

Reform of Higher Engineering Education and Engineering Education Accreditation

Yu Shouwen

Tsinghua University, Beijing, China

E-mail: yusw@mail.tsinghua.edu.cn

1---Background

- Higher requirements for engineers and technicians.
- “Global economic”, “**Big Engineering**”.
- A large number of **manufacturing businesses**
- It is definitely important **to train out** a large number of **high-quality engineers and technicians** in China.
- China’s **industrial structure is bound to be changed**

(1) **An Overview of China's Higher Education (中国高等教育概况)**----Prof. Ge D K,2005

The total number of students in regular higher education

in **2004: 14.15** millions ,

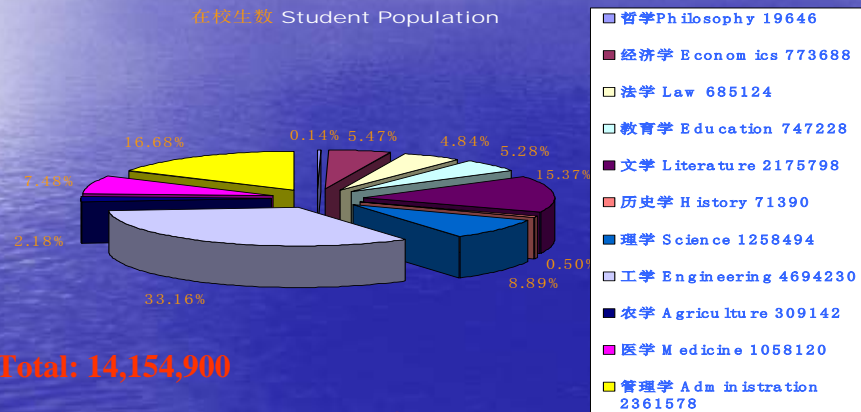
in **2005: ~20.00** Millions

~23.00 millions (with Adult-Univ.)

2004年普通高等教育在校生总数1415.49万

Total number of Students in Different Academic Fields in Regular Higher Education in 2004, 2004年普通高等教育分科学生数

在校生数 Student Population



Types of Higher Educational Institutions

办学机构类型

(2004)

普通高等学校1731所(其中民办226所)

1731 Regular HEIs (226 non-state)

本科学校684所

684 Universities

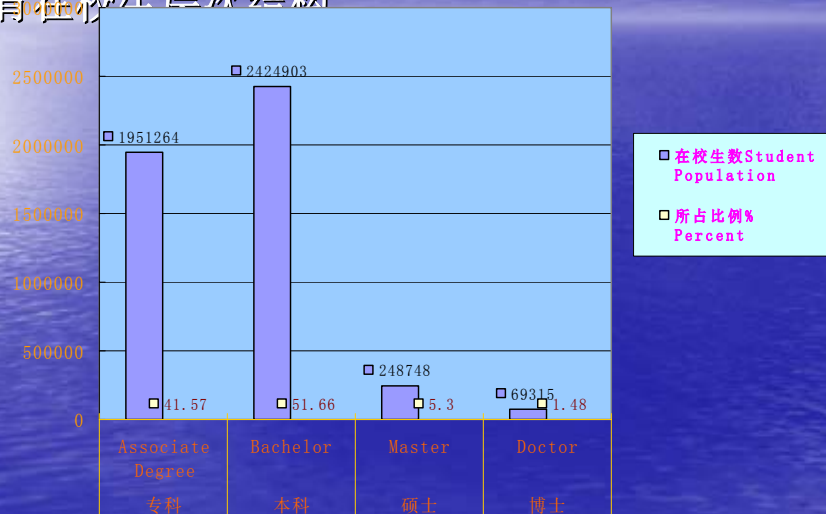
专科(高职)学校1047(872所)

1047 Tertiary Colleges

另外, 独立院校249所

In addition, 249 Independent Colleges

Number of students at Different Levels of Engineering Education in 2004, 2004年工程教育在校生层次结构



Number of HEI Offering Engineering Education in 2005
2005年举办工程教育的高校教育

	设工科专业学校数 Number of HEI Offering EE Programs	学校总数 Total Number of HEI
合 计 Total	1528	1751
本 科 Bachelor	604	704
专 科 Associate Degree	924	1047

✓New Enrollments in Engineering Education
During 1998-2004 1998-2004年工程教育招生数

年 度 Year	1998	1999	2000	2001	2002	2003	2004
招生数 New Enrollments	441553	646665	887408	955314	1136727	1345638	1587209
增长率% Increasing Rate		46.45	37.23	7.65	18.99	18.38	17.95

Graduate Students

- **1999—up to 2004**:—average increasing rate of total number **V=30.2%**
- 2000—V=40.0%
- 2003---V=32.7%
- Enrolments of freshman:
1999—**92** thousands
2004---**326** thousands

Enrollments (Mil.)

• Year	Univ.	Institute	Total	MA	Dr	Total
• 2005	2.30	2.35	4.65	0.316	0.054	0.37
• 2006	2.60	3.00	5.60	0.344	0.056	0.40

China's engineering education

- In general, the **engineering education** programs compose about **30-35%** in China's higher education system.
- Neither like the **American** one which has a pre-job training system offered by American industry
- Nor like the **Germany** one which offers adequate training and practice in industry to graduates of engineering before graduation.
- They lack **R & D** work. –**Innovation**-- China's industry and enterprises have requirement .It is key point of the policy of development .

- Great development of Higher E E
- Human resource
- Balance between quantity and quality
- Face big change for the industrial structure , Requirements of innovation

R & D center

Total number of students in EE ~ 1/3

Total number of students in HEE

Globalization of Education ~ Localization

(3)-- Encouraging Young People to Be Modern Engineers in the 21st Century

- ‘Better Engineers and Better Professionals’
- Some outstanding **Chinese youths** in current society didn't want to choose engineering technology as their major. They were **unlikely to be** cultivated to be engineers and professionals.
- The **preferred majors** of many young people included such **hot specialties** as: finance, commerce, administration, foreign language, law etc.
- What is the **reason**—Construction of industry and the needs of market of human resource.---Reform of EE
- Following **achievements**—in the reform of Engineering Education in China:

1)--Engineering specialties

- **Firstly**, many engineering colleges have offered some **engineering specialties** to meet the demand of the time
- Industrial engineering
- Financial engineering
-
- Other **interdisciplinary** specialties such as systematic engineering, distributive engineering and technology, social engineering science etc

2)--Master of Engineering Program

- Since 1984 China has begun to carry out **Master of Engineering Program**. mid-1990s, Master of Engineering was set up.
- Up to ~ **80 thousand per year** now, covers **dozens of fields** of engineering. For candidates had **practical experience** concerning engineering of more than **3 years**
- **Two-year period** of courses learning and thesis writing, finally achieve ME by passing the oral defense.

3), B.-M.-integrated Degree Program

- **Thirdly**, schools of engineering at some Chinese universities, Tsinghua University's engineering departments, have carried out **Bachelor-Master consecutive pursuit system**.
- In Tsinghua, About **50% of students** prefer such a learning approach, students at Chinese engineering colleges will take average **4 years** to achieve a bachelor's degree.

4)– Practical Activities

- Fourthly A recent survey revealed that “UROP” and “UPOP” developed by MIT
- In China, Tsinghua University’s “Students’ Research Training” (“**SRT**”) program and national “**Challenge Cup**” of science and technology contest also appeal to a great number of undergraduates and even postgraduates to participate in such activities.
- Most Chinese universities encourage students to involve themselves in such **practical activities** as science and technology innovation or establishment of enterprises.

5),Distance education system

- Engineering technology circles distance education system,--**Continuum Education**
- **CERNET—big network.**
- To accomplish course concerned with engineering technology and administration or courses **for postgraduates**
- Such a distance-education approach important form of **further education for engineering technicians**

The Structures of Engineering Education

- The structure of engineering educational specialties will **match up to industrial structure** of national economy,
- That the structure of engineering educational levels will match up to **technological structure of industrial economy**,
- The structure of engineering educational form will match up to the structure of **university-enterprise cooperative education**,
- The structure of overall arrangement for engineering education will **match up to the objectives of reform and development of our country** and the status as global education.

4.Engineering Education Accreditation

Accreditation of engineering education

- 建筑学
- Architecture
- 土木工程
- Civil Engineering
- 建筑环境与设备工程
- Building Environment and Equipment Engineering
- Mechanical Engineering,....(University of Shanghai Sci. and Tech.,--ASIIN)
- 航海等
- Navigation, etc.
- 工程硕士--Master of Engineering—Professional Degree

- **1),**Comparing research—ABET, EUR-ACE, ASIIN,
- **2),**Exchanging—Roundtable Meeting of Academy of Engineering (China, Japan, Korea)
- **3),**The Experts committee of Engineering Education Accreditation of MoE has established
- **4),**Drawing up the documents of the principle ,criteria and procedure of the EE Accreditation
- **5)** Case-study: EEA for other fields and specialities
Mechanical Eng., Chemical Eng.,.....
- **Several Accreditation of EE Accreditation since 1995 —**

Several Case- Studies

(see Li Zh C,2001; Shen Z Y,2001)

1)--Architecture, Civil Engineering

Engineer-Accreditation----EEA

- Chinese Registered Exploration and Design Engineers and relating issues on Engineering Education Accreditation
- Considering Chinese condition—Requirements of the medium and small sized engineering constructions:
- Structural **Engineers** and Water conservancy—Two classes: Class 2:for small scale engineering design
- **Relating EE Accreditation:**
- Registered Engineer must: 1) Graduated from a formal professional university
- 2) Class 2: Graduated from Vocational training school at least)

- **Relating EE Accreditation:** 4-year engineering program in an accredited University, **This 4 years program should be peer reviewed**, Accreditation committee of the related professional education
- **Practice** training
- Qualification **Examination:**
 - a) Fundamental examination;
 - b) Professional examination

2),Professional Accreditation for civil engineering program in China (Shen Z Y,2001)

- National Board of Civil Engineering Accreditation (**NBCEA**) established in **1993** authorized by the Ministry of Construction
- Accreditation documents:
 - Status of the National Board of Civil Engineering Accreditation
 - **Criteria** for National Accreditation of Bachelor Degree Program in Civil Engineering
 - **Procedure** of National Accreditation of Bachelor Degree Program in Civil Engineering
 - **Guidelines** for visiting team Work

- Since **1995**—till **2005**, **35** Civil Engineering programs in different Universities have been accredited
- A mutual **recognition** agreement was signed in Match of 1998 by **NBCEA** (China) and Joint Board of Moderators—**JBM** (UK), ABET—sent Observers joining the activities of this accreditation in China

NBCEA and Accreditation Criteria

- **NBCEA 22** Members
- Educationists and experts in CE—**11**
- Prestigious Engineers —**8**
- Ministry of Construction—**2**
- Ministry of Education—**1**
- **Criteria:** Teaching Condition (4 sub-indexes)
- Education Process (2 sub-indexes)
- Education Quality (3 sub-indexes)

Procedure:

- Review **application** report
- Review of **self evaluation** report
- Review of **visit report** and make decision
- **Appeal** and Arbitration
- Visiting team work: Organization of visiting team(4-6 members)
- Arrangement of visit

3),—USST—Accreditation-Consistencies in comparison to the ASIIN-rules

--"USST-Prof.Zhang,2005-Sept."--

When comparing the two Chinese-German study programs from USST and HAW in **mechanical and electrical engineering** to the ASIIN standards

The major features to ensure comparability were:

- defined educational **objectives** and profiles
- structure and contents of the **curricula** with a significant share of mathematics, natural sciences, engineering basics and deepening, engineering applications (at least 2,5 years respectively ca. 1.500 student hours without thesis or internships)
- established **credit point** system (30 student work hours = 1 cp) and modularization of the curricula
- technical equipment and laboratory **facilities** for student training in engineering applications
- transparent formal **regulations** for studying, examinations, access requirements, degrees granted
- scientific **environment**, formally fixed co-operations and qualification of the **teaching staff** involved in the program

Differences in comparison to the ASIIN-rules

The major discussion points were with this regard:

- the increase of teaching in specific fields of natural sciences, mathematics and engineering basics
- the **workload** for the students - which seemed significantly higher than in Europe – and the **lower share of self-study** by the students in the single courses
- the availability and contents of the company placements of students, that should assure on the **job training** in engineering activities
- the **enhancement of internal quality assurance** measures leading to continuous improvement of the study programs and their outcome

Accreditation procedure and audit team for the USST study programs

01-07/2004

Application for the ASIIN-accreditation for the bi-national bachelor programs for mechanical engineering and electrical engineering offered by the USST Shanghai and the HAW Hamburg.

Presentation of a **written self report** by the persons in charge of the program describing the two study programs and the responsible institutions.

09/2004

On-site-visit of the peer group:

2 professors for mechanical engineering from German HEI

2 professors for electrical engineering from German HEI

2 representatives with substantial professional and managing experience with companies working in the fields of engineering in China and Germany

11-12/2004

Assessment of the **report of the auditors** within the two responsible **technical committees** of the ASIIN.

Assessment of the report of the auditors and the comments of the technical committees within the accreditation commission of the ASIIN. Final decision by the **accreditation commission** to grant the accreditation for the two bachelor programs under conditions to be fulfilled within one year.

4)--Quality Assessment for Master of Engineering 工程硕士的质量评价, Related to Accreditation,

--Prof. Chen HM, Tsinghua Univ.2005-09

The council has set up the basic quality assessment **indexes system** for M.Eng.

制定了工程硕士教育基本评价指标

- **Assessment method:** self-assessment, peer review, expert's review. 自评、互评与抽评相结合
- **First quality assessment in 2002** 评估试点
electronic & communication, mechanical engineering fields (电子与通信工程、机械工程)

Framework of Quality Assessment 评估方案

- **Basic and Additional parts** : 120 points
(评估分为基本和附加两部分)
- **Basic part:** acceptable assessment
(基本部分采用合格评估), 100 points
- **Additional part:** 20 points
(附加部分)

Quality Assessment-1: Student **recruitment** (招生20 points)

Three indexes:

- Qualification of applicants
报考条件
- Origin of applicants 考生来源
- GCT's grade 成绩
- University entrance exam (written or oral examination) 学校自行组织的考试

Quality Assessment-2: curriculum and **teaching quality** (课程教学质量30 points)

Five indexes:

- Curriculum design (课程建设)
- Quality of faculty (授课教师水平)
- Teaching management (教学组织与实施)
- Teaching quality (教学效果)
- Lecture notes and relevant documents
(教学文件归档)

Quality Assessment-3: thesis quality (学位论文质量 30 points))

Four indexes:

- Thesis topics (论文选题)
 - Project from industry or having potential applications in industry
- Independent work (独立工作)
- Co-directors (校企双导师)
 - Advisors from university and industry
- Thesis defense committee members (答辩委员会成员)
 - University professors and experts from industry

Quality Assessment-4&5 : Administrative work and Additional part

- Administrative work (管理 20 points)
administration, regulations, documents, etc.
管理机构、规章制度、档案管理等。

□ Additional part (附加分 20 points)

The characteristic is important for running a school & its effect

鼓励办学特色明显、办学效果好的培养单位。

Linking with the Engineers Accreditation

- Integrated design—both of the Engineers Accreditation and **Engineering Education Accreditation**
- Linking different stages:
Accreditation—Certification—License of Engineers

Respect engineers and their work

If science and technology are well respected, engineering is well developed, and economy is invigorated, and if the first priority is well given to the humans and engineers are highly respected, China's engineering education and its huge team of engineers will be able to come out to the world with a completely new outlook

