

Qualifications Frameworks for Engineering Education

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To say what I am going to say...

- ① **Some historical notes about the Bologna Process in Europe**
 - ① **Political, economical and academic issues**
- ② **Qualifications Frameworks and Engineering Education**
 - ② **Qualifications Frameworks at meta-, sectoral and branch levels**
 - ② **Meta frameworks and legal structures inspired by the Bologna Process**
 - ② **Meta frameworks and the offer of Engineering Education**
- ③ **The role of sectoral and branch level frameworks in field-specific quality assurance systems**
- ④ **Concluding Notes**

Life over the past 30 years Driving forces for changes

- ☞ **Last quarter of the 20th Century - Intense search of new routes for Europe and for the role of Europe in the World, driven by**
 - ✓ **Progress observed in Science and Technology, namely**
 - **in digital systems and communications**
 - **in health and life sciences**
 - ✓ **Political changes that took place in Europe**
 - ✓ **Expectations and demands of Society**
 - **Education for All**
 - **Quality requirements**

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Life Today I - Facts

- **Economy and market forces - driving force of Today's Societies**
- **The computer and communications era - dramatic changes of the concepts of time and space - globalisation**
- **Decreasing demography and the increase of Expectation of Life - Social sustainability**
- **Sharp increase in standards and competition - Worldwide and within the European Space**
- **The need for mass education policies**
- **Significant change in the concepts of individual career management**
- **Job market and opportunities - wider than ever**

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Life Today

II - A new paradigm of coexistence

- ☞ A global World living in and with a new paradigm of coexistence
 - ✓ **COOPETITION = COOPERATION + COMPETITION**
- ☞ That requires
 - New management and transnational cooperation policies
 - A new cultural paradigm of Education - Lifelong Learning
 - Mobility of students and professionals
- ☞ Which in turn requires
 - Policies and Instruments for recognition of academic and professional qualifications
 - **POLITICAL WILL**

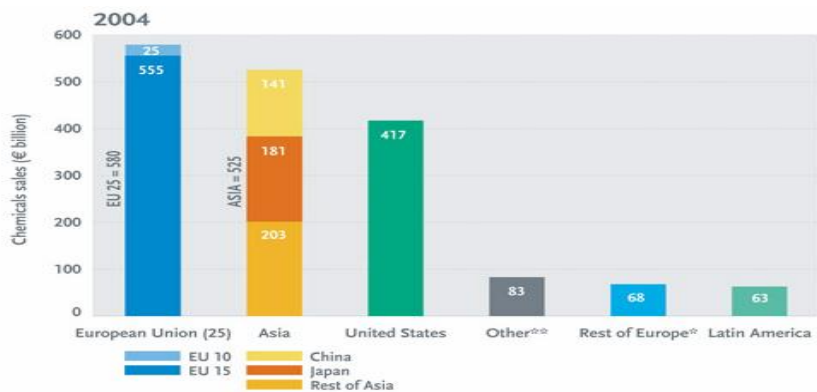
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Life Today...

III - Just an Example of World Competition

Geographic breakdown of World chemicals sales, CEFIC F&F2004



World chemicals sales in 2004 is estimated at € 1736 billion
The EU accounts for 33% of the total

Source: Cefic

Definition: Rest of Europe* = Switzerland, Norway, and other Central & East (excluding the new EU 10 countries)

Other** including Canada, Mexico, Africa & Oceania



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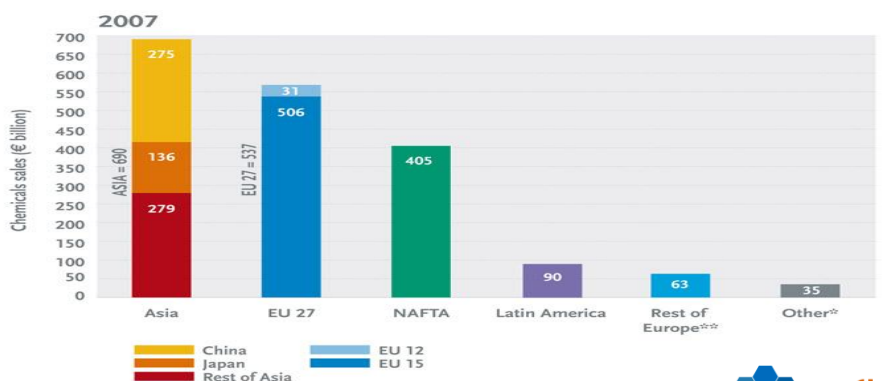
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Life Today...

III - Just an Example of World Competition

Geographic breakdown of World chemicals sales, CEFIC F&F2007

Chart 1.1: Geographic breakdown of world chemicals sales



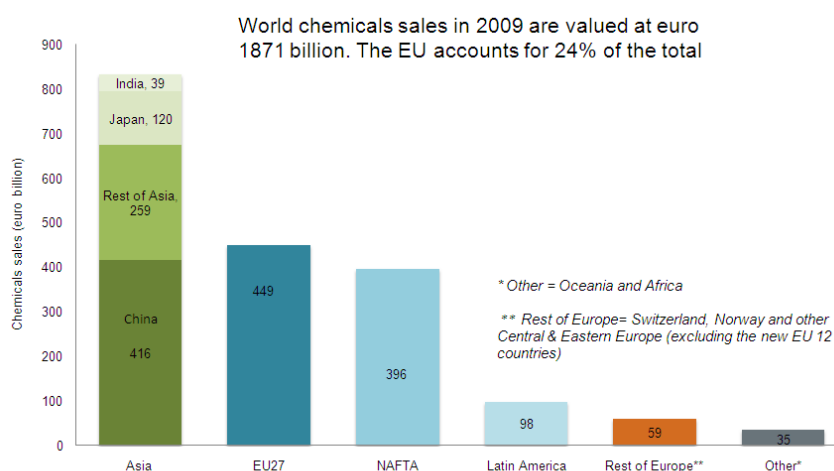
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Life Today...

III - Just an Example of World Competition

Geographic breakdown of World chemicals sales, CEFIC F&F2009



Source: Cefic Chemdata International

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The Treaty of Rome

The Lisbon Treaties 2000.. 2007/2010

and the Bologna Process

- ☞ The Treaty of Rome ,1957 - basis for the European Economic Community
 - ✓ Economy
 - ✓ Market & Services

- ☞ The Lisbon Treaty of March 2000
 - ✓ The Economy Dimension - The EURO
 - ✓ The People Dimension - The Social Dimension
 - ✓ The Knowledge Society Dimension -
 - Identified with the Bologna Process and the creation of the European Area of Knowledge

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The Bologna Process

What needs to be understood

- ☞ Understand the Bologna Process as one of the dimensions of the prevailing strategy for European development - based on **KNOWLEDGE AND TRANSNATIONAL CO-OPERATION**

- ☞ Understand the Bologna Process as having two main groups of objectives, naturally interlinked
 - ✓ Objectives of political, social, and economical nature
 - ✓ Objectives of a dominant academic nature

- ☞ Understand that indeed these objectives mean, in many countries, a major reform (... a small revolution...) in Higher Education and in Society

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The Bologna Process, 12 Years after What it is not... What it is...

☞ The Bologna Process is not...

- ✓ Any criticism or defeating position relatively to the past of Higher Education
- ✓ A magic solution to improve from night to day the system of Higher Education

☞ The Bologna Process is...

- ✓ The perception of the recent past and of the present and the preparation of the future in a Global World of fast and deep changes

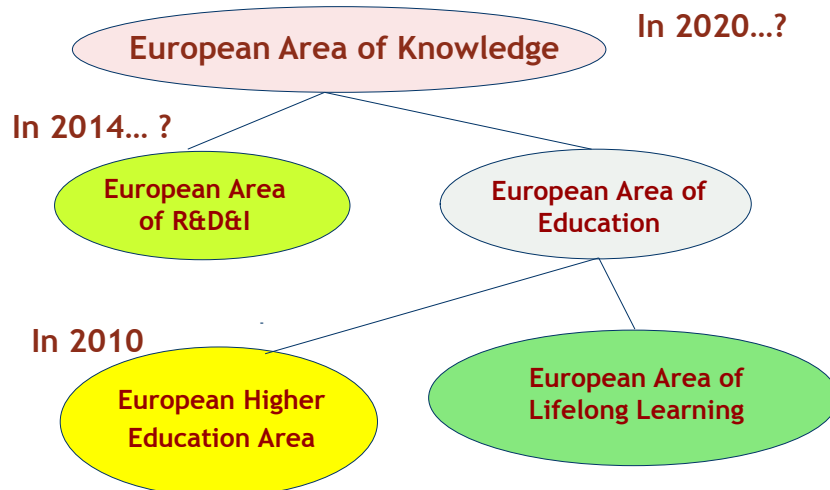
☞ The Bologna Process is indeed a major dimension of the European answer to the

- ✓ **CHALLENGES OF A CHANGING WORLD**

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The European Area of... Knowledge... Officially launched on 11-12 March 2010, in Budapest-Vienna Still under construction... till 2020...



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From Bologna, 1999, to Budapest-Vienna, 2010... and beyond Characterizing the Process Today

- ☞ **Policy areas**
- ☞ **Structural organization issues**
- ☞ **The Substance - academic issues**

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From Bologna to Leuven/Louvain-La-Neuve... and beyond Policy Areas - Political objectives and concerns

- ✓ **Mobility**
- ✓ **Social dimension**
- ✓ **Employability**
- ✓ **Lifelong Learning**
- ✓ **Attractiveness or the Process in a global dimension**

- ✓ **Challenges posed by Global Competition - 'Borderless Higher Education Market'**
- ✓ **Need for International Cooperation - recognition**
- ✓ **The demographic challenge - new publics**
- ✓ **New leading roles and responsibilities**
- ✓ **Monitoring quality within diversity with multidimensional transparency tools**
- ✓ **Accessing diverse sources of funding**

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From Bologna to Budapest-Vienna ... and beyond The Structure - action lines and instruments for action

- ✓ **A Degree Structure -**
 - **Based on recognised QUALIFICATIONS FRAMEWORKS**
- ✓ **A System to measure work and OUTCOMES**
 - **The ECTS credit and accumulation system**
- ✓ **A way of documenting qualifications**
 - **The DIPLOMA SUPPLEMENT**
- ✓ **A System to guarantee transparence**
 - **Building accepted QUALITY ASSURANCE procedures**
- ✓ **A System for recognition of qualifications**
 - **OVERCOMING DIFFICULTIES posed by the diversity of 'recognition cultures'**

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From Bologna to Leuven/Louvain-La-Neuve... and beyond The Substance - the latecomer in the Bologna Process...

- ✓ **Changes to a large extent still to occur**
 - **New contents... closer to more immediate Societal concerns**
 - **New programme structures, linked to a concept of lifelong Learning**
 - **New Methods - change from**
 - ✓ **Teacher-Centred to Student-Centred methodologies**
 - ✓ **Teaching based on Teacher Inputs to Learning Centred in well defined objectives - Learning Outcomes**
 - ✓ **Teaching Times to Student Workloads required to achieve desired Learning Outcomes**

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The Core of the Bologna Reforms

Keywords characterizing Structural Issues

- ☞ **The name of the game is BUILDING TRUST**
- ☞ **TRUST GOES WITH MOBILITY, COOPERATION, ACCREDITATION**
 - ✓ **MOBILITY AND COOPERATION** require professional recognition
 - ✓ Professional recognition requires **TRUST**
 - ✓ **TRUST** requires transparency and readability of structures and professional qualifications
- ☞ **All is achieved through:**
 - ✓ **COMPARABLE QUALIFICATIONS FRAMEWORKS**
 - And**
 - ✓ **RECOGNISED QUALITY ASSURANCE PROCEDURES**

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Qualifications Frameworks in *strictus sensus* and in *lactus sensus*

- ☞ ***Strictus sensus*** a Qualifications Framework (QF) is a systematic description of an education system, expressing the expected learning outcomes for a given qualification, that is expressing what a learner is expected to know, understand and be able to do after successful completion of a process of learning.
- ☞ QF thus focus mainly on outcomes and on the several learning paths, including those of lifelong learning, that may lead to a given qualification.
- ☞ In ***lactus sensus***, a Qualifications Framework should include (or articulate with) descriptors at lower layers... of higher detail:
 - ✓ Sectoral descriptors
 - ✓ Branch level descriptors

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Qualifications Frameworks The different layers - Who does what...

- ☞ **High level descriptors - Meta Frameworks**
 - ✓ Characterized at institutional level of governments and stakeholders
 - ✓ They represent the 'legal crust'
- ☞ **Complemented by Sectoral descriptors**
 - ✓ By area and specialty
 - ✓ In close cooperation with higher education institutions and professional associations
 - ✓ In transnational cooperation
 - ✓ They represent Bologna in practice
- ☞ **Complemented by descriptors at branch level**
 - ✓ Typically developed in Education Working parties and Academic Consortia, at European Level, or within regulatory bodies at national level
 - ✓ They are the basis for credibility of the whole system

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Meta Qualifications Frameworks and the Directive for Recognition of Professional Qualifications

☞ (Two plus One) major documents at High Level

- ✓ The QF-EHEA - Qualifications Framework for the European Higher Education Area - An Agreement
 - Adopted in Bergen 2005, within the Bologna Process
- ✓ The EQF-LLL - European Qualifications Framework for Lifelong Learning - A Recommendation
 - Adopted by the EC - approved on April 23, 2008 by the Parliament and the Council of the European Union
- ✓ The Directive for Recognition of Professional Qualifications, approved by the European Parliament and by the Council on September 7, 2005 - A Law within the Union
 - National laws should have been passed in all EC Countries till the end of 2007....

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QF-EHEA - Qualifications Framework for the European Higher Education Area (Bergen, 2005)

- ☞ A degree structure with three main cycles, including, within national contexts, the possibility of intermediate qualifications
- ☞ Adopts the Dublin Descriptors developed by the Joint Quality Initiative Group as the cycle descriptors, characterizing levels to be attained in
 - *knowledge and understanding*
 - *applying knowledge and understanding*
 - *making judgements*
 - *communication*
 - *Learning skills*
- ☞ These are high level broad descriptors that will have to lead to more specific descriptors in each area or specialty within a given area

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EQF-LLL - The European Qualifications Framework for Lifelong Learning

- ☞ Approved by the Parliament and the Council of the European Union on April 23, 2008
- ☞ Adopts 8 levels of qualifications characterized in terms of
 - Knowledge
 - Skills
 - Competences
- ☞ Establishes a link of compatibility with the Framework for Qualifications of the European Higher Education Area

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A major Legal Document - the Directive for Recognition of Professional Qualifications (I)

- ☞ Reaffirms previous Directive, accepting 7 fully regulated professional areas with recognized specifications - **Health area and Architecture**
- ☞ For the remaining professions - Article 11.º establishes 5 levels of qualifications:
 - ✓ 2 levels requiring secondary education, general or vocational
 - ✓ 1 level, requiring short post-secondary education, not necessarily at higher education level, plus professional training
 - ✓ 2 levels of post-secondary education at higher education level, plus adequate professional training

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A major Legal Document - the Directive for Recognition of professional Qualifications (II)

☞ Art. 11, e) - higher level

...completed a post-secondary course of at least four years' duration...at a university or establishment of higher education...and where appropriate completed professional training...

☞ Art. 11, d) - intermediate level

...training at post-secondary level of at least three and not more than four years' duration...at a university or establishment of higher education...as well as the professional training that may be required...

☞ Art. 11, c) - lower level

...training at post-secondary level other than that referred in d) and e) of a duration of at least one year...as well as the professional training which may be required in addition to that post-secondary course...

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Qualifications Frameworks and the Directive A striking coincidence or concerted action?

☞ The Bergen QF-EHEA, the EQF-LLL and the Directive point out in the same direction

- ✓ Recognition of different qualification levels
- ✓ Recognition that qualifications can be attained through routes in two different subsystems

☞ They fit remarkably well in the world of engineering and the offer of engineering education in Europe

☞ They should obviously be translated into our accreditation systems

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Qualifications Frameworks and the Directive A striking coincidence or concerted action?

Bologna EQF-EHEA CYCLES	European Union EQF-LLL LEVELS	EU-Directive of Professional Recognition Art. 11 - LEVELS
Third Cycles	Level 8	
Second Cycles	Level 7	Art 11° e)
First Cycles	Level 6	Art. 11° d)
Short Cycles Linked to or Within First Cycles	Level 5	Art. 11° c)

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Academic Degree Structures in Engineering I - Discussion within FEANI - 2003-2005

- ☞ FEANI is the main European Association of national associations of engineering
- ☞ Objective of the discussion - influence the making of the Directive on Professional Recognition
- ☞ Ended up with the recognition of two main levels of engineering education and also two possible profiles as entry routes for the profession . Looking ahead:
 - ✓ In line with the Bologna Agreements
 - ✓ In line with the recommendations of the EQF-LLL - The European Qualifications Framework for Lifelong Learning

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Academic Degrees Structures in Engineering II - Concerning levels of qualification - (I) - Art. 11, c)

- ☞ Level of Qualification: Art. 11, c)
 - 1 year of post-secondary course work + Professional Training \geq 1 year
- ☞ At least for the time being, in most countries, not leading to a recognised competence group of Engineering, though they are vital as support to the 'Engineering Activities'
- ☞ Let's identify them as Technicians

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Academic Degree Structures in Engineering II - Concerning levels of qualification - (II) - Art. 11, d), e)

- ☞ **Two levels** of qualifications associated to those levels approved in the Directive of Professional Recognition and recognized in the QF-EHEA and the EQF-LLL
 - **1st Cycle, Level 6, Art. 11, d): (3-4)U**
 - ✓ **First Cycle Degrees are entry routes for achieving the qualification of Technical (or Associate) Engineers, whatever the European designation**
 - **2nd Cycle, Level 7, Art. 11, e): $\geq 4U$**
 - ✓ **Second Cycle Degrees are entry routes for achieving the qualification of Engineers, or equivalent European designation**

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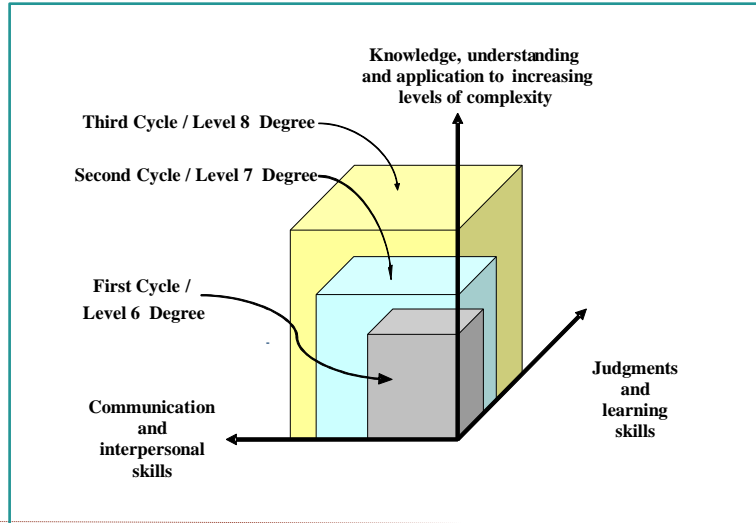
Academic Degree Structures in Engineering III - Concerning Profiles

- ☞ **Two main profiles in Engineering**
 - **More Theoretically oriented**
 - ✓ **Programmes with a stronger emphasis on basic and engineering sciences in the first years**
 - ✓ **Generally linked to Second Cycle degrees**
 - **More Applications oriented**
 - ✓ **Designed to qualify after First Cycle, independently of pursuit of studies through Second Cycles, be it directly or through bridging programmes**

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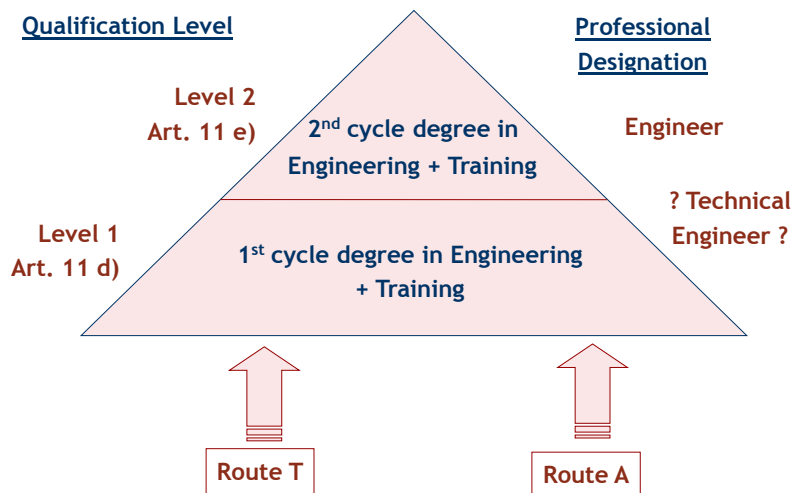
Academic Degree Structures in Engineering IV - A single route for the different qualification levels



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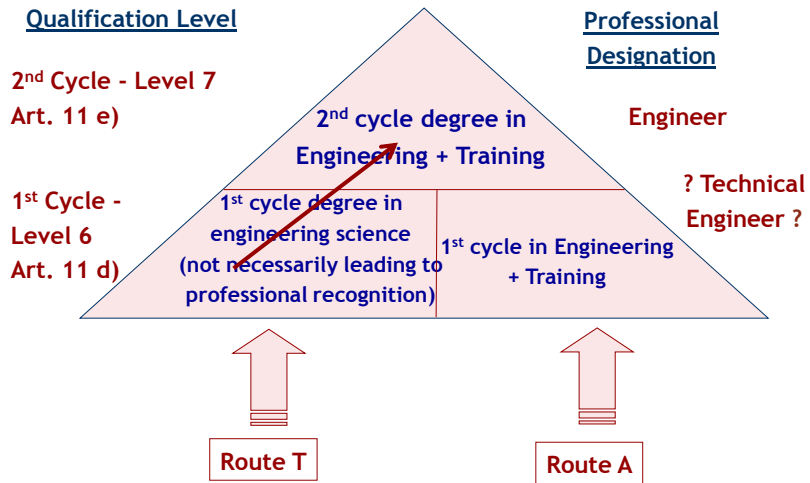
Academic Degree Structures in Engineering V - Two routes for the different qualification levels (I)



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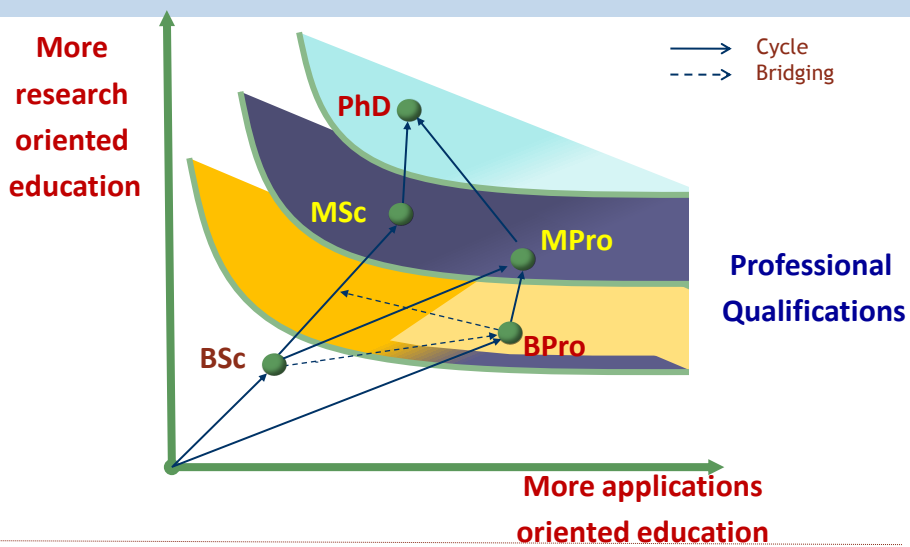
Academic Degree Structures in Engineering V - Two routes for the different qualification levels (III)



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Academic Degree Structures in Engineering V - Two routes for the different qualification levels (V)



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Academic Degree Structures in Engineering VI - Understanding fundamental differences between levels of qualifications

- ☞ Programme Outcomes must be evaluated in relation with the level of intervention in the Engineering Activity
 - Social responsibility (namely, signing projects)
 - Capacity to tackle large, complex problems
 - Capacity to adapt to new jobs of high complexity and responsibility
 - Capacity for effective activity in the production line
 -
- ☞ For the First and Second Cycle Degrees in Engineering, and for the different subsets of Programme Outcomes, the differences in outcomes are mostly related with
 - scope, depth and breadth
- ☞ For the Master degree, developing the right **ATTITUDE** to use knowledge or skills in a given situation is a major outcome

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Academic Degree Structures in Engineering VII - Accumulated long education (I)

- ☞ In the engineering profession, qualifications for a significant number of activities require accumulated long education at higher education level.
 - In most countries this means the equivalent to 300 ECTS, but it is known that this is not the generalized situation.
- ☞ 'Musts' of Today's life
 - We must open to new publics
 - We must bring in the concept of accumulated credits through lifelong learning
 - We must bring in the 'delicate' issue of recognition of experiential learning

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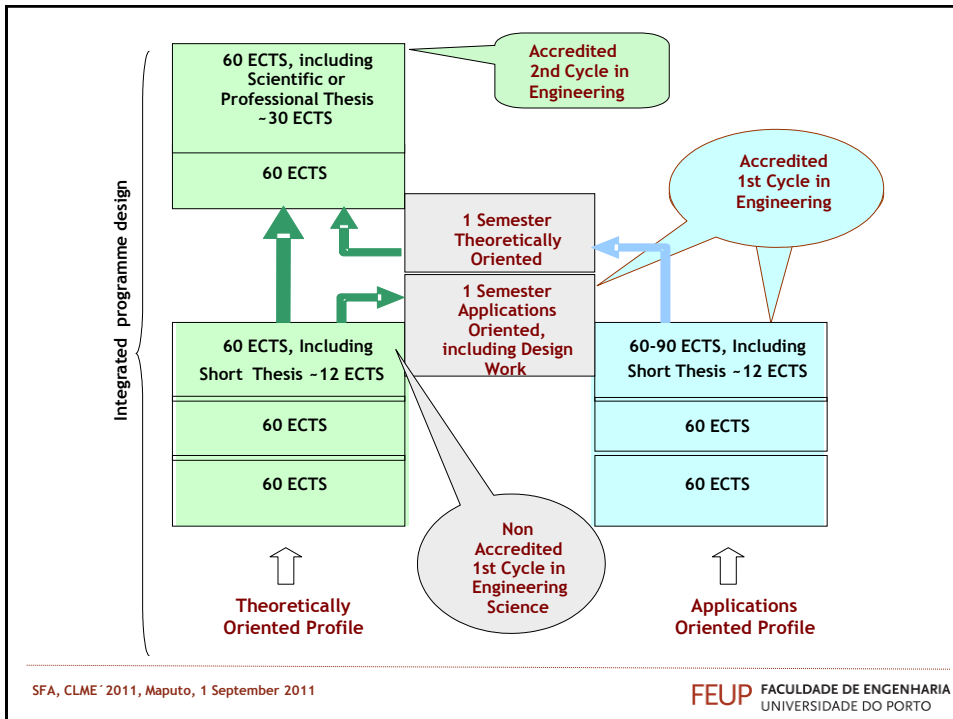
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Academic Degree Structures in Engineering VII - Accumulated long education (II)

- ☞ What is in discussion is whether such education should be achieved through long cycle degrees, or if it can be achieved through accumulated two-cycle studies.
 - The question of the type of offer is more and more a political issue of educational policies
 - In fact, most European countries are adopting the two-cycle system, independently of the qualifications associated to First Cycle degrees

Academic Degree Structures in Engineering VIII - Prevailing concepts in the design of the Degree System

- ☞ **More flexible paths - MORE differentiation (competences) offered**
 - Either more research oriented, or more innovation oriented, or with a higher entrepreneurial spirit, etc....
 - Bringing in the concept of “Communication Pipes” between different profiles of education - **Bridging programs**
- ☞ **More attractive offer** in order to bring into the system students with different backgrounds and interests
- ☞ **Promotion of a true offer for lifelong learning through**
 - **Complementary modules** of (advanced) specialization courses
 - Implementation of the concept of ‘**accumulated credits**’ for recognition of studies



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Quality Assurance in Engineering and Sectoral and Branch Level Frameworks

- ☞ Quality Assurance Systems represent a major tool for the goal of building TRUST
- ☞ Quality Assurance systems should include clear and measurable objectives and standards, associated to an accepted QF.
- ☞ The understanding by all stakeholders of academic degrees and related specific knowledge, competences and skills of their graduates is essential for both internal and external evaluation and for recognition.
- ☞ This means that we have to develop and implement field-specific strategies and methodologies for QA that must be supported by sectoral and branch specific descriptors of qualifications.

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Relevance of Sectoral and/or Branch Level Frameworks Taken from the BFUG document - Bologna Beyond 2010 February, 2009

“... While learning outcomes have been generically defined for the degree structure in the context of the Dublin descriptors, the key point is to develop subject specific descriptors for knowledge, skills and competences.”

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Relevance of Sectoral and/or Branch Level Frameworks Taken from the Leuven/Louvain-la-Neuve Communiqué 29 April 2009

“
...
Curricular reform will thus be an ongoing process leading to high quality, flexible and more individually tailored education paths.

Academics, in close cooperation with student and employer representatives, will continue to develop learning outcomes and international reference points for a growing number of subject areas
...”

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Bringing Qualifications Frameworks into Practice Sectoral and Branch Specific Frameworks in Engineering

- ☞ TUNING methodology
 - ✓ E4 proposals for Engineering
- ☞ TU3 proposals - Delft, Eindhoven e Twente
- ☞ EUR-ACE standards for professional quality assurance
- ☞ CDIO - Conceive-Design-Implement-Operate
- ☞ ABET standards for professional quality assurance
- ☞ The AHELO proposals for first cycle standards
- ☞ European projects to identify core outcomes (knowledge and competences) at branch level
- ☞ Initiatives leading to core curricula recommendations
- ✓ European Working Parties on Education

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Bringing Qualifications Frameworks into Practice The EUR-ACE Framework and Accreditation System

- ☞ **European Project that aimed at establishing an European System for Qualification of Engineering Education programmes**
 - ✓ 14 European Institutions, among them “Ordem dos Engenheiros - Engineers Portugal”
 - ✓ FEANI, SEFI, CESAER, EUROCADRES, ENQHEEI, ASIIN, CTI, IEI, CoPI, UNIFI, OE, UAICR, RAEE, EC-UK
- ☞ **First Phase for setting the standards, supported by the European Commission (DG EaC) within SOCRATES and TEMPUS programmes; Concluded in 2005**
- ☞ **Second Phase for implementation, supported by the European Commission (DG EaC) within SOCRATES and TEMPUS programmes; concluded in 2008**

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The EUR-ACE Framework and Accreditation System Knowledge and Competence areas

- ☞ **Programme Outcomes that must be satisfied**
 - **6 areas of competences are defined**
 - ✓ Knowledge and Understanding
 - ✓ Engineering Analysis
 - ✓ Engineering Design
 - ✓ Investigations
 - ✓ Engineering Practice
 - ✓ Transferable (personal) Skills
 - For each category, the EUR-ACE Framework Standards list the expected Programme Outcomes of First Cycle and Second Cycle Studies

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Meta- and Sectoral Frameworks
What is equal, what is different
QFs, the Directive and the EUR-ACE System

Bologna QF-EHEA CYCLES	European Union EQF-LLL LEVELS	EUR-ACE	EU-Directive of Professional Recognition Art. 11 - LEVELS
Third Cycles	Level 8		
Second Cycles	Level 7	Second Cycles	Art 11° e)
First Cycles	Level 6	First Cycles	Art. 11° d)
Short Cycles Linked to or Within First Cycles	Level 5		Art. 11° c)

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Three indicators of relevance
I - The OECD-AHELO Initiative
Assessment of HE Learning Outcomes

- ☞ **Report about the engineering sector published on June 23, 2009**
- ☞ **Proposes a set of qualifications descriptors for First Cycles that was the result of a synthesis between:**
 - **The ABET EC 2000 criteria**
 - **The EUR-ACE criteria for FIRST CYCLES**
- ☞ **And gives one further relevant step:**
 - **Proposes descriptors of 'Learning Outcomes at branch level (Civil, Electrical and Mechanical Engineering).**

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Three indicators of relevance

II - Report on progress in quality assurance in higher education (Text with EEA Relevance), European Commission, Brussels, 21.9.2009 COM(2009) 487 final

*Pg. 9:
Good practice*

The EUR-ACE label in engineering exists at the bachelor and master level. Standards were defined at European level, but are applied through national quality assurance agencies that are authorised to issue EUR-ACE “labels” together with their national accreditation. Several hundred labels have already been awarded, but they are still available from only seven National agencies

Three indicators of relevance

III - Report - The EU Contribution to the European Higher Education Area, Vienna, 12.03.2010

Distributed in the Budapest-Vienna Meeting of European Ministers of Higher Education, 11-12 March, 2010

On page 8, we can read:

“The Register is open to agencies operating in Europe, be they national or international, public or private, general or subject-specific. The Commission is supporting the development of a series of subject-specific European quality labels, which could/may lend their standards to existing agencies or become agencies in their own right. Examples include the EUR-ACE label in engineering and the Eurobachelor, Euromaster and Eurodoctorate labels in chemistry.”

CLOSING VERTICALLY THE PROCESS

Descriptors at Branch/Programme Level

- ☞ The Recommendations in the TUNING AHELO conceptual framework of expected/desired Learning Outcomes in Engineering (2009)
 - Specific LO for Civil Engineering - 1st Cycles
 - Specific LO for Electrical Engineering - 1st Cycles
 - Specific LO for Mechanical Engineering - 1st Cycles
- ☞ The Recommendations of the WPE-EFCE - Working Party on Education - European Federation of Chemical Engineering (2010)
- ☞ The VDI-GVC Recommendation for Chemical and Processing Engineering (2008)
- ☞ The CHEMPASS Project (2006-2009) - that aimed at identifying relevant general and specific Learning Outcomes for Chemical Engineering Programmes

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Descriptors at Branch/Programme Level

Recommendations of the WPE-EFCE (I)

- ☞ WPE-EFCE - Working Party on Education - European Federation of Chemical Engineering
 - ✓ Currently with 41 members, representing 26 Countries
- ☞ In 2005 - EFCE Board approved a set of Recommendations on core curriculum for chemical engineering - contents and methodologies
- ☞ In 2010 - EFCE Board approved a major revision of the Recommendations, aligning them with the Bologna Process main concepts (Learning Outcomes) and with the EUR-ACE Framework Standards
- ☞ See EFCE Site at <http://www.efce.info/wpe.html>

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Descriptors at Branch/Programme Level Recommendations of the WPE-EFCE (II)

- ☞ **These recommendations propose**
 - **Learning outcomes for chemical engineering education**
 - ✓ **Adopting the EUR-ACE Framework Standards for Accreditation of Engineering Education**

 - **How to achieve the proposed learning outcomes**
 - ✓ **Core curriculum**
 - ✓ **Teaching and learning**
 - ✓ **Industrial experience**
 - ✓ **Review of the educational process**
 - ✓ **Student assessment**

To say what I am going to say...

- ① **Some historical notes about the Bologna Process in Europe**
 - ① **Political, economical and academic issues**

- ② **Qualifications Frameworks and Engineering Education**
 - ② **Qualifications Frameworks at meta-, sectoral and branch levels**
 - ② **Meta frameworks and legal structures inspired by the Bologna Process**
 - ② **Meta frameworks and the offer of Engineering Education**

- ③ **The role of sectoral and branch level frameworks in field-specific quality assurance systems**

- ④ **Concluding Notes**

Routes for Professional Qualification and Transnational Cooperation

- ☞ The Engineering Profession requires different qualification levels and education profiles that should be guaranteed and identified through transparent Quality Assurance Procedures
- ☞ The framework being developed and put in practice at European level serve adequately the needs of industry and society in general
 - ✓ Short vocational studies, first cycle studies and second cycle studies (stand-alone or integrated) constitute the basis of such framework
- ☞ The concept of Credit Accumulation, together with Lifelong Learning, is of utmost relevance in this new paradigm of building professional qualifications

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Mobility - Recognition of Qualifications - Cooperation Qualifications Frameworks

- ☞ Mobility is a distinctive need of Today's Global World
- ☞ Recognition of professional qualifications is a major task ahead...
- ☞ Mobility and Recognition require transparent and compatible Frameworks at different complementary layers
- ☞ Mobility and Recognition of Qualifications are not an illusion, a dream, an objective or a target...

They are a MUST...

Required for Development and for Progress on Earth

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Towards Comprehensive Field-Specific QA Systems

The relevance of Sectoral Frameworks

The Case of EUR-ACE

- ☞ At sectoral and branch level, recommendations, descriptors, reference points and tools for characterizing degree programmes should be developed through institutional co-operation
- ☞ EUR-ACE is not the first effort, at European level, to develop sectoral descriptors, BUT it is up to this stage the most comprehensive in the way it brings together academics and professional , universities and professional associations
- ☞ Possibly for that reason, EUR-ACE has been praised and has received significant support from the Commission, in different occasions.

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Towards Comprehensive Field-Specific QA Systems

Branch level Recommendations

compatible with Sectoral Frameworks

- ☞ Branch level initiatives are required to close the loop and build robust and transparent field-specific quality assurance systems
- ☞ EUR-ACE has served as reference for relevant initiatives at branch level, that are expected to have significant follow-up in the near future -
 - ☞ The branch level recommendations of the European Federation of Chemical Engineering (2010)
 - ☞ The VDI-GVC Recommendations for Chemical and Processing Engineering (2008)
- ☞ IN ALL, Field-specific QA systems should include a comprehensive set of reference outcomes, coherent at all levels

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The Future

- ☞ **Within diversity, curricula should be designed with reference to such agreed recommendations or descriptors of learning outcomes at high level, sectoral level and branch level**

- ☞ **The aim is to increase transparency in order to**
 - ✓ **throw down barriers of recognition**
 - ✓ **promote co-operation, namely through joint degrees**
 - ✓ **increase mobility of students and staff**

This is the way to walk to the future...