Innovating Education of Talents in Chemistry for Business Success in SMEs' Innovations
InnoChem

European Summary Report of the Status Quo Analysis

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This European summary report is based on the three national reports in order to take stock of the work already achieved, provide introductory input to the assessment of the strategy, strategic and supporting objectives, as well as relevant measures to could be included in the road maps.

A. THE SQAs

Further to the kick-off transnational meeting of this project in April 2015, the representatives of the three countries (Czech Republic, Greece and Slovakia) start working on the preparation of their respective Status Quo Analysis (SQA). During the meeting a detailed presentation was made on Cefic's study on ***"Critical needs for innovation in the chemical industry"*** which constitutes a solid basis for the activities to be conducted.

The first results of each SQA were discussed at the second transnational meeting in November 2015. It was a good opportunity for participants to share experience acquired in so far.

The drafting of the three SQAS was achieved by January 2016. The present European summary report is based on the text of each of them as received in English.

One of the goals of the SQAs is to carry out comparative analysis of the existing curricula in each country and the needs of industry, especially SMEs, to enhance their creativity and develop cutting edge innovations, as well as the available best practice and know-how so that the curricula of tertiary education can be improved.

Each SQA contains the following sections:

1. Characterization of the chemical sector in the country and the role of SMEs in innovations.
2. Product innovation trends in their perspectives in the country.

3. The critical skills needs for innovations with particular emphasis on development of SMEs
4. State of affairs in current education.
5. Support of stakeholders (particularly relevant authorities and institutions) needed for innovating tertiary education to include the critical skills identified.
6. Administrative procedures and time-line for implementing a new curricula.
7. Obstacles to innovating curricula for tertiary education.

The SQAs are due to be finalized by end of May 2016. In the meantime the Participants would have met during the third transnational meeting fixed on 18/19 April 2016.

B. MAPPING THE FUTURE SKILLS FOR ENGINEERS AND SCIENTISTS – FOR INNOVATIVE ACTIVITIES

The main foundation of the project is the Cefic study. As mentioned on its cover ***"In order to speed up the delivery of solutions to societal challenges and to remain competitive, the European chemical industry needs the right force, prepared to push innovation forward".*** Since Cefic study is based on the needs of large chemical companies, it was decided that each team will defined the skills needed with regard to their local industry structure.

Each SQA define in details the structure, focus for innovation and industrial landscape of their chemical industry. This industry in the three countries is characterized by the important presence of SMEs.

Using Cefic Questionnaire each national association interrogated companies on the skills needed for future workforce. Each of them received about 20 responses and conducted interviews with some of them. These samples were representative of the size of companies present in their country, the sectors, innovation driving forces, and the value chain was involved where relevant.

The results are summarized in the tables below (taking the 5 best responses). These include respectively for future engineers and scientists the required (i) Business skills, (II) personal skills and (iii) scientific and technical skills.

BUSINESS SKILLS FOR FUTURE ENGINEERS to turn ideas into sustainable markets Top 5 (1=best score) °when equal rating	**Cefic**	**Czech Republic**	**Greece**	**Slovakia**
Project Management	**1**	**1**		
Innovation Management	**2**	**5**	**1°**	**3**
Understanding suppliers & customers	**3**	**4**	**3°**	**2**
Strategic & visionary management	**4**		**3°**	
Business development	**5**		**1°**	**5**
Cost optimization		**2**	**3°**	**1**
Quality management		**3**	**3°**	**4**
Business process optimization			**3°**	
Financial			**3°**	
Intellectual property law				
Regulatory affairs				
Marketing				
Supply chain management			**3°**	

PERSONAL SKILLS FOR FUTURE ENGINEERS for Successful collaboration Top 5 (1=best score) °when equal rating	Cefic	Czech Republic	Greece	Slovakia
Communication	**1**	**2**	**1°**	**4°**
Team work	**2**			
Problem solving (analytical, reasoning)	**3**	**1**	**1°**	**1**
Creative thinking	**4**			
Leadership	**5**		**1°**	
Networking			**1°**	
Language/intercultural		**4**		**2°**
Decision making		**5**		**2°**
Negotiation				
Ability to work independently		**3**	**1°**	**4°**
Organization			**1°**	
Communication				
Coaching			**1°**	

INTERDISCIPLINARITY - MOST IMPORTANT SCIENTIFIC AND TECHNICAL SKILLS FOR FUTURE ENGINEERS for breaking through solutions	
Cefic	Process modelling and simulation scale-up, reaction engineering and process design
Czech Republic	Health, safety and environment, organic chemistry, safety engineering, inorganic chemistry, material chemistry, operational excellence, environmental/sustainable chemistry
Greece	Process design, product development, safety engineering, operational excellence, cost engineering
Slovakia	Health, safety and environment, operational excellence, organic chemistry, equipment design, product development

BUSINESS SKILLS FOR FUTURE SCIENTISTS to turn ideas into sustainable markets Top 5 (1=best score) °when equal rating	Cefic	Czech Republic	Greece	Slovakia
Intellectual property law	**1**	**2**		**4°**
Innovation management	**2**	**4**	**2°**	**1**
Strategic & visionary management	**3**			
Understanding suppliers & customers	**4**	**3**		**3**
Project management	**5**	**1**		**4°**
Business development			**5°**	
Regulatory affairs				**4°**
Scenario planning			**5°**	
Costs optimization		**5**	**2°**	**4°**
Financial			**5°**	
Business Process optimization			**2°**	
Quality management			**1**	**2**
Supply chain management				

PERSONAL SKILLS FOR FUTURE SCIENTISTS for Successful collaboration Top 5 (1=best score) °when equal rating	Cefic	Czech Republic	Greece	Slovakia
Creative thinking	**1**	**2**	**5°**	**1**
Communication	**2**		**1°**	
Team work	**3**	**5**		**5**
Networking	**4**		**5°**	
Problem solving (analytical, reasoning)	**5**	**3**	**1°**	**2**
Leadership				
Language/intercultural		**1**	**5°**	**3**
Decision making				
Ability to work independently		**4**	**1°**	**4**
Negotiation				
Coaching				
Organization			**1°**	
Decision making				

INTERDISCIPLINARITY - MOST IMPORTANT SCIENTIFIC AND TECHNICAL SKILLS FOR FUTURE SCIENTISTS for breaking through solutions	
Cefic	Catalysis, nanotechnology, formulation chemistry, sustainable chemistry, interface chemistry, biochemistry, and white biotechnology
Czech Republic	Organic chemistry, polymer chemistry, analytical chemistry, product development, health, safety and environment
Greece	Inorganic chemistry, polymer chemistry, environmental/sustainable chemistry, organic chemistry
Slovakia	Product development, organic chemistry, health, safety and environment, analytical chemistry, formulation chemistry, environmental/sustainable chemistry

C. ASSESSMENT OF THE STRATEGY

The curricula

of studies have been analysed in each SQAs, as well as how to make the changes.

Obstacles to change the curricula were listed. These may be of various types such as:

- Legal,
- Administrative and excessive bureaucracy,
- Procedures,
- Technical,
- Resources (eg funding or limitation from the state to recruit new teachers),
- Lack of communication between HEIs and the industrial sector,
- Complexity of evaluation system,
- HEIS endogenous problem related to compliance with strategic plans, to the refusal of evaluation process,
- Shortcoming in staffing, fragmentation of campuses, constant reduction of state contribution, etc.

The non-attractiveness of the scientific studies and careers was underlined in the three SQAs.

Of great importance is also the mention of the stakeholders who can support the process of changing the curricula. These lists include authorities, institutions but also industry. Cooperation, synergies, and post-graduates as well as long-life learning have been mentioned.

In each country in order to draft the SQAs dynamic exchanges and co-operation was organized between companies, their representatives and HEIs. This will be pursued to define the actions to be included in the roadmaps.

Therefore, from the English version available of the three SAQs, we can conclude that these have fulfilled the targets defined in the project document, to include a *'comparative analysis of the existing curricula in the country and the needs of industry, especially SMEs, to enhance their creativity and develop cutting edge innovations'…..* and

'The Status Quo Analysis will identify the set of competences (skills and knowledge) to be addressed in the enhanced curricula and potential barriers to introducing new curricula and cooperation with companies in practical part of the study.'

D. ELEMENTS THAT COULD BE INCLUDED IN THE ROADMAPS

There is certainly the need to include the:

1. WHAT: the content of the future curricula, looking particularly to what is existing V/s skills identified and defining the gaps to be filled.

   Defining skills needs in concrete terms may also be an asset. For example when considering Communication, what is the missing type? Communicating involving non-experts? Communicating in their domain? Communicating with their colleagues? Communicating with customers? Communicating with authorities?

2. HOW: type of pedagogy that could be used. This could include stand-alone skills or a combination of soft skills and technical/scientific skills, up-to the combination of the three types of skills recommended. Sometime the target can be achieved just by freeing time in the curricula for projects.

3. METHOLOGY TO FULLFIL THE WHAT AND THE HOW: to be defined taken into consideration in each country the parameters for enhancing curricula involving a wide range of interveners. It is important to close the gaps and make things functioning.

4. MANAGEMENT OF THE PROCESS: to include milestones, deliverables, timelines and system to measure the completion of these. Communication and dissemination are to be considered as well.

Rather than having a full catalogue of typical actions that may exists, each road map could include some specific actions. In any case these need to be:

- Well targeted.
- Realistic.
- Affordable.
- Optimizing the skills of student.

Strategies ought to be developed to ensure that any projects are:

- Innovation driven,
- Defined concretely,
- Taylor made for the gap to be filled in a particular curricula,
- Involving team working, and

- Stemming from the daily life of SMEs and the chemical sector in each country.

Exploring new type of learning could also be an asset to circumvent for example the lack of funds or teachers eg e-learning.

The finding a creative solutions is a must in this project.

To provide just one example, as mentioned above, rather than changing the usual courses, or instead of these, there could be time dedicated for projects. A particular project can be run at University with the help of an SME to develop needed skills in a practical way. The students would not have to undertake training period in companies (which is sometime difficult to find within SMEs). In this example the project may combine the enhancement for a scientist of several skills, including: organic chemistry, communication, language, and innovative management. This could be a good opportunity for SMEs to have particular projects developed by students, to their mutual benefit.