

**Tertiary education yesterday, now and
tomorrow
(a personal view of engineering professor
and university manager).**

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Introduction



- **Harmonization of study systems in Europe**
- **Motivation for creative thinking**
- **Quality assessment and control**
- **Future of Engineering education, the role of ICT**
- **The role of IT for managing the university**
- **The CTU case study**

Harmonization of study systems in Europe

Degree of Diploma Engineer (Germany)

Traditional educational systems:

- The long study programmes (5 to 6 years)

The new European structured systems:

- The structured study programmes (Bachelor stage, Master stage, Doctoral stage)
- The length usually $3 + 2 + 3$

Structural study systems - advantages

- Decreasing of difficult theoretical courses for freshmen, i.e. decreasing of drop out
- Better conditions for mobility in the second and the third stages
- Choice of study length
- Bachelor's position on the labour market is much better than position of unsuccessful students of long study programs leaving university after 3 or 4 years without any degree

Structural study systems - disadvantages

- The average actual length of study is prolonged due to usual prolongation in each stage.
- Bachelor's position on the labour market is much better than position of student leaving after 3 or 4 years university without any degree.
- Necessity to teach theoretical background divided to all three stages. That will create the less efficiency of educational process.

Implementation of structured study systems

- General formulation of the profile:
Bachelor x Master x Doctor.
- Proper ratio of different types of courses i.e. the percentage of theoretical and preparatory courses, specialised engineering courses, managerial courses, and humanities.
- General constraints on the length of the study programme, the credits to be awarded, and the ratio of obligatory and facultative courses.

Motivation for creative thinking

- All students even the undergraduate should experience through, and about R&D
- Curriculae should cover also any „project oriented educational courses“.
- The basic paradigms of higher education:
- Teaching - Learning – Discovery
- Influence world-famous professors – researchers

Motivation for creative thinking continuing

- As the example of the good practice it can serve e.g. The Honeywell Nobel Initiative i.e. support of Nobel price winners visits and lectures in research universities. Students are very interested on these lectures and they are strongly motivated to try to work in prestigious research teams.

Quality assessment and control

- Success on the global educational market is based mainly on the quality of university.
- The 13th century up to half of 20th century universities – very small exclusive institutes educating very small part of society, professors-top level specialists.
- The Humboldt's based on the top research
- The quality of traditional “stone” university was given automatically and no specific process of a quality control was necessary. ⁹

Quality assessment and control

- The fast development and massification of the tertiary education in the last decades changed these boundary conditions.
Anywhere but especially in developing and transitive countries human resources are limited thus the quality tends to decreasing.
- Top level quality needs to be assessed and controlled according to the national and international standards.

Quality assessment and control

- The quality of educational activities mainly using questioners filled by students, graduates, and employers.
- Data collection and data analysis is impossible without using of ICT.
- The quality of research activities can be measured easier but it also needs operation with large databases. Each modern university has its own component of information system for primary data collection. Data processing can be made by the similar software as for educational quality.

Future of Engineering education, the role of ICT

- Nowadays, young people are very familiar with modern ICT devices and systems Using of them is necessary in education and administration, too
- Universities will use most modern approaches in learning and will apply the most advanced teaching tools and computer systems. It will made education more convenient and interesting.
- Very important role in the improvement of quality of the university and their efficient development has the information system first for the managerial₁₂ purposes, second as a tool for modern learning.

Future of Engineering education, the role of ICT

- Development of ICT is faster and faster thus it is difficult to predict the future after 10 years and near impossible after 20 years
- It seems to be that role of mobile devices (Iphones, Ipads) will increase, the necessity of full 24/7/365 access is clear, quality of e/learning courses should increase.
- Academic excellence and administrative performance needs widening of ICT use

ICT and education

- The educational activities should be strongly supported by the component of IS for study agenda supporting all processes starting from application of freshmen through the organization of each term, registration of exam grades up to the printing of diplomas.
- IS should contain the recommended curriculae and content of all courses. IS should be directly linked with the educational software.
- Optimizing of costs and data security due to cloud solution will extend e-learning applications.

ICT and education

- World wide educational software is MOODLE representing very good support of individual study and communication between students, teachers and tutors.
- Disadvantage of MOODLE is a large number of versions without compatibility that causes problems in transferability and sharing of different courses

ICT and Distant Learning

- All over the world it is growing number of part time students thus ODL should be increased.
- The quality of educational software should be higher than it is for presence study
- Engineering education should have virtual labs and labs with remote control, too.
- ODL software have to support real time communication between teacher and student and among students, too

The role of IT for managing the university

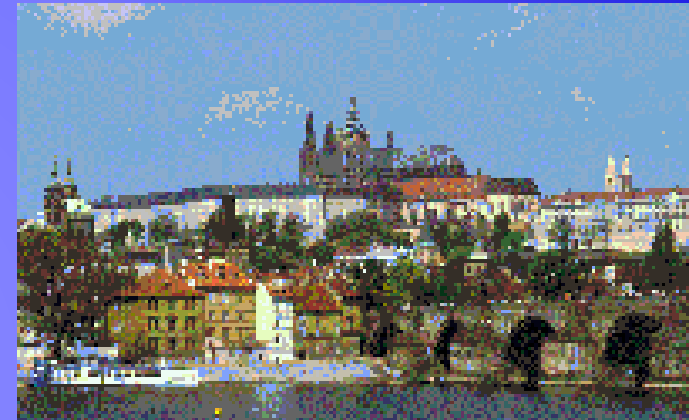
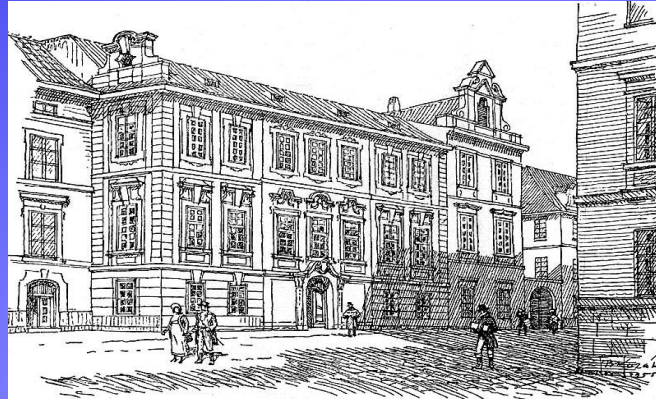
- The managerial IS should contain special components for accounting, personal agenda and aggregating data outputs for the top management and governmental offices.
- On difference with study system the core of managerial one is usually developed and delivered by the commercial software house, the farther development and upgrade can be made by the internal Information Centre or Faculty of Informatics staff.

Czech Technical University

- Oldest university of technology in Europe
- QS world ranking of universities:

Year	Eng.&Technol.	Nat.Sc.	Total
2007	359	460	520
2010	121	246	401+
2013	207	-	501+

CTU History



1707 - Rescript of Joseph I.

1717 - Czech General Estates School

1803 - Prague Polytechnic

1879 - Technical University

1920 - Czech Technical University

1950 - Lost of full spectrum character

1990 – CTU began to transform itself in the spirit
of its own tradition

CTU Personalities



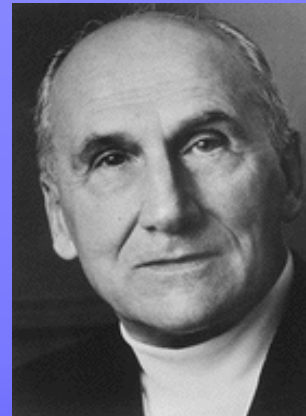
František
Josef
Gerstner
(1756 – 1832)



Christian
Doppler
(1803 – 1853)



Antonín
Svoboda
(1907 - 1980)



Vladimír
Prelog
(1906 - 1998)

CTU Nowadays

Ctu nowadays is the largest technical high education institution in the Czech republic with more than 23 000 students and 1600 teaching and research staff.

The courses are covering not only engineering and natural science disciplines, but also economics and management, social sciences and industrial design.

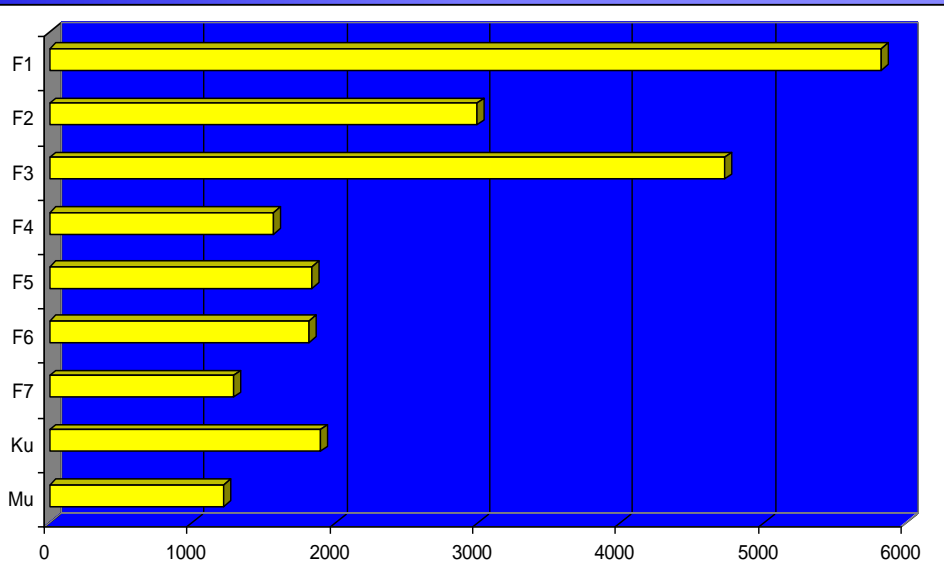
Ctu is nowadays a typical central european university of technology consisting of 8 faculties: civil engineering, mechanical engineering, electrical engineering, nuclear and physical engineering, architecture, transportation sciences, biomedical engineering and information technology.

Ctu aims to be an excellent research university in a wide range of technical fields.

Ctu aims to co-operate with universities all over the world and to have strong links with industry.

CTU Nowadays

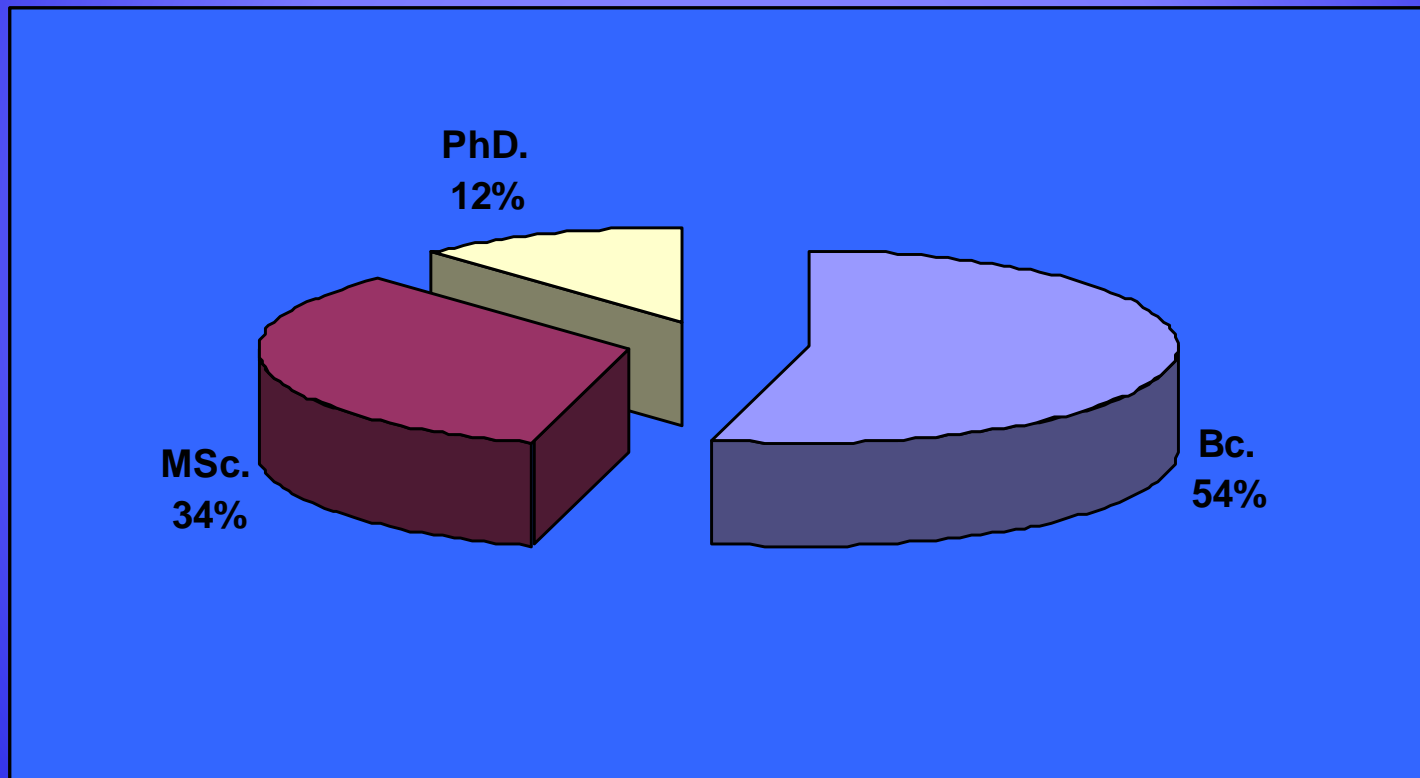
Number of Students (total 23 190) - academic year 2011/2012



Faculty of Civil Engineering (5 823)
Faculty of Mechanical Engineering (2 995)
Faculty of Electrical Engineering (4 728)
Faculty of Nucl. Sciences and Phys. Eng. (1 566)
Faculty of Architecture (1 838)
Faculty of Transportation Sciences (1 823)
Faculty of BioMedical Eng. (1 289)
Faculty of Information Technology (1 901)
Masaryk Institute of Advanced Studies (1 227)

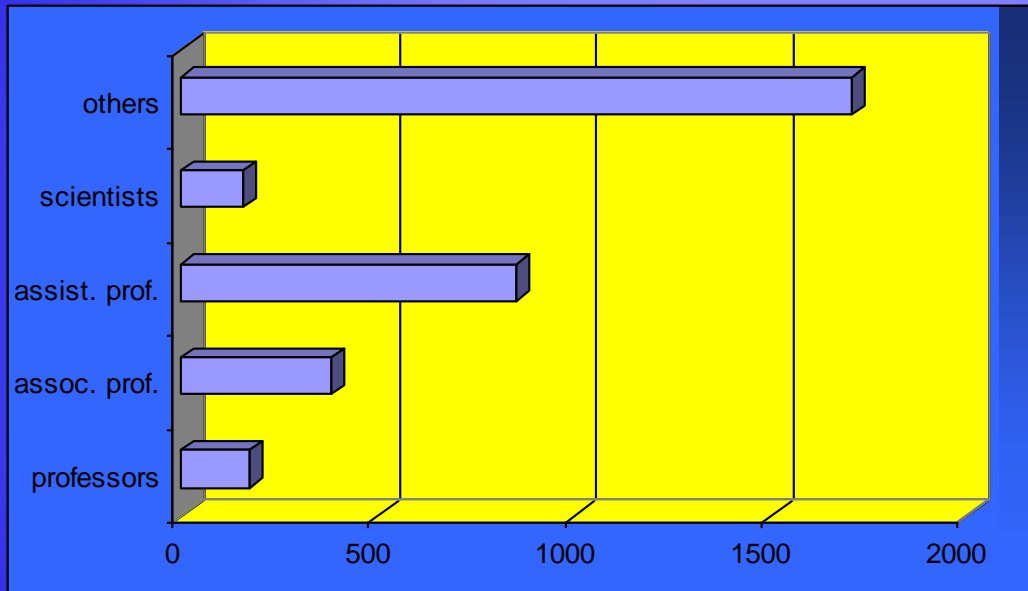
CTU Nowadays

Number of bachelor, master and PhD. students



CTU Nowadays

University staff (1563 + 1707 = 3270)



others (1707)
scientists (156)
other teachers (853)
associate professors (382)
professors (172)

students/teacher = 16

Role of CTU Information Systems

The quality of the university and their efficient development has the information system in his roles:

- managerial purposes,
- tool for modern learning,
- support of the research activities, grant applications

The CTU Information System

- The IS of CTU has been based on Oracle databases under the portal environment.
- Core of system was developed by the commercial software house.

Farther development and upgrade is made by the Computing and Information Centre of the university.

- Despite of the long term operation (20 years) it gives very good information in comprehensive form.

Components of CTU IS

- KOS (component for study agenda) supported all processes during the study of any student (application of freshmen, organization of each term, registration of exam grades up to printing of diplomas).
- In the KOS they are described ECTS rules, the recommended curriculae and content of all courses.
- The mentioned component is also linked with the educational software (MOODLE, MATLAB, etc.)²⁷

Components of CTU IS - cont.

- Component VVVS(external relations) is supported all research activities (application and registration of grants, publication and other research results, access to the world databases, international co-operation etc.)
- Component FIS (financial IS) includes accounting, all money transfers registration of all equipment, communication with governmental offices, etc.

Components of CTU IS - cont.

- Component PMSV(personalities) registries personal data of all employees and compute salaries for them access to the world databases, international co-operation etc.).
- Component MIS (managerial IS) acquired and processed data from all other components. This component contains statistical software and produced aggregated data for all levels of university management with different access.

Thank you for your attention