

# Perspectives of the Engineering Education in Germany and Europe

**International Mechanical Engineering Education Conference**

**„Mechanical Engineering Education and Global Industry“**

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**Beijing**

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# Facts and Figures about Germany

Map of German  
Higher Education  
Institutions



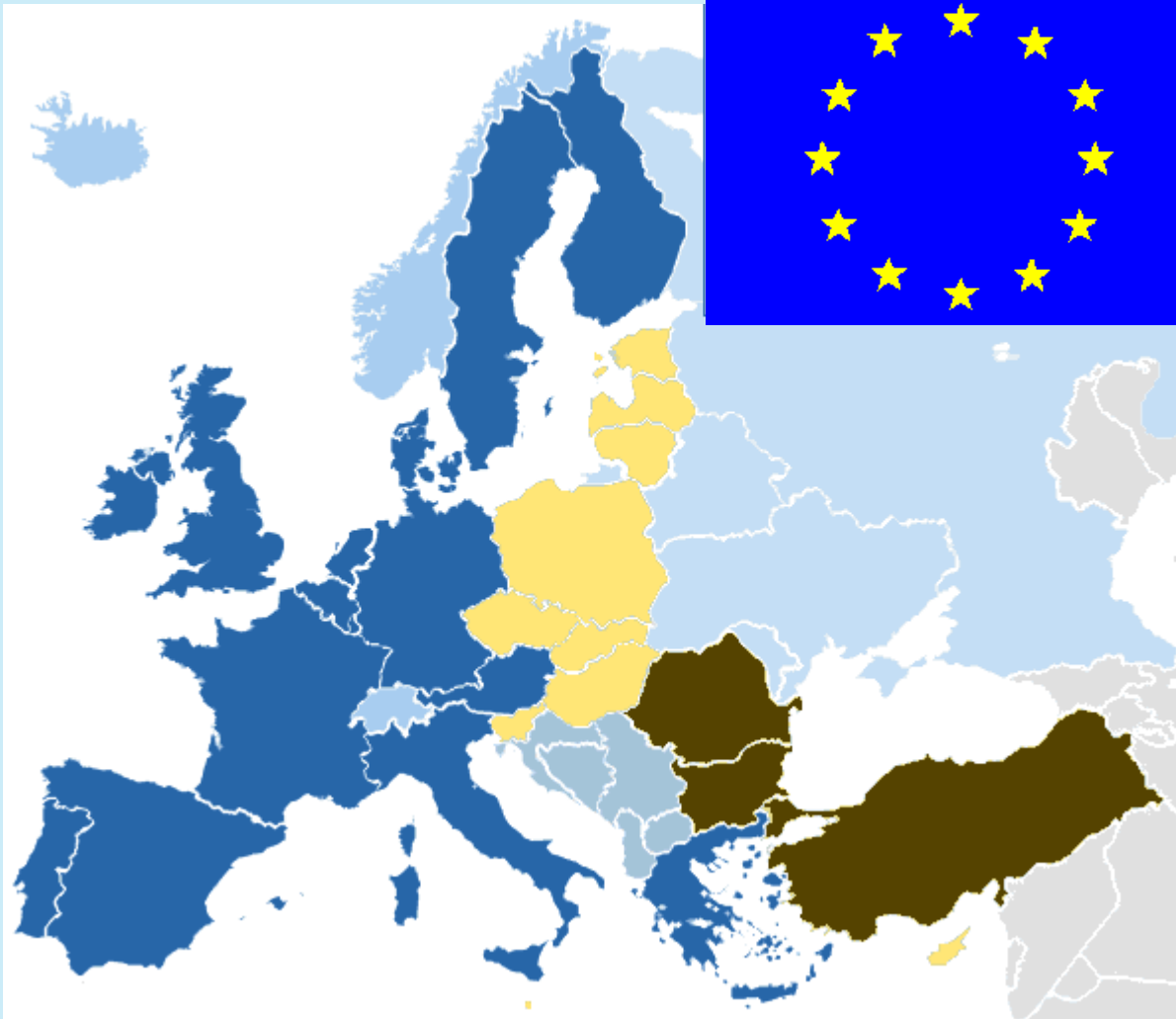
## Germany

Area:	356,973 km <sup>2</sup>
Population:	81.8 mio.
Number of engineers:	about 1 mio. (largest group of graduate professionals in the country)
Gross National Product:	2,115 billion € (2003)
Unemployment rate:	10.5 % (among engineers 9 %)




## Some Basic Facts about German Higher Education

Number of Higher Education Institutions:	332
- hereof Universities:	117
- hereof Universities of Applied Sciences:	159
- private universities:	57
Number of students:	1,939,233
Number of students in private HEIs:	40,571
Number of engineering graduates per year:	35,000

# The European Union Facts & Figures



446 millions of citizens  
25 countries  
3,971,457.70 qm<sup>2</sup>  
22 languages  
25 different HEI systems  
and quality assurance  
systems  
Growing „grey“ HEI  
market

-  Member States (15)
-  New Members since  
May 1st, 2004 (10)
-  Candidate Countries (3)

# Typical Options for European HE Systems

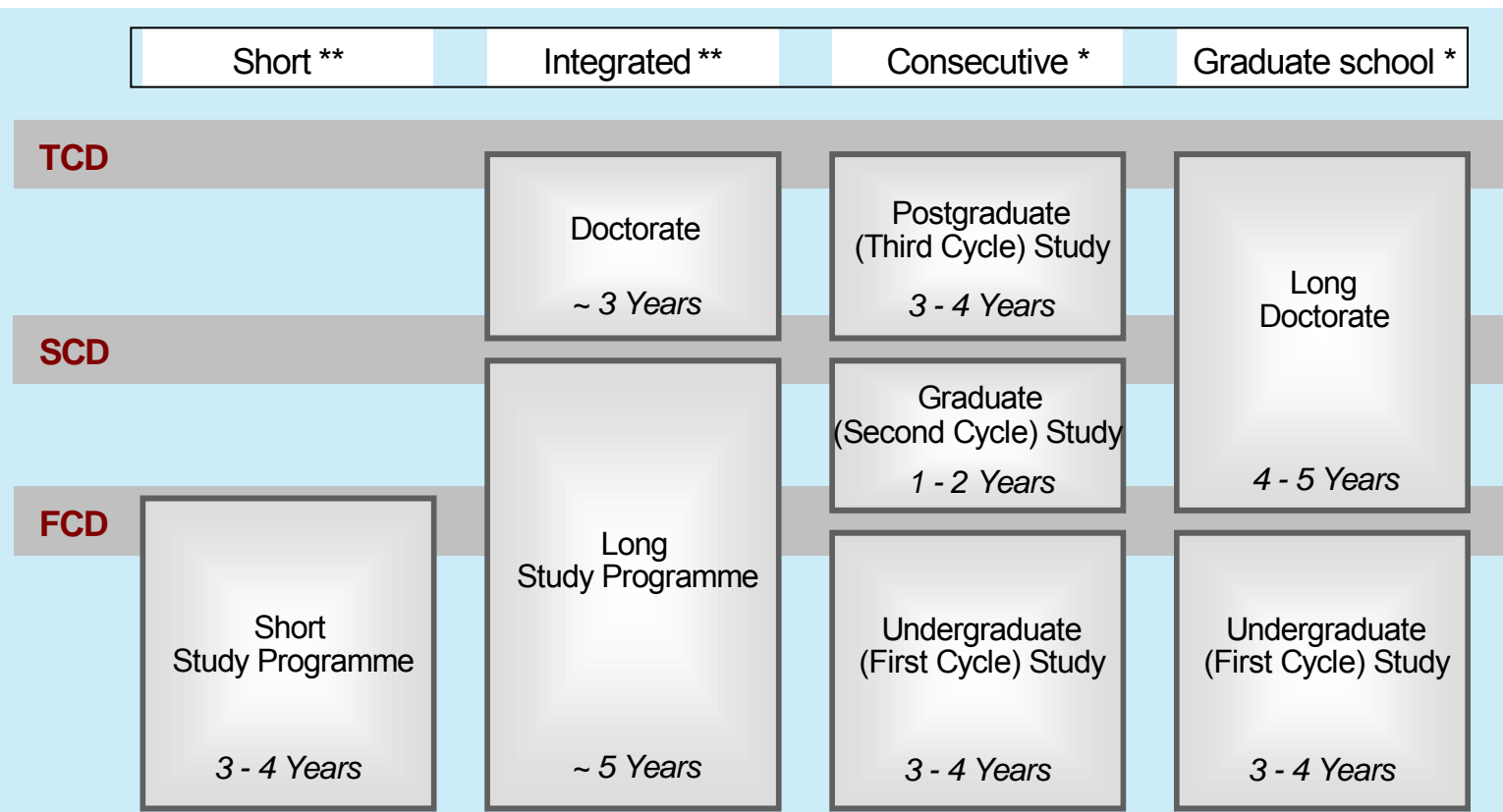


Fig. 1: Typical options for Higher Education Systems.  
 \* Options compatible with the Bologna declaration  
 \*\* Traditional in continental Europe

# Variety of Academic Titles in Europe for Engineers

Akademiingeniør  
Bachelor of Arts  
Bachelor of Engineering  
Bachelor of Science  
Civilingeniør  
Civilingenjör  
Diplom-Ingenieur  
Diplom-Ingenieur ETH  
Diplom-Ingenieur (FH)  
Diplomi-Insinöör  
Diplomirani Inženir  
Doktor-Ingenieur  
Dottore in Ingegneria

Engenheiro  
Europa-Ingenieur  
Ingenieur (grad.)  
Ingeniør  
Inginer  
Insinööri  
Ingeniero Químico  
Ingeniero Superior  
Ingeniero Técnico  
Ingénieur civil  
Ingénieur diplômé  
Ingénieur industriel  
Ingénieur technicien

Inženyr  
Inžinier  
Inżynier  
Magister Inżynier  
Master of Arts  
Master of Engineering  
Master of Science  
Okleveles mérnök  
Okleveles üzemmérnök  
Sivilingeniør  
Teknikfræðingur  
Teknikumingeniør  
Verkfræðingur

# Common European Market

## Goals:

**Freedom of movement of workers, right of establishment, freedom of services.**

**Declaration of Lisbon, Barcelona: „To make Europe the most competitive and dynamic knowledge-based economy in the world.“**

# The Bologna Process – Measures and Goals

## Creation of a European Area of Higher Education until 2010:

- Introduction of a system of easily legible and comparable degrees
- Introduction of a system comprehending basically two study cycles; The degree awarded after the first cycle shall also be relevant to the European labour market as an appropriate level of qualification.
- Introduction of a credit point system

## Goals:

- Enhancement of students' and professors' mobility by overcoming possible obstacles
- Enhancement of European cooperation with regard to quality assurance in terms of comparable criteria and methods
- Enhancement of the European dimension in the area of higher education as "hallmark"

# The Bologna Process – Milestones (1)

- **1998: Sorbonne Declaration (United Kingdom, Germany, France, Italy)**
  - Initiative in order to harmonize the architectural structure of the European System of higher education
- **1999: Bologna Declaration (29 undersigning states)**
- **2001: Prague – 1<sup>st</sup> follow-up conference (33 undersigning states)**
  - Enhancement of life long learning
  - Advancement of the European competitiveness
- **2003: Berlin – 2<sup>nd</sup> follow-up conference (40 undersigning states)**
  - Until 2005, mandatory start of the introduction of the 2-cycle system
  - Establishing of the quality assurance system
  - Completion of the 2<sup>nd</sup> cycle allows access to doctoral studies

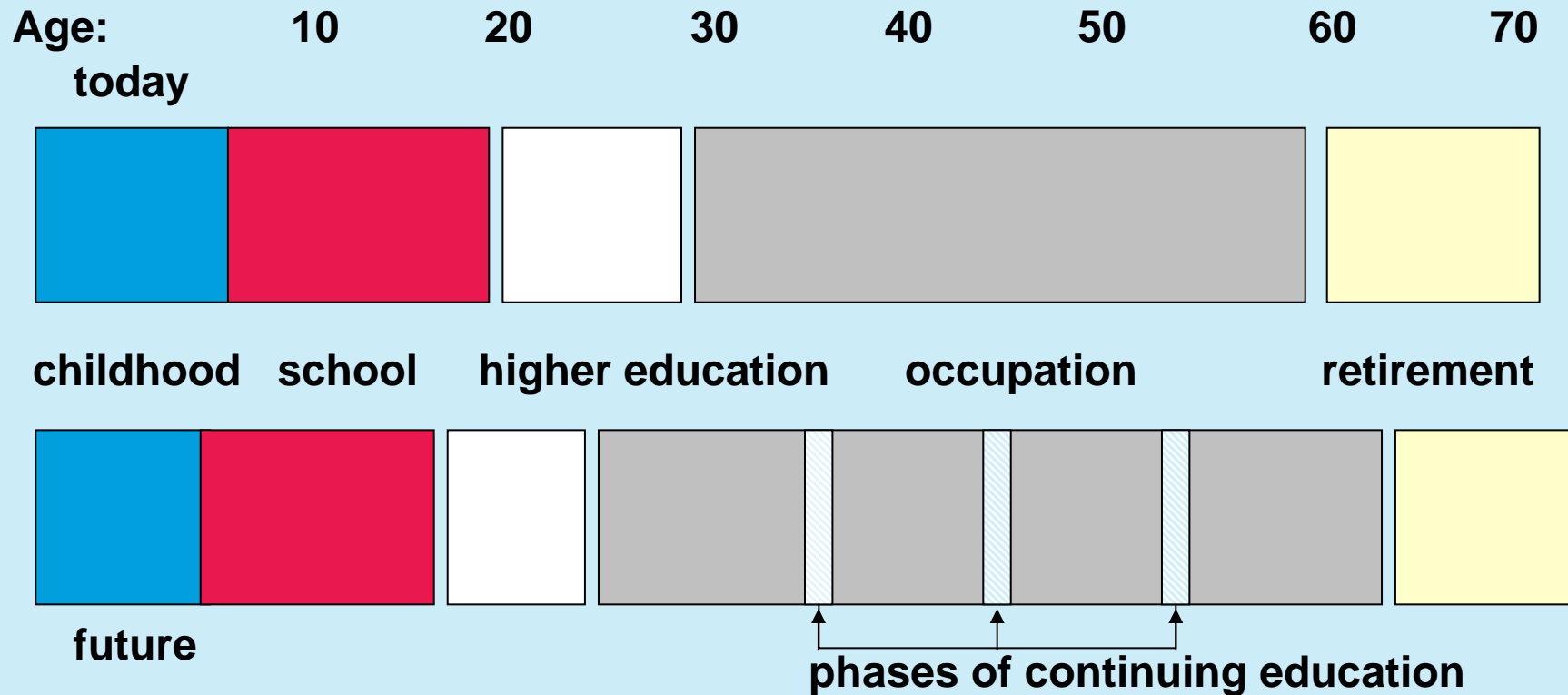
## The Bologna Process – Milestones (2)

- **2005: Bergen – 3<sup>rd</sup> follow-up conference (45 undersigning states)**
  - **Interim outcome of the hitherto existing progress**
  - **Standards and guidelines concerning quality assurance**
  - **Creation of national qualification frameworks**

# Structural Goals of the Study Reform in the Framework of the Bologna Process

- **Reduction of the duration of studies**
  - by the introduction of shorter study courses qualifying for a profession → Bachelor
- **Reduction of the number of university drop-outs**
  - by study offers with great practical orientation as early as in the first semesters  
→ Bachelor
- **Increasing the attractiveness of the German higher education for students from abroad**
  - by the introduction of a world-renowned study structure with globally known degrees
- **New organization of the interface first education / continuing education**

## Outline of Curricula Vitae Today and in the Future



**Today:** Long initial education, early retirement

**In the future:** Short initial education, phases of continuing education, retirement at a later date

# Breakthroughs in Technologies

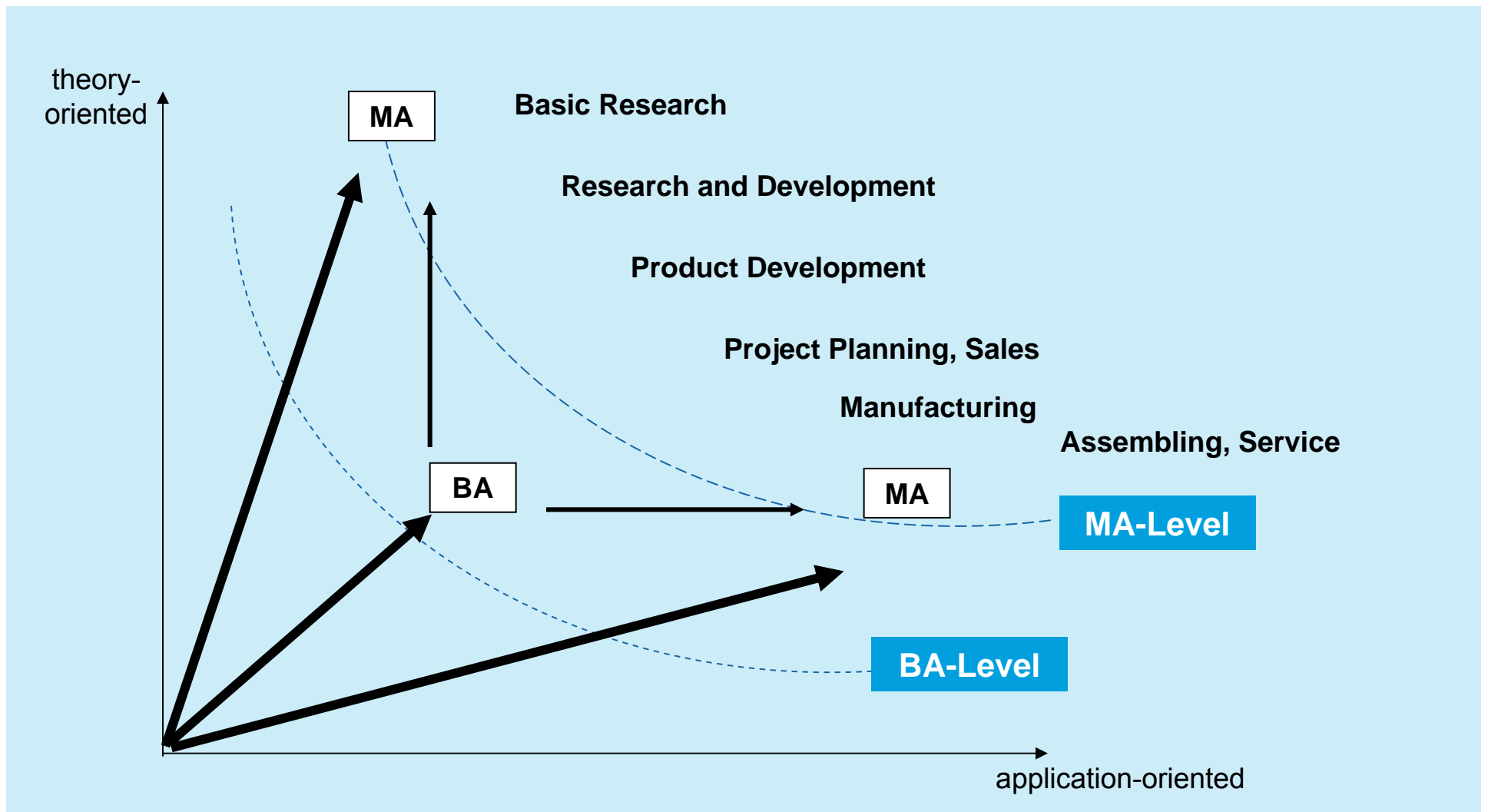
- **Nanotechnology**
- **Biotechnology**
- **Microelectronics / Telecommunications**
- **Photonics/Optics**
- **Manufacturing**

# European Research Advancement

## 7<sup>th</sup> Framework Plan

- **Health**
- **Food, Agriculture and Biotechnology**
- **Information and Communication Technologies**
- **Nanosciences, Nanotechnologies, Materials and new Production Technologies**
- **Energy**
- **Environment (including Climate Change)**
- **Transport (including Aeronautics)**
- **Socio-economic Sciences and the Humanities**
- **Security and Space**

# Qualification Profiles



# Competencies of Engineers Demanded by Industry Today

- **Conflict solving**
- **Competence to analyze and synthesize**
- **Independent work**
- **Application of knowledge in practice**
- **Work in international teams**

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BLK-Project “Introduction of a performance point system in the engineering sciences“

[www.relint.densto.es](http://www.relint.densto.es)

# Requirements in Terms of Content on the Modern Engineer

- **Strong analytical skills, good knowledge of mathematical and scientific basics**
- **Practical ingenuity; creativity; spirit of innovation**
- **Good communication skills in different languages**
- **Business, management skills**
- **High ethical standards**
- **Prepared for life long learning**
- **Able to put problems in their socio-technical and operational context**
- **Adaptive leader**

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Based on: Dr. Wayne Clongh, President, Georgia Institute of Technology

# The New Market Oriented System of Quality Assurance/Accreditation in Germany

## The “old system”

- Framework regulations for final examination issued by the Standing Conference of Länder Ministers of Education (KMK) together with the German Rectors conference (HRK)
- Stipulation of all aspects of a field of study in a highly bureaucratic and complicated procedure, frequently lasting years

**goal:** guarantee a homogeneous higher education quality nationwide

## The “new system”

- Emergence of innovative BA/MA study designs on a competitive basis
- Trends towards specialisation and concentration on a specific profile due to financial restraints
- institutionalization of a nation-wide web of accreditation and evaluation agencies
- privatization of quality assurance measures and retreat of relevant state authorities

**goal:** to induce more competition/guarantee high standards in the new study programs

# Accreditation in Germany

## German Accreditation Council

*(established by resolution of the Conference of Ministers of Education in December 1998)*

The A. C. has accredited

**AQUAS**

Agency for Quality Assurance and Accreditation of Study Programs

**ZEVA**

The Central Evaluation and Accreditation Agency

**ACQUIN**

The Institute of Accreditation, Certification and Quality Assurance

**AHPGS**

Accreditation Agency for Study Programs in special education structure, Health and Social Work

**FIBAA**

The Foundation for International Business Administration Accreditation

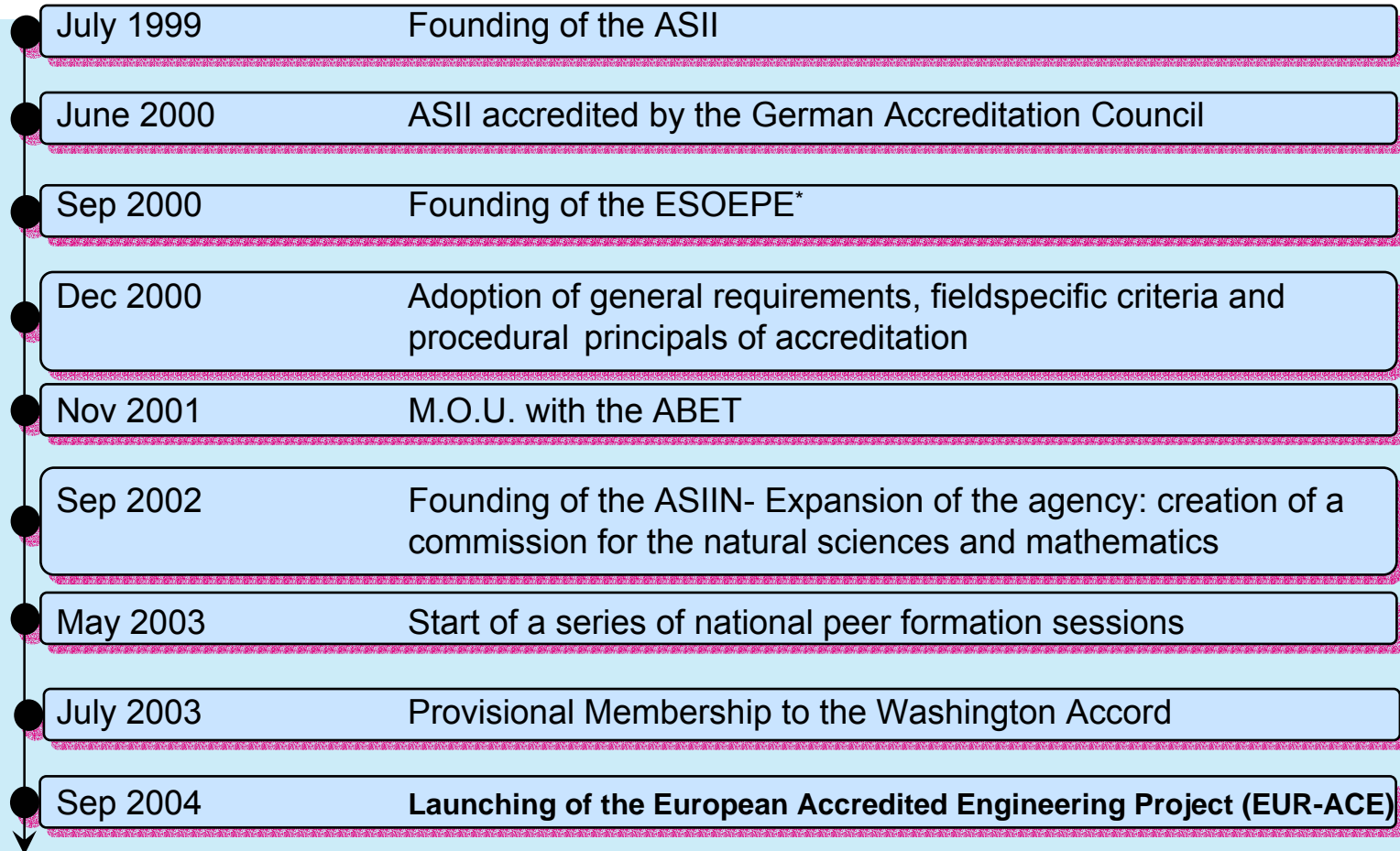
**ASIIN**

Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences and Mathematics

**Characteristics: cross disciplinary, regional membership of individual Universities**

**field specific accreditations members: universities as well as industry, technical scientific associations and professional organisations**

# Developmental Phases of ASIIN



\* The European Standing Observatory for the Engineering Profession and Education

# The European Landscape: Context for the Development of Accreditation Schemes

- 1.) Characterised by mostly public higher education systems institutions and programmes derive their formal degree-awarding capacity from the state. Because of the diversity of both degrees and institutions, public knowledge about their quality is not sufficient across national borders and even sometimes within one country.
- 2.) In some countries the academic degree constitutes the automatic admission ticket to the job market whereas in others additional prerequisites are demanded to acquire professional status (e.g. registered engineer).
- 3.) Degree and institutional diversity is matched by a great variety of national quality assurance and accreditation systems (some of them are national, others decentralized). There are few mechanisms in place to recognise the results of an evaluation and accreditation.
- 4.) Problem of a growing non-official higher education sector and the phenomenon of trans-national education with a lack of regulatory codes.

# The EUR-ACE Project

To address these problems and to establish a common standard for the accreditation of engineering programmes and graduates in Europe, the

## **EUR-ACE Project**

has been developed under the auspices of the “European Standing Observatory for the Engineering Profession and Education” (ESOEPE).

The EUR-ACE Project was officially initiated at a kick-off meeting in London on September 2-3, 2004. It has a budget of almost EUR 500,000 including a grant of almost EUR 350,000 from the EU-Commission Socrates Programme.

The participating institutions and organisations will within a year develop and test a common standard for the accreditation of engineering courses in a 5-stage process. Also, a detailed proposal will be formulated on how to set up and run the system that must become self-supporting within five years.

## What is the Purpose of the EUR-ACE Project?

In order to overcome the difficulties in the mutual recognition of academic and professional qualifications, and facilitate the mobility and trans-national acceptance of engineers

EUR-ACE will “propose a framework for setting up a [single] European system for accreditation of engineering education at the First Cycle and Second Cycle level (as defined within the Bologna process)”

and will thus contribute to establishing the European Higher Education Area ....

# European Network for the Accreditation of Engineering Education (ENAE)

