

Integrated Analysis of Qualifications Frameworks and Field-Specific Quality Assurance Procedures The EUR-ACE System in the Engineering Field

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Innovation and Quality in Higher Education
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To say what I am going to say...

Integrated Qualifications Frameworks

- ① Qualifications Frameworks and Quality Assurance in the context of the Bologna reforms
 - ① Bologna - Why?, What?? and How?
- ② Qualifications Frameworks in three layers
 - ② Meta frameworks; Sectoral frameworks - EUR-ACE; Branch level descriptors
- ③ General issues about quality assurance - global vs. field specific systems
 - ③ EUR-ACE as sectoral reference for field-specific quality assurance in Engineering
- ④ Concluding Notes

Bologna - WHY ?

Driving forces for changes in Europe and in the World Facts of the last quarter of the XX Century

- ☞ 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, Berlin 1989
 - ✓ Expectations and demands of Society
 - Education for All - mass education policies
 - Quality requirements of a Society of "Comfort" - sharp increase of energy consumption

Bologna - WHY?

Life Today

A Mix of Challenges, Threats and Opportunities

- ☞ The computer and communications era - globalisation
- ☞ The global market economy - driving today's Societies
- ☞ The increase of Expectation of Life vs. Social sustainability - work longer years - back to School
- ☞ The decrease of knowledge half-time - back to School
- ☞ The demographic challenge - new publics
- ☞ Global Competition - 'Borderless Higher Education Market' and the emerging Asian talents and economies
- ☞ Significant change in the concepts of individual career management, mainly for Young People - need for the offer of **education to adapt**

Bologna - WHAT ? 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 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 FOR A CHANGING WORLD**

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Bologna - HOW? Essential policies and instruments

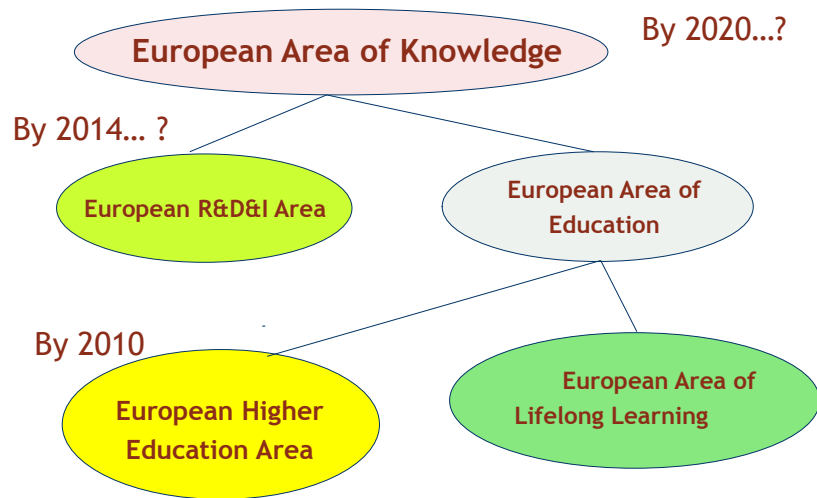
- ☞ **A global World living in and with a new paradigm of coexistence**
 - ✓ **COOPETITION = COOPERATION + COMPETITION**
- ☞ **That requires**
 - **Mobility of students and professionals**
 - **A new cultural paradigm of Education - Lifelong Learning**
 - **New management and transnational cooperation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

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Bologna - HOW, 10 Years on? The European Area of... Knowledge... still under construction till ... 2020 !!!....



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From Paris and Bologna to Budapest-Vienna 2010... ...and beyond... Characterizing the Process

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

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From Bologna to Leuven/Louvain-La-Neuve... 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'

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
- ☞ **Such requires:**
 - ✓ **COMPARABLE QUALIFICATIONS FRAMEWORKS**
 - And**
 - ✓ **RECOGNISED QUALITY ASSURANCE PROCEDURES**

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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

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....

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

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

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

- ☞ Article 11 - Five levels of qualification particularly relevant for professions that are out of the Annex for fully regulated professions
 - ✓ 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

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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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

... ”

Bringing Qualifications Frameworks into Practice Sectoral or Subject Specific Frameworks

Initiatives that came to life along the years

- ☞ 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
- ☞ European projects to identify core knowledge and competences at discipline level
- ☞ Initiatives leading to core curricula recommendations
 - ✓ European Working Parties on Education and joint initiatives at academic level

Qualifications Frameworks for Quality Assurance The EUR-ACE Project

- ☞ **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**

The EUR-ACE System I - The concept and objective

- ☞ **EUR-ACE developed Framework Standards, that were compiled as a “synthesis” between existing National Standards**
- ☞ **An European accreditation system that aims at**
 - ✓ **Ensuring consistency between existing national “engineering” accreditation systems;**
 - ✓ **Adding an European “quality label” to accreditation;**
 - ✓ **Introducing “accreditation” in other European and third countries;**
- and thus**
 - ✓ **Improving quality of education**
 - ✓ **Facilitating transnational recognition**
 - ✓ **Facilitating (physical and virtual) mobility**

The EUR-ACE System II - System Characterization

- ☞ **Programme Assessment Procedures should include clear information and evidence on the following components:**
 - ✓ Needs, objectives and outcomes
 - ✓ Educational process
 - ✓ Resources
 - ✓ Assessment of the educational process
 - ✓ Management system

- ☞ **In this context 'the criteria to be assessed' and the associated 'requirements' in the form of questions, valid for both FC and SC programmes should be addressed when assessing an engineering programme on education**

The EUR-ACE System IV - Knowledge and Competence areas

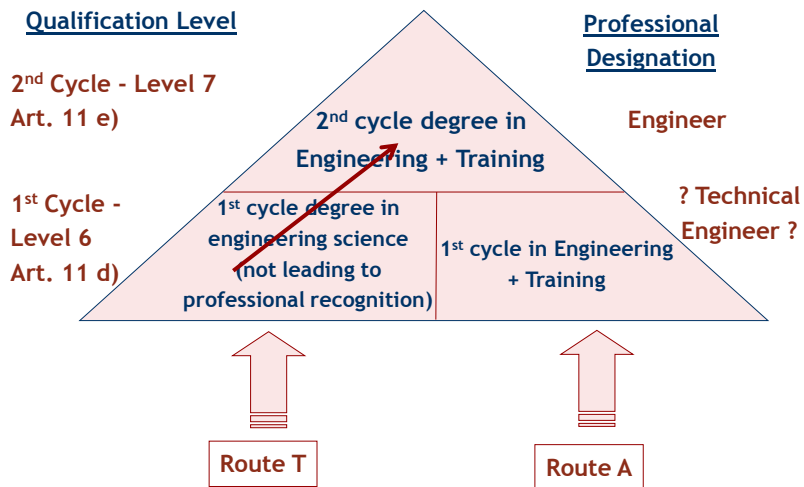
- ☞ **Programme Outcomes that must be satisfied**
 - **6 areas of competences are defined**
 - ✓ Knowledge and Understanding
 - ✓ Engineering Analysis
 - ✓ Engineering Design
 - ✓ Investigations
 - ✓ Engineering Practice
 - ✓ Transferable (personal) Skills

 - **For each category, the EUR-ACE Framework Standards list the expected Programme Outcomes of First Cycle and Second Cycle Studies**

How do EUR-ACE fits with Meta-Frameworks? QFs, the Directive and the EUR-ACE System

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Qualifications Frameworks and Academic Degree Structures in Engineering How they fit together



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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
- ☞ The VDI-GVC Recommendation for Chemical and Processing Engineering (2008)
- ☞ The CHEMEPASS Project (2006-2009) - that aimed at identifying relevant general and specific Learning Outcomes for Chemical Engineering Programmes

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>**

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

- ☞ **These recommendations cover**
 - **Learning outcomes**
 - **Adopting the EUR-ACE Framework Standards for Accreditation of Engineering Education**
 - **Achieving the learning outcomes**
 - **Core curriculum**
 - **Teaching and learning**
 - **Industrial experience**
 - **Review of the educational process**
 - **Student assessment**

Descriptors at Branch/Programme Level

Examples of Recommendations of the WPE-EFCE (III)

First Cycle Chemical Engineering programme outcomes

After graduation, a first cycle degree chemical engineer should fulfill the following qualifications:

Engineering Design

The graduates have:

- ✓ The ability to develop a basic design for products and processes according to specified requirements
- ✓ A basic understanding of design methods and the ability to apply them

Descriptors at Branch/Programme Level

Examples of Recommendations of the WPE-EFCE (IV)

Second Cycle Chemical Engineering programme outcomes

After graduation, a first cycle degree chemical engineer should fulfill the following qualifications:

Engineering Design

The graduates are able to:

- ✓ Develop concepts and solutions to problems based on fundamental principles but also to problems which are posed in an unusual way - if necessary involving other fields
- ✓ **Develop new products, equipment, processes or methods**
- ✓ Use their powers of judgment as engineers in order to work with complex and possibly incomplete information, to recognise discrepancies and to deal with them

Descriptors at programme level Recommendations of the WPE-EFCE (III)

- ☞ Using as reference accumulated knowledge, competences and skills after a Second Cycle in Chemical Engineering :
- ☞ A minimum dimension is proposed to
 - ✓ Basic sciences, enlarged with life sciences
 - ✓ Chemical engineering sciences
 - ✓ Chemical engineering core
 - With engineering design,
 - With a dissertation for training R&D&I,
 - With diverse profiles through electives and external training.

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

- ☞ The core curriculum proposed covers only approx. two thirds of a first and a second level degree study
- ☞ Typically a first cycle (“bachelor’s”) degree course will contain 20-30 % science courses, 40-50 % engineering courses, and up to 10 % non-technical topics.
- ☞ The core recommended for First Cycles gives a science content of 25 %, an engineering content of 36 %, and a non-technical content of 6 % of the total study (180 credits), leaving one third to deeper coverage of some of topics specific of a given course.
- ☞ The core curriculum proposed for Second Cycle (“master”) studies makes up 63 % of the total study (of 120 credits), leaving 37% for additional specialization and broadening.

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General Quality Assurance Strategy at European Level Main Documents and Milestones

- ☞ Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG), Bergen 2005
- ☞ The European Quality Assurance Register (EQAR), London 2007
 - Formally set on March 4, 2008
- ☞ Process led by the Council of Europe, catalysing the approval of National Qualifications Frameworks
- ☞ Creation of National Accreditation Agencies that are expected to register with EQAR

Quality Assurance in Engineering I - Global vs. Field Specific Systems

- ☞ The issue is not to abandon “general” QA approaches, that lead to a relevant evaluation of the educational process, but rather to understand the relevance of “field-specific” QA systems
- ☞ “Field-specific” QA systems accentuate the need for aligning the goals of educational programmes with the expectations of the relevant stakeholders, in order to be comparable and ensure their relevance for the labour market.
- ☞ “Field-specific” QA systems give credibility and concreteness to the whole “Bologna”/EHEA system.

Quality Assurance in Engineering II - Issues leading to Field-Specific QA Systems

- ☞ 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.

Accreditation Systems of Engineering Education

- ☞ The word “accreditation” employed as linked to a field-specific QA approach, in which the aims and contents of the educational programmes are to be specified:

“Accreditation of an engineering educational programme is the primary result of a process used to ensure the suitability of that programme as the entry route to the engineering profession.”

- ☞ Hence, sectoral and branch specific descriptors of outcomes, applied in combination with the ESG, should lead to “pre-professional accreditation” and Mutual Recognition Agreements for academic and/or professional purposes.

EUR-ACE Implementation I - Creation of the ENAEE (I)

- ☞ The EUR-ACE project has led to the creation on 8 February 2006 of an European Association
- ✓ The ENAEE - European Network for Accreditation of Engineering Education
- ☞ The ENAEE is responsible for maintaining and awarding the EUR-ACE label
- ☞ 7 European Agencies are currently accredited for awarding the EUR-ACE Label
- ✓ **Ordem dos Engenheiros - Engineers Portugal**, is one such Agency and is now preparing its accreditations

EUR-ACE Implementation II - The full set of main documents

☞ Main documents

- The EUR-ACE Framework Standards for the Accreditation of Engineering Programmes (approved on 5 November 2008)
 - ✓ Programme Outcomes for Accreditation
 - ✓ Criteria and Requirements for Programme Assessment and Programme Accreditation
 - ✓ Procedures for Programme Assessment and Programme Accreditation
- The Standards and Guidelines for Accreditation Agencies

☞ Currently, being reviewed for convergence and substantial compatibility with ESG, INQAAHE and ECA guidelines and codes of good practice

EUR-ACE - Accredited Agencies

ENAAE, proprietor of the EUR-ACE® trademark, authorizes National Agencies to award the EUR-ACE® (FC and/or SC) label

☞ As of May 2010, seven “Agencies” are authorized (EUR-ACE-accredited):

- **Since November 2006 (renewed December 2008):**
 - ASIIN (Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences and Mathematics), Germany
 - CTI (Commission des Titres d’Ingénieur), France
 - Engineers Ireland
 - RAEE (Russian Association for Engineering Education)
 - Engineering Council, United Kingdom
 - Ordem dos Engenheiros, Portugal
- **Since January 2009:**
 - MÜDEK (Association for Evaluation and Accreditation of Engineering Programs), Turkey

EUR-ACE - Labels awarded per Agency As of May 2010, 600 EUR-ACE labels have been awarded

Agency	Date accr/n	Countries oper.	FCD	SCD	Total
ASIIN	Nov.2006	DE, CH	104	86	190
CTI	"	FR, BE,BG,ES	--	213	213
Eng.Ireland	"	IE	72	21	93
RAEE	"	RU, (KZ)	5	30	35
EngC	"	UK	?	?	36?
OE	"	PT	0	4	4
MÜDEK	Jan.2009	TR	29	--	29

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Awarded EUR-ACE Labels (as of May 2010) Listed per Country

Country	Agency	FCD	SCD	Total
DE	ASIIN	101	86	187
CH	ASIIN	3	0	3
FR	CTI	--	207	207
BE	CTI	--	1	1
BG	CTI	--	3	3
ES	CTI	--	1	1
IE	Eng.Ireland	72	21	93
RU	RAEE	5	30	35
UK	EngC	?	?	36?
PT	OE	0	4	4
TR	MÜDEK	29	--	29

Outside EHEA CTI

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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 European Development and for Progress on Earth

Bologna and Routes for Professional Qualification and Transnational Cooperation (I)

- ☞ 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 within the Bologna agreements seem to 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

Bologna and Routes for Professional Qualification and Transnational Cooperation (II)

- ☞ At sectoral and branch level, recommendations, descriptors, reference points and tools for characterizing degree programmes should be developed through institutional co-operation
- ☞ 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

The Relevance of EUR-ACE

- ☞ 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 receives significant support by the Commission.
- ☞ EUR-ACE had served as reference for a new initiative at branch level, that it is expected to have significant follow-up in the near future - The branch level recommendations of the European Federation of Chemical Engineering

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