

Questions of the Quantity and the Quality in Engineering Education

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Abstract: Fundamental question is: In Hungary nowadays the schooling rate of the 20-24 year age-group is 28% and this rate was 15% at the time of the social change (1990), but in the meantime the number of staff did not increase substantially. The Government wish to achieve the schooling rate 50% for 2010. In all countries the state is increasing the number of students in higher education to the highest degree with decreasing institutional cost. It is not accidental therefore quality has become a key word in higher education. Recently in Hungary the number of the first year engineering students are about 25% of total sum. What is to be the strategy of engineering education in the case of schooling rate? The paper deals with this question from the point of view of engineering society, connected with schooling rate, system of education process, quality, accreditation, scientific qualification and financing system. The Hungarian Chamber of Engineers (HCE) regards the strategic importance for keeping the level of quality of engineering education from the point of view of the global and European integration of Hungary. Therefore the HCE wish to deal with the questions of engineering education continuously. Last year I was asked by Presidency of HCE to write an essay about the strategic questions of engineering education. It was discussed at many forums and the Committee of HCE approved a Resolution. The conclusion is: The engineers who have good science knowledge, creative thinking, technical and economical knowledge, their knowledge is very convertible, therefore over the traditional profession they are much in demand for a broad circle of employment and they fulfill their position very well. Because of the above and the finance situation and infrastructure of engineering education the HCE agree to keep the present schooling rate.

Keywords: mass education, schooling, quality, qualification

1. Introduction

In Hungary the Hungarian Chamber of Engineers (HCE) conducts and certifies the qualification of professional engineers. Practically in every country the qualification of professional engineers depends on essentially the qualification of the engineering degree. There have been some significant changes in recent years that have given cause for concern and that require us to undertake a fundamental review of the educational process. The HCE regards the strategic importance for keeping the level of quality of engineering education from the point of view of the global and European integration of Hungary. Therefore the HCE wish to deal with the questions of engineering education continuously. Last year I was asked by Presidency of HCE to write an essay, titled "Strategic Fundamental Questions of Engineering Education". It was discussed at many forums (engineering institutions, HCE members, symposium etc.). The Committee of HCE also discussed this essay and the opinions and the Committee approved a Resolution, which was sent to the educational bodies and Ministry.

This paper is based upon that essay and the aim of the paper is to give an overall picture of the situation of the Hungarian engineering education, as an opening for international comparison.

2. Schooling rate in Hungarian higher education

In the period of 1990-1998 the number of all students increased 2.5 times (100,800 → 250,000) in higher education, but in the meantime the number of staff did not increase substantially (16.300 - 17.570). Nowadays the schooling rate of the 20-24 year age-group is 35-40% in West European countries. In Hungary this rate was 15% at the time of the social change. The Government wish to keep up the present level of state-financed regular student numbers (42,000 students/year) in the next decade, which means that the schooling rate will increase significantly in Hungary

because of the population decrease. According to the prognosis we will achieve the today's level of West European countries about 2005-2010. Developed countries wish to achieve the schooling rate 45-50% for that period.

Forecast of entrance student number into secondary school [1]:

Year	Finished in Primary School	Entrance to Secondary School	%
1995	122,000	74,000	61
2000	118,000	77,000	66
2005	119,000	86,000	72
2010	111,000	90,000	81

Note: Hungary has about 10 million inhabitants.

Because of the above forecast we have to reckon with weaker grounding of school students in higher education. Added to this problem is the foreign language education: Who will do the task? (Secondary or higher education or the task of all society).

The „mass” education means a lot of graduates. What are we to do with this large number of graduates generally?

1. possibility is: Tendentious (put occupation) education for a profession. It was in the socialist era in Hungary. Everybody had job. Today this is already an impracticable plan obviously.

2. possibility is: Standby (fitness for occupation) education. Nobody is guaranteed a job.

3. possibility is: Keeping up level of education – socialization, a social interest. For instance a mother, who has an engineering diploma, educates her 3 children at home. I think it is not necessary to explain why it is good if this mother has a graduation.

Who has an engineering graduation, would make a politician, manager, seller, civil servant etc. as good at the very least as other graduates (or better).

Recently in Hungary the number of the first year engineering students are about 25% of the total sum. The number of the first year college level (B.Sc.) engineering students are double of university level (M.Sc.) first year students. (Note: This rate is triple in USA).

3. Question of modification of entrance system, schooling

Starting-point is: “There is no legal ground to refuse the chance of further education from the applicants in a state of parliamentary democracy and market economy” (Education Ministry). Generally the international tendency is directed towards to the abandonment of entrance examination.

In Hungary – particularly in the older age-group, professors – there exists a strong nostalgia for the traditions, talking about past great polymaths, school-creating professors. In all countries the state is increasing the number of students in higher education to the highest degree with decreasing institutional cost. In the case of such conditions the question is whether the arising quality gap may bridge or not. It is not accidental therefore quality has become a key word in higher education. Our traditional education system is untenable, true enough that education power investment also decreased, while the nostalgiasers hinder the modernizing of system.

Some professors suggested increasing the severity of entrance examination in engineering for the sake of preserving the quality of engineering education. This is a very comfortable, easy way to preserve the quality of engineering education. (It was in Hungary 10 years ago). But now I am very opposed to this solution. On the one hand everybody has a right to learn, on the other hand this is a question of engineering education policy.

What is to be the strategy of engineering education in the case of schooling rate? Is the 25% rate a lot or not in Hungary? It not a lot, according to the above and the demand of economical development, but in Hungary we see the reality of the present rate because of the present finance position and infrastructure of engineering education. (Proposition concerning the schooling aims at the improvement of quality – see Financing questions.)

4. System of education process, implementation of credit system

In the past 15-20 years Hungarian higher education was reorganized essentially from the so-called “Prussian” education system to the so-called “Anglo-Saxon” system. This reorganization was given total assistance from the government programs to then Phare projects (normative finance, ECTS etc.).

On the other hand the management of such a fundamental question as dual or linear type of higher education is not consistent, it is confused. The Hungarian Higher Education Law and the Hungarian Accreditation Board defend the dual structure, but the present higher education system has more and more linear elements (credit system, comparability, student mobility etc.), that does not work in a dual system.

In engineering education the essential condition of the realization of a credit-system is an up-to-date infrastructure (laboratories, equipment, computers, libraries etc.). However at present the infrastructure of the engineering education is very insufficient and is in poor condition. At the same time to initiate the credit-system there is a reduction of the past 32-35 lessons/week to 20-24 lessons/week, which means an increase in independent student work. This fact does not cause great difficulty in “chalk-user and reading” education (law, historical etc), but it is a problem in engineering education (because of the minimum library facilities and out of date laboratories). In engineering education the essential condition of this lesson-reduction is also an up-to-date infrastructure. In the past 10-15 years there was not any laboratory development, apart from informatics.

The engineering subjects expect much more teachers (more contact lessons), than the basic subjects or social science subjects, personal consultations (e.g. design) are needed. This gives grounds for the increase of engineering college education time to 8 semesters, which is needed for European compatibility as well. At present in Hungary there is total disorder of college education time: there are 8 semesters education (e.g. teacher training study field), 7 semesters (e.g. engineering management) and 6 semesters (traditional engineering study). In a well functioned credit system the traditional study years (first-year student, third-year student) are of no importance. Prescribe and assure of credit does not cause any special difficulties for the obtaining of M.Sc. or B.Sc. degree.

5. Quality, accreditation

The three methodological approaches to quality: higher education accreditation (peer review system that is primarily influenced by the academic community itself), performance indicators (favoured by the state) and market-led system (consumers – students, academics, the state, employers, professional bodies – oriented approach). The latter meets mostly the criterion of quality. Generally we can say recently the direction of changing is from accreditation towards the performance indicators and market judgement, depends on the power relations. In this process the leading roles are students, teachers, state, employers, professional bodies. [2]

In Hungary the academic accreditation of higher education only shows essentially whether personal (the rate of scientific degrees) and infrastructure conditions of an institution are adequate to the education process in the institution. At the accreditation procedure on the one hand the quality assurance (point of view of customer, the employer) does not have an important role, on the other hand the procedure is not independent (“rivaling” university experts), therefore the result is totally subjective concerning quality. The Hungarian Accreditation Board has 30 members, according to the Law 15 members are academics, 10 members are from research institutions and 5 members are nominated by professional bodies. The trick is members must have a scientific degree, therefore all members are academics practically (professional bodies could not choose but professors), that is the higher education accredit himself. [3]

Present practice so wants to solve the enforcement of student opinions, that it gives disproportionately large student representation in the leading university bodies.

In different countries the situation is different, it depends on power relations. Unfortunately in Hungary the academics are very powerful. In the United Kingdom the accreditation body of engineering is called the Joint Board of Moderators and has 25 members, half being academics and half being practicing engineers – all of them are senior and experienced in their profession. They accredit universities and courses in both UK and overseas (based on an agreement – the Washington Accord). They have established guidelines appropriate to engineering profession and to meet local and national needs, but which are flexible. The visiting team comprises two academics and two practicing engineers. [4]

The qualification system of the Hungarian Chamber of Engineers is very similar to the qualification procedure of the Engineering Council of United Kingdom, but there is a big difference in accreditation. In Hungary the accreditation has a contradiction to the principles of quality assurance and to terminate this contradiction is a hard task because of academic resistance. “Nobody is prophet in his own country”, perhaps for this reason too, it is necessary to give consideration to join the Washington Accord or to elaborate and implement an equivalent accreditation system.

Formation of the market conditions in education and the “mass” education requires unequivocally the implementation of an up to date and effective quality assurance system in the institutions.

6. Scientific qualification – Ph.D., position of university staff

In Hungary at present two parallel systems work, the Ph.D. qualification is given by the university and the „soviet-Russian” type Doctor of Academy is given by the Hungarian Academy of Sciences. Practically the Ph.D. is not

enough for the professorship in the university, the title Doctor of Academy is needed (Note: this interferes with the university autonomy and it is contradiction to the Education Law).

In the field of engineering profession the scientific qualification system is tragic in more prominent professional opinion as well. Recently engineers who work in practice to obtain scientific qualification meets so many difficulties, that it occurs only occasionally outstanding practicing engineer who can take it upon himself to do this. For this reason to engage prominent professionals (for assistant?) to engineering education is almost impossible. In consequence of this our engineering education would become such as the medical universities would educate „theoretical surgeons”. In engineering scientific qualification it would need a possibility to lay stronger stress on the creation (with the keeping of other requirements – doctor examinations and foreign languages knowledge).

In higher education there continuous a real value-loss of operational cost and effective withdrawals are in “harmony” with the wage of university staff. In the higher education the staff never was paid proportionally compared to industrial employees, but in the last few years the situation is became degrading to the matchless degree. In the Hungarian higher education the selection and employment of staff is becoming more and more difficult in this impossible finance situation. Today a young engineer who meets the university personal criteria (outstanding professional, language, computer etc. knowledge) is practically impossible to employ, because the market offers multiple income to a talented young person than the university can and does.

The doctorate system did not fulfill the hopes. The involvement is low level, the scholarship is little, the participants have no perspective (continuous reduction of staff), more of them consider the university occupation as a “springboard” and good time to seek a suitable job. Not the best apply for doctorate and few finish it with Ph.D. degree. The present system does not assure the “teaching assistant” and it does not serve even the teaching recruitment. Of course it is not necessary for every Ph.D. students (immediately) to be professor (see e.g. USA, Germany where about half of Ph.D. graduates go to industry and maybe go back later on).

The teaching staff grows old. Who will stand on the teaching platform in two decades?

7. Integration of higher education

The integration of Hungarian higher education institutions came into being with power and it was distorted because of the lack of clear conditions and because of the influence of a sphere of interest. According to the international experiences of higher educational integration the integration was successful where it was carried out with clear, well-measured conditions Dutch example: The condition of state finance is the institution schooling/year has at least 600 students. This meant 63% of institutions has not other possibility, than to carry out the integration. Similarly to the Dutch case, the Australian government attached the state finance to a minimum student number (2000). The condition of total state finance is minimum 8,000 students [5]. Beside the above conditions the institutions decides without restriction about integration. (There is no previous list about likely merging, there is no sphere of interest, there is no politics).

Unfortunately in Hungary the position of engineering education is getting worse with integration (except Budapest). In developed countries there are many examples about special situation of medical, agricultural and technical universities connected with the integration. This means that medical universities have a close connection with hospitals, agricultural universities have a close connection with study farms and technical universities have a close connection with industrial parks, laboratory practice. Therefore these universities are not merged to other type of universities generally.

There is no real university autonomy in Hungary. The viewpoint of international conferences and international examples prove as well there is no university autonomy without ownership. (In Hungary the owner is the State Treasury). Without putting in order of ownership the state finance system does not work in accordance with the announced purpose, it is directed by spheres of interest in the future too, competition can not develop between universities in accordance with equal conditions.

8. Financing questions

The financing of engineering education is in proportion much less than the financing of medical or agricultural. (They can manage to obtain better).

In normative finance the double rate of university and college basic normative value is unjustified totally. It would be real about equal rate (80-90%). Present finance system hinders the real integration process, the cross teaching between the very different financed faculties is impossible. The finance different between the universities and colleges is increased more by other finances to universities e.g. research finance, OTKA (research), Szechenyi professorship etc. On

the one hand all forums admit this rate is untenable and there are promises of the ceasing of this disproportion. On the other hand according to the new finance plan this disproportion increases further. [6]

Present system of state financed students is unfair (there is disproportion difference between the state financed student group and the student group paying full tuition fees) According to the present rules getting through is unsolvable on the grounds of study results between the state financed education and the full tuition fees education. (On the base on the order of Education Minister it can take over student from the full tuition fees education only on the place of student who failed in finally). As we see it in the case of state financed students at higher education the complete abolition of reduced tuition fees was a wrong decision. The exemption from tuition fees connected with study results would be more real and it would solvable the above contradiction. (In present-day societies the poor student can't afford it to be "asinus" - donkey-, if he want study).

Further great contradiction of this finance system is connected with the quality of education. The financing of higher education institution depends on the number of students, which is based on a given (by Education Ministry, Higher Education Scientific Council) schooling number of students essentially. The Education Ministry controls the actual students' number twice a year, which actual students' number is the base of the next term finance. This means e.g. if the schooling number of students of an institution is 2,000 students, then considering 5-year education time the institution get financing for 10,000 students only, if the dropping out of student is zero. A larger rate (20-30%) of student drop-outs could make the university become bankrupt, that is it may be against the university's interest to keep the education quality level. Many times it was suggested ceasing schooling frame-number and the institution does get financing for the total students' number without the dropping out of students, according to the above example, for maximum 10,000 students and the institution decides the schooling number of students on its own authority and at its own risk, that is the institution could school more than 2,000 students with the rate of dropping out (more or less by faculties).

8. Conclusions

Recently in Hungary the number of first year engineering students are about 25% of the total sum. The engineers who have good science knowledge, creative thinking, technical and economical knowledge, their knowledge is very convertible, therefore over the traditional profession they are much in demand for a broad circle of employment and they fulfill their position very well. Because of the above and the finance situation and infrastructure of engineering education we agree to keep the present schooling rate.

The Higher Education Scientific Council and the Hungarian Accreditation Board are fundamental importance as decision-making preparatory bodies of the Hungarian higher education, therefore we consider it necessary proportional representation of the engineering intellectuals in these bodies. The HCE have to get a particular role in the accreditation process of engineering education.

Present obtaining system of state finance is unfair. There is disproportionate difference in bearing the burden between the state financed student group and the student group paying full tuition fees. We propose elaborating a cross study system between the state financed education and the full tuition fees education on the grounds of study result.

The most important investment of development of engineering higher education institutions is putting in order the wage –system of teaching staff, which assures the mobility between industry and higher education. Here a forming contraselection would prepare our subordination in the globalization.

Have to consider the engineering creations as well from the point of view of staff employment and accreditation of institutions, not only the scientific degrees and publications. In engineering scientific qualification Ph.D. a possibility to lay stronger stress on the creation is needed (with the keeping of other requirements – doctor examinations and foreign language knowledge).

9. References

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