šárka Dintarová. The following conclusions for development and improving the study at the Faculty and conclusions for general improving of university surrounding resulted from this meeting:

1. Subjects are not tied together – Some subjects of Bachelor study programs do not take the best benefit of their potential. For example, in the Degree study program Chemistry and Toxicology of Environment or Waste Management.
2. Subjects in English – discussion about introducing of selected subject taught in English (for example in Master’s branches of study).
3. Improvement of availability of information about new branches of study.
4. Freedom of subject choice – study programs are almost entirely composed of compulsory subjects. There is not much scope for individual profiling of a student. Limited possibilities for subjects, some subjects are overlapping.
5. Well appreciated is the accessibility of information about the Faculty - Faculty Facebook page, "first-year student guide " contains more information, communication of students with academics.
6. The proposal for implementing new lecture concerning the introduction into study, formal processes and procedures of the university, study system and activities of university departments at which the students can actively work.
7. Familiarization of students with the work of the Faculty Senate and with its student members’ activities. Transfer of information from the Senate with Faculty Facebook page.



Fig. 1: The meeting for students of Faculty of Environmental technology held in 2016

Organization of this type of meetings will be supported in the future. We will also discuss the possibility of foundation of a student's association for easier communication and reporting proposals to faculty representatives.

2.2. Discussion of university management with employees

An annual New Year meeting of Faculty's employees and doctoral students with the Dean of the faculty will be always focused on current issues of the academic environment, which influence life of the Faculty.

2.3. Meetings of former graduates and employers with students

2.3.1. Conference 4elements

The Faculty will organize meetings under the name "4elements". There will be two types of the meeting:

- Summer meeting – It is the Community day of the Faculty, which is focused on teambuilding and sport activities, formal and informal cooperation across the Faculty and the opportunity to meet colleagues informally in their free time. Moreover, there are interesting lectures focused on soft skills, which directly or indirectly relate to everyday scientific and pedagogical activities. The lecture topics are selected to be as attractive as possible for doctoral students even for Faculty employees. Another part of the program is a meeting with former successful graduates of University of Chemistry and Technology.
- Winter meeting is focused on presentation of original student scientific works and on communication between all research teams from Faculty of Environmental Technology. The purpose of winter meeting is the presentation of solutions of problems connected



with all elements forming our environment: water, air, earth and fire (energy). We want to start discussion among doctoral students, who form the key part of the Faculty. At the same time, we want to present the research activities of the Faculty to other institutions and public. Therefore, the organizers will invite guests from state administration and representatives of key industrial partners of UCT. Winter meeting 4elements will include lecture and poster sessions.

2.3.2. Round table “Study in practice - Practice in study”

In the framework of Innochem project, a special meeting was held in May 2016. Representatives of university management, university employees, potential industrial partners, potential employers of future graduates and students were present. Activities of various companies were presented. These presentations included also offers of jobs and student jobs, proposals for cooperation and topics for Bachelor’s and Master’s Thesis, which solve real problems and needs of industry. These meetings will be not only opportunity for industrial companies to present their activities, but representatives of these companies can outline their requirements for knowledges and skills of students and graduates (future employees). At the same time, the representatives can give proposals for new subjects for teaching. The meetings described above will be held regularly as a discussion forum for convergence of education given by university with actual needs of industrial partners.

2.4. Communication with industrial partners - web pages

Employers often require young graduates seeking work to have some professional experience. In spite of students often apply working holidays and temporary jobs; it is difficult for them to gain relevant experience. That is why it is suitable to make contacts between students and employers in that way, so that the students can get the professional experience already during their study. One way leading to this goal is the creation of career portal, which would respond to actual situation in offers of jobs, partial jobs, work holidays, internships and trainings related to professional activities of the Faculty.

Employers have been interested in students from our university, but there have been no suitable and effective way to contact them. On the other hand, thanks to career portal the students can more easily find job, partial jobs, or suitable internship. Employers will be able to find students and new graduates in other way than via known social network, for example LinkedIn. The creation of our own career portal, which connects students having particular skills with appropriate job offers, can help also the employers

The portal, which would be created according to experience of British and American universities, can show to students even to companies if a student’s qualification is in accordance with an employer’s demands. This system was proven by famous universities for example by American university Yale or by British Oxford and Cambridge. The students get an overview,

which skills they should evolve to get a job more easily. The portal could get necessary information directly from UCT information system (SIS) and in the future, employers could find out which subjects a student passed. On the other hand, a student could compare its academic achievement with academic achievement of other students, although employers say, that students' academic achievement is not the most important criterion. With the agreement of students, it would be also possible to create a database containing information about students. The employers thus could search suitable candidate for their free job positions. Competent employees of industrial partners will be able to announce their proposals for Bachelor's and Master's Thesis. This kind of cooperation between university and companies will bring benefits to both sides.

2.5. Communication with industrial partners and public - Faculty Facebook page

The next way of the communication enlargement is also Faculty Facebook page. At present time, its content is regularly up-dated and extended by interesting events happened at Faculty's departments. The Faculty Facebook will be regularly updated even in the future. At present time, there is available a lot of information from the area of engineering and nature sciences on the web page: <https://www.facebook.com/VSCHTFTOP/>

3. Innovation of the structure of education

3.1. Modification of the structure of Bachelor curricula - the plan of the study structure

At present time, our Faculty prepares changes in the structure of Bachelor study. The Bachelor study will consist of three study programs focused on topics from the area of fuels, energy and environment. Particulate programs can be characterized by following key words:

1st Program: industry and environment; energy, technology of fuels, secondary raw materials; an engineering approach to solve problems and needs of industry and environment.

2nd Program: particulate components of environment and their complexity; water, air, soil, sediments; removing contaminants from environment; a synthetic approach to solve environmental problems.

3rd Program: man and environment; toxic substances in environment, their determination and impacts; analytical approach to problems connected with environmental protection and protection of human health.

Traditional Master study programs will follow up new Bachelor study programs. The traditional Master study programs include energy, production and processing of crude oil, solid,



gaseous and alternative fuels, water technology, waste technology and environmental protection and industrial ecology.

The first proposals of a new structure of Bachelor study for curricula are presented in the following tables.

Energy and Fuels							
1. study year							
Winter semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N101002	Chemical Calculations	101	0	2	0	c	2
N101005	Inorganic and General Chemistry I	101	3	2	0	c,T	8
N215022	Application of Computer Techniques	215	0	3	0	c	3
N216034	Climatic change	216	2	0	0	T	3
N218026	Alternative energy sources	218	2	0	0	T	3
N240011	Toxicology a ecotoxicology I	240	2	0	0	T	3
N413022	Mathematics I	413	3	4	0	c,T	9
							30
Summer semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N101003	Laboratory of inorganic chemistry	101	0	0	4	c	3
N110004	Organic chemistry	110	2	2	0	c,T	6
N218027	Alternative energy sources II	218	2	0	0	T	3
N240009	Environmental engineering	240	3	0	0	T	5
N444001	Physics	444	3	2	0	c,T	7
N834008	English language	834	0	2	0	c	1
							25
2. study year							
Winter semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N110002	Laboratory of organic chemistry	110	0	0	4	c	3

Energy and Fuels							
N216003	Fundamentals of Coal and Gas Processing and Utilization	216	2	0	0	T	3
new	Environmental chemistry	240	2	0	0	T	3
N320001	Biochemistry I	320	3	0	0	T	5
N403011	Physical Chemistry	403	3	2	0	c,T	6
N444003	Laboratory of Physics	444	0	0	3	c	3
N834009	English language	834	0	2	0	c,T	2
Summer semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N216026	Fundamentals of Purification of Waste Gases	216	2	1	0	c,T	4
N216028	Basic environmental legislation	216	2	0	0	T	3
N218004	Energy and environment	218	2	1	0	c,T	4
N218016	Sources of Chemical Information	218	0	3	0	c	3
N402002	Analytical chemistry	402	2	2	0	c,T	5
N403013	Laboratory of physical chemistry	403	0	0	4	c	3
N409002	Chemical engineering	409	2	3	0	c,T	6
							28
3. study year							
Winter semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N215005	Fundamentals of Petroleum Processing and Utilization	215	2	0	0	T	3
N215007	Fuels Analysis	215	3	0	0	T	5

Energy and Fuels							
N218023	Nuclear Energy & Radioactive Waste	218	2	0	0	T	3
N251005	Laboratory of fuels	251	0	0	6	c	4
N402003	Laboratory of analytical chemistry	402	0	0	5	c	4
N409003	Chemical engineering	409	2	3	0	c,T	6
N409013	Laboratory of Chemical engineering	409	0	0	3	c	3
							28
Summer semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N215002	Fundamentals of Combustion Processes	215	2	0	0	T	3
N215006	Organic technologies	215	2	0	0	T	3
N216024	Pipeline Transportation of Fuels and Energy	216	2	1	0	c,T	4
N437005	Enterprise Economics	837	2	1	0	c+T	4
N963014	Bachelor thesis	963	0	0	12	c	15
							29

Water and environment							
1. study year							
Winter semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N101002	Chemical Calculations	101	0	2	0	c	2
N101005	Inorganic and General Chemistry I	101	3	2	0	c,T	8
N413022	Mathematics I	413	3	4	0	c,T	9
N240011	Toxicology a ecotoxicology I	240	2	0	0	T	3
N240022	General biology and Ecology	240	3	0	0	T	5
							27
Summer semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N101003	Laboratory of inorganic chemistry	101	0	0	4	c	3
N110004	Organic chemistry	110	2	2	0	c,T	6
N444001	Physics	444	3	2	0	c,T	7
N834001	English language	834	0	2	0	c	1
N101006	Inorganic and General Chemistry II	101	2	2	0	c,T	5
N217032	Environmental Statistic	217	1	2	0	c,T	4
							26
2. study year							
Winter semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N110002	Laboratory of organic chemistry	110	0	0	4	c	3
N320001	Biochemistry I	320	3	0	0	T	5
N403011	Physical Chemistry	403	3	2	0	c,T	6
N834002	English language	834	0	2	0	c,T	2

Water and environment							
							16
Summer semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N402002	Analytical chemistry	402	2	2	0	c,T	5
N409002	Chemical engineering	409	2	3	0	c,T	6
N218016	Sources of Chemical Information	218	0	3	0	c	3
							14
3. study year							
Winter semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N402003	Laboratory of analytical chemistry	402	0	0	5	c	4
N409013	Laboratory of Chemical engineering	409	0	0	3	c	3
N409003	Chemical engineering II	409	2	3	0	c,T	6
N216007	Air chemistry	216	2	0	0	T	3
N217006	Fundamentals of Wastewater Treatment	217	3	2	0	T	7
New	Laboratory of Environmental engineering				?	c	?
							23
Summer semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N963014	Bachelor thesis	963	0	0	12	c	15
N217003	Hydrochemistry	217	3	2	0	c,T	7
							22

Ecotoxicology and environmental analysis							
1. study year							
Winter semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N101002	Chemical Calculations	101	0	2	0	c	2
N101005	Inorganic and General Chemistry I	101	3	2	0	c,T	8
N413022	Mathematics I	413	3	4	0	c,T	9
N240022	Toxicology a ecotoxicology I	240	3	0	0	T	5
N240011	General biology and Ecology	240	2	0	0	T	3
							27
Summer semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N101003	Laboratory of inorganic chemistry	101	0	0	4	c	3
N110004	Organic chemistry	110	2	2	0	c,T	6
N444001	Physics	444	3	2	0	c,T	7
N834001	English language	834	0	2	0	c	1
N101006	Inorganic and General Chemistry II	101	2	2	0	c,T	5
N240009	Environmental engineering	240	3	0	0	T	5
							27
2. study year							
Winter semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N110002	Laboratory of organic chemistry	110	0	0	4	c	3

Ecotoxicology and environmental analysis							
N320001	Biochemistry I	320	3	0	0	T	5
N403011	Physical Chemistry	403	3	2	0	c,T	6
N444003	Laboratory of Physics	444	0	0	3	c	3
N834002	English language	834	0	2	0	c,T	2
N240010	Environmental chemistry	240	2	0	0	T	3
Summer semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N402002	Analytical chemistry	402	2	2	0	c,T	5
N403013	Laboratory of Physical chemistry	403	0	0	4	c	3
N409002	Chemical engineering	409	2	3	0	c,T	6
N217030	Technical hydrobiology and microbiology	217	2	0	0	T	3
N403014	Physical chemistry II	403	3	2	0	c, T	7
							24
3. study year							
Winter semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N402003	Laboratory of analytical chemistry	402	0	0	5	c	4
N240018	Toxicology a ecotoxicology II	240	3	0	0	T	5
N402004	Analytical chemistry II	402	2	1	0	c,T	4
N216007	Air chemistry	216	2	0	0	T	3
N444004	Measuring and Control Engineering	444	2	0	0	T	3
N215007	Fuels analysis	215	3	0	0	T	5
							24



Erasmus+

Ecotoxicology and environmental analysis							
Summer semester							
Code	Subject	Department	Lecture	Seminary	Laboratory	Examination	Number of Credits
N963014	Bachelor thesis	963	0	0	12	c	15
N240017	Laboratory of ecotoxicology	240	0	0	8	c	6
							21

3.2. Possible extension of the structure of study program Department of Economics and Management - the plan of the study structure

At present time, Department of Economics and Management (further “Department”) considers to prepare new interdisciplinary of 5-years Master’s program. Particulate program can be characterized by following key words:

- Technology, Management and Economics in Chemistry (oriented to Production management)
- Technology and Management in Chemistry (oriented to Research management)

Graduate profile would consider:

- Competitiveness growth is currently associated with the development and introduction of new products and services in accordance with the requirements of the market and the society, as well as with the effective use of existing and new resources and technologies.
- Scientific, technological and trade cooperation with enterprises and institutions in diverse business fields is typical for successful organizations and enterprises in the chemical industry.
- The preparation of graduates to be ready to operate in such conditions requires an effective combination of technical and technological knowledge and skills with competencies in management and economics.

The proposals of a new structure of Master study would cover:

- theoretical knowledge gained by studying inorganic, organic, physical and analytical chemistry, biochemistry and mathematics including statistics and physics;
- knowledge of macroeconomics and microeconomics, business process management and business economics, marketing, logistics, accounting, finance, selected legal issues and human resources management;
- insight into raw material and material resources for chemical and food industry, issues connected with their use, qualitative and quantitative knowledge of identification and consumption of chemical, biochemical and food products, including specialty chemicals;
- knowledge of the available chemical and food processing technologies, biochemical processes and principles, trends of further development and their design using the knowledge of chemical engineering;
- knowledge and skills in project management in research and development, industrial practice, structuring and management of supply chains and systemic assessment of their effectiveness;
- skills in mathematical modeling, including simulation of complex systems and their software support;

- ability to work in teams or lead teams of experts from various fields of business supported by the acquisition of soft skills in communication and negotiation, creativity, organization and planning, problem solving and leadership.

New curricula are subject for further program development.

3.3. Including of practice into the study

Employers in relation to the inclusion of compulsory practice in the study must create conditions for the realization of professional practice with regard to various aspects - professional practice refill (educational orientation), organization (supervision, responsible person), compliance with legal standards (occupational safety and health).

For the realization of the above it is necessary a close co-operation between academia and the industry to ensure the desired effect of practice - to increase the level of knowledge and skills of graduates and linkage of studies with an immediate reality in the chemical industry companies.

3.4. Further training of industrial partners

The Faculty's departments plan to contribute on further education of graduates and other employees of industrial partners. For example, Department of Power Engineering prepares an education training "Corrosion, corrosion inhibition and chemical cleaning in energetic cycles". Here is its preliminary program:

I. Lectures

1. Construction materials for power plant equipment

Technical drawing: principles, formats, projections, sections, dimensioning, tolerance, examples of drawings. Materials for power equipment: requirements, labeling, inspection, welding, usability, engineering, testing, durability.

2. Corrosion in power plant equipment

Introduction to problematics of corrosion: corrosion research in the country, corrosion in power equipment. Thermodynamics and kinetics of corrosion's processes. Electrochemical methods of corrosion processes study. Corrosion in a water environment, effect of ions. Corrosion in steam pipeline circuit, water and steam energy.

3. Corrosion inhibition in power plants, maintenance procedures

Chemical and physical influence of corrosion processes. Types of corrosion protection. Corrosion inhibitors. Best practices for protection of power plants. The alkalizing preparations, oxygen depolarization response. Corrosion protection during a shutdown of steam generators.

4. Formation of layers on surfaces of power plant equipment, types and properties

sediment of steam: the creation, composition, effect on the equipment during operation and shutdown, removal. Elemental analysis and identification matrix layer and using a portable XRF spectrometry. Exposure of samples and testing of coatings on energy equipment materials. Problematics of layers' formation in the environment of nuclear energy.

5. Methods of analysis of superficial surface layers and deposits

Qualitative methods of analysis, infrared and Raman spectroscopy, analysis of samples in the average. Distribution surface analysis, micro spectroscopy and scanning micro spectroscopy, mapping surface. Quantitative analysis of infrared and Raman spectroscopy, use of chemometrics for quantitative analysis of mixtures method PLS, PCA and cluster analysis. The principle of XPS (X-ray Photoelectron Spectroscopy). Options characterization of samples: elemental surface analysis, detection of chemical bonds and concentration depth profiles.

6. Surface layers stability and exfoliation

The structure of layers generated in energy regimes. Influence of deposits on industrial facilities. Exfoliation. The possibilities of detecting and preventing the presence of layers.

7. Methods of surface layer removal, chemical cleaning, and corrosion inhibition

Chemical cleaning of steam generators, cleaning procedures. Continuous cleaning and cleaning during outages. Shikora's reactions, equipment passivation. Corrosion inhibitors - types of inhibitors, principles of action, effects of structure on inhibitors' properties. Applications of inhibitors, the risk of inhibitors use, "dangerous inhibitors". Testing of inhibitors.

II. Laboratory exercises:

1. Assessment of the solubility of oxide layers on the surface of construction materials at given conditions
2. Assessment of the solubility of calcium sulfate and calcium phosphates at given conditions
3. Analytical determination of cations and anions for chemical cleaning energetic equipment under operation

4. Enhancing the attractiveness of study

4.1. Title of the Faculty

The Faculty of Environmental Technology carried the title “Faculty of Fuels and Water” after its foundation. The title was changed into “The Faculty of Environmental Technology” at the beginning of eighties in the context of new activities focused on environmental technology. However, the current title does not reflect an energy/ fuel topic involving almost one half of all Faculties’ working teams. Moreover, phrase environmental protection concerns rather of a protection of a regional landscape and it is not exactly the main activity of the Faculty. The field of technical protection of environment has usually international name “Environmental Engineering”. The planned change of the title of the Faculty would result in more suitable title better representing activities of the departments. Moreover, title that is more attractive could address a greater number of potential students.

Several alternative titles of the Faculty were proposed. The objective was to evaluate current title and possible choose more suitable one. An electronic enquiry was distributed into employees, present and former students and selected externs for this purpose. The results of the survey showed that the most favored title is the present one. Although it does not reflect exactly the activities of particulate departments, it has its own history (more than 20 years) and some tradition at present time. The current title had also the best rating given by all categories of answerers (Bachelor students, Master students, Ph.D. students, employees, graduates and others).

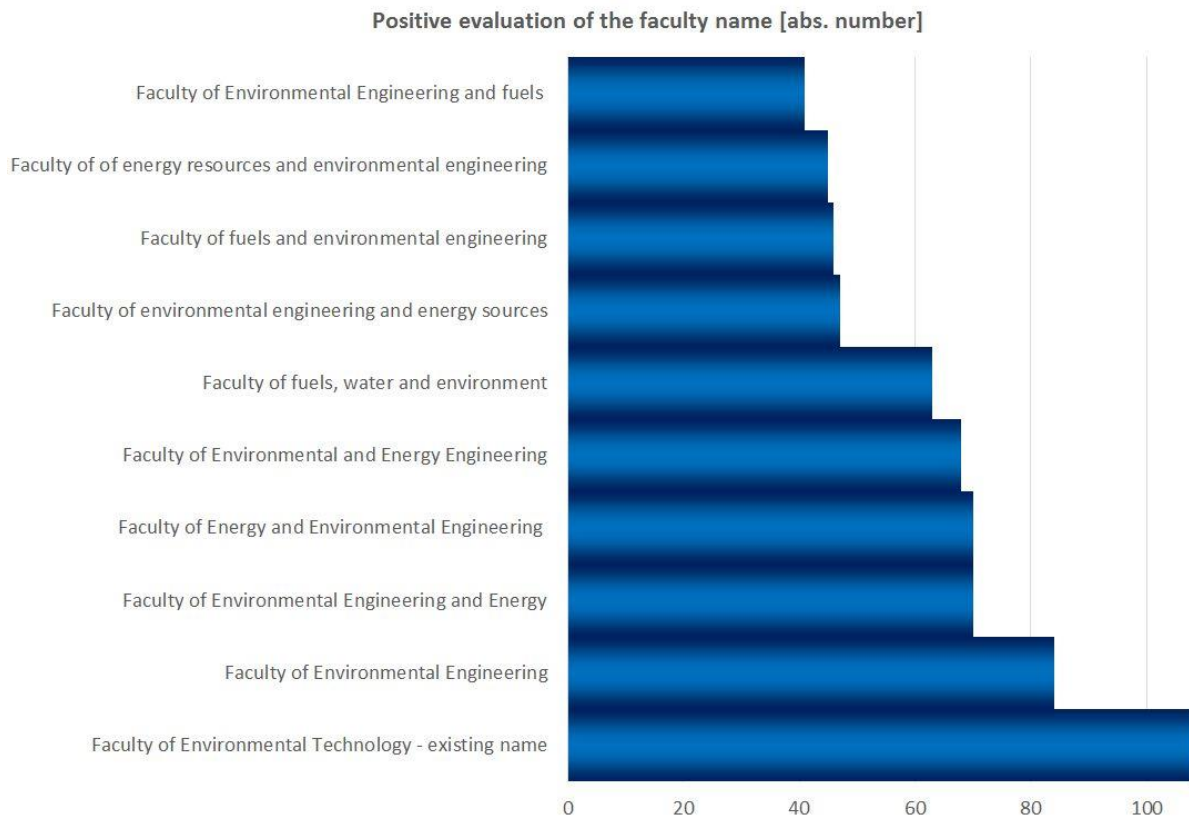


Fig. 2: Positive evaluation of the faculty name

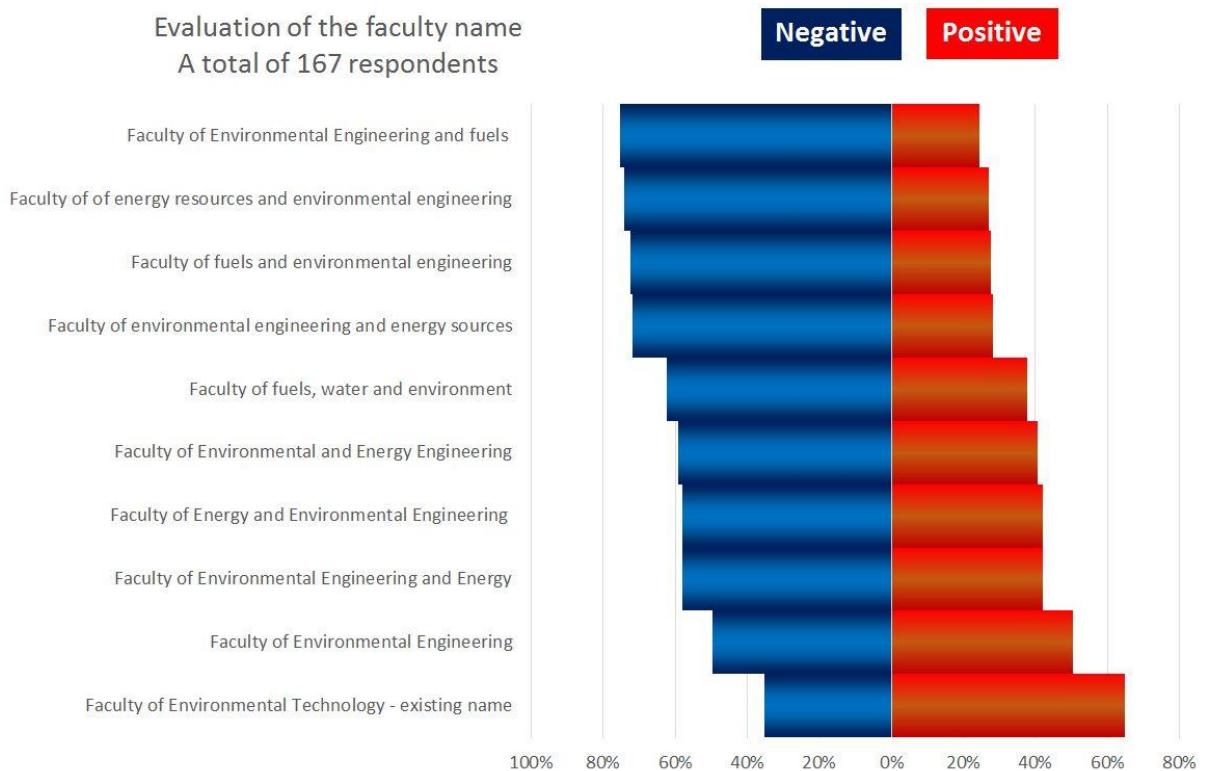


Fig. 3: Evaluation of the faculty name

4.2 Practitioners

Current training of graduates from our university is all in theory at a very good level. The problem, however, is their training in practical skills and abilities to apply scientific knowledge in a real environment. In this context, it is necessary to use a good experience that we have in ensuring cooperation with the actors of the economic sphere.

Beneficial for increasing the application of students' abilities could be creating conditions for the involvement of practitioners in educational activities. Practitioners could be that some subjects in the lectures to present their practical experience in the field in which they work. Lectures practitioners could be one part of the upcoming career portal.

4.3. The offer of excursions to industrial plants

The association of the Chemical Industry in cooperation with its members and the Association of technical colleges develops concept of excursions to industrial plants that already works well on a regional level. Excursions offer will be expanded thanks to interregional contacts with corporate members and educational institutions. Appropriate outreach tool is the website of the Association of Chemical Industry of the Czech Republic - there will be placed information about excursions offers from the Society

4.4 Promotion of chemistry among young people

Association of Chemical Industry of the Czech Republic as the co-organizer and general partner of the national finals of the competition "Looking for the best young chemist of CR" will continue to develop this competition - the 4th year 2015/ 2016 of the contest was attended by 12,000 elementary school pupils from across the country, it is the largest competition of its kind in CR. The result of years of efforts is the statistical upsurge of an interest in studying of chemistry at secondary schools in the traditional regions of the Czech chemical Industry.

5. National qualification system

Support for further education - creation of professional qualifications

The National Qualifications Framework, implementation of Act no. 179/2006 Coll., on verification and recognition of further education.

National Qualifications Framework describes what is needed in order to pursue a profession or its parts, i.e. the partial work. It is the state (Czech Republic), guaranteed nationwide system built on real requirements for the performance of activities within individual professions and jobs. NQF defines requirements for the competence of individual skills regardless of their mode of acquisition. As the common framework for initial and continuing education it also allows

comparison of our national qualifications with qualifications set out and described in other European countries.

It allows to candidates to gain a nationally recognized certificate of a professional qualification or to acquire the knowledge needed to obtain specific professional qualifications and those after the test by an authorized person to confirm obtaining official certification. It helps to all who embark on a journey to find better jobs in order to gain full qualifications and better jobs.

The main objective of the National Qualifications Framework is to complement the qualification system depending on the demand in the labor market. The emergence and development of NQF is actively participating employers in particular through sectoral councils. NQF, its structure, method of making and approval processes and its use are based on the law no. 179/2006 Coll., on verification and recognition of further education.

Professional qualification in the chemical industry

Using the National Qualifications Framework, employers may define requirements for the level of knowledge and skills needed to pursue a specific occupation, and thus determine the required employee profile. Graduates (and employees) can on the knowledge acquired from the secondary and tertiary education establish further personal development, and in the specific skills required by the labor market. In the chemical industry there is required a qualification for highly educated people, which is defined and revised fully in line with the increase of the level of knowledge and experience of employees, in order to increase the innovation potential of the chemical industry and sustain its competitiveness.

Creating content and professional qualifications of current chemical specialization:

a) Approval process - REACH manager:

- orientation in the proper handling of hazardous substances and mixtures in chemical operations
- evaluating and using expert knowledge and advice from other disciplines
- use of research findings and applied ecology
- orientation in technical documentation and labeling of chemicals
- identifying, defining and controlling inputs and outputs of chemical processes according to standard procedures
- keeping records set in paper or electronic form, or create own documentation
- administrative and technical support personnel sales of chemical products
- monitoring legislative changes, updates and registration laws
- orientation in techniques of environmental protection in the handling of chemicals
- hazard assessment, risk management, toxicological and Eco toxicological properties of chemical substances

- Orientation in legislation on chemical substances and mixtures under REACH and CLP.

b) The ongoing revision to the requirements of the industry - Chemical Engineer Product

Manager:

- orientation in legislation related to chemical production
- orientation in the regulations on chemical substances and preparations for REACH
- orientation in techniques of environmental protection in the handling of chemicals
- orientation in technical documentation and labeling of chemicals
- Preparation and completion of documents for business contracts and business dealings with business partners
- preparation of documents for closing orders, processing of documents for complaint proceedings with business partners
- search and preparation of documents necessary for the preparation of plans and concepts of business
- implementation of required chemical product in the product plan
- communication with customers
- presentation organization in dealing with business partners and other stakeholders
- presentation of chemical product, benefits, technical facts, possible uses, potential uses
- entering chemical technology specifications required by the client product technical and production department.
- coordination of business in securing the purchase of goods, raw materials and products, sales coordination, preparation and management of production operations from a business perspective in the chemical industry.

c) Prepared to build and specification - Chemical Engineer Economist:

These vocational qualifications will be prepared based on the specifications of knowledge and competencies employers, labor market economists lack the deep knowledge of the specifics of the chemical industry.

6. Activity schedule

Enlargement of communication with students and industrial partners

Discussion of university management with students	continuously
Discussion of university management with employees	continuously
Meetings of former graduates and employers with students 4elements	regularly (twice a year)

Study in practice - Practice in study

Communication with industrial partners - web pages	continuously 12/2017
Communication with industrial partners and public - faculty Facebook	continuously
Expansion of foreign communication and cooperation between universities	continuously.

Innovation of the structure of education

Modification of the structure of Faculty Bachelor study program	12/2018
Proposal of possible structure of Department study program	06/2018
Practice inclusion into the study - solution proposals	12/2018
Further training of industrial partners	12/2017

Enhancing the attractiveness of study

Title of the Faculty	01/2017
Practitioners - schedule of lectures for the faculty	12/2017
Offer excursions to industrial plants	
Review of the current status and update	12/2017
Promotion of chemistry among young people	continuously.

National qualifications framework

Implementation of the REACH manage qualification	12/2017
Revision of the qualification of the Chemical Engineer product manager	12/2017
Proposal for a new qualification of the chemical engineer economist	12/2018.