Professionally oriented second cycle qualifications

Prof. Mladen Mauher, Ph.D., Polytechnic of Zagreb
Prof. Miroslav Slamić, Ph.D., Polytechnic of Zagreb

U zimskom semestru akademske godine 2010./2011. na visoka učilišta Republike Hrvatske u sve godine studija upisalo se ukupno 148 747 studenata, što je za 2,4% više u odnosu na zimski semestar prošle akademske godine.

Od ukupnog broja studenata upisanih na visoka učilišta u Republici Hrvatskoj, na fakultete je bilo upisano 76,1%, na veleučilišta 16,2%, na visoke škole 6,4%, dok ih je na umjetničkim akademijama bilo upisano 1,3%.

Izvor: Studenti u akademskoj godini 2010/2011, DZS, 2012.

STUDENTS ENROLLED, BY INSTITUTIONS OF HIGHER EDUCATION, 2006/2007 – 2010/2011 ACADEMIC YEAR – excerpts:

	2006./2007.		2007./2008.		2008./2009.		2009./2010.		2010./2011.		
	ukupno *Total*	I. godina *1st year*	ukupno *Total*	I. godina *1st year*	ukupno *Total*	I. godina *1st year*	ukupno *Total*	I. godina *1st year*	ukupno *Total*	I. godina *1st year*	
Visoka učilišta	136 129	49 065	138 126	50 990	134 188	55 377	145 263	61 146	148 747	58 794	*Institutions of higher education*
Veleučilišta	16 141	7 984	18 735	10 012	18 983	9 712	22 034	11 135	24 122	10 959	*Polytechnics*
Visoke škole	9 413	3 518	7 054	2 977	7 691	3 554	9 027	3 995	9 539	3 984	*Schools of professional higher education*
Fakulteti	109 095	37 158	110 720	37 586	105 942	41 637	112 437	45 366	113 143	43 083	*Faculties*
Stručni studij	16 703	7 017	17 541	8 105	17 220	7 620	16 266	7 434	15 709	6 667	*Professional study*

Characteristics

A characteristic of universities of applied sciences is

- their strong orientation towards professional practice
- the role of the universities of applied sciences in vertical mobility, in the emancipation of groups within society and the increase in the level of education of our working population

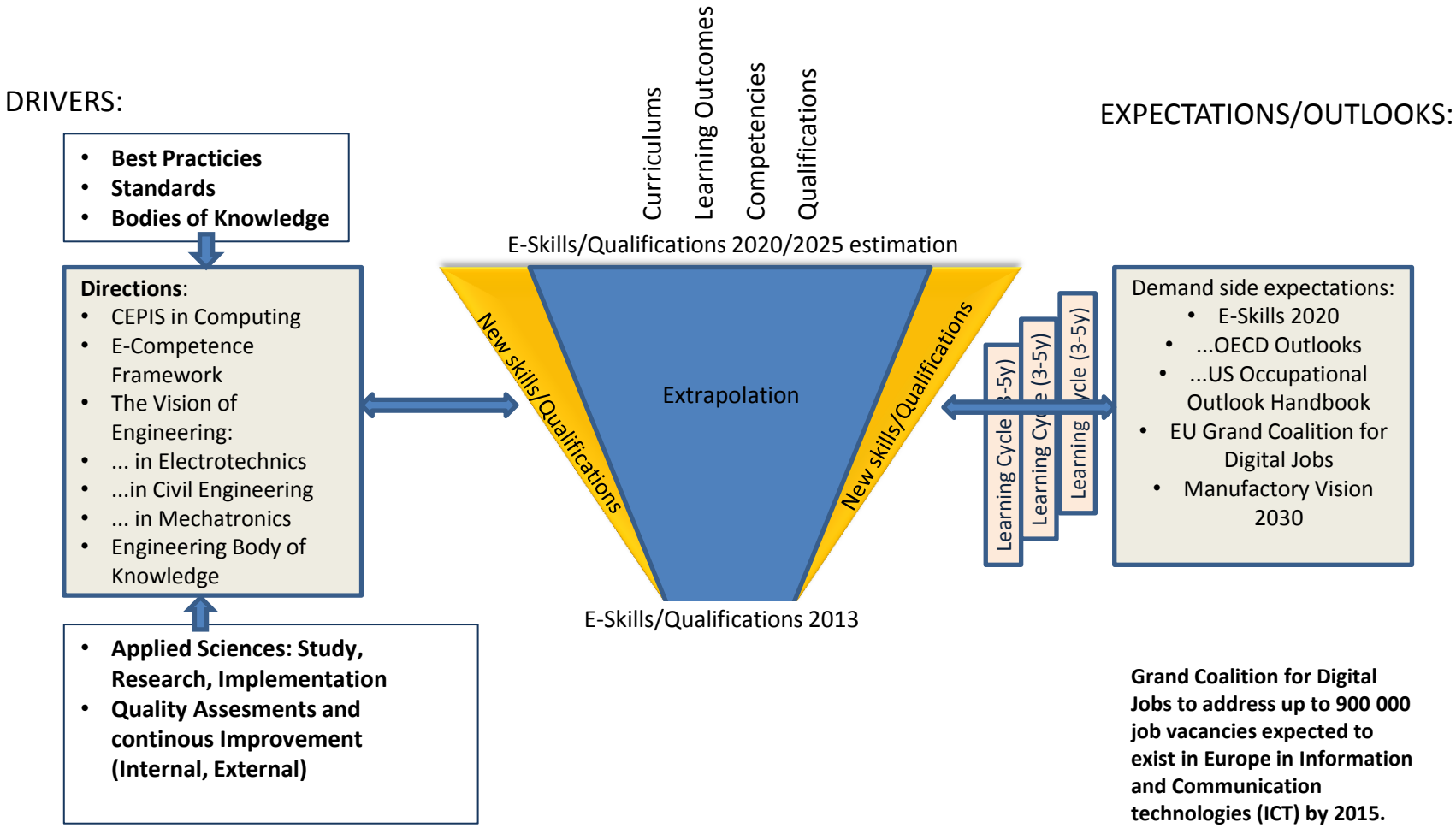
Increased Complexity

The increased complexity of professional practice, however, has made new demands on universities of applied sciences:

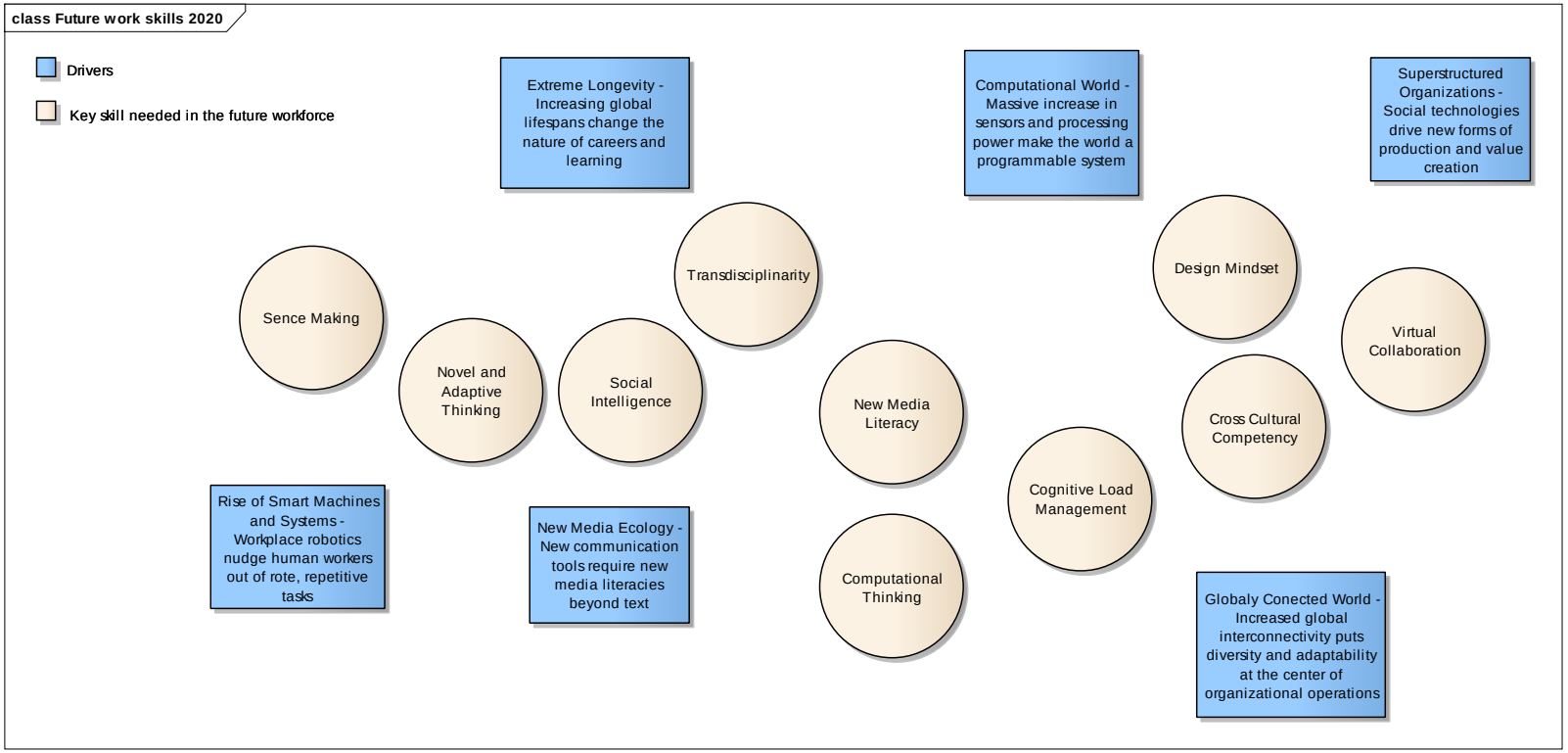
- Stable jobs have been replaced by dynamic professions in which the ability to think and act in an interdisciplinary way has become increasingly important
- The traditional separation between development and implementation has become blurred, which means that the education offered by universities of applied sciences has to ensure that students develop a capacity for critical reflection which enables them to contribute later to innovation in professional practice
- Finally, our society requires responsible professionals suitable for an international environment in which highly educated people are held to account for the social consequences of their actions.
- This development has led to a broadening of the task of universities of applied sciences. Providing education has pride of place, but the development of applied research is a necessary complement to the education of professionals in higher education

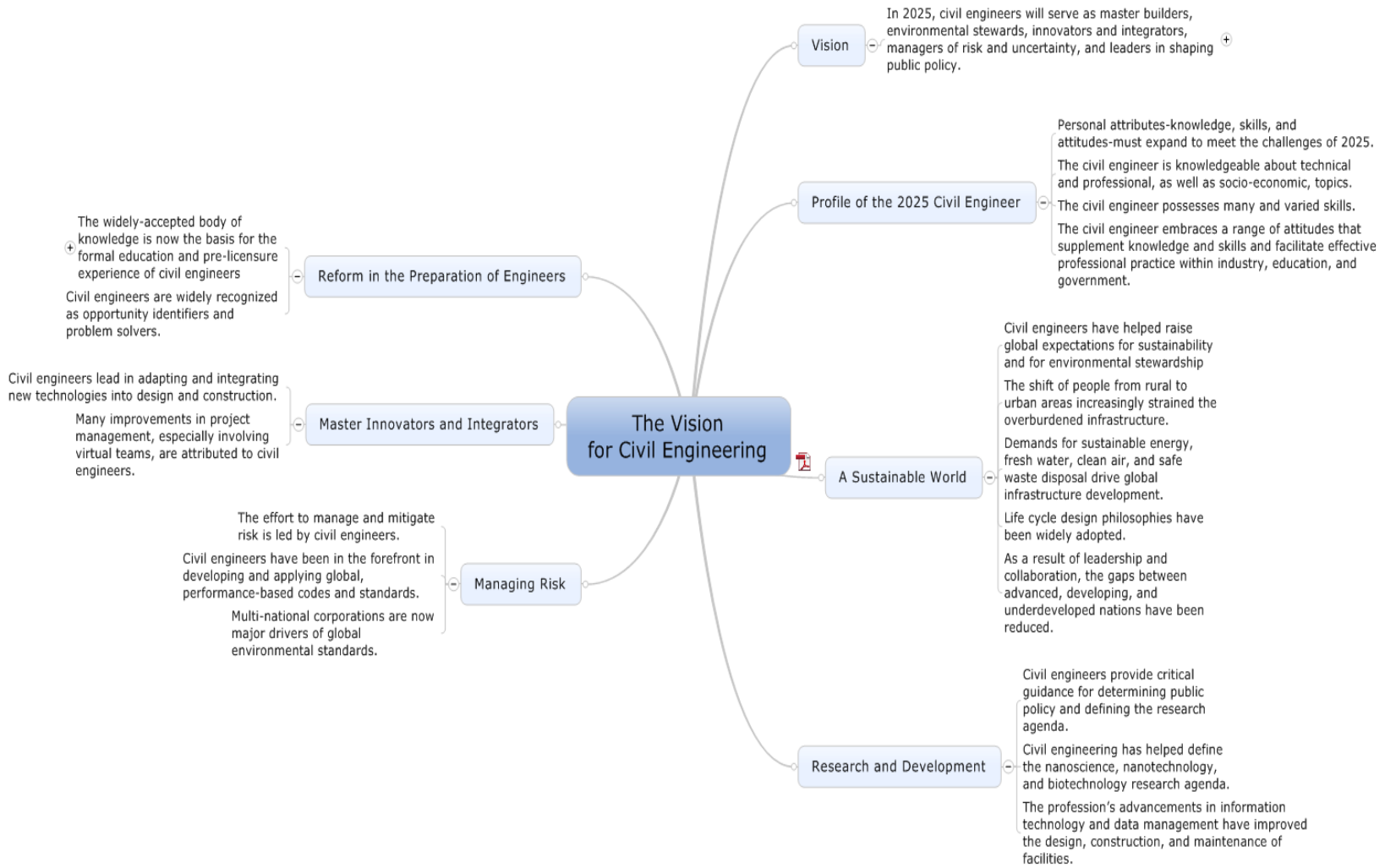
PART I:
Background
and Approaches to
Professional
Qualifications

Qualification Demand Side Drivers

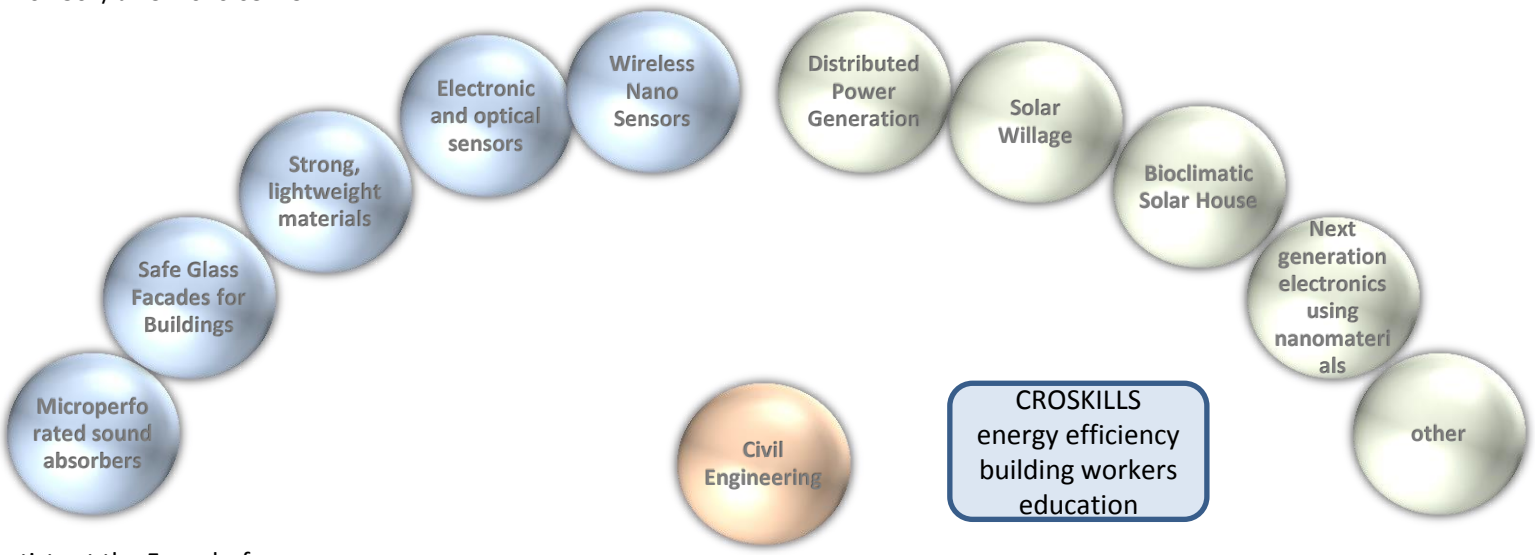


Future work skills 2020




The Vision for Civil Engineering
Vision
In 2025, civil engineers will serve as master builders, environmental stewards, innovators and integrators, managers of risk and uncertainty, and leaders in shaping public policy.
Profile of the 2025 Civil Engineer
Personal attributes-knowledge, skills, and attitudes-must expand to meet the challenges of 2025.
The civil engineer is knowledgeable about technical and professional, as well as socio-economic, topics.
The civil engineer possesses many and varied skills.
The civil engineer embraces a range of attitudes that supplement knowledge and skills and facilitate effective professional practice within industry, education, and government.
A Sustainable World
Civil engineers have helped raise global expectations for sustainability and for environmental stewardship
The shift of people from rural to urban areas increasingly strained the overburdened infrastructure.
Demands for sustainable energy, fresh water, clean air, and safe waste disposal drive global infrastructure development.
Life cycle design philosophies have been widely adopted.
As a result of leadership and collaboration, the gaps between advanced, developing, and underdeveloped nations have been reduced.
Research and Development
Civil engineers provide critical guidance for determining public policy and defining the research agenda.
Civil engineering has helped define the nanoscience, nanotechnology, and biotechnology research agenda.
The profession's advancements in information technology and data management have improved the design, construction, and maintenance of facilities.
Managing Risk
The effort to manage and mitigate risk is led by civil engineers.
Civil engineers have been in the forefront in developing and applying global, performance-based codes and standards.
Multi-national corporations are now major drivers of global environmental standards.
Master Innovators and Integrators
Civil engineers lead in adapting and integrating new technologies into design and construction.
Many improvements in project management, especially involving virtual teams, are attributed to civil engineers.
Reform in the Preparation of Engineers
The widely-accepted body of knowledge is now the basis for the formal education and pre-licensure experience of civil engineers
Civil engineers are widely recognized as opportunity identifiers and problem solvers.

Saafi et al. Wireless and embedded nanotechnology-based systems for structural integrity monitoring of civil structures: a feasibility study. International Journal of Materials and Structural Integrity, 2010; 4 (1): 1
DOI: 10.1504/IJMSI.2010.032494

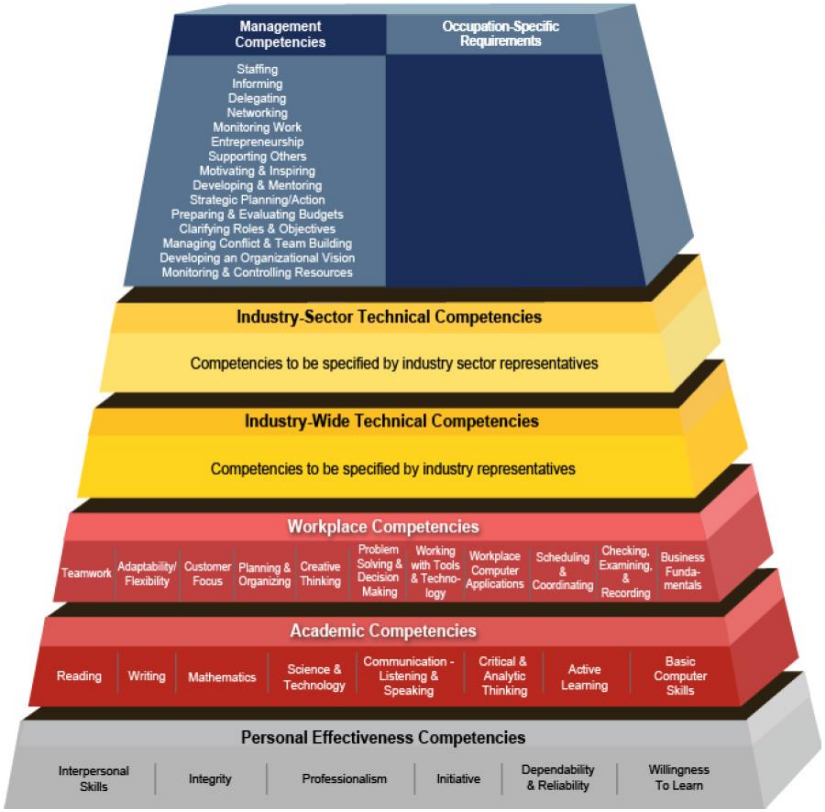


Scientists at the Fraunhofer Institute for Building Physics

In 2025, civil engineers will serve as master builders, environmental stewards, innovators and integrators, managers of risk and uncertainty, and leaders in shaping public policy.

Personal attributes—knowledge, skills, and attitudes—must expand to meet the challenges of 2025

"Building Blocks" for Competency Models



The upper tiers represent the specialization that occurs within specific *occupations* within an industry. Information on occupational competencies can be found in O*NET OnLine http://www.onetonline.org/.

Tier 5 is to be filled in with the competencies specific to a sector within an industry.

Tier 4 is to be filled in with industry-wide competencies.

Tier 3 – Workplace Competencies represent motives and traits, as well as interpersonal and self-management styles.

Tier 2 – Academic Competencies include cognitive functions and thinking styles.

Tier 1 – Personal Effectiveness Competencies are often referred to as "soft skills".

Qualification Demand Side Drivers

Commercial and Industrial Construction Competency Model

Industry-Sector Technical Competencies

- Construction of Commercial/ Industrial Buildings
- Materials & Installation
- Heavy Equipment Operations
- Customer Service & Contractual Relationships
- Green Building Practices

Industry-Wide Technical Competencies

- Building & Construction Design
- Material Resources
- Operation, Installation, & Repair
- Regulations & Quality Assurance
- Health, Safety, & Security

Heavy Highway Civil Construction Competency Model

Industry-Sector Technical Competencies

- Construction of Heavy Highway & Civil Structures
- Site Preparation
- Heavy Equipment Operations
- Materials & Installation
- Traffic Control

Industry-Wide Technical Competencies

- Building & Construction Design
- Material Resources
- Regulations & Quality Assurance
- Health & Safety

Residential Construction Competency Model

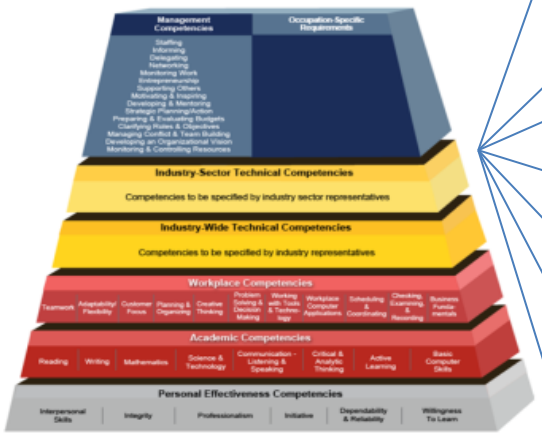
Industry-Sector Technical Competencies

- Construction of Specific Home Components
- Specialty Skills
- Business Fundamentals
- Customer Service & Homeowner Relations
- Green Building Practices

Industry-Wide Technical Competencies

- Building & Construction Design
- Material Resources
- Operation, Installation & Repair
- Regulations & Quality Assurance
- Health & Safety

Building Blocks Model



Energy/Generation, Transmission and Distribution Competency Model

Industry-Sector Technical Competencies

- Non-Nuclear Generation (Coal, Natural Gas, Oil, Hydro, Solar, Wind, BioFuel, Geothermal)
- Nuclear Generation
- Electric Transmission & Distribution
- Gas Transmission & Distribution

Industry-Wide Technical Competencies

- Safety Awareness
- Industry Principles & Concepts
- Environmental Laws & Regulations
- Quality Control & Continuous Improvement
- Troubleshooting

Renewable Energy

Industry-Sector Technical Competencies

- Biomass
- Solar
- Wind
- Geothermal
- Water
- Fuel Cells and Hydrogen Energy

Industry-Wide Technical Competencies

- Fundamentals of Energy and Power
- Energy Efficiency
- Renewable Energy Technologies
- Quality Assurance and Continuous Improvement
- Policies, Laws and Regulations
- Health, Safety, and Security

Information Technology Competency Model

Industry-Sector Technical Competencies

Industry-Wide Technical Competencies

- Principles of Information Technology
- Databases and Applications
- Networks, Telecom, Wireless & Mobility
- Software Development & Management
- User & Customer Support
- Digital Media and Visualization
- Compliance
- Risk Mgmt., Security & Info Assurance

Mechatronics Competency Model

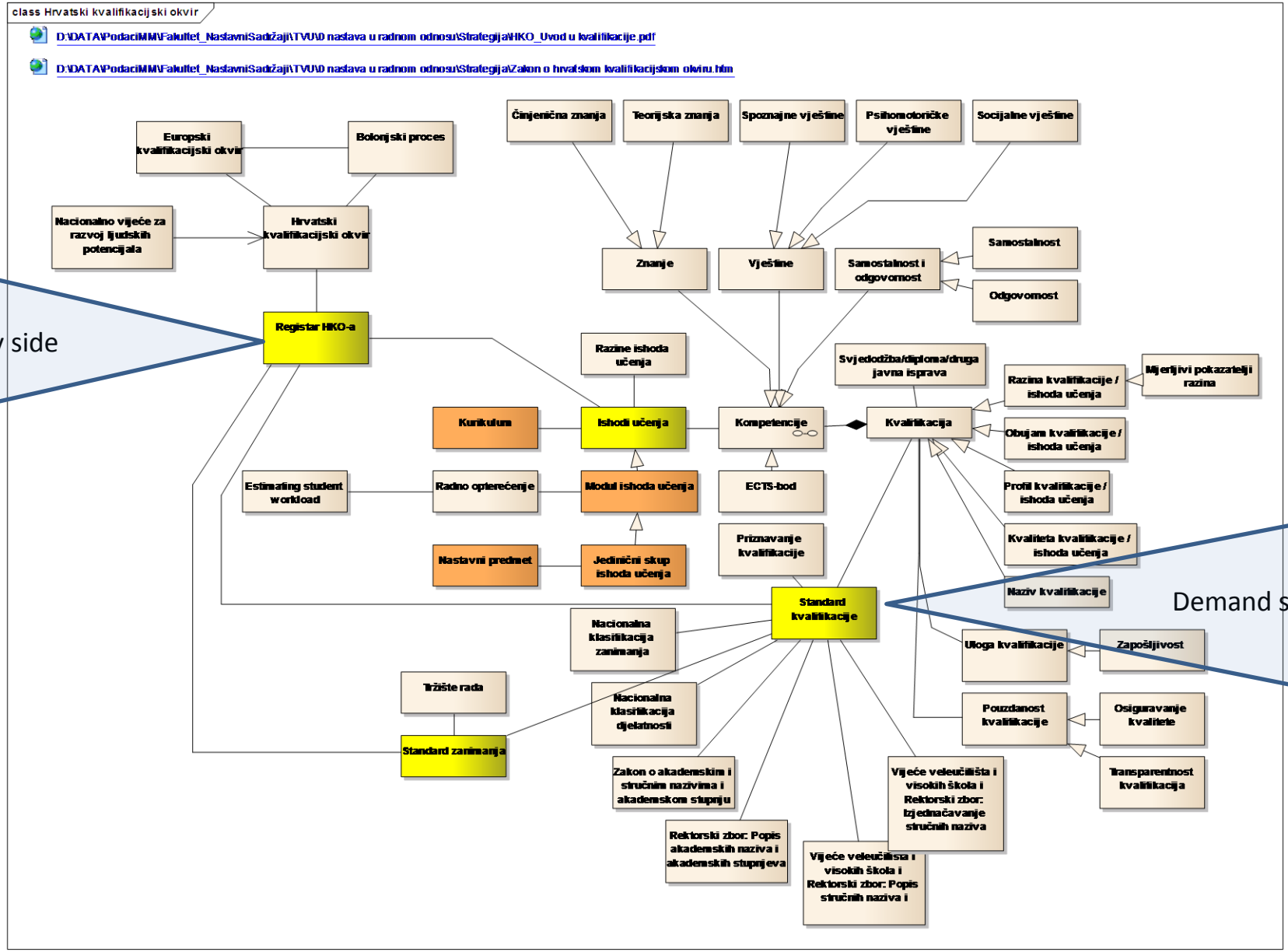
Industry-Sector Technical Competencies

- Mechatronics
- Mechanical
- Electrical
- Computers
- Controls
- Industrial Safety

Industry-Wide Technical Competencies

- Design & Development
- Operations
- Maintenance, Installation, & Repair
- Quality Assurance & Continuous Improvement
- Health, Safety, Security, & Environment

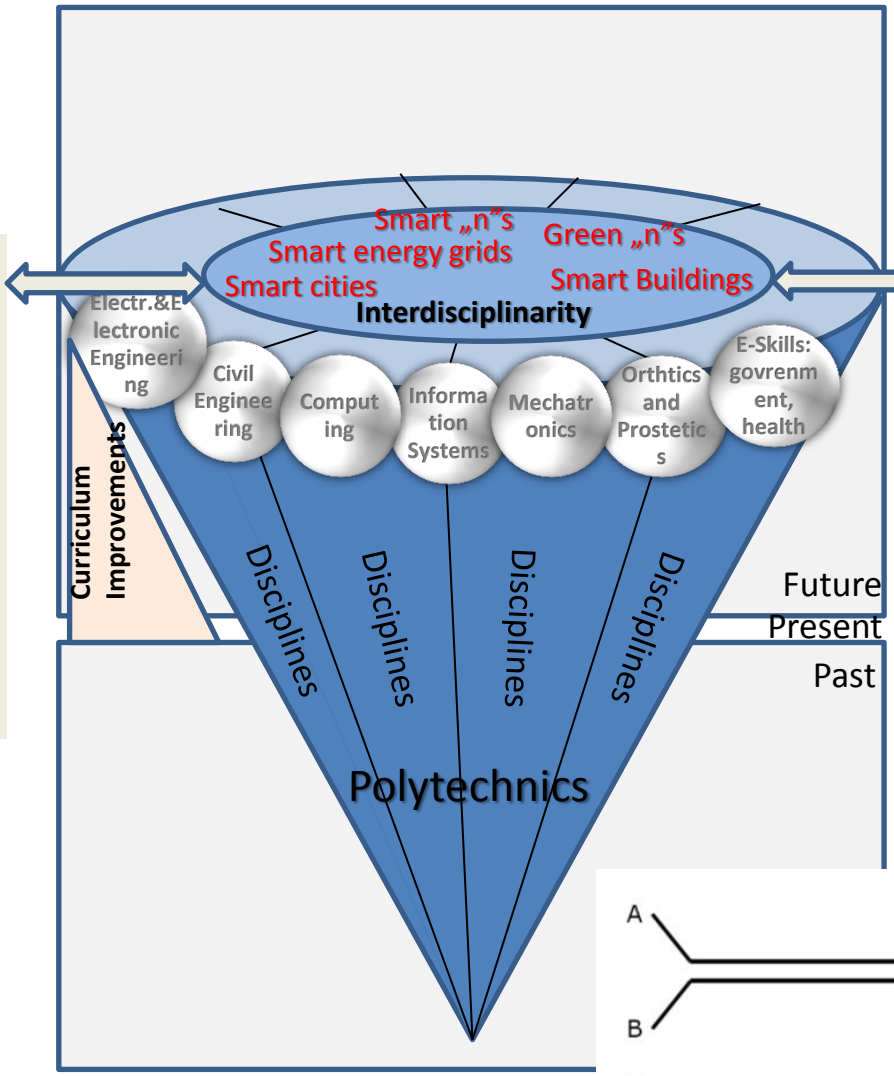
Qualification Framework – Demand/Supply Side Interaction Model



"Rare Elements Age" - *Critical Elements for New Energy Technologies*

The technology push:

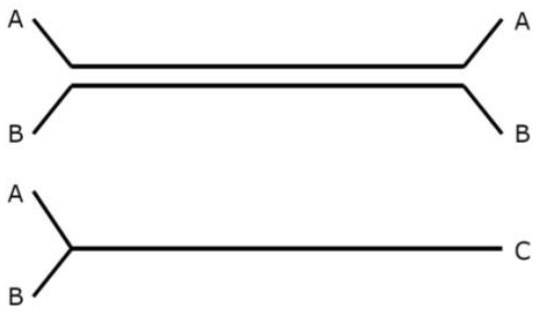
- New materials: Carbon, organic electronics , ...
- Nano-devices: Quantum confinement effects , ...
- Sensors: Transduction mechanisms, ...
- Bio Technologies
- Integration of Technologies



Smart Material Houses
Hybrid Houses

Smart sensors
Computing Technologies
Ubiquitous and Pervasive Computing
Context-Aware Computing
Agent Based Computing
Appliance monitoring and control
Safety and security
Smart energy metering
Environmental control

Internet of Energy - intelligent electronic networking of all components of an energy system.

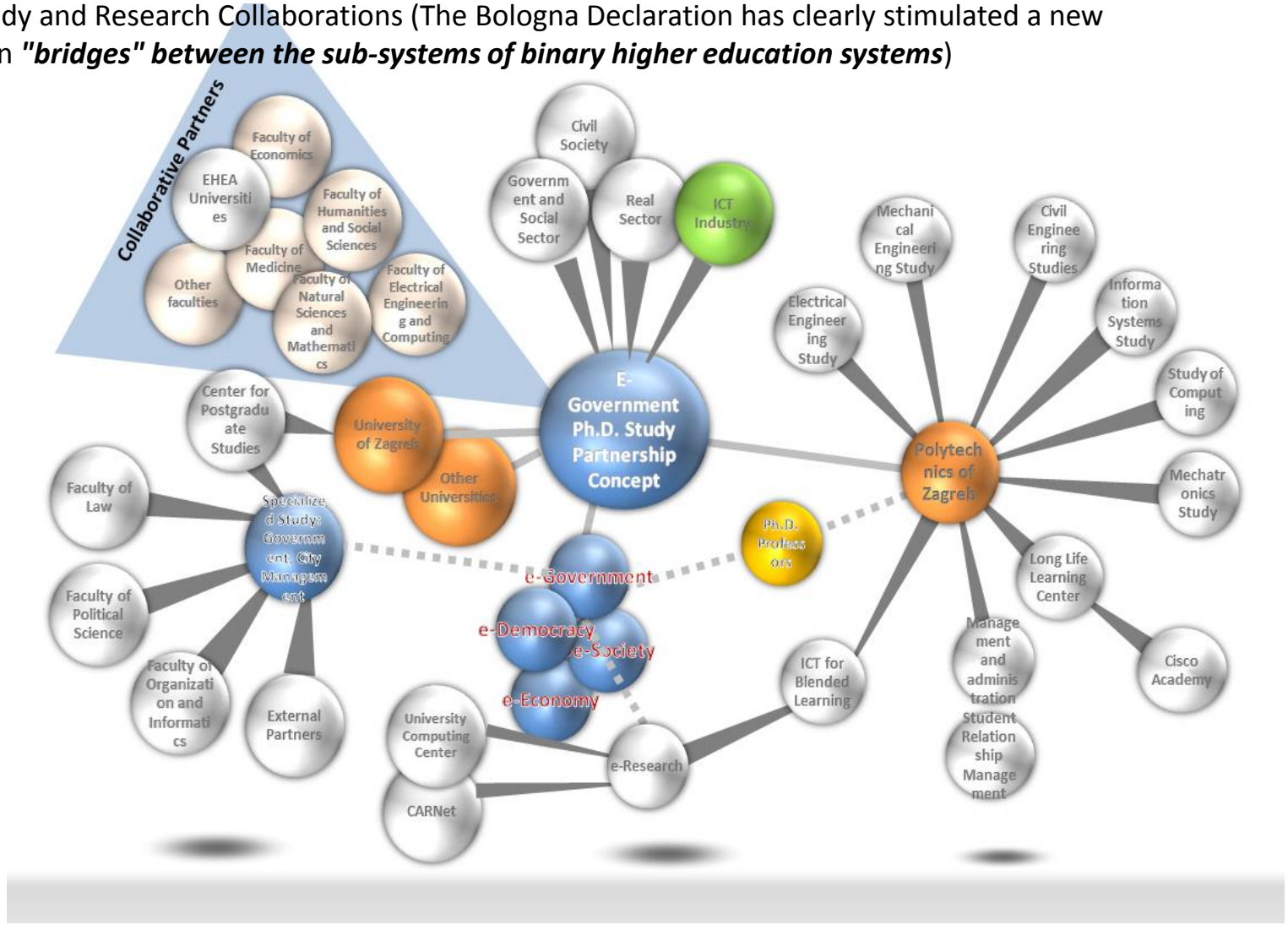


Multidisciplinarity:
"Join together to work on common problem, split apart unchanged when work is done."

Interdisciplinarity:
"Join together to work on commen problem. Interact may forge a new research field or discipline."

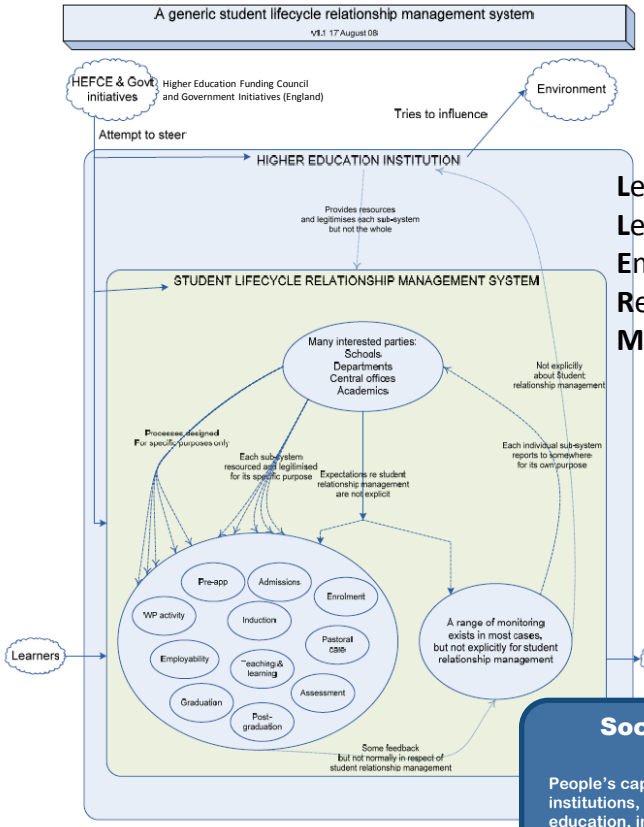
Source: National Academy of Sciences, USA, 2004.

Open Study and Research Collaborations (The Bologna Declaration has clearly stimulated a new debate on ***"bridges" between the sub-systems of binary higher education systems***)



„Doctoral students can either complete their theses at a university or at the cooperating University of Applied Sciences" (**Cooperative Research Colleges of Universities and Universities of Applied Sciences,** President of the German Rectors' Conference (Hochschulrektorenkonferenz-HRK), Prof. Dr. Margret Wintermantel, Berlin 2010.)

LLE Relationship Management and Tripple Helix Knowledge Clusters
Collaborative Processes in Formal and Lifelong Learning Processes



Learner
Lecturer
Employer
Relationship
Management

Innovation

Introducing, accepting, and implementing a new idea, process, product, or service

Information Sharing

When information residing in one domain intentionally gets shared with another domain

Knowledge Sharing

When knowledge residing in one domain intentionally gets shared with another domain

Knowledge Spillover

When knowledge residing in one domain fortuitously gets shared with another domain

Social Capital

People's capacity, social relations, institutions, cultural cohesion, education, information, skills, and knowledge

Triple Helix Knowledge Clusters

Where people share their experiences and knowledge in free-flowing creative ways so as to foster new approaches to problem solving and improvement, help drive strategy, transfer best practice, develop professional skills

Foundation for Interdisciplinary Collaboration

Trust

A belief in character, ability, integrity, familiarity, and morality

Respect

Willingness to show consideration or appreciation

Communication

An act or instance of transmitting

Knowledge

Acquaintance with or understanding of a science, art, or technique

Problem Solving Strategies

How to get from the current state to a goal state

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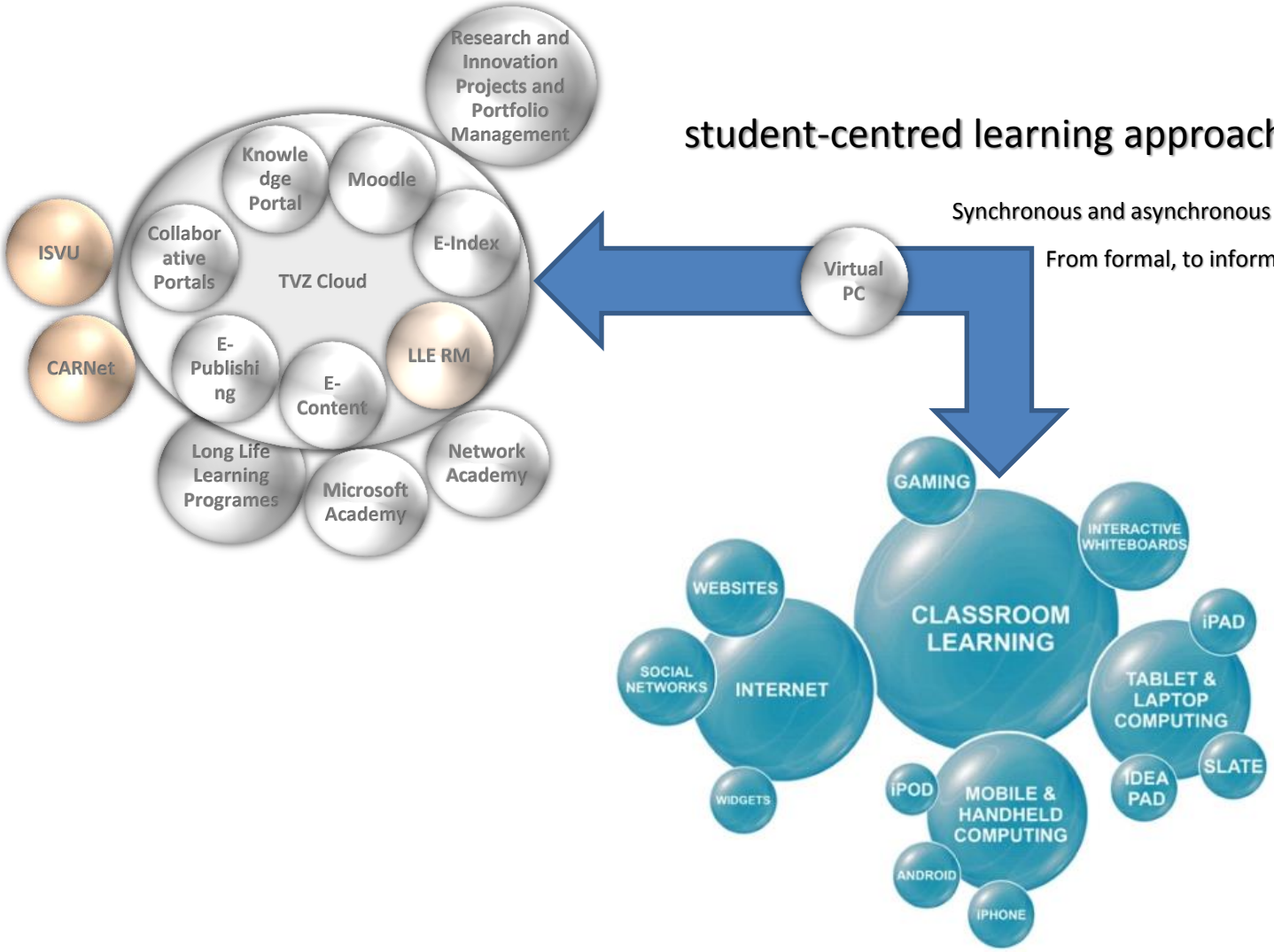
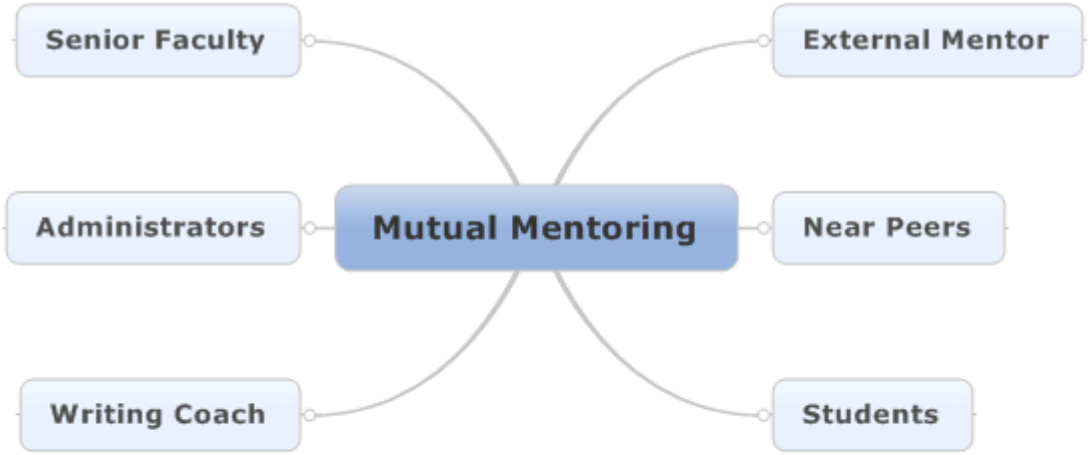


student-centred learning approach

Synchronous and asynchronous learning enablements

From formal, to informal, to blended learning

Mutual Mentoring is a network-based model of support that encourages the development of a wide variety of mentoring partnerships to address specific areas of knowledge and expertise.

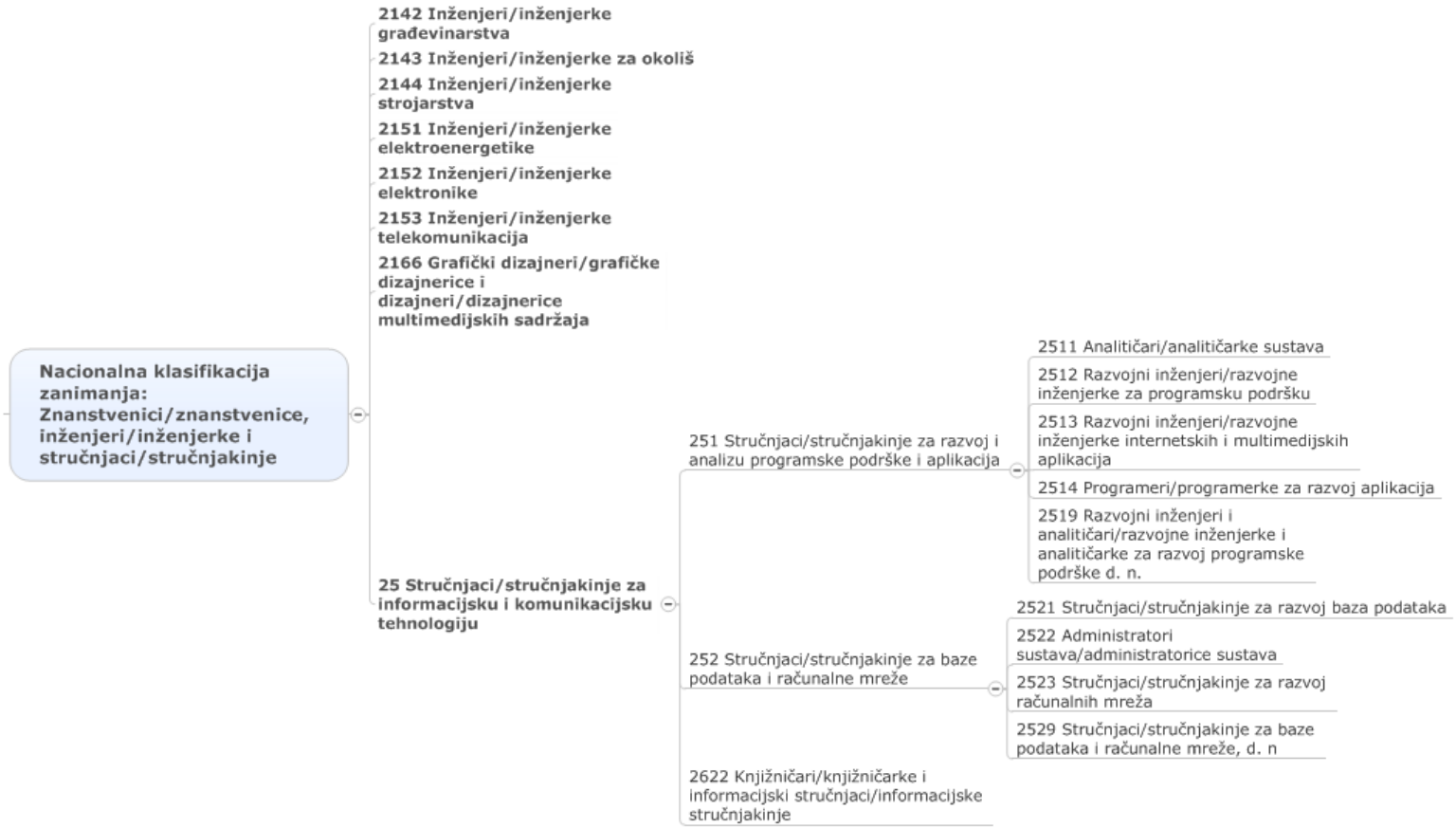


It encourages:

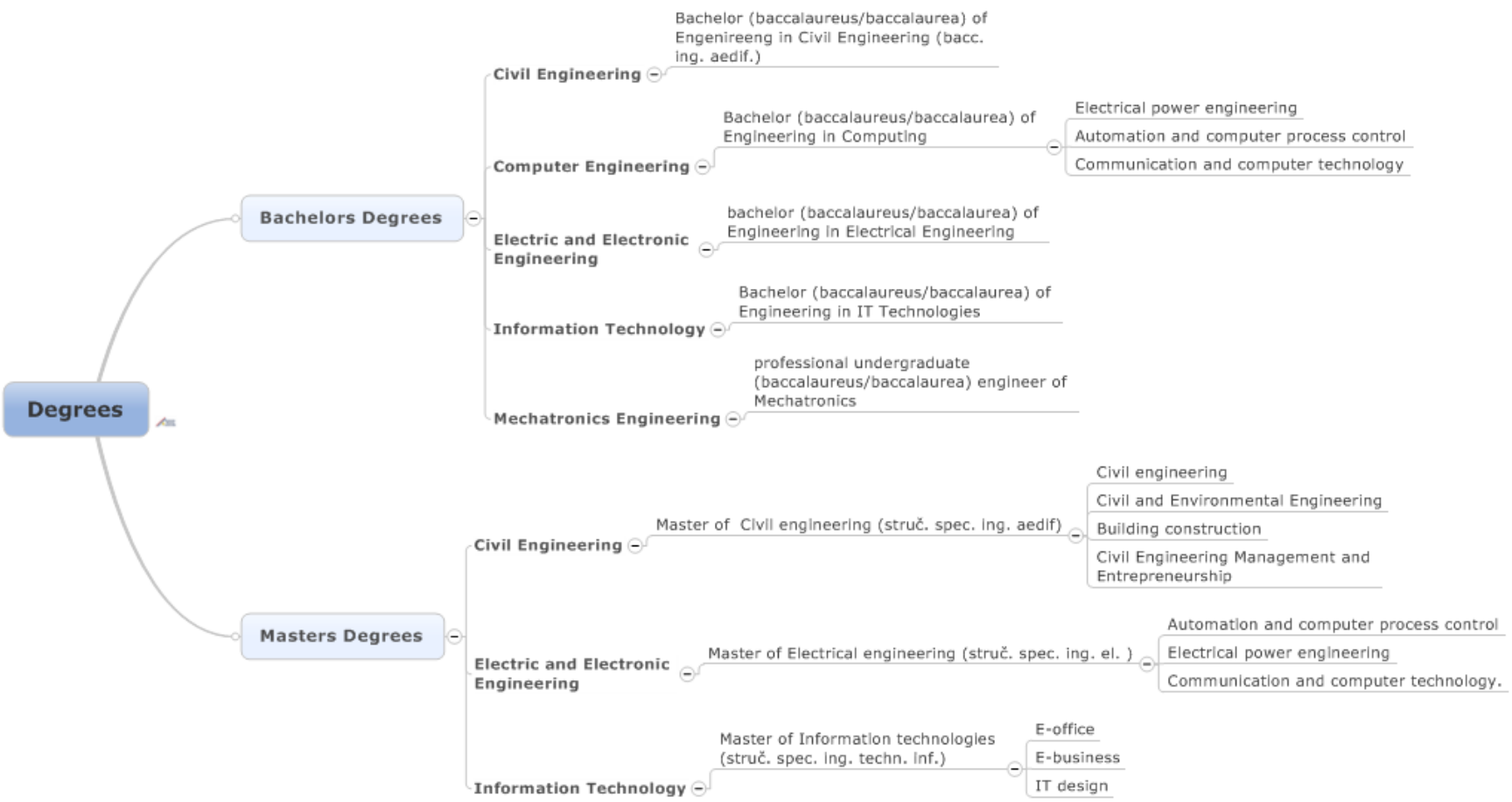
- A broad network of multiple, diverse mentors
- A variety of mentoring approaches
- A focus on areas of experience or expertise, rather than "one-size-fits-all" knowledge;
- Benefits to not only the "protégé," but also the "mentor"
- Opportunities to be mentored and mentor others.

Characteristics

- mentoring partnerships that include a wide variety of individuals—peers, near peers, tenured faculty, chairs, administrators, librarians, students, and others;
- mentoring approaches that accommodate the partners' personal, cultural, and professional preferences for contact (e.g., one-on-one, small group, team, and/or online);
- partnerships that focus on specific areas of experience and expertise, rather than generalized, "one-size-fits-all" knowledge;
- a reciprocity of benefits between the person traditionally known as the "protégé" and the person traditionally known as the "mentor;" and
- perhaps most importantly, new and under-represented faculty members who are not seen or treated solely as the recipients of mentoring, but as the primary agents of their own career development.


Nacionalna klasifikacija zanimanja: Znanstvenici/znanstvenice, inženjeri/inženjerke i stručnjaci/stručnjakinje
2142 Inženjeri/inženjerke građevinarstva
2143 Inženjeri/inženjerke za okoliš
2144 Inženjeri/inženjerke strojarstva
2151 Inženjeri/inženjerke elektroenergetike
2152 Inženjeri/inženjerke elektronike
2153 Inženjeri/inženjerke telekomunikacija
2166 Grafički dizajneri/grafičke dizajnerice i dizajneri/dizajnerice multimedijskih sadržaja
25 Stručnjaci/stručnjakinje za informacijsku i komunikacijsku tehnologiju
251 Stručnjaci/stručnjakinje za razvoj i analizu programske podrške i aplikacija
2511 Analitičari/analitičarke sustava
2512 Razvojni inženjeri/razvojne inženjerke za programsku podršku
2513 Razvojni inženjeri/razvojne inženjerke internetskih i multimedijskih aplikacija
2514 Programeri/programerke za razvoj aplikacija
2519 Razvojni inženjeri i analitičari/razvojne inženjerke i analitičarke za razvoj programske podrške d. n.
252 Stručnjaci/stručnjakinje za baze podataka i računalne mreže
2521 Stručnjaci/stručnjakinje za razvoj baza podataka
2522 Administratori sustava/administratorice sustava
2523 Stručnjaci/stručnjakinje za razvoj računalnih mreža
2529 Stručnjaci/stručnjakinje za baze podataka i računalne mreže, d. n
2622 Knjižničari/knjižničarke i informacijski stručnjaci/informacijske stručnjakinje

Polytechnic of Zagreb Degree Scheme



REPUBLIC OF CROATIA
THE POLYTECHNIC OF ZAGREB
POLYTECHNICUM ZAGRABIENSE

DIPLOMA SUPPLEMENT

This Diploma Supplement follows the model developed by the European Commission, Council of Europe and UNESCO/CEPES. The purpose of this supplement is to provide sufficient independent data that could contribute to international 'transparency' and fair academic and professional recognition of qualifications (diplomas, degrees, certificates etc.). It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It should be free from any value judgements, equivalence statements or suggestions about recognition. Information in all eight sections should be provided. Where information is not provided, an explanation should be given.

1 INFORMATION IDENTIFYING THE HOLDER OF THE QUALIFICATION

1.1 **Surname**

[redacted]

1.2 **First Name (s)**

[redacted]

1.3 **Date (day/month/year), place and country of birth**
13 July 1979, Zagreb, Croatia

1.4 **Student identification number or code**
2403005628

2 INFORMATION IDENTIFYING THE QUALIFICATION

2.1 **Name of qualification and (if applicable) title conferred (in English language)**
Master of Information Technology
(abbr: MIT or ME(IT))

2.2 **Main field(s) of study for the qualification**
Technical sciences – computing, study programme: Specialist Graduate Professional Study Programme in Information technologies

2.3 **Name and status of awarding institution**
The Polytechnic of Zagreb is a public higher education institution (HEI) established by a Decree of the Croatian Government on 21 May 1998. The accreditation for the specialist graduate professional study programme in Information technologies was issued by the Ministry of Science, Education and Sports on 9 June 2005.

2.4 **Name and status of institution administering studies (if different from 2.3)**

2.5 **Language(s) of instruction/examination**
Croatian

3 INFORMATION ON THE LEVEL OF THE QUALIFICATION

3.1 **Level of qualification**
Specialist graduate professional study programme (second-cycle degree)

3.2 **Official length of programme**
Four-semester study programme (thesis included), 120 ECTS credits

3.3 **Access requirement(s)**
At least one of the two conditions fulfilled: 1) a corresponding three (or more) – year study completed, 2) a two-and-a half-year study completed, with bridge courses enrolled, according to the decision of the enrolment board

4 INFORMATION ON THE QUALIFICATION CONTENTS AND RESULTS GAINED

4.1 **Mode of study**
Part-time study

4.2 **Programme requirements**
The main objective of the study programme is to provide students with professional knowledge and skills. Additonally, students are trained to manage projects and develop the sense of entrepreneurship and ethics. The first semester common courses teach students how to develop competences in the fields of economy, law, management and communication skills. The next two semesters offer a series of professional subjects.
At the beginning of the study each student is assigned a mentor (by choice), who advises the student on which subjects to choose and, consequently, the specialization to go for. During the third semester the student gets in charge of a seminar paper, which is a preparation for the graduation thesis. During the fourth semester the student works out the graduation thesis, under the guidance of the mentor. The classes are organized in such a way as to develop students' competences for both individual and team work. Working out the graduation thesis, students enhance and demonstrate their competences to develop and/or implement ideas, to solve problems in new environment, to integrate knowledge, to present conclusions and ideas to specialists and non-specialists, to take responsibility for making decisions, to recognize the importance of other fields of expertise and their cooperation.

Professionally oriented second cycle qualifications

-Part 2-

Prof. Mladen Mauher, Ph.D., Polytechnics of Zagreb
Prof. Miroslav Slamić, Ph.D., Polytechnics of Zagreb

Master degree – Professionally oriented second cycle qualification (Information technology at Polytechnics of Zagreb)

Established	• Since 2006. Two years (4 semesters) part-time study.
Characteristics	• Flexible modular design (6 modules) but more course and lecture oriented and less competences oriented • 70 % courses are elective
Improvements	• Several incremental updating with new courses and lecture contents
Preparation for certification	• Industrial/Vendor oriented certificate • Professional EUCIP CORE certificate

Master degree – redesign and improvements

Assumptions

- IT environment has changed dramatically. *In the future IT will be reduced to three kinds of jobs.
  - Consultants
  - Project managers
  - Developers

Framework

- e-Competence Framework – ICT knowledge, skill and competence on a European level:
- **Definition:
  - **Competence** - „demonstrated ability to apply knowledge, skills and attitudes for achieving observable results";
  - **Skill** is defined as „ability to carry out managerial and technical tasks"
  - **Attitude** defined as „cognitive and relational capacity" and
  - **Knowledge** represents the „set of know-what"

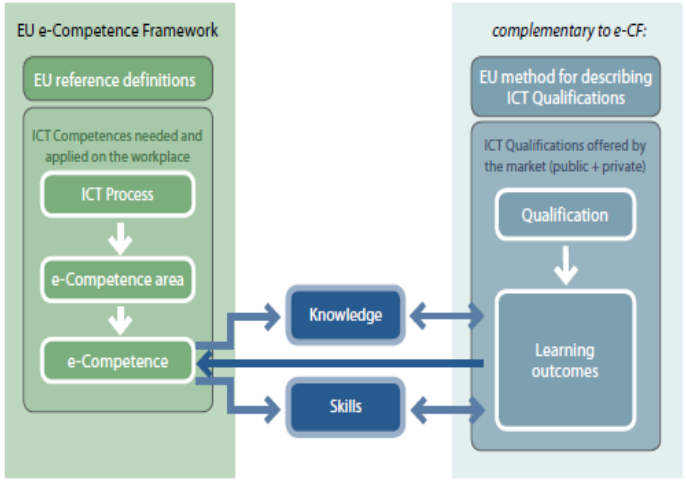
Areas of interest

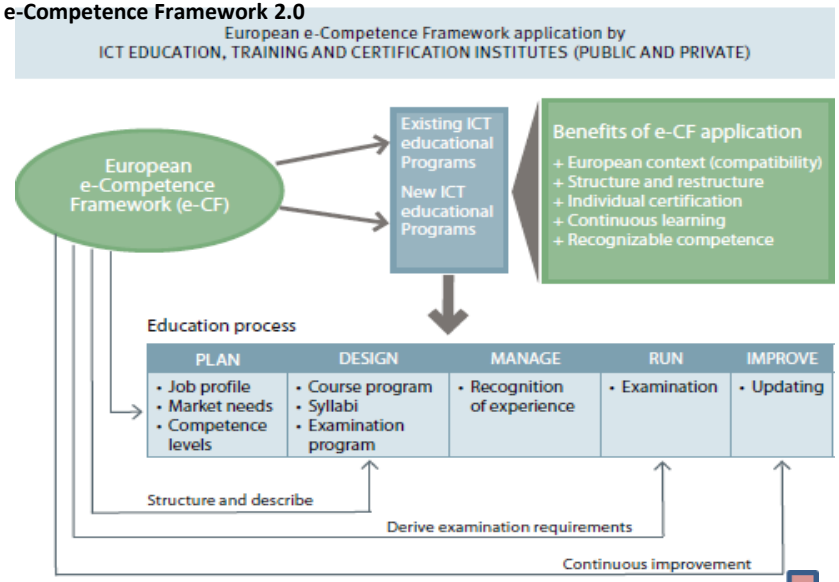
- Rich WEB, Multimedia and e-Publishing
- e-Government, e-Democracy, e-Participation citizen online, etc.
- e-Health (***Information and Communication Technologies (ICT) applied to health and healthcare systems can increase their efficiency, improve quality of life and unlock innovation in health markets.)
- e-Business (****In a increasingly information-based and knowledge-intensive global economy)
- Networked Systems (data centers and cloud)
- Software engineering and embedded systems

*http://www.techrepublic.com/blog/hiner/the-future-of-it-will-be-reduced-to-three-kinds-of-jobs/8717 (2011.)
**European e-Competence Framework – Methodology
***eHealth Action Plan 2012-2020 - Innovative healthcare for the 21st century
****European e-Competence Curricula Development Gudidelines – Final Report

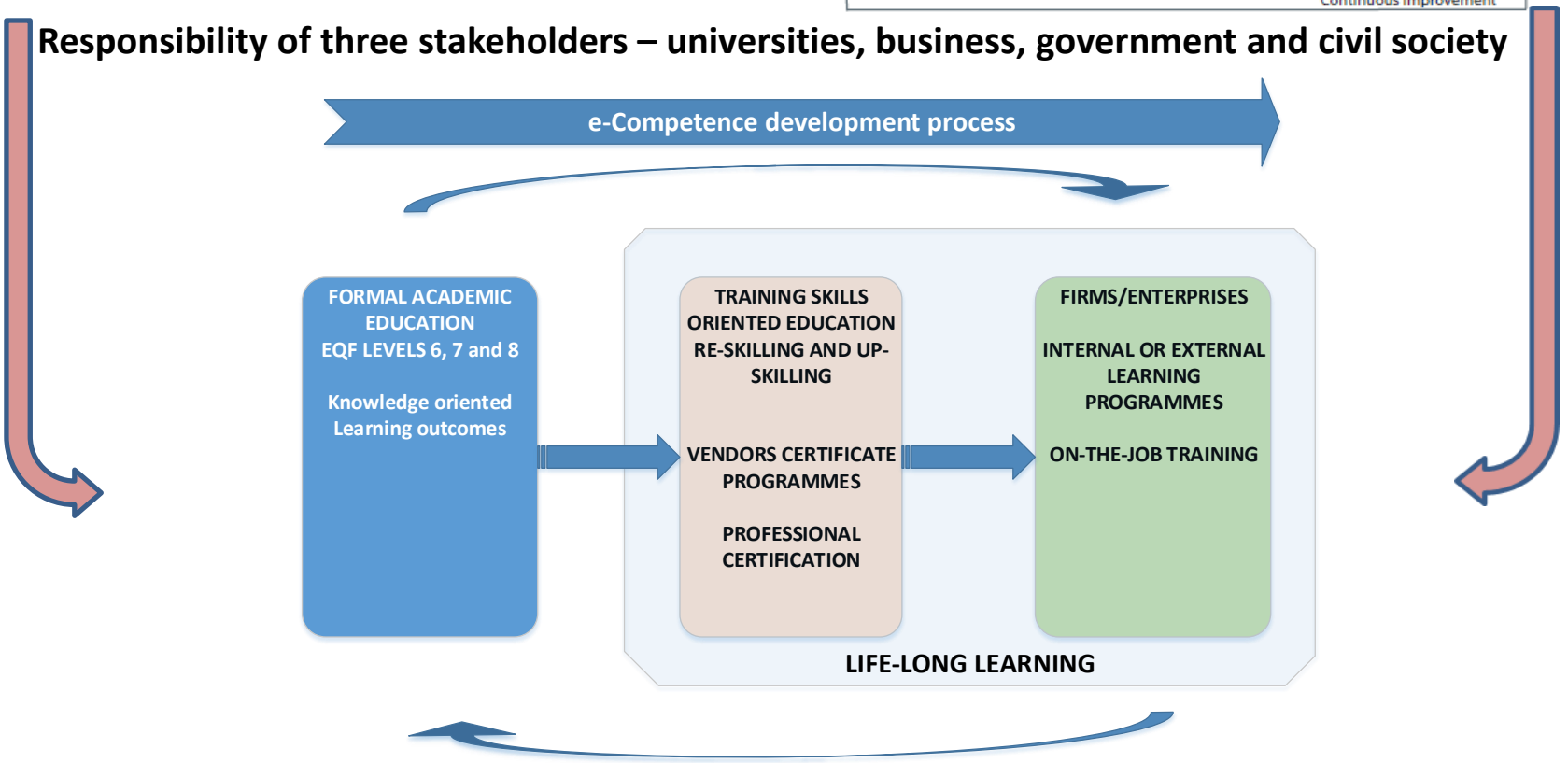
From:User Guidelines, European e-Competence Framework 2.0

Links between e-CF competences and ICT qualification





Responsibility of three stakeholders – universities, business, government and civil society



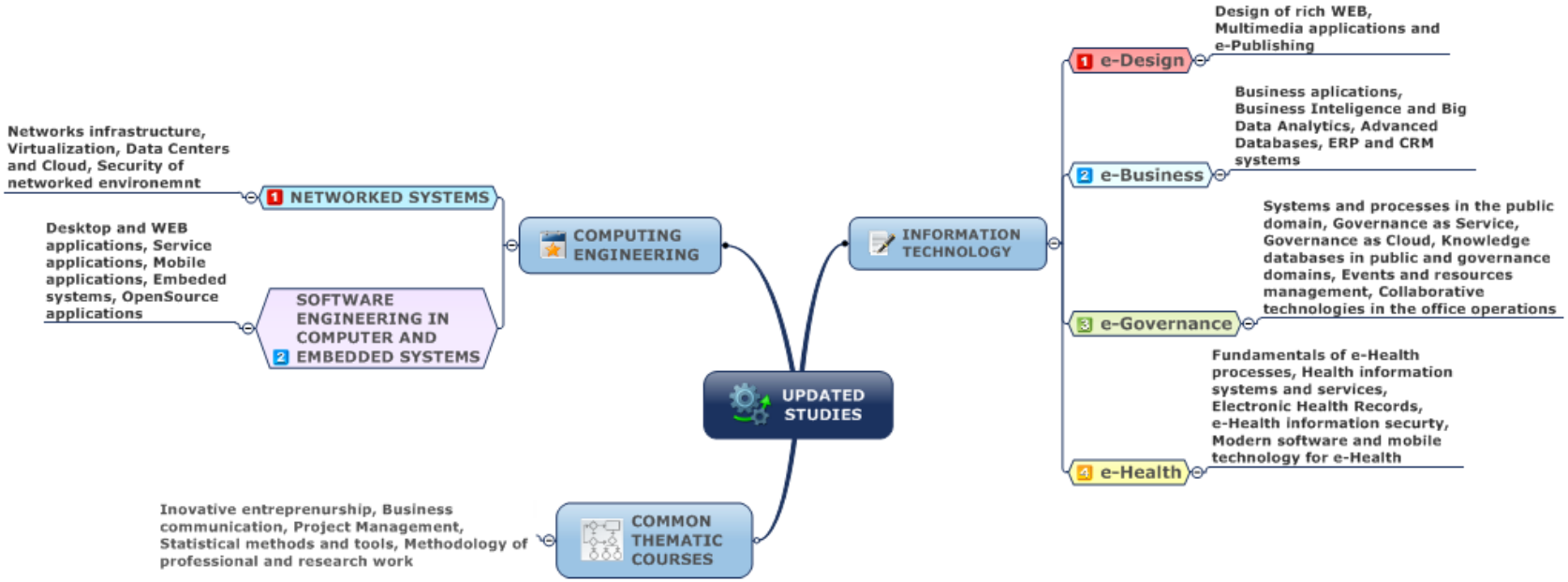
Design new professionally oriented curricula

Orientation

- e-Competence oriented rather than NoICT- skills (NoICT – not only ICT)
- Flexible modular design – modules are interoperable and plug-and-play
- 70 % and more courses are elective
- Learning paths selected by students
- Educate together with business/industrial practitioners
- Modern learning environment (blended learning, interactive E-Learning, live streaming of lectures, ...)

Aims

- To be attractive for potential students
- To be relevant for industry



Example of implementation of e-CF

E-Competences achieved for **IT developer specialist profile**.

Dimension 1	Dimension 2	Dimension 3				
5 e-Comp. areas (A – E)	36 e-Competences identified	e-Competence proficiency levels e-1 to e-5, related to EQF levels 3-8				
		e-CF levels identified per competence				
		e-1	e-2	e-3	e-4	e-5
A. PLAN	A.1. IS and Business Strategy Alignment				■	■
	A.2. Service Level Management			■	■	
	A.3. Business Plan Development			■	■	■
	A.4. Product or Project Planning		■	■	■	
	A.5. Design Architecture			■	■	
	A.6. Application Design	■	■	■		
	A.7. Technology Watching				■	■
	A.8. Sustainable Development			■	■	
B. BUILD	B.1. Design and Development		■	■	■	■
	B.2. Systems Integration		■	■	■	
	B.3. Testing	■	■	■		
	B.4. Solution Deployment	■	■	■		
	B.5. Documentation Production	■	■	■		
C. RUN	C.1. User Support	■	■	■		
	C.2. Change Support		■	■		
	C.3. Service Delivery	■	■	■		
	C.4. Problem Management		■	■	■	
D. ENABLE	D.1. Information Security Strategy Development				■	■
	D.2. ICT Quality Strategy Development				■	■
	D.3. Education and Training Provision		■	■		
	D.4. Purchasing		■	■	■	
	D.5. Sales Proposal Development		■	■	■	
	D.6. Channel Management			■	■	
	D.7. Sales Management			■	■	■
	D.8. Contract Management		■	■	■	
	D.9. Personnel Development		■	■	■	
	D.10. Information and Knowledge Management			■	■	■
E. MANAGE	E.1. Forecast Development			■	■	
	E.2. Project and Portfolio Management		■	■	■	■
	E.3. Risk Management		■	■	■	
	E.4. Relationship Management		■	■	■	
	E.5. Process Improvement			■	■	
	E.6. ICT Quality Management		■	■	■	
	E.7. Business Change Management			■	■	■
	E.8. Information Security Management		■	■	■	
	E.9. IT Governance				■	■

A.5. Architecture Design

A.6. Application Design

Defines the most suitable ICT solutions in accordance with ICT policy and user/customer needs. Accurately estimates development, installation and maintenance of application costs. Selects appropriate technical options for solution design, optimizing the balance between cost and quality. Identifies a common reference framework to validate the models with representative users.

B.1. Design and Development

B.2. Systems Integration

B.3. Testing

B.4. Solution Deployment

C.1. User Support

E.5. Process Improvement

B.1. Design and Development

Proficiency Levels

Level 2 Systematically develops small components.

Level 3 Acts creatively to develop and integrate components into a larger product.

Level 4 Handles complexity by developing standard procedures and architectures in support of cohesive product development.

Level 5 Has ultimate responsibility for strategic direction of product, technical architecture or technology development

Knowledge Examples

K1 appropriate software programs/ modules, DBMS and programming languages

K2 hardware components, tools and hardware architectures

K3 functional & technical designing

K4 programming languages

Skills Examples

S1 explain and communicate the design/development to the customer

S2 perform and evaluate test results against product specifications

S3 apply appropriate software and/or hardware architectures

S6 use data models

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Thank you to attention!