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SYMPTOMS OF FINANCING HIGHER EDUCATION R&D

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Abstract

After reading articles and essays on the international and domestic pursuits and tendencies that determine the financing of higher education based on the experiences of different research units, the authors thought it is worth examining whether the changes that occurred at the national research institutes will direct the R&D of Hungarian higher education toward the international tendencies or there is a danger of the consolidation of mechanisms and organisational structures that emerged along the crisis management strategies developed during the transformation period. This article tries to find the answer through analysing the financing of R&D. The authors relied mainly on the empirical experiences of 42 case studies[1] elaborated with OMFB support at the Budapest University of Technology and Economics. The authors show the most important financial sources for R&D at TUB, and they present the channels of transfers and leakage in the system of financing R&D.

Keywords: financing R&D, university financing.

1. Introduction

In the knowledge based 20th century economy researchers and analysts try to find the answer for the problems of competitiveness and growth within the competition of nations and regions in the coherent system of science and technology. This may give priority to education and research, including higher education – the topic for our article –, which with its present structure and standards is not yet able to improve the country's position in the competition of knowledge based economies.

Fundamental questions of R&D which determine the activity of higher education R&D and the resources available for financing may be summarized as follows:

- Is it possible to increase the ratio of R&D/GDP to an adequate level so that real GDP increases?
- Will a new type of cooperation that improves the innovative capacity of the economy evolve between higher education and the corporate sector?
- Will the concentration of intellectual and real resources in the field of research reach the level that enables the integration of domestic research institutions into the international system of financing research?

[1] For the list of case studies see the Appendix.

These questions may be answered authentically only if the government intentions committed to changes are not successfully opposed by those interested in maintaining the status quo in financing R&D or by business interests determined by the regulatory environment.

2. Sources of Financing R&D Activities of the Higher Education

Besides the macroeconomic environment – rate of economic growth, changes in R&D/GDP ratio, etc. – the future tendency of financial resources devoted to higher education R&D is determined by the extent to which colleges and universities are able to integrate the resources along the strategic relations developed with the commercial sector. We do not yet know how much the higher education is able to strengthen its positions in the field of resource distribution.

There are four main financial resources regarding the financing of Hungarian higher education R&D. The following table illustrates their proportions and the changes:

Table 1. R&D expenses of the higher education sector by type (%)

Financial source	1991	1992	1993	1994	1995	1996	1997	1998
Government budget	85.4	87.8	85.0	89.8	89.8	85.0	86.1	87.4
Corporate (business)	12.5	6.4	5.9	2.3	2.1	2.9	1.9	5.4
Other national	1.5	4.3	6.1	5.2	4.3	7.3	7.5	4.5
Foreign, international	0.6	1.5	3.0	2.7	3.8	4.8	4.5	5.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total (HUF billion)	5.4	6.6	7.8	10.3	10.2	11.1	14.3	17.3

Source: [OMFB, 1999], Table 18.

2.1. Budgetary Resources

The government's role in higher education R&D resources is significant, it amounted to 84.4% in 1998. This proportion markedly exceeds the weight of the budget in the total national R&D expenditures (54.7%).

Despite the high percentage mentioned above, government participation in the financing of higher education R&D is not satisfactory. The reason is that although the higher education R&D investment in 1998 was HUF 17.3 billion in nominal terms – three times more than in 1991 – in real terms it hardly equals the investments in 1991.[2]

Besides the stagnation in real terms of resources, there has been a tendency of increasing educational tasks in the higher education sector in the past 10 years.

[2] [4] page 9.

However, the number of teachers-researchers – as well as the time available for research work – has decreased which draws away further government resources from higher education.

Further tension in financing is caused by the fact that besides the stagnation in real terms of government resources financing higher education between 1991–1998 the research units can obtain a growing proportion of the budgetary resources through the competing research programs. In 1998 the budget distributed 33.5% of the total central R&D resources to the research units on a competitive basis. While recognising the advantages of competition, in the present state of under-financing, growing share of allocation through competition may lead to growing uncertainty in obtaining the resources.

This tendency is further emphasised by the drive to increase resource concentration according to which (for example at TUB and possibly at other institutions as well)[3] a part of the so-called normative research financing may be obtained by the research units through competition. We have to stress that although it has beneficent effect on research units and projects as they strengthen, the tendency might jeopardise the financing of institutions. The case studies showed that a significant amount of educational and project objectives as well as PhD education cannot be assured without keeping up research units.

Although the objective would be to increase the resources ensuring the concentration of intellectual capacities, means and the association of different resources – according to the case studies – the advantage gained from obtaining foreign and corporate resources is a disadvantage when applying for budgetary resources. Universities (for example the universities of technology), which have good positions in the competition for corporate research assignments and foreign resources, are less able to obtain budgetary resources for financing R&D.

2.2. Corporate Resources

Corporate resources are insignificant in financing the R&D investments of higher education: they amounted to 5.4% of total R&D expenditure in 1998. Nonetheless, the share of corporate resources at the universities of technology was 14.3%, which is about three times of the average of higher education. This share is even more significant at TUB: it is 63% of total faculty research resources that came from external researches in 1999.[4]

The reason for universities to market their activities is to maintain their 'normal' functioning. This is the only way to obtain further resources for undisturbed education, to keep up the minimum level of equipment and the adequate salary level for the remaining research members.

[3] In 1999 its value at TUB was 40% of the contribution remained after the 10% central cut.

[4] Among the faculty resources, the 63% of external researches also include the international resources beside corporate resources. These figures cannot be compared to the average data of higher education.

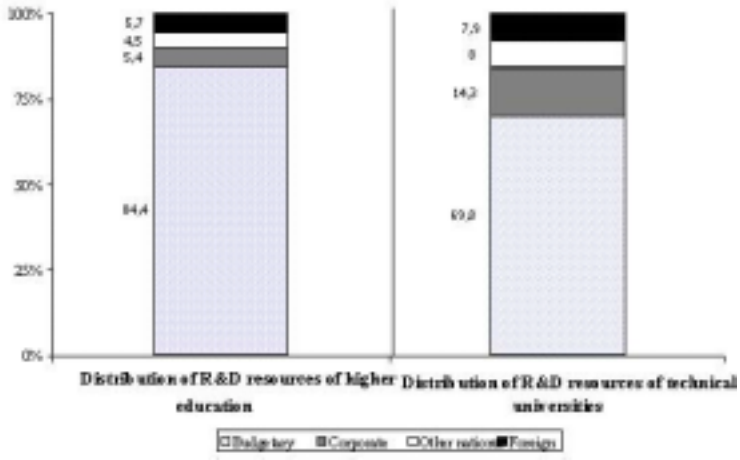

Fig. 1. Distribution of R&D resources in national higher education and at the universities of technology in 1998

Source: own calculations based on data from [4] , p. 23.

It is a positive phenomenon that university research units try to forge long-term associations with corporations. The interest of corporations has also increased. Due to the decrease in the length of the product life cycles, corporations try to accelerate the innovation process and establish new types of cooperation with organisations that are connected with different elements of the innovation process.

However, there are possibilities of rebuilding the relations between universities and corporations:

- short-term financing pressure of universities stabilises and 'external worker-service purchasing' players appear along the efforts of gaining corporation profits, or
- '...universities may become partners in long-term R&D cooperation and innovation, with corporations appearing as buyers or partners which might enrich research and may promote improvements in the quality of knowledge and technology spreading ability of the national innovation system...'.[5]

The 42 case studies represent sufficient examples for the possibilities mentioned. The questions are: are there government, corporation and university intentions, will there be enough resources, and is it possible to create mechanisms on a short-term basis that would strengthen the second alternative.

In our research work we have found many examples for the interactive, long lasting strategic relations between the University and corporations fruitful

[5] see [5]

for both parties. These relations formed mainly between the big monopolistic service providers that have adequate capital (for example: Paks Power Plant Ltd, MÁV, MOL), the multinational corporations with subsidiaries in Hungary (Siemens, Ericsson, Nokia, GE) and the research units of TUB. The associations formed have the ability to concentrate the resources of corporations and research units of TUB, therefore they have a higher chance in the competition for governmental and international resources (for example see the HSN Lab case).

In our research project we also found some negative tendencies:

- The industrial assignments – even though they have an inspiring effect on research – often mean the solution of routine tasks. In these cases the researcher – led by the pressure of gaining financial resources – provides service work.
- Inadequate price in the contracts accepted by research units is due to the bad bargaining position of the research units and the low R&D cost-bearing ability of the companies – especially in the small and medium-sized enterprise sector.
- Buyers expect fast results with positive effects appearing in short-term business success; they are not able and not willing to invest in long-term research.
- Research units are barely able to ensure continuous and long-term research projects backed by sustainable financing system.
- It is not always possible for the researchers to introduce project results to the international and national professional public (or only after the results of the research are built into the production cycle). Therefore, research results appear later in education and at professional forums.[6]

2.3. Foreign Resources

Though the significance of foreign resources in financing higher education R&D is increasing it does not constitute a significant part of total resources.

It is the government's duty to improve the ability of national research units to obtain international resources. In the 5th EU Framework Program, which started in 1999, Hungary participated as a full-right associated partner paying the quotas and being financed from the same budget. Preferences granted for paying reduced quotas disappear by 2002. Similarly to other EU countries, Hungary will also have to pay 4–5% of R&D resources each year as a membership duty.

According to our case studies usually foreign resources stand behind the larger-scale R&D contracts. In 16 out of the 42 cases, foreign resources appeared directly. On the other hand, a significant part of corporate resources (24 cases) is pertaining to foreign companies or foreign owned national companies. The own part is not yet always required in Hungary, however, the own part and other requirements weaken the University's possibilities of participating in foreign tenders. An appropriate R&D policy could help this situation.

[6] See[4, p. 9]

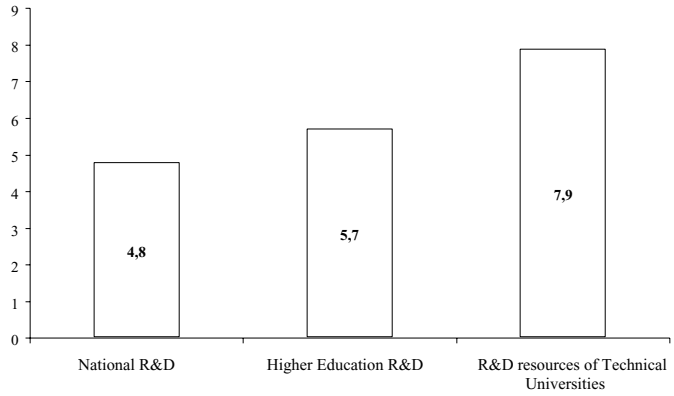

Fig. 2. Share of foreign resources in financing national R&D (%, 1998)
Source: [R&D preliminary] p. 10.

3. Concentration of Resources

The fundamental precondition for the resource concentrating ability of university research units is the own capital accumulated at the university research units for research purposes.

Adequate concentration of intellectual and material resources and developed research infrastructure are essential for successful cooperation between higher education and corporate R&D. Several university research units have told us that the inadequate number of university researchers, narrowing research time, poor stock of up-to-date equipment, laboratory device and research infrastructure constrain the accessibility of further resources. Many times the poor infrastructure hampered the conclusion of further research contracts in prospective scientific fields.

Table 2. Concentration of resources in the R&D activities of higher education

	At all research units		In higher education	
	1990	1998	1990	1998
Number of researchers per research unit (FTE)	14.0	6.0	5.5	3.3
Costs per research unit (HUF m)	19.5	39.2	5.1	12.9
Costs per research project (HUF m)	–	2.99	–	1.8

Source: [4, p. 15, 16 and 27] .

Instead of increasing the intellectual potential of university research units – because the wage level is not comparable to that of the competitive sector and some advantages of having a university status were abolished – we are facing a decreasing number of ageing university teachers-researchers. The number of research units

has significantly increased whereas the number of researchers per research unit decreased by 40% between 1990 and 1998.

The inadequate supply of instruments threatens with lagging behind in the competition for the national and international assignments. Certainly we found examples in the case studies where the researcher did not associate poor equipment with the problem; moreover, the insufficient equipment and the obsolete laboratory gave a chance for 'free scientific thoughts' and the research brought international success. Nonetheless, fruits of basic research are usually enjoyed by those who are able to provide quality personnel and laboratory background for the application of the basic research results for product development.

We have to mention the need for liquid assets, i.e. working capital for R&D activities as part of the university research capital. If the financing chain breaks or in case of a periodical insufficiency of external resources these assets may keep the marketable research projects alive. The present system does not ensure sufficient resources for the preparation of pre-research and reference works, which are necessary for obtaining assignments. Even if contracts are already signed, the university does not perform advance payment for the costs of the research work. After termination of the projects the research units have to give account for the application of resources. Reserves for equipping and financing costly investments improving the infrastructure that would ensure the continuity of research topics are not allowed. When the university research unit uses company instruments, labs etc. or equipment leased by the buyer and if the research unit cannot or is not willing to take part in the risks pertaining to the utilisation of research results (for example it is not able to contribute to the costs of licence registration therefore it is not able to obtain continuous revenues from marketing the research results) the research unit turns into a simple external worker, a supplier of intellectual products for the corporations without getting a chance for consolidation, for long-term survival.

A possible method for the concentration of resources for research work is connecting research units in research cooperations and research centres, providing them a system of financial resources that strengthen each other regarding certain elements of the innovation process.

At present the statistical data show the disintegration of resources and instruments in research (figures show signs of decrease in the concentration against government intentions). The case studies also include a couple of cases where 'associations' were established for the concentration of resources. Nevertheless, at the University about HUF 1.1 million was usually the cost of a single research project in 1996 and the corresponding data is less favourable for 1998. Therefore, the data on average do not show increasing resource concentration for research projects.

4. Leaking Resources in Higher Education R&D Expenditures

R&D expenditures escape and get transferred from higher education to other areas. Some of the phenomenon can be explained, but a significant part remains hidden

even for the researchers. When we examined the reasons for the leakage of resources and the mechanisms that enable and keep up this phenomenon, we could identify four categories of money transfers and leakage (see *Fig.3*).

4.1. Transfer of Resources to Maintain Operability of the University

Presumably substantial proportions of research resources are not used for the given research project but they ease under-financing of higher education. These R&D expenditures directly or indirectly leak from the financing of research to afford costs of education and to maintain operability of the university.

Since this transfer decreases salaries and contractual price is already small, the researchers are forced to undertake further external research assignments. The transfer in question also decreases the resources for instruments or replacements. Therefore, the quality of available equipment of the research units worsens, which might threaten the opportunity for further research projects.

The existing internal and external regulatory system also gives way to and stimulates resource movements from one area to another within the university.

The university absorbs $10 + 1\%$ of R&D costs as overhead and the faculties[7] withdraw another 14%. These amounts finance the contribution to the current expenses of the institution providing the research background. Furthermore, it makes the development of research infrastructure possible through the concentration of resources. Though these cuttings of R&D resources are significant, this is not what the researchers find disturbing. They expressed dissatisfaction with the system of redistribution in general as they do not have access to adequate information regarding the use of resources. According to the researchers, the cuts should improve University's research infrastructure but experiencing the continuous deterioration of the infrastructure they think that the financial resources do not leak only from the research units towards education but the centralised resources must also leak.

Due to the accounting and taxation regulations, out of every contracted HUF 100 the research units may use only HUF 50 for purchasing equipment. The remaining amount after the university and faculty cuts is 75%, which is burdened by 18% corporate tax if it was used for investments and in addition there is the unrecoverable 25% VAT.[9]

The regulation is ambiguous. The researcher and the client do not understand how the research unit can be treated as an enterprise regarding R&D investments, how the rule 'investments only from the taxed profit'[10] can be enforced, while it is treated as a budgetary institution with no right to claim the VAT back.

[7] The utilisation of this 14% is different at each faculty but the automatic redistribution of resources to the given research unit is quite frequent.

[8] For analysing the transfer of resources we concentrate on certain R&D resources that are significant in this respect.

[9] $0.75(1 - 0.18)(1 - 0.2) \cong 0.5$

[10] In case the resource was obtained from a business contract.

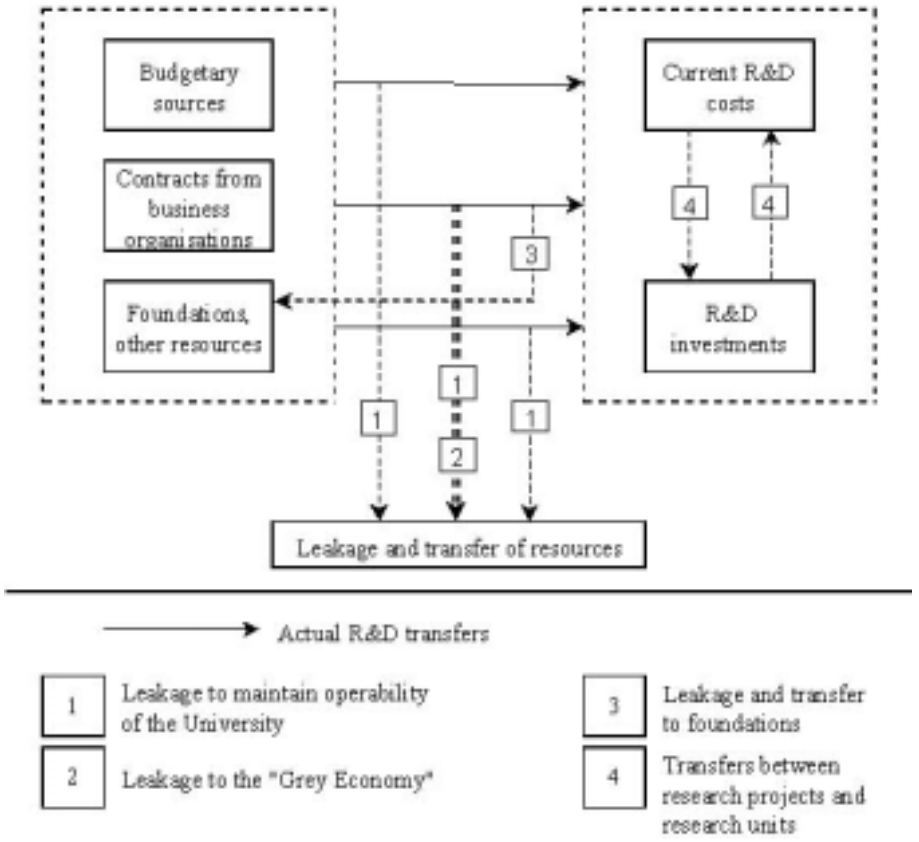

Fig. 3. R&D resources and their use[8]

Another problem also emerges from the regulations. When the industrial revenues are spent, the research units are obliged to purchase within the framework of public procurement procedures, which slow down and frequently increase the purchase price. It is another case of indirect leakage.

4.2. Leakage to the 'Grey Economy'[11]

The transfer of research resources to the field of education, the additional work, the regulatory and the internal system of cuts as well as the client's opposing interest, equally motivate the researcher to take scientific activity outside the university:

[11] See the [5]. The research on innovation at TUB did not study research activity done by the researchers outside the university.

- If research has no significant infrastructure needs – i.e. the institutional infrastructural background is not vital for accomplishing the project – and direct economic profit is expected from the research result, the projects will leave the university.
- Presumably in certain research projects that require significant equipment, the amount appearing as a university resource may sometimes be a mean of legalising the use of university research infrastructure, while other contracted fees do not go through the university.

Of course the grey economy established around the universities is not a favourable phenomenon. On the other hand, the grey economy – in its own way – helps moderating the brain-drain of corporations in Hungary and abroad. Therefore while the researcher 'imposes tax' on the university in connection with certain R&D revenues, he/she actually supplements his/her own salary. This way the researcher's salary level gets closer to the higher levels offered by the private sector.

4.3. Transfer of Resources to Foundations

In the regulatory environment determining the establishment and utilisation of higher education resources, the resources leak to the grey economy formed around the universities. Some other resources with commercial objectives leak to the foundations. In this case the foundation between the company (as the buyer) and the research unit is able to use a larger portion of the acquired corporate resources for the given research project. The explanation lies in the university and foundation withdrawal system as well as in the different nature of the regulatory framework.[12]

The question regarding R&D resources flowing through the foundations at our University raises the problem of proportionate bearing of burdens. In the opinion of researchers the research units that do not have enough experience, information, routine and enough risk taking capability take a bigger part in bearing the common burdens. Instead of strengthening the position of inexperienced research units, the system leads to a redistribution of resources against their interests.

4.4. Transfers between the Different Research Projects and Research Units

The fourth group of leakage and transfer of resources is cross-financing i.e. resource-flow between research units with similar projects in a close relationship.

The principal reasons leading to cross-financing are the following:

- When a project terminates, the resources originating from business contracts have to be accounted for, there is no possibility to retain reserves. On the other

[12] Foundation resources at TUB are not burdened with central and faculty cuts. Presumably the foundations have claim to a certain part of the business resources for financing their non-profit activities but generally this amount does not reach the level of central and faculty skimmings.

hand, keeping the research units and projects alive is not possible without this 'continuous financing'.

- In case of certain purchases adding together available resources is necessary, which might result in further cross-financing.
- Financial resources may be used in different ways during their application due to the characteristics of the regulatory system.

Based on our case studies we can say that the phenomenon of cross-financing is a general Hungarian research 'survival technique'.

Out of the above described four groups of leakage and flow channels, the resources from the university research units escape through only one channel. In reality, the resources showing up in the grey economy often do not even appear among the university resources. However, the amount may be substantial and with adequate support some of it can probably be turned back to higher education. This might turn not only the resources but the researchers as well towards the university research projects in a more intensive manner.

Transfers through the other three channels show the deficiency of the regulatory and financing system. Its effects spoil clarity. On the other hand, resource flows may also be looked upon as crisis management techniques, whose returns are the following:

- they ensure the material base of education,
- they enlarge the possibilities for the use of resources for research projects,
- they bridge gaps in resource supply,
- they make the concentration of resources possible for larger purchases.

5. Summary

Changing the financial system of higher education R&D might help the model change in the following ways:

- The innovation process must be accelerated by connecting together the financial resources regarding the elements of the innovation chain and by establishing institutional system for cooperative financing.
- A concentration of resources must be attained in the field of higher education so that it ensures the active participation of the national universities in the distribution of international resources.
- Intellectual resources and financial resources excluded must be returned towards higher education. Appropriate regulatory system and mechanisms must be established to promote this process.

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