



INTERNATIONAL CO-OPERATION AND INDUSTRY-ACADEMIA LINK IMPROVEMENT FOR ENG STUDENTS AT UNIVERSITY OF MISKOLC

Á. Döbröczöni L. Szentirmai L. Kalmár
University of Miskolc, Hungary

University of Miskolc

MISKOLCI
EGYETEM

Faculty of Mechanical Engineering and Informatics

OUTLINES

- **INTRODUCTION: CRADLE, PAST AND PRESENT OF UNIVERSITY OF MISKOLC**
- **ENVIRONMENT FOR ENGINEERING EDUCATION IN CURRENT YEARS**
- **INTERNATIONAL CO-OPERATION IMPROVEMENT**
- **ACADEMIA-INDUSTRY LINK IMPROVEMENT**

CRADLE, PAST AND PRESENT OF UNIVERSITY OF MISKOLC

- Royal Chamber in Vienna: a decree in 1735 - "Berg-Schola" (School for Mines and Metallurgy) in Selmecebánya – now in Slovakia. Objective of School: train executive officers first of all for exchequer-integrated mines and metallurgical industry and for private industry. Education and practice 2 years and five branches listed as exploitation of a mine with rules, laws in mining, measurement performer, ore preparatory, chemist and metallurgist, coinage specialist and gold-examiner.

- In 1770 **Academy rank** was awarded by the Queen, Maria Theresa by decree on Systema Academiae Montanisticae, duration of education was 3 years. In 1809 a course of philosophy involved mathematics, physics and logics. Such courses proved to be basis for Universities of Sciences. Early 19th century duration of study went up to 3.5 and 4 years.
- In 1786 Prof. J. Born organised the first "Societät der Bergbaukunde" (**Society for Mining and Metallurgical Engineering**) and it had 154 members from scientific and cultural fields like A. L. Lavoisier, J. W. Goethe, J. Watt and with sessions in 15 European and American countries.

- **In 1919** – when Selmecebánya became a city of newly formed Czechoslovakia – **University moved to Sopron**, Western Hungary. In 1929 **Publications** in foreign languages came out, which are still alive under a different title.
- **In 1949** the Acts 22 and 25 by Parliament said: "a **Technical University for Heavy Industry** has to be established in Miskolc. The university will contain faculties of mining, metallurgical and mechanical engineering."
- University of Miskolc (UM) has now **three engineering faculties** (Mechanical, Earth Science and Technology, Material Science and Technology).

- **Specialisations** are running in information technology, mechatronics, electrical, mechanical engineering, mining, environmental engineering, and many others. The academic staff has 400 members and the number of full-time students exceeds 4300.
- **Since 1983 new Faculties** were established as of Law, Economics, Social Science and Humanities, Health Care. In addition, a Music School and a Teacher Training College was attached to the University, thus the total number of academics exceeds 800 and that of full-time students' is over 14,000.

ENVIRONMENT FOR ENGINEERING EDUCATION NOWADAYS

- In 1950 Western Europe gained 0.3 trillion (10^{18} =one trillion in British term and one quintillion in US term) US dollars from foreign trade sector while 20-times higher in 2000. Member States of European Union (EU) increased their GDP per capita between 1973 and 2000 by 50%.
- In 1995 EU had 15 Member States with 370 million population and seven trillion US dollars of GDP, thus it became an equal partner to the US. Giant European Single Market receives 75% of export goods coming from Europe in comparison to former 30%.

- Europe has some 4,000 institutions of higher education in 45 countries. 1,000 of which are genuine "universities" on the basis of the criterion of being authorised to award doctoral (PhD or equivalent) degrees. HEE institutions play vital role because more than 50% of economic growth is attributed to technological progress. **Knowledge-based society** revolves around four pillars:
 - i. production of knowledge through research,
 - ii. its transmission through education and training,
 - iii. its dissemination through information and communication technology (ICT),
 - iv. its exploitation in process of technological innovation.

- Nearly 7% of higher education students in Member States come from foreign countries. „Hard“ sciences and technologies attract a large number of foreigners mainly in UK and France.
- **EU programmes** provided aid to mobility. In early 21st century 100,000 students and 12,000 academics benefited from Erasmus scheme a year. 40,000 people took part in Leonardo programme, which supported academia-industry mobility projects between 1995 and 1999.
- **UM is participating in organised mobility flows** approaching European average percentage, but hosts less students. Those graduates who worked out their theses based on projects at EU Universities could obtain the best jobs.

- **EC projects** improve quality of higher education by staff exchange, training abroad programmes for students, modernisation of premises and equipment, introduction of new teaching methods, harmonisation of course content by TEMPUS, TEMPUS TACIS, Research and Technological Development (RTD) Frameworks and other schemes.
- **Club of Rome**: *An end to growth*. In 1987 UN World Commission on Environment and Development by *Gro Brundtland*, developed **sustainable development** : *to meet the needs of present generations without compromising the capacity of future generations to satisfy their own.*

INTERNATIONAL CO-OPERATION IMPROVEMENT

- Components of international co-operation by UM:
 - (i) bilateral agreements on staff and student mobility flows on education and RTD schemes,
 - (ii) participation in various EU education and RTD programmes,
 - (iii) hosting and participating in international conferences, seminars, workshops,
 - (iv) professional publications, and
 - (v) application and implementation of projects announced by EU and Hungarian authorities.

Early bilateral schemes

- The major forms of international relations with over 60 institutions are as follows:
 - o exchange of information, professional literature, teaching materials, technical books
 - o joint research, preparation and submission of projects
 - o participation in international conferences, events, performing lectures and presentations
 - o short visits and scholarship-funded study trips
 - o student exchange, summer practice, study trips
 - o receiving visitors, visiting professors
 - o participation in the work of international organisations.

Participation in EU/EC Projects

- A Work Committee with UM prepared proposals for the realisation of Bologna Declaration.
- **UM strengths**: historical tradition in education, qualified and experienced teaching staff, vivid international relations, successful participation in international projects, an ever-transforming training structure and educational profile meeting the demands of a rapidly changing world, flexible university management, quality assurance.
- **UM weaknesses**: not enough courses offered in foreign languages, shortcomings in infrastructure and information technology (IT), rather late introduction of ECTS, low number of students speaking foreign languages at appropriate level.

- **Aims and priorities** are as follows:
 - o improve good command of foreign language
 - o create environment for launching engineering programmes in foreign languages
 - o adapt European Credit Transfer System (ECTS)
 - o improve international character of engineering curricula by ICT integration
 - o offer a greater variety of programmes (two-tier programmes, distance and adult education)
 - o develop our competitiveness and appeal in the field of international education and research
 - o encourage our students to take up the course on European Studies
 - o apply quality assurance in education to a greater extent
 - o keep, even improve the standard of degrees.

- **UM contributes to Europe of Knowledge** by its cultural and scientific tradition. Bologna Declaration is a guiding principle in defining the main objectives to be implemented. Hungarian Government is to raise number of students in higher education up to 50% of the 18-23 age group by 2010.
- Two large-scale EC projects are well worth mentioning such as E4 and TREE. **E4** comes from initials of Enhancing Engineering Education in Europe between 2000 and 2004 with over 110 HEE institutions by University of Florence.
- Training and Research in Engineering in Europe (**TREE**) Thematic Network Project 2004-2008 with over 120 HEE institutions developed the activities along five main lines. UM and the Faculty were and are active within the projects and contributed to publicise its achievements by various means.

Staff and Student Mobility Flows

- o Strengthen objective criteria for selection in student and staff mobility flows.
- o Monitor selection procedures.
- o Teaching materials presenting at partner universities approved by Faculty.
- o Encourage staff to find specific topics to core curricula at partner universities.
- o Strengthen unique character of what we can offer to foreign students.
- o Raise the number of staff in mobility however financial constraints are strong. Yet, the university will do its best to find additional resources.

- ECTS gave a step forward to **competitiveness and mutual recognition of studies**. Easier for our students to participate in a study programme and to take up more course units. Faculties measure to make the departments efficient and launch more courses in foreign languages, primarily in English, where Hungarian and foreign students can study together. Departments promote incoming staff mobility and encourage staff of partner departments.
- Strengthen UM position in **curriculum development** and education management projects relying on TEMPUS experience of teaching staff.
- **Quality of mobility flows** will be supported by University Project Network and Quality Assurance Office with its own web-page on most significant education and research projects.

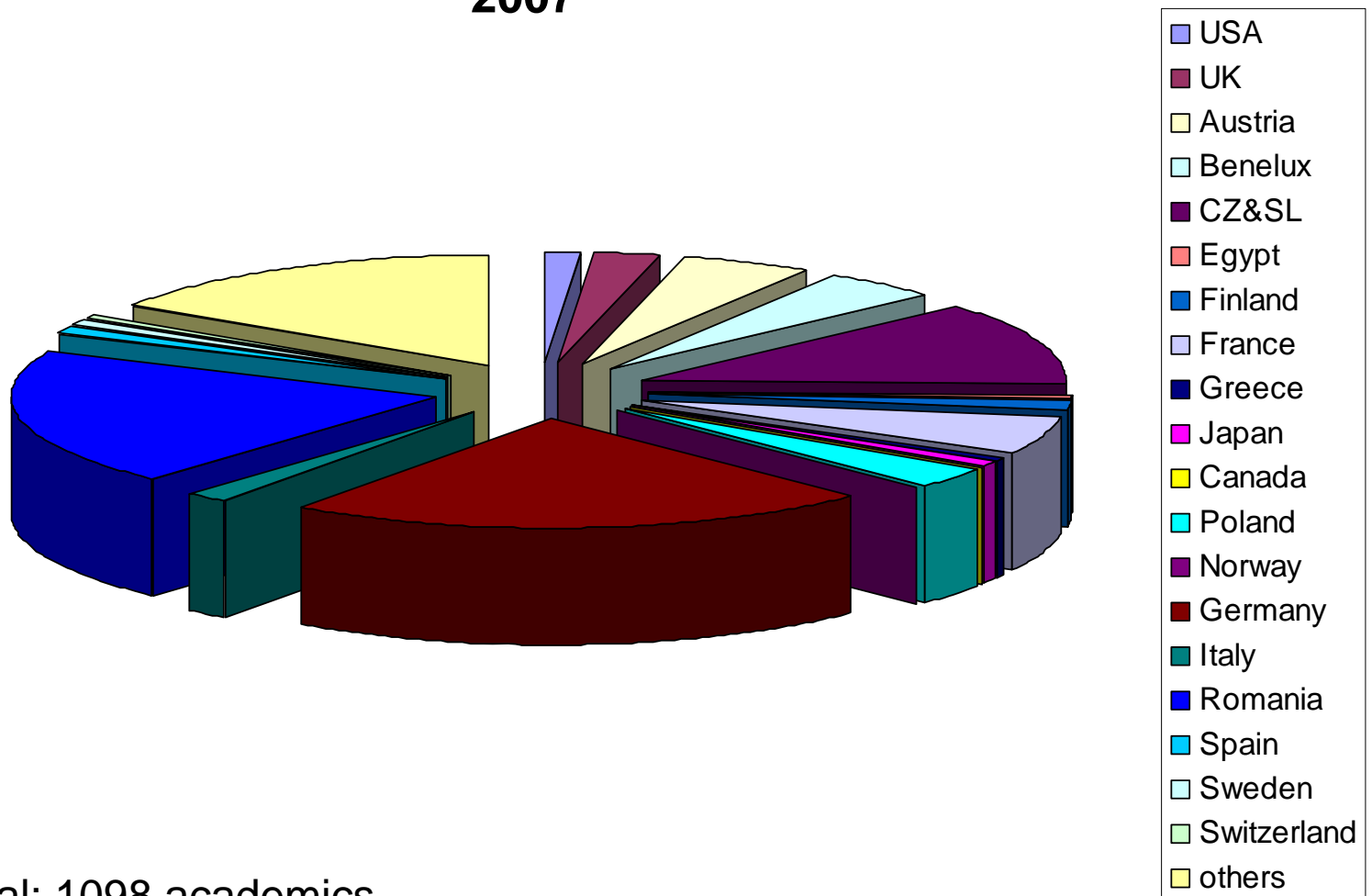
- The **principle of equal chances**, equal treatment and no discrimination as for sex, race, religion and social status is the university's firm standpoint. UM has a growing number of female students. Advisory service for physically handicapped students provides necessary help in terms of human treatment and financial support (the city and its region is an economically poor area, with high unemployment rate).
- UM definite aim to participate in **Intensive Programmes and Thematic Networks** within Erasmus, Socrates and in the Grundtvig, Jean Monnet and Transversal programmes.
- **Assessment criteria and final selection** results will be accessible on the internet and notice boards. **Foreigners** are welcome to UM with warm hospitality. The professional co-ordination of placements takes place at faculty level.

Bilateral co-operation of today

- Faculty puts great emphasis on bilateral co-operation with German Universities: Otto von Guericke Universität Magdeburg, Dortmund, Essen, Duisburg, Freiberg, München, Erlangen. Joint projects have been established particularly targeting both staff and student exchanges mainly by financial aid of the German Foundation DAAD. This foundation has managed to establish joint research projects between respective German Universities and UM.
- Technische Universität Berlin was first West-Berlin partner of UM and co-operation goes back to early 1980es. TEMPUS projects (microelectronics, mechatronics, PhD programmes in engineering and others) enjoyed active participation of TU Berlin staff.

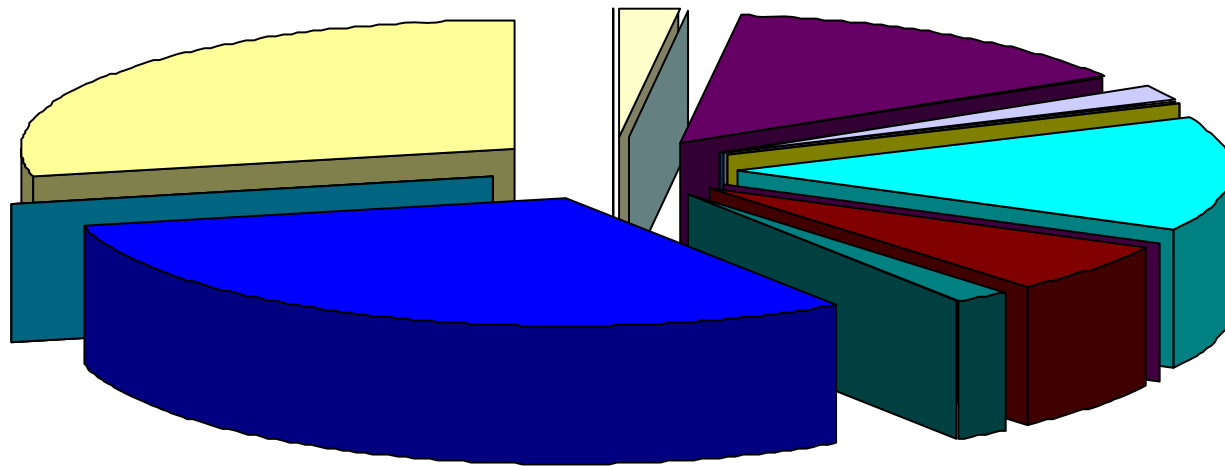
- Faculty has also vital international co-operation schemes with Universities of Leoben, Klagenfurt, Vienna, Zürich, Bath, Edinburgh, Dublin, Delft, Tampere, Zaragoza, Barcelona, Lisbon, Athens, Ankara and some others.
- 12 years ago a successful co-operation started with University of Nagaoka in Japan. 15 students enjoyed mobility from both parties per annum to other Universities. Universities of Muroan, Osaka and Okayama are also new members.
- Since early 1960es co-operation running with 15 former Eastern European Universities. Many academics from 24 countries participate in annual microCAD Conferences at UM dedicated to computer application.
- Highlight was SEFI-IGIP Joint Annual Conference hosted by UM 1- 4 July 2007 and Faculty staff played vital role.

Academic staff mobility to partner Universities 2007



Total: 1098 academics

Academic staff mobility from partner Universities 2007



- USA
- UK
- Austria
- Benelux
- CZ&SL
- Egypt
- Finland
- France
- Greece
- Japan
- Canada
- Poland
- Norway
- Germany
- Italy
- Romania
- Spain
- Sweden
- Switzerland
- others

Total: 280 academics

ACADEMIA-INDUSTRY LINK IMPROVEMENT

- Academia-industry link is improved:
 - (i) research projects with domestic industry,
 - (ii) establishment of University-attached research centre on mechatronics and material science,
 - (iii) introduction of a Regional University Knowledge Centre in mechatronics and logistics,
 - (iv) joint research projects with EU universities.
- Engineers with 1% of total employees contribute by 20% to Gross Domestic Product (GDP) by innovation in highly developed countries. This figure envisages a new structure and content of education.

No.	Intellectual power and quality	Firms %
1.	Carry out respective engineering works adequately	98.1
2.	Work in precise, accurate, recognised way	97.5
3.	Keep the deadlines at any time without delay	93.1
4.	Co-operate with colleagues in an excellent way with efficient team works or projects	93.0
5.	Being capable in engineering problem-solving	90.6
6.	Capability in carrying out specially works or projects alone	86.2
7.	Good communications skill and efficient personal contacts at workplace	82.3
8.	Creativity in engineering	73.6
9.	Engineering knowledge of high standard	72.3
10.	Capability in career success, self-management	58.0
11.	State-of-the-art knowledge in economics and marketing	38.9
12.	Establishment of professional link independently	18.4

Co-operative Research Centre on Mechatronics and Material Science

- Research Centre (after its Hungarian initials its acronym is MeAKKK or in a shorter form MeAK3) was established in 2001 at UM which serves as a **scientific research unit** for medium and large size enterprises showing interest in fundamental and applied research in the areas of mechatronics and material science.
- More than **30 enterprises** contributed to success by Hungarian Forints (HUF) 250 million and this input was increased by the Ministry of Education with the same amount of money i.e. with another HUF 250 million. For easier exchange rate, Euro 1 equals roughly HUF 250.

- Between 2005 and 2007 MeAK3 has been running by **60 enterprises** by HUF 500 million. Increase in input was due to recognised achievements.
- Faculty is running **mechatronics programme** in 5-year-duration co-ordinate of Machine Tools Department since 2000. In 2004 BSc programmes started in this discipline.
- There was a new **'Robert Bosch' Department of Mechatronics** serving both education and research initiated by German Bosch GmbH Industry with financial aid at UM in 2005 involving four Bosch sister companies working in Hungary.

- **General objectives** of industry-academia link within MeAK3 are:
 - **Scientific research of joint interest** to be implemented within co-operation scheme.
 - **Unify management of research** in mechatronics and material science with co-operation between two large different teams and Departments as well.
 - Ensure **large-scale financial aid and academic support** to students of MSc and PhD programmes such as stipends, visits to enterprises, provision of tutors for diploma-work, recommendations for topics of MSc and PhD theses, preparation of joint project applications, support both from academic and financial aspects of scientific papers/projects of students.

- o Build up knowledge having business aspect and marketing convertibility into curriculum, entrepreneurship and applied RTD.
- o Participation in modernisation of HEE as updating of curricula, establishment of new specialisation, etc.
- o Contribute to availability of new generation of scientifically trained engineers and other personnel of Consortium by enlargement of University facilities and knowledge-based teaching and research.

- **Main outputs** of projects regarding academia-industry link:
 - o All projects **involved best graduates and PhD students**. Some diploma works and PhD theses were prepared on project achievements carried out by student invited by his/her professor.
 - o Projects' achievements were published at large-scale national conferences. **Output** were put both in graduate curriculum and continuing education programmes.
 - o Valuable contributions were also presented and papers were **published** at International Conferences, their Proceedings and in periodicals.

Regional University Knowledge Centre

- Hungarian National Research and Technology Office announced recently applications for 'Regional University Knowledge-Centre' (after its Hungarian initials: RET). Centre started its activity at UM in 2005 for four years in the first period.
- Centre is to contribute to development of new products and technologies and in addition, to economic improvement of region in mechatronics and logistics. This **objective** can be implemented by knowledge-based UM and other HE institutions and research laboratories in co-operation with nearby dominant enterprises.

- RTD of the new Centre was focused into three main strategic fields:
 - o development of intelligent components, units and products, increase of life-expectancy, thus all belong to the **world of production area**,
 - o mixture of materials with relevant production technologies and mechatronics application in engineering fields are connected to the **group of materials and their technologies**,
 - o control close to production processes, then intelligent controls and logistics systems are linked to the **intelligent systems programme**.

- The **activity of the Centre** in the first few years contributed to:
 - o development of **innovative** products, processes and systems,
 - o **establishment and management** of knowledge-based network,
 - o commencement of **transfer of knowledge and technology**,
 - o the reinforcement of **scientific activities** in the region,
 - o the increase of **engineering education** standard.
- There have been over 20 important **projects** carried out and finalised in the first years successfully

Joint Project with Duisburg University

- Due to Lisbon-Strategy Hungary and Germany agreed to intensify scientific and technological collaboration.
- In mechatronics field the objective is to involve existing as well as future domain-specific development for process of new mechatronic products. Form of network will be an interdisciplinary and mechatronic development environment.
- Research-Base is primarily created by Universities of Duisburg-Essen and of Miskolc. Aim is to approve approach on real examples of mechatronic component development. This target is accomplished in co-operation with industry partners working in the region of Miskolc.

**THANK YOU FOR YOUR KIND
ATTENTION!**

2nd Deans Conference
SEFI – Technische Universität Berlin
24-26 February, 2008.