

# Some Aspects Of Engineering Education In Czech Republic During The Transition Period

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**Abstract:** *The main problem of contemporary relation between industry and the engineering education institution in the Czech Republic lies in the insufficient ability of industry to make use of the intellectual potential of technical universities as well as in the insufficient ability of technical universities to concentrate research and development so as to satisfy the industrial needs and to commercialize of results.*

*The heritage of the monopolistic orientation to the Soviet's block countries isolated Czech technical universities from top level technology. Nivelization and the social position of teachers, ideologization and politization of universities together with the old fashioned equipment and computers were the negative factors that affected technically oriented young people and their creative thinking as far as their choice of being or not being a technical university teacher is consider.*

*After 1989 new opportunities for young people caused further withdraw of perspective middle generation from the positions of technical university teachers. The situation was similar in the departments for development, innovation and design centres of industrial enterprises, which in the transition period have been under pressure of buying know-how and engineering from abroad.*

*The final results of this process lead to the stagnation of the technical level and a bed position of traditional machinery products on the world market which is one of the important reasons of deficit of trade balance of Czech economy.*

*The paper analyses the reasons of the lack of interest for engineering carrier as well as a proposal for new activities among technical universities, industry and state to solve these contemporary problems.*

## **Short history of Czech engineering education**

In 1787 was established under Prague university a School for engineers, which was in 1868 divided into Czech and German parts. The Czech part became for the Czech Technical University in

Prague. A German Technical University was founded in Brno in 1849 and its Czech counterpart followed in 1899. A Mining Academy was founded in Pøíbram in 1849 and it become a German College of mining in 1904. The establishment of an

independent Czechoslovak republic on 28<sup>th</sup> October 1918 in which the Czech lands and Slovakia were linked together had a profound effect on the development of higher education. Czech part of the Prague Polytechnic became the Czech Technical University (ĚVUT Praha) as well as in Brno (VUT Brno), and in Pøíbram was established my Alma Mater Technical University of Mining and Metallurgy (V\_B). Czechoslovakia had advanced industry before World War II and its engineering education was ranked among the most advanced in the world. Technical universities had a character of elite institutions with high social prestige. After disintegration of Czechoslovakia in 1939 the Czech lands became the Protectorate of Bohemia and Moravia and was occupied by German troops. Czech higher education institutions were shut down on the 17<sup>th</sup> November 1939 and remained closed until the end of the war. Immediately after the end of World War II there was a substantial increase in the number of students who returned to complete their studies. New faculties were established at the existing universities. Our Technical University of Mining and Metallurgy was transferred to the Ostrava, centre of mining and metallurgy and heavy machinery for preparing of engineers in this strong developing regions. The higher education system was clearly separated from technical secondary level schools, which had a long tradition, high standard and prepared a good professionals for industry. Profile of Technical universities was based on Humboldt traditions of unit science and education.

The period of communistic regime was deformed by strong ideologization and politization of Technical universities. Orientation on heavy industry and adopt of Social model of higher education with special institutions for science - Academy of Science led to many changes in the structure of engineering education. Chemical engineering was separated from ĚVUT Prague, new engineering faculties were established in Plzeò (1950), Pardubice (1950), Liberec (1953). Many departments of Technical University Brno (VUT) were adopted in the Military Academy, which had many priorities in its development. Academy of Science offered more opportunities to scientific researchers without burdening them with the obligation of teaching. The separation between research and teaching increased. The political influence increased after Soviet invasion in August 1968 and caused continues decline in the quality of teaching and research. Despite the proclaimed importance of higher education, the inefficient economy lacked funds for ensuring standards and stimulating public appreciation of higher education.

## **The contemporary situation of technical universities in relation to Czech industries**

- The heritage of an unilateral orientation towards the socialist countries' block until 1989 has led to an isolation of Czech technical universities from the peak technique and technology.
- Until 1989 the high colleges have not constituted any attractive career for a young man with technical orientation and creative notion - bad conditions for research, obsolete instrumentation and computer art, ideologization and politization of colleges, social situation of academic staff.
- Since 1989, according to colleges' autonomy, the liability to prepare the technical educated class for the next millennium has been transferred to the colleges and the same time the conditions for the activity of technical colleges are set out by the State's legislative measures and by the industries depending on their conditions and thus on their demands for colleges.
- It is not possible to compensate the exodus of creative engineers from the industries and technical colleges by new graduates and that is one of the main reasons why our products are out of competition in foreign and internal markets as well as a reason of trade deficit and the danger of suffering a loss of continuity of „know-how“.
- The causes for the decrease of research and development capacities in enterprises are given by:
  - natural retirement;
  - no possibility to complete the technical departments by new graduates;
  - insufficient social assessment of creative technical work and low social prestige of engineering professions;
  - minimum development of new products;
  - inflow of foreign companies which offer high salaries;
  - pressure for purchase of know-how and engineering from abroad.

The education of a first-quality engineer in the colleges conditioned by educationalists' accomplishments and consequently by sufficient interest in a career of an academic and by interest of the best graduates of secondary schools.

In the present time neither of these conditions is fulfilled.

There is a minimum interest in a career of an educationalist in the technical college.

In effect, almost no excellent specialists from the industries are coming to the technical colleges.

- High qualification postulates (excellent studies results, engineering experience, doctorate, life-long education, knowledge of languages)

- The salary scale of an academic to the end of his career is under the level of an average salary in a prospering firm
  - The social prestige of this profession corresponds neither with the world-wide standard nor with the European one.
  - The lack of creative and development engineers leads to:
    - increasing the age-average of particular workplaces;
    - disrupting the continuation of education and passing over the experiences to young engineers;
    - decreasing part of our own know-how and to the further retardation behind the developed countries as to the technical level.
- The interest in studying technical branches which was in a deep damping since 1989 has been moderately increasing during the recent two years.
- The reason for non-interest in the studies of technical branches:
    - the studies of technical branches are regarded as very difficult;
    - there is a need for life-long studies;
    - a low financial assessment - lasting levelling of salaries;
    - a low social prestige of engineering professions;
    - a high work-load and responsibility - the work results are concrete, the errors being directed to an individual;
    - a deformed idea of social utility of technical professions;
    - the negative influence of mass media which on the one hand present the successful undertakers, managers, financiers, famous personalities, and on the other hand they emphasise the negative influence of technique upon ecology, and at the same time the significance of technical creativeness for the development of economy, medicine, ecology etc. excepts notice;
    - the absence of technical education in the family, extinction's of family tradition for the choice of career;
    - the humanisation of the Czech educational system and an impressive reduction of technical subjects in the education schedules of elementary schools, including the negative influence of feminization;
    - liquidation of technical circles in the schools;
    - the market behaviour in secondary schools being financed by the state budget according to the number of the accepted students - opening of a number of so called attractive branches to the detriment of technical branches.
  - The consequences of lasting non-interest would become evident in:
    - the deficiency of graduates in the branches demanded by the industrial companies;

- the decrease of existing character of studies and education of less qualified graduates;
- the extinction of the nowadays so called non-attractive branches and disintegration of special faculties;
- the exodus of qualified pedagogues off the educational system caused by an unclear perspective.

The directions of the government for the sphere of research and development, dated 23. 4. 1997, represent positive steps towards the creation of promotion of research and development which would be compatible with the system in the European union. The technical colleges would have the possibility to obtain a grant for the solution of the tasks of industrial research and development.

The co-operation between universities and the industrial sphere is laid down in „The Directions...“. The key element of research and education into the item deductible from the tax base.

To increase the effect of the co-operation between industries and technical colleges, there was set up The Forum of Industries and Universities, that incorporates all technical colleges.

The Forum has firstly:

- to incorporate students and pedagogues into the solutions of the tasks of basic and applied research in the form of practice, dissertations and doctorands in industrial companies;
- to help to exchange the opinions about the needs of schools and industries and about further actual problems in the field of development of national economy, science, technique, education and culture.
- to formulate the attitudes towards the actual problems of education, evolution of economy and the Czech republic's science policy; to practise the adult education in the particular field and to acquaint the public with the basic standpoints and proposals;
- to help to create the conditions for increasing the technical level of colleges and industries;
- if necessary, to cooperate with the state bodies and institutions in the preparation and application of legislative and other significant measures aimed towards the development of industries and the institutions of higher learning.

### **Starting points and recommendable activities**

#### **Technical universities**

The key general element of changes is the education towards logical consideration and creative thought:

- to create conditions for scientific, researching and creative activity at the colleges and to enlist the peak experts from the practice and research;
  - to make an effort for further funds in addition to the state budget from the industries and commercial sphere.
  - to concentrate the intellectual and material capacities on the realisable outputs of science and research;
  - to increase the responsibility for the use of funds from the state budget as well as from additional sources;
  - to seek technical talents and to care for their motivation to the object of studies;
  - to increase the attractivity of technical branches by introducing the special subject already in the first year and so to enable the application of theoretical knowledge's in special activities and seminar courses and to lead the students to the technical branches;
  - to respect as much as possible the current demands on the graduates of technical branches, the knowledge of foreign languages, first-rate theoretical knowledge's and practical skill, an active approach to the solution of problems, talent and interest in the profession, logical thought.
- Universities must be accessible to the needs of industrial and commercial spheres, they must react to the demand in the diversified offer of educational schedules for specialisation, requalification and innovation within the framework of life-long education and within the framework of distant education.

### **State**

The necessity of existence of a strong legislative framework for the activities of universities - Higher learning Act, the implementation of Directives - is the precondition of a number of changes on the part of universities.

The determination of strategic and perspective directions in the state's policy for industries and education and their reflections in the system of financing the science, learning system and in the policy of grants, including the grants from the Ministry of industries and trade.

To stimulate the interest of peak graduates of secondary schools in the technical branches.

To create an effective system supporting the technical colleges:

- by modifying the coefficient of exacting character for technical branches;
- by introducing a schedule supporting the development of these branches;
- by representation of the technical branches in the accreditation commission to the Czech government;
- by a tax allowance for the companies supporting the education and investing in the research;
- by economic autonomy of universities (the right of

from more sources).

Introduction of contractual salaries instead of the single salary rule.

To increase the portion of technical subjects in the obligatory teaching schedule of primary schools.

In secondary schools, to provide complex information's about real possibilities of assertion, perspective and about the present and future situation of labour market, etc.

To revive or to introduce the technical natural historical circles or other circles of special interest in the primary and secondary schools with a direct participation of experts from practice.

To increase the role of Governmental Council for science and technology and to strengthen the representation of universities in this council.

The protection and utilisation of intellectual property, including the principle that the results of the solution of problems, including patents and industrial designs, are in the ownership of the designer.

Commercialisation of results of science and research in establishing joint ventures between the universities and the industrial sphere for innovative undertaking, utilisation of intellectual potential of technical universities.

The support of technological parks and innovation centres during their openings at the technical universities.

The support of industrial research and development.

The engagement of universities in the fields of standardisation, quality control and utilisation of accredited laboratories.

The utilisation of the universities' potential for the maintainable development of towns and region - structural projects.

young pedagogues, doctorands and graduands;

- to set the subjects of diploma works aiming towards the development tasks of

the company;

- to support the cooperation with universities in the research and development tasks;

- to use the possibility to affiliate the funds of the companies and that of

universities for building up of scientific-technological parks, specialised

working sites, authorised testing laboratories;

- to create conditions for co-operation of personal and publicity departments with

the universities;

- to utilise the possibilities to inform the students about the company and the

possibilities of employment;

- to motivate the students by providing stipends and grants for professional short-term affiliation in foreign countries.

## **Industrial companies**

- to define the corresponding position of working sites in the field of

construction, design and development and to include their perspectives into the

companies' long-time strategy;

- to support, stimulate and enforce the creative activities;

- to aim the personal policy towards the professionally growth of technical workers;

- to aim the salaries policy towards the corresponding assessment of engineering

professions and stabilisation of technical departments;

- to cooperate with universities in conceptions of teaching the technical subjects

- to support lecture activities of the peak company's professionalists at

universities;

- to support the professionally excursions and practice of students of technical

subjects;

- to enable unpaid as well as paid professional