Stakeholder meeting

CHEM

30.09.2022

Aalto University
School of Chemical
Engineering

Agenda

12:00 – 12:30 Lunch and networking

12:30 – 13:00 Introductions and summary of the objectives

13:00 – 14:30 Working in stakeholder groupings

1 The future of the industry from your point of view

2 Future skillsets and core competencies

14:30 – 14:45 Coffee break

14:45 – 15:15 Presenting a summary of workshop remarks/outcomes

15:15 – 15:30 Your feedback and conclusion of the event

Participating in this event

- **Our main goal is to get our stakeholder's input – please tell us what you think and how you see things**
- **Invited academic faculty present on campus are the people in the key role at the school to give input in the discussion**
- **Other school personnel have a possibility to listen to the discussion and get ideas for the portfolio development work. All the comments are welcome at presemo:** https://presemo.aalto.fi/chemstakeholders/

Introductions: Clusters

- **Biomass refining and advanced lignocellulosic materials**
- **Molecular bioscience and Industrial biotechnology**
- Chemical and metallurgical engineering (CMET)
- Chemistry and materials science (CMAT)

Introductions: People

- Industry representatives;
- Aalto representatives
- Student (Guild) representatives;
- Learning Services (Planning Officers and Pedagogic Specialists);
- Other members of personnel following conversations via Zoom

Groups

1

- Jouni Paltakari, chair
- Mari Ruskola, Kemira
- Hanna Hyyryläinen, Kemianteoll. ry
- Jenny Müller-Wahlman, Stora Enso
- Johan Engström, Andritz
- Tapani Vuorinen, Aalto
- Thad Maloney, Aalto
- Lauri Rautkari, Aalto
- Ilmari Hieta, Aalto
- Anja Hänninen, Aalto (Taking notes)
- Suvi Toivonen, Aalto (Zoom administration)

2

- Alex Frey, chair
- Emilia Nordlund, VTT
- Harri Kallioinen, Valio
- Leena Otsomaa, Orion
- Laura-Leena Kiiskinen, Medix Biochemica
- Carmela Kantor-Aaltonen, Kemianteoll. ry
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- Minna Marin, Aalto (Taking notes)
- Jukka Välimäki, Aalto (Zoom administration)

CHEM Portfolio renewal

- **Rationale**
- **Findings so far (summary of in-house and stakeholder contributions)**
- **Objectives for the day:**
  - Identifying business/industry sector of the future;
  - Mapping skills sets and core competencies of the future;
  - Other industry feedback
- **First student intake for revised curricula in 2024**

Rationale - Why?

- **Clearer portfolio and programme profiles and differentiation within the portfolio (conclusion from TEE 2020 evaluation)**
- **Increasing size of student cohorts affects the master programmes and majors in 2024. The resourcing (personnel and space) must be well planned by that.**
- **Need to use teaching resources more efficiently and scale up when possible the number of participants in courses. Teacher workload uneven.**
- **Role of minors in portfolio is unclear**

Master’s portfolio renewal goals

Applicants

Clear and attractive view for applicants to studies and future work opportunities

Number 1 choice in Chemical Engineering

Educational offering is understood nationally and internationally

Students

Clear and understandable study paths

Clear view and support on the employment opportunities

Flow of studies

Teachers

Workload

Synergy

Managing growing student numbers

More clear and transparent processes and leadership structures

Stakeholder

Future workers

Necessary skills, knowledge and competences

Educational offering is understood nationally and internationally

Competencies for future engineers

1. Disciplinary knowledge	
1.1	know ledge
1.2	core engineering fundamental know ledge
1.3	advanced engineering know ledge, methods, tools

2. Personal and professional skills and attitudes	
2.1	Analytical reasoning and problem solving
2.2	Experimentation, investigation and know ledge discovery
2.3	Systems thinking
2.4	Attitudes, thoughts and learning
2.5	Ethics, equity

3. Interpersonal skills: Teamwork and communication	
3.1	Teamw ork
3.2	Communication

4. CDIO in the enterprise, societal and environmental context	
4.1	External, societal, and environmental context
4.2	Entreprise and business context
4.3	Conceiving, systems engineering and management
4.4	Designing
4.5	Implementing
4.6	Operating
4.7	Leading engineering endeavors
4.8	Entrepreneurship

2.1 ANALYTICAL REASONING AND PROBLEM SOLVING
2.1.1 Problem Identification and Formulation
Data and symptoms
Assumptions and sources of bias
Issue prioritization in context of overall goals
A plan of attack (incorporating model, analytical and numerical solutions, qualitative analysis, experimentation and consideration of uncertainty)
2.1.2 Modeling
2.1.3 Estimation and Qualitative Analysis
2.1.4 Analysis With Uncertainty
2.1.5 Solution and Recommendation

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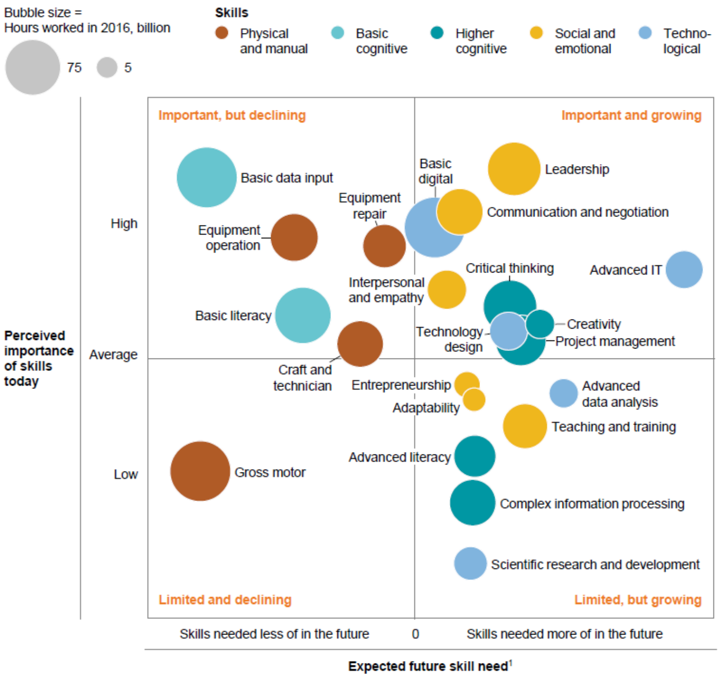
CDIO Syllabus v2.0

An Updated Statement of Goals for Engineering Education

Members: e.g. DTU, KTH, NTNU, RWTH Achen, Delft Tech. U., U. Turku, TAMK, Metropolia,…

Skills of today vs skills of tomorrow:



McKinsey Global Institute

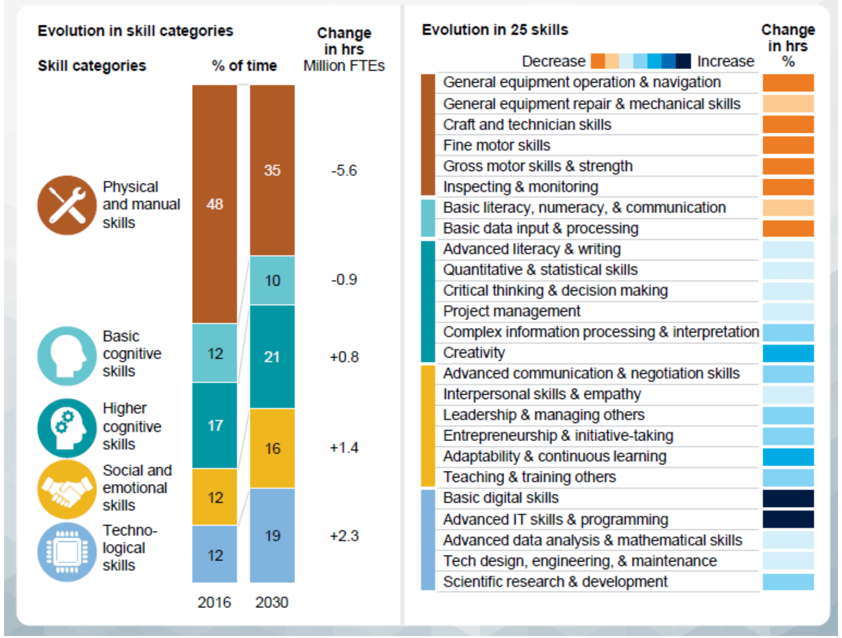
Four specific groups of skills stand out.

- leadership
- advanced communication
- advanced IT and programming
- critical-thinking skills

skills that are ranked as less important today but growing strongly in the future:

- advanced data analysis,
- complex information processing,
- adaptability
- teaching and training

Estimated skill shifts by 2030 in the manufacturing sector

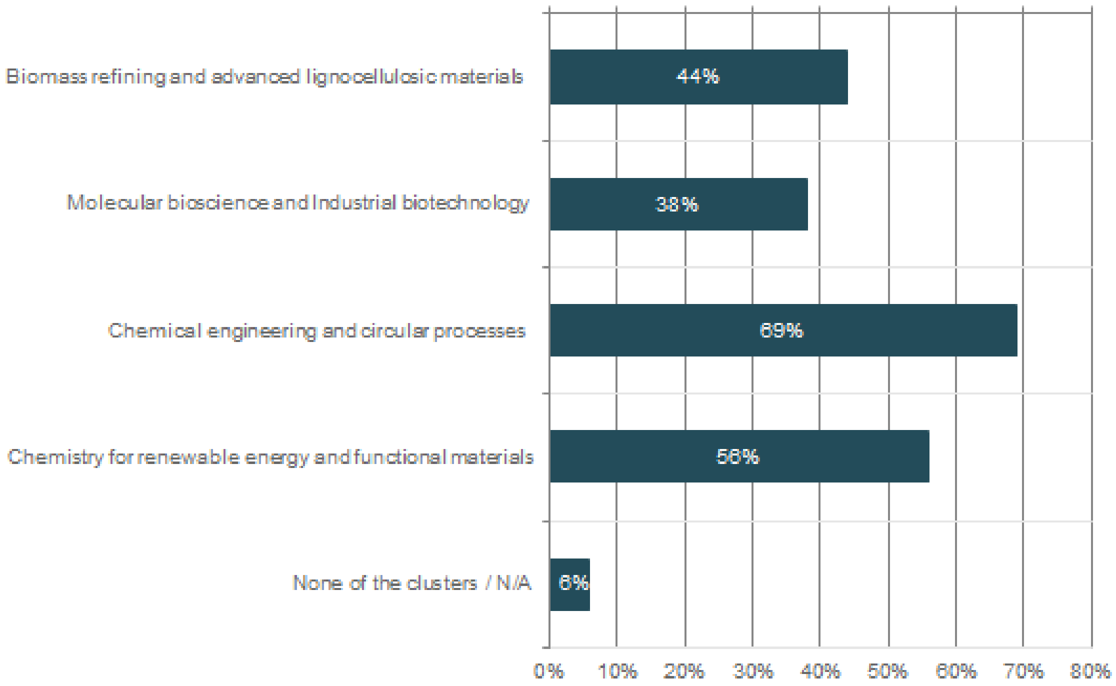


McKinsey Global Institute

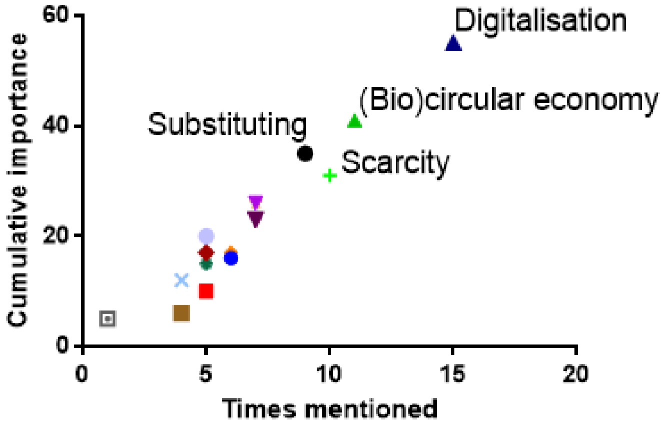
Identification with clusters

1. Which one(s) of the School of Chemical Engineering clusters do you identify with?

Number of respondents: 16, selected answers: 34



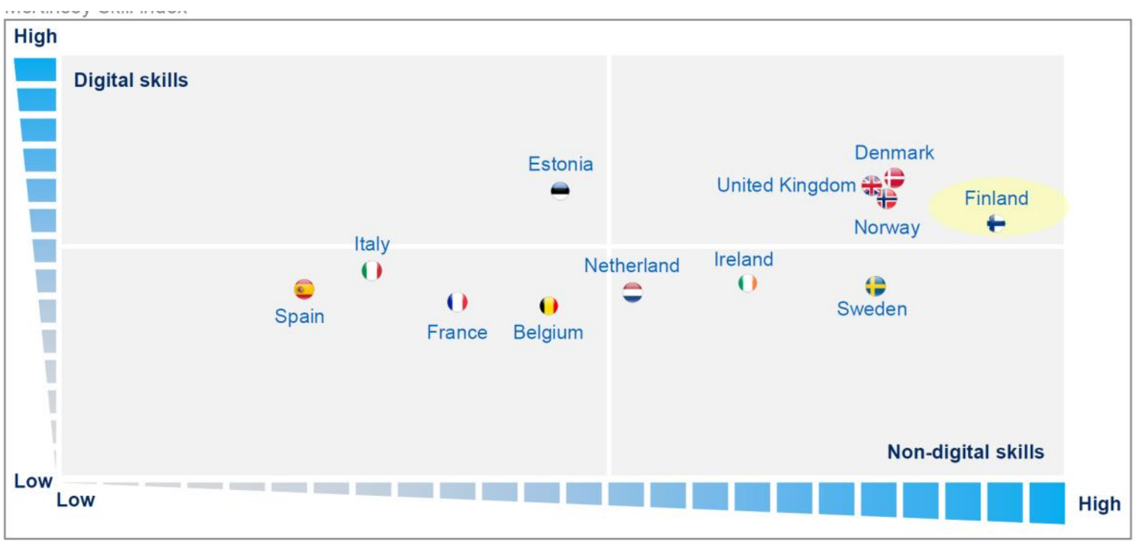
5 most significant changes that are likely to happen within (your field of) chemical engineering by 2035



N = 16

- Biotechnological processes will partially replace chemical processes
- Biotechnological processes will be used in food production
- Substituting fossile-based with renewable ones using sustainable energy sources
- Utilisation of novel organisms as hosts
- (Bio)Circular economy and reusing/recycling
- Digitalisation will develop further, incl. automatisation, AI, machine learning, simulation...
- Recycling of increasingly complex material combinations
- Computational methods and numerical modeling will become increasingly important
- Processes for upgrading of "more difficult" feedstocks (e.g. biowaste)
- Energy storage and conversion
- Electrification of chemical industry, e.g. batteries, electrocatalysis
- Sustainability and responsibility will guide decision making
- Scarcity: having to make business with less resources or for a higher price
- Fragmentation of job market into small companies and entrepreneurs (start-ups)
- Other:
- Other:

Skill gap – digital vs non-digital skills



SOURCE: OECD; Eurostat; PIACC; CEDEFOP McKinsey analysis

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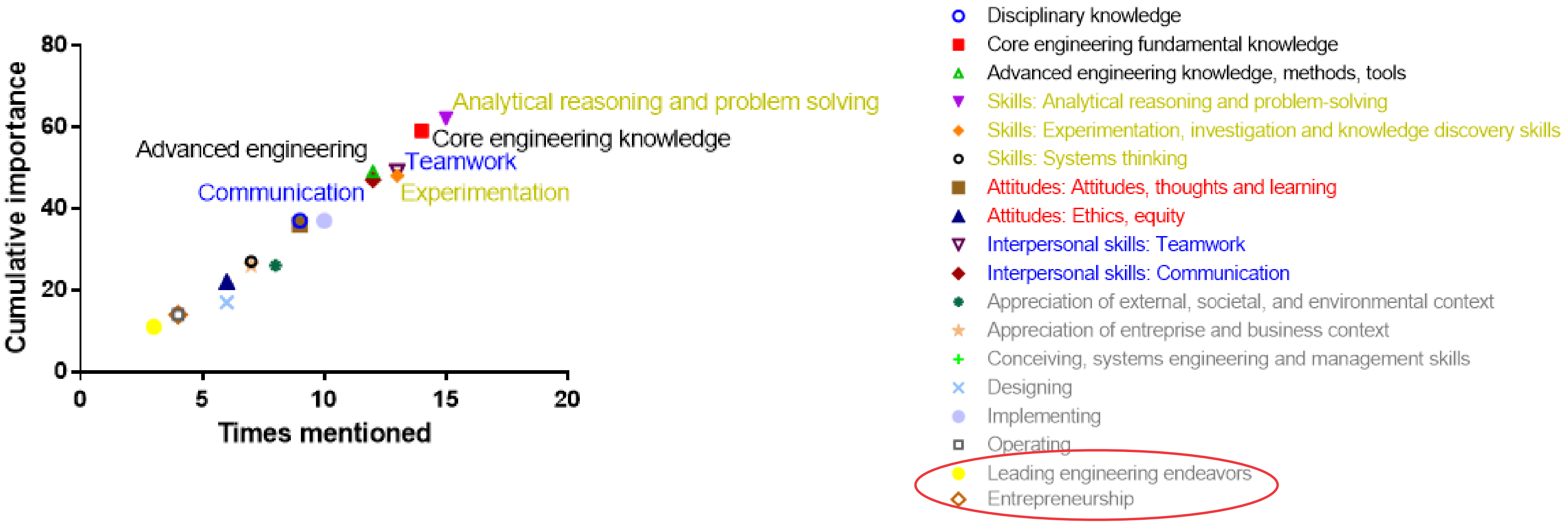
What kind of employees you will need to respond to these changes



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Questionnaire based on the CDIO Syllabus v2.0

An Updated Statement of Goals for Engineering Education

Members: e.g. DTU, KTH, NTNU, RWTH Achen, Delft Tech. U., U. Turku, TAMK, Metropolia,…

Working in stakeholder groupings

1

2

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Groups (again)

1

- Jouni Paltakari, chair
- Mari Ruskola, Kemira
- Hanna Hyyryläinen, Kemianteoll. ry
- Jenny Müller-Wahlman, Stora Enso
- Johan Engström, Andritz
- Katariina Kemppainen, Metsägroup
- Tapani Vuorinen, Aalto
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Stay in this room and Zoom meeting

2

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Move to the lecture hall Ke3 or join: https://aalto.zoom.us/j/61967559862

Group 1 1

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Future of the industry from your point of view

Looking at the list of changes that many identified as important, please write on a post-it note:

- **Most significant for your industry in future (please select 1)**
- **Least significant for your industry in future (please select 1)**

1

- Biotechnological processes partially replacing chemical processes
- (Bio)circular economy, reusing/recycling
- Recycling of increasingly complex material combinations
- Upgrading of "more difficult" feedstocks
- Substitution of fossil fuels with sustainable energy sources
- Digitalisation evolving further
- Computational methods and numerical modeling increasing their importance -1
- Energy storage and conversion
- Electrification of chemical industry -4
- Sustainability and responsibility guiding decision-making
- Operating with scarcity or higher prices

Future challenges

Particularly important skills in your field in future

Competences (skills, knowledge & attitudes) of ideal graduate in your field in 2035

- Biotechnological processes partially replacing chemical processes +3
- (Bio)circular economy, reusing/recycling +5
- Recycling of increasingly complex material combinations +2
- Upgrading of "more difficult" feedstocks +2
- Substitution of fossil fuels with sustainable energy sources +1
- Digitalisation evolving further +8
- Computational methods and numerical modeling increasing their importance -1
- Energy storage and conversion
- Electrification of chemical industry -4
- Sustainability and responsibility guiding decision-making +5 (+2 included in everything)
- Operating with scarcity or higher prices

Future challenges

Particularly important skills in your field in future

Competences (skills, knowledge & attitudes) of ideal graduate in your field in 2035

Future skillsets & core competencies 1

While looking at the list, please reflect on skills and competencies to address these issues.

Please write down:

- What skills will be needed most in future?

1

- Biotechnological processes partially replacing chemical processes
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- Recycling of increasingly complex material combinations
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- Substitution of fossil fuels with sustainable energy sources
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- Energy storage and conversion
- Electrification of chemical industry
- Sustainability and responsibility guiding decision-making
- Operating with scarcity or higher prices

- Core disciplinary knowledge
- core engineering fundamental knowledge
- advanced engineering knowledge, methods, tools
- Analytical reasoning and problem solving
- Experimentation, investigation and knowledge discovery
- Systems thinking
- Attitudes, thoughts and learning
- Ethics, equity
- Teamwork
- Communication
- External, societal, and environmental context
- Entreprise and business context
- Conceiving, systems engineering and management
- Designing
- Implementing
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- Entrepreneurship

-
-
-

Future challenges

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- Core disciplinary know ledge +3
- core engineering fundamental know ledge +5
- advanced engineering know ledge, methods, tools +5
- Analytical reasoning and problem solving +7
- Experimentation, investigation and know ledge discovery +1
- Systems thinking +2
- Attitudes, thoughts and learning
- Ethics, equity +1
- Teamw ork +2
- Communication +4
- External, societal, and environmental context +3
- Entreprise and business context
- Conceiving, systems engineering and management
- Designing
- Implementing
- Operating
- Leading engineering endeavors
- Entrepreneurship (or business skills?) + Project management skills +1

Future challenges

Particularly important skills in your field in future

Competences (skills, knowledge & attitudes) of ideal graduate in your field in 2035

Future skillsets & core competencies 2

1

While looking at the two lists, imagine hiring a fresh chemical engineering graduate in 2035.

- What competences (skills, knowledge and attitudes) would an ideal candidate possess?

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1

- Biotechnological processes partially replacing chemical processes
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Future challenges

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- Well communicating team player with advanced engineering knowledge, capable of learning, problem-solving and implementing responsibility in complex industrial and business environment.
- High ethics
- Self management skills
- Able to adapt and adjust
- Soveltuvuus työtehtävään ja core-osaaminen.
- Soveltuvuus monialaiseen tiimiin ja soveltua yrityksen toimintatapaan.
- Perussubstanssi kunnossa, vastuullisuus, kestävyys, turvallisuus
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- Liiketoimintaosaamista
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- Kielitaito ja kulttuurien tuntemus
- Perustaidot kemiasta
- Ei kaikkai vastauksia heti mutta osaa löytää ratkaisuja
- Analyyttinen systeemiajattelu
- Ei saa olla liian kulmikas.

Future challenges

Particularly important skills in your field in future

Competences (skills, knowledge & attitudes) of ideal graduate in your field in 2035

Group 2

2

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Future of the industry from your point of view

Looking at the list of changes that many identified as important, please write on a post-it note:

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Future challenges

Particularly important skills in your field in future

Competences (skills, knowledge & attitudes) of ideal graduate in your field in 2035

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- **Upgrading of "more difficult" feedstocks +**
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- **Computational methods and numerical modeling increasing their importance + +**
- Energy storage and conversion
- **Electrification of chemical industry - -**
- Sustainability and responsibility guiding decision-making
- **Operating with scarcity or higher prices +**

Future challenges

Particularly important skills in your field in future

Competences (skills, knowledge & attitudes) of ideal graduate in your field in 2035

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- **Electrification of chemical industry - -**
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- **Operating with scarcity or higher prices +**

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Competences (skills, knowledge & attitudes) of ideal graduate in your field in 2035

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Future challenges

Particularly important skills in your field in future

Competences (skills, knowledge & attitudes) of ideal graduate in your field in 2035

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Future skillsets & core competencies 2

While looking at the two lists, imagine hiring a fresh chemical engineering graduate in 2035.

- What competences (skills, knowledge and attitudes) would an ideal candidate possess?

- Biotechnological processes partially replacing chemical processes
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- Recycling of increasingly complex material combinations
- **Upgrading of "more difficult" feedstocks +**
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- Digitalisation evolving further
- **Computational methods and numerical modeling increasing their importance + +**
- Energy storage and conversion
- **Electrification of chemical industry - -**
- Sustainability and responsibility guiding decision-making
- **Operating with scarcity or higher prices +**

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-
-
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Future challenges

Particularly important skills in your field in future

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Future challenges

Particularly important skills in your field in future

Competences (skills, knowledge & attitudes) of ideal graduate in your field in 2035

Summary

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Engineering

Group 1

1

- Biotechnological processes partially replacing chemical processes +3
- (Bio)circular economy, reusing/recycling +5
- Recycling of increasingly complex material combinations +2
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- Substitution of fossil fuels with sustainable energy sources +1
- Digitalisation evolving further +8
- Computational methods and numerical modeling increasing their importance -1
- Energy storage and conversion
- Electrification of chemical industry -4
- Sustainability and responsibility guiding decision-making +5 (+2 included in everything)
- Operating with scarcity or higher prices

Future challenges

- Core disciplinary know ledge +3
- core engineering fundamental know ledge +5
- advanced engineering know ledge, methods, tools +5
- Analytical reasoning and problem solving +7
- Experimentation, investigation and know ledge discovery +1
- Systems thinking +2
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- Communication +4
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- Implementing
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- Entrepreneurship (or business skills?) + Project management skills +1

Particularly important skills in your field in future

- Well communicating team player with advanced engineering knowledge, capable of learning, problem-solving and implementing responsibility in complexindustrial and business environment.
- High ethics
- Self management skills
- Able to adapt and adjust
- Soveltuvuus työtehtävään ja core-osaaminen.
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- Ei kaikkai vastauksia heti mutta osaa löytää ratkaisuja
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Competences (skills, knowledge & attitudes) of ideal graduate in your field in 2035

Summary of workshop remarks/ outcomes Group2

Main future trends

- Digitalisation evolving further AI, ML, data science
- Upgrading more challenging feedstocks/ Operating with scarcity or higher prices

Top three skills needed to address them:

- Self-leadership
- Attitude/capability to learn
- Debating, scientific debate
- Core disciplinary knowledge

FUTURE CHALLENGES

- Biotechnological processes partially replacing chemical processes
- (Bio)circular economy, reusing/recycling
- Recycling of increasingly complex material combinations
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Findings

- Core engineering skills continue to be a fundamental requirement
- Digitalisation identified as fundamental for operations: now and in future
- Problem-solving and openness to life-long learning will help engineers to adapt to new challenges
    - Openness to change
- Importance of soft-skills: Communications and team working skills

Questions for you

- Digitalisation: what exactly is it?
- Adding requirements is fair enough.. But what could we take out?
- Sustainability? Self-evident, general knowledge in 2035
- Importance of PhD education

Your feedback and concluding the event