



Skills for Innovation

in the European Chemical Industry



In order to speed up the delivery of solutions to societal challenges and to remain competitive, the European chemical industry needs the right workforce, prepared to push innovation forward.

The right workforce for tomorrow's innovation

In the final report of the European Commission's High Level Group on the Competitiveness of the European Chemical Industry published in July 2009, three recommendations were made in the area of human resources.

In order to address these recommendations, Cefic initiated in September 2009 a study which aimed to investigate the critical – business, personal, scientific and technical – skills that scientists and engineers will need to boost innovation in the European chemical industry of the future.

Additionally, suggestions for changes in higher educational curricula and life long learning programmes were formulated.

Business skills to turn ideas into sustainable markets

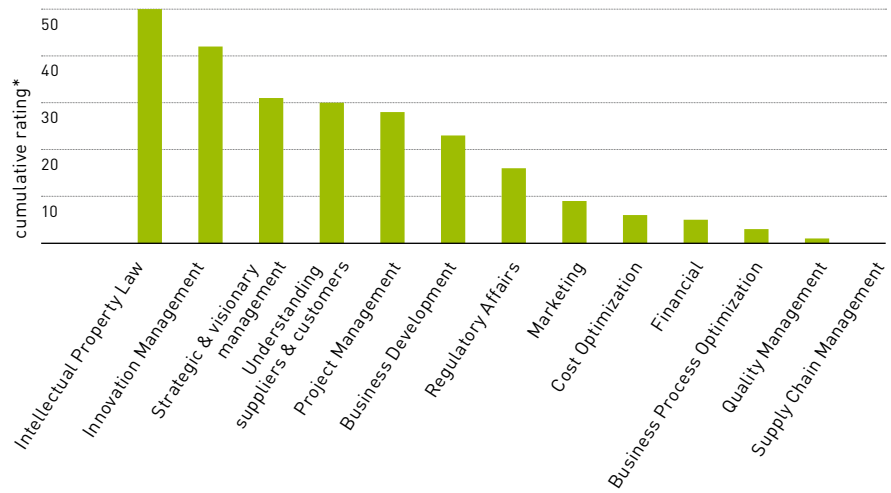
FOR SCIENTISTS...

Since innovative ideas must be protected by patents or other intellectual property rights in order to lead to competitive advantage, **Intellectual Property law** skills will remain the most important business skills for future scientists.

Innovation management from research to sales is complex but will be crucial to generate new businesses based on innovative ideas.

Strategic & Visionary Management skills will be critical to create new innovations and to define long term focus areas.

Most important business skills for future scientists



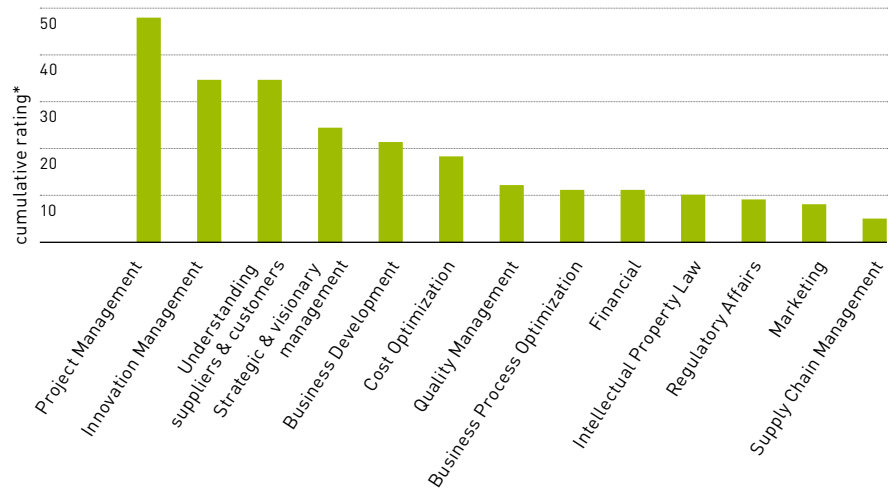
FOR ENGINEERS...

Well structured **project management** abilities will be essential for engineers who have to turn innovative ideas into profitable and cost-effective business.

Innovation management will be key to generate new business and remain competitive.

Understanding suppliers and customers will be essential to develop the right products for society.

Most important business skills for future engineers



Personal skills for successful collaboration

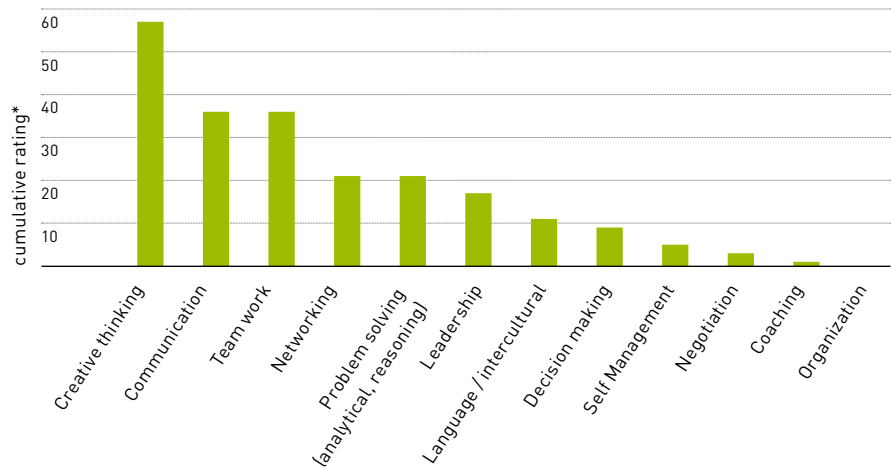
FOR SCIENTISTS...

Creative thinking will remain the most important skill for scientists who will have to generate new ideas contributing to new business.

High-quality **communication** skills will be required to ensure effective collaboration between scientists from different disciplines and also with business people.

With projects getting more complex and the involvement of a wide spectrum of different disciplines to develop solutions, **team work** skills will be key to foster successful innovation.

Most important personal skills for future scientists



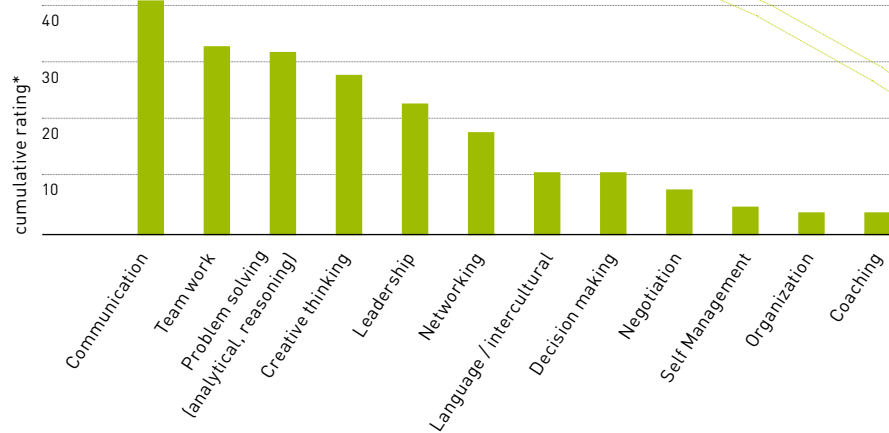
FOR ENGINEERS...

Communication skills will be crucial for engineers who will have to promote ideas both internally and externally towards customers and business partners.

As interaction with different disciplines will be required, **team work** will be critical to support innovation.

Problem solving skills entailing analytical and reasoning skills, will remain essential for future engineers.

Most important personal skills for future engineers



Scientific & Technical skills for breakthrough solutions

FOR FUTURE SCIENTISTS...

catalysis, nanotechnology, formulation chemistry, sustainable chemistry, interface chemistry, biochemistry and white biotechnology have been identified as some of the most important technical skills. Nevertheless, basic chemistry related skills such as organic chemistry and polymer chemistry will remain important.

FOR FUTURE ENGINEERS...

process modelling and simulation, scale up, reaction engineering, and process design are considered the most critical scientific and technical skills. Process intensification but also material chemistry, nanotechnology, particle science are also seen as essential.

PROCESS MODELLING & SIMULATION MATERIAL ENGINEERING

INDUSTRIAL BIOTECHNOLOGY NANOTECHNOLOGY ADVANCED FLUIDS DYNAMICS

POLYMER CHEMISTRY CATALYSIS HEALTH, SAFETY AND ENVIRONMENT
COST ENGINEERING

PARTICLE SCIENCE & TECHNOLOGY PRODUCT DEVELOPMENT

BIOCATALYSIS PHOTOCHEMISTRY PROCESS CONTROL AND OPTIMIZATION

Because innovation often happens INORGANIC CHEMISTRY

at the interface of disciplines, ENVIRONMENTAL / SUSTAINABLE CHEMISTRY

scientific interdisciplinarity is key for innovation

and the future of the chemical industry

ORGANIC CHEMISTRY INTERFACE CHEMISTRY CATALYTIC PROCESS DESIGN

PROCESS SYSTEMS ENGINEERING SUSTAINABLE CHEMISTRY

BIOCHEMISTRY SOLID-STATE CHEMISTRY SUPRAMOLECULAR CHEMISTRY
METABOLIC ENGINEERING / MODELLING

FORMULATION CHEMISTRY COMPUTATIONAL CHEMISTRY AND MODELLING ELECTROCHEMISTRY

TOXICOLOGY, PHARMACOKINETICS REACTION ENGINEERING

Improving higher education and training

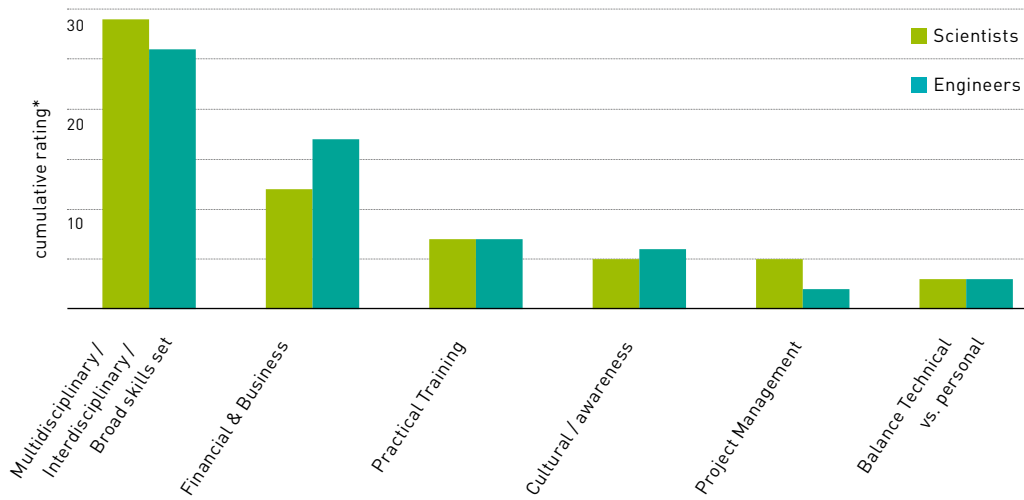


The most important initiative to improve innovation will be to provide future engineers and scientists with a **multidisciplinary and broad skill set**. This would require students to acquire understanding of different scientific and technical skills, as well as business and personal skills that will allow them to easily adapt to new tasks, job functions or even different scientific areas and will lead to efficient interdisciplinary work.

A **greater focus on financial and business skills** will be required in scientific curricula in order to effectively turn ideas into business.

A better balance between theory and practical training, more focus on cultural skills and cultural awareness (especially for emerging markets) and better project management skills are some of the other suggestions which should contribute to enhance innovation in the European chemical industry.

To be further developed in higher education curricula



The chemical industry is continually evolving due to scientific and technological breakthroughs, emerging markets, changing legislation and sustainability requirements. Engineers and scientists will need to develop a wide range of skills in order to adapt to this fast changing world and to respond to these new challenges.

These aspects should be reflected in education as well as in life long learning programmes, which should always be tailored to individual needs.

Open a dialogue with Higher Education

Future human resources needs of the chemical sector and higher education curricula must be better aligned in order to enhance innovation.

This study investigating the critical skills that scientists and engineers need to enhance innovation in the future European chemical industry is a first step. The next crucial step is to ensure an **effective collaboration** between the chemical industry and academia, and to respond to the identified needs through tailored, concrete actions.

Issues such as integration of business and related skills in scientific curricula, or broadening the scientific multidisciplinary skill base have to be addressed in order to ensure innovation can successfully complement research.

All the results of this study were obtained by use of structured telephone interviews with 16 high-level industry representatives involved in the long-term strategy of their company. These interviewees represented 12 chemical companies representing a total workforce of more than 300 000 employees in Europe.

The complete Cefic study on Skills for Innovation is available by your request for a copy to swi@cefic.be.

* The consolidated order of importance of skills as mentioned in the charts are based on the answers of the interviewees who were asked to indicate which will be the five most important skills for engineers and scientists for their chemical sub-sectors in 2015 and beyond. A scale of 5 to 1 was applied with 5 for the first most important skill, and 1 for the fifth most important skill. In practice, the skills as listed in the questionnaire submitted to interviewees were not considered as exhaustive lists. If appropriate, additional skills which were not listed in the predefined list of skills could be included by the interviewees.



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