

Research and development - A priority for the High Technical Schools

Gheorghe Atanasiu

“Politehnica” University, Timisoara, Romania

Abstract. In the new context of knowledge age, the high education is facing a series of strong pressures, which requires new structures. Joining the general and the professional education with the life long learning is the requirement for present universities. The modern instruction in the engineering domain has two aspects today: one concerns the training of high level technical personnel, who should be endowed with the necessary ability to exploit the present technology and the other has the goal of creating an elite research personnel that will take over the scientific development of the new techniques and technologies. The Humboldtian principle of the unity between research and teaching (Einheit von Forschung und Lehre) must be nowadays the core of the present high technical education.

Recent trends in electrical and electronics engineering technology are expressed by adopting the “open pedagogy”, with an increase for the science and technology in specific domain. In this context the interest of our faculties (Electrical Engineering and Computer Science) is extended in various professional domains such as power and energy, industrial electronics, solid state area, transportation, test and measurement, engineering software tools, computers, communication, consumer and medical electronics, aero space and military area and finally environment problems.

The new social contract for university research must be build upon: generating new ideas, new practices, new products, and finally new business.

The strictly professional instruction, towards the target profile, will be realized in co-operation with the industrial societies, with similar objectives. The research activity, enlarged with the participation of graduate students, must be taken for the social needs, being a support component for the educational process.

In this context the Sixth Framework Program of the European Community for Research, Technological Development and Demonstration Activities (2002-2006) must become a goal for the Romanian universities.

1 General remarks

At the threshold of the third millennium the human society has stepped into the so-called “knowledge society”, being involved already, for some decades, in the “information society”. In this new context the higher education is facing a series of challenges which require new structures. *Joining together the general and the professional education with the long-life-learning is the present requirement for the universities.*

The “digital society and economy” imposes new requirements concerning “what we learn”, “how we learn” and the *new social contract for the academic research*. These requirements are imposed by the so-called “learning consumers”, i.e. businesses, employers, families and, not at last, the students.

The education philosophy of universities has changed in depth in recent years. The triggers were: acceptance of continuous learning, the university losing its prevalence, continuous reform of the educational structure, new exterior organization of the formal structure, the work-learning equivalence and lastly by the recent multimedia structure, opened to everyone, all the time and everywhere.

With the “bytes explosion” the universities have moved to the new structure of “*open university*”. The horizon XXI for our European universities is marked firstly by the introduction of the ECT System. This trend is and must be followed, in the spirit of the Bologna Declaration, by good reliable information on educational system, qualification and the quality of institutions/programmes.

For the high technical schools, particularly for the Romanian technical universities, we should be endowed with the ability to exploit the present technology nowadays, by endorsing the creation of elite research personnel, which will take over the scientific development of the new techniques and technologies.

We are obliged and must rediscover the core the real university, i.e. the Humboldtian principle of the unity between research and teaching (Einheit von Forschung und Lehre). *Re-engineering the engineering schools is our actual goal.*

2 Beyond specializations' boom

The increase of science and technology, in many domains of electrical and electronic engineering has big repercussion upon our faculties. Presently, disciplines and scientific domains that where once independent find themselves linked.

In this dynamic context the interest of our faculties is extended to various professional domains as are power and energy, industrial electronics, solid state area, transportation, test and measurement, engineering software tools, computers, communication, consumer and medical electronic, aero space and military area and finally environmental problems.

All these specific domains have given rise to the explosion of a multitude of specializations. For this reason, the faculties in the domain of electrical engineering are facing various requirements, which rise some difficulties to be satisfied.

The schooling of engineers can not be reduced, in the five years of instruction period, to the training of a specialist (one-subject man), in a tight domain, even this specialty is momentary required in the job market.

Maintaining a professional level of knowledge, in synchronism with the fast developing of the science and the technologies impose to be able to subscribe to the long-life-learning concept. I do not relive here a novelty. The school must build up the young people with the sight to future, not an encyclopaedist of things which are well known today.

Sixty year ago Albert Einstein wrote: “First and foremost is the development of the general capacity of independent thinking and judgment and not the receiving of specialty knowledge. If someone is mastering the basis of the studied domain, and has to think and work independently, he will surely find his way, and more over will be good trained to make face to the changing and progress, than the one who was educated, in principal, to receive detailed knowledge”.

3 Where we are?

The large diversity of electrical engineering domain has raised a multitude of professional specializations, from power energy to the recent nanotechnology. When we look at the details of a certain specialization we will discover links with other specific domains.

For example, the electric machine is only a part of an electric drive, in which we find also a power converter, a microcontroller with a dedicated soft, each of them being a distinct domain. This complex device, one of the multitude today examples, is the confirmation that today knowledge of an engineer is more and more complex, with roots in various domains. The DIP-IPM (dual-in-line-package intelligent-power-module) is a new integrated module which offer lower cost, improved manufacturability and increased reliability.

This big-bang of specializations gives us the right to split our faculties into a Babel tower?

What can we find in the profile of our engineering faculties of our country: neither more nor less than ninety six specializations! Only in the electrical domain there are twenty four specializations.

Is this specialization saraband benefit for the students and for their future profession?

I think not, because their links to complementary disciplines are very weak, or pure and simple torn.

How could they tackle a practical problem or moreover a scientific research with limited knowledge, even if they know in detail a part of the problem?

The dichotomy of the two actual options for the academic education, general education in opposition with the professional education, has the solution given by the individual education in correlation with long-life-learning.

The introduction two years ago of the ECTS in our universities is a good opportunity to bring up the individual education into the habit of our school. But like all the beginning it is looked upon as suspicious, particularly by the instructors. The principal benefice of the ECTS, the mobility of the students through the curricula of their own faculty, or between other faculties or universities of our country and at last mobility towards other country universities, is yet not in our preoccupation, or is very few utilised.

Another project of the European Union, "joint declaration of the European Minister of Education, Bologna on the 19th June 1999", which was signed also by our former education minister Andrei Marga, must be put in practice.

Research in our High Technical Schools being in a direct correlation with the instruction, structure and autonomy of the university, it is now imperious required to motivate our industrial enterprises.

4 The social contract

The mentioned Humboldtian principle is nowadays more actual for our academic society than years before. Our present Ministry of Education and Research shepherd today fifty six state universities and more than hundred private universities.

Are their activities in concordance with the above principle?

Are all this universities in concordance with the above activity?

No doubt that no!

For our High Technical Schools the challenge is now to be able to catch the scientific road of the actual European research programme or to remain outsider onlooker.

On 3 June 2002 the Council of Minister European Parliament and Commission has concluded the Six Framework Programme 2002-2006 (FP6). The launch of this FP6 was marked in Brussels on 30 September 2002 at a reunion of the Concurrence Council Board.

The five specific programmes adopted where strengthening toward the followings, with a total amount of 17.5 milliards EURO:

- Integration and reinforcing the European space of research.
- Organization of the European space of research.
- Activity of the Central Commission of Research (CE).
- Nuclear energy.

- Activity of Euratom.
A short overview of the seven thematic priorities proposed is given below:
- Life science, genomes and biotechnology for health.
- Information society technologies.
- Nanotechnologies and nanosciences, multi-functional materials and new production processes and devices.
- Aeronautics and space.
- Food quality and safety.
- Sustainable development, global change and ecosystem.
- Citizens and governance in a knowledge-based society.

The program calls for a better use of the results obtained by academics, academic research being the strong joint of the EU research sector.

The first conference SAIL (Strengthening Academic and Industrial links) will take place at the university of Coventry Techno Centre. The conference programme includes presentations from experts across Europe in the areas of knowledge transfer, technology transfer, research and development and incubator schemes.

The conference will be of interest to people involved with innovation and business development at the regional level and university staff working with industry. The conference programme includes presentations from experts across Europe in the areas of knowledge transfer, technology transfer, research and development and incubator schemes. The conference will be of interest to people involved with innovation and business development at the regional level and university staff working with industry; (<http://www.sail-eu.net/docs/Confprog.doc>)

As a candidate for the EU our country has also the perspective to join this FP6, a challenge for integration. The undertaken projects are research interactive aimed to mobilizing a member of participating teams from different countries. Being able to enter in this competition the first thing, for our universities, is to find partners in member states research institutions or universities.

Secondly, our strategy is to expand research funding and put it in the road to sustainability.

And finally, the most difficult thing is to wake up the interest of our national enterprises for the academic research.

5 Creating the future today

Our high technical schools are facing a serious provocation: to be or not to be in the European network of the academic research institutions. The world moves and moves quickly.

The Bologna Declaration has been signed on June 1999. The Framework Program 2002-2006 was concluded in June 2002 and was adopted in 30 September 2002. At the same time as above, in Barcelona, the EU Research Commission has advanced a 3% of GNP for the R&D in the member states.

It is clear that all this propositions are not view only as expenditures, they are an investment for the future generations. They cause the progress of the science and the technology, which is decisive for a sustainable development and for a qualifying profession in a modern economy based on knowledge.

Which can be our universities answer at this facts? In my opinion these can be resumed in the followings:

1. First of all the *priority of education* (2nd article of the Education Law) must be reality.
2. Recognition of the High Technical Education in affecting the quality of life by improving the understanding their science and technical competence.
3. Application of professional competence of the *universities hierarchies criteria* and introduction of the *didactic and scientific evaluation of the teaching staff*. In this context the performance criteria could stimulate the wage system instead of the years of service. In this point of view a candidate for the university degree of associate professor or professor should have coordinate, at last once, as project director a scientific programme.
4. According to the above criterion *a re-evaluation of the income of the teaching staff* is now more than necessary.

5. *Spreading out research and development programs must be a constant preoccupation for our universities.* Two ways are open in this context: direct links with economic societies (sincerely very difficult nowadays in our country) or getting grants through competitions in various offered programmes (CNCSIS, CNFIS, ANSTI or UE).

6. *Introduction of an percentage contribution from the benefit of the productive societies,* for the acquisition of new equipments for the university laboratory.

7. *Ensuring an equal treatment for the investment capital and expenses for human capital formation.* In this objective case, in the book keeping documentation the economic societies can insert this expenses as an investment. This recommendation is already mentioned by the EU Commission in the White Book "Teaching and Learning" from 1995.

8. *Adopting the principles of the Bologna Declaration,* a turning point in the development of European Higher Education.

9. And at last our *participation in the network of the FP6.*

6 Conclusion

Wishing to range our country to the EU states members we must not fail to go off the New Millennium Train, this being an effort of our entire society and particularly for our political class.

Our chance is to change the human investment capital orientation, being our best national wealth, which we have not the right to scatter.

To probe further

1. *** "Sorbonna Declaration", Paris, 25 May 1998.
2. *** "The Bologna Declaration", Bologna, 18-19 June 1999.
3. *** EAIE Comment on the Bologna Declaration, November 1999.
4. Guy Hang, Jette Kirsten, "Vision of a European Future: Bologna and Beyond", EU Rectors' Conference³ and the Association of European Unibersities, 2001.
5. Gheorghe Atanasiu, "Engineering Education at the Threshold of the Third Millennium", Sharing Experience to Increase Internationalisation and Globalisation in Engineering Education, Fachhochschule Mannheim, 100th Anniversary Jubilee, 17-19 Sept. 1998.
6. L.J. Perelmann, "School's out", Aron Books, 1992.
7. Gheorghe Atanasiu, "Disciplines Modules-A New Perspective for High Technical Education", Unique and Excellent, Ingenieurausbildung im 21 Jahrhundert, Biel/Swiss, 2000.
8. Gheorghe Atanasiu, "Pressure to change in the Education Methodology for Electrical Engineering", International Conference OPTIM 2002, Brasov, 16-17 May 2002.
9. Philippe Busquin, "In the Starting Blocks", RTDinfo, Magazine for European research, 34, July 2002.