INNOVATION AND KNOWLEDGE TRANSFER IN ROMANIAN UNIVERSITIES

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Abstract:

The present paper shows how the international productivity and competitiveness of a country depend on the rapid accumulation of knowledge based on the entrepreneurial innovative education and on the real transfer of the new technologies and positive experience. Although there is no explicit relationship between investments in education and the GDP variation the paper shows the existence of an influence of the education and scientific research on the economic growth of a country. We made a long term evolutionary analysis of the GDP and we showed that investments in education and research made four-five years ago are implicitly reflected in the GDP growth. By studying the investments evolution in education and research the paper demonstrates the existence of a similitude between the previous shape of the investments' curve in education and research and an ulterior shape of the GDP' s curve.

Keywords: *Innovation, transfer of knowledge, technology transfer, academic entrepreneurship.*

1. A FACTUAL AND STATISTICAL ANALYSIS OF THE UNIVERSITY SYSTEM'S EVOLUTION IN ROMANIA

The higher education system in Romania is going through a process of change. The new reformist tendencies have imposed the repositioning of higher education institutions in the social and economic environment. The requirement of higher education development stems from the fact that the economic development of a country is directly linked to the quality of its human capital.

Highereducation in Romania hasundergone major changessince 1990. First, thenumber of studentshasgrowntremendously.In the period 1990-2010 their number increased from 164,507 to 999,523. There has been an increase of about 6 times. The number of higher education institutions has increased from 56 universities (186 faculties in 1990) to 107 universities (with 629 faculties in 2010). The number of university teachers increased from 11,803 in 1990 to 27,765 in 2011, marking a growth of only 2.35 times compared with the 6 time increase in the number of students. This led to a degradation of the quality of education due to the increased ratio between the number of students and the number of teachers. After 1990 the first private universities emerged as an alternative to public education.

The material basis for higher education has extended, but not at the same pace with the increase in the number of students. If in 1990 Romanian universities had 933 amphitheatres, 2,361 seminar rooms and 3,994 laboratories in 2011 there were 3,160 amphitheatres, 4,316 seminar rooms and 9,456 laboratories. The result was an extensive development of higher education that cannot be maintained in the long term.

The increase in the number of students was not correlated with the increase in the number of university teachers, nor to the development of the material basis. Over the past four years there has already been a decline in the number of students compared to the peak reached in the 2008-2009 academic year, a decrease due to the fall in the number of high school

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graduates and to the effects of the economic crisis. For an intensive development of higher education, it is necessary to take serious measures for the transformation of universities, following the academic entrepreneurship path.

Among the various factors influencing the transition of universities in terms of their role, there are the changes the advanced economies have undergone towards knowledge-based innovative systems, open and more interactive. These changes have challenged universities to reorganize their research and innovation section, to assess their educational mission and methods, and to develop knowledge sharing. This process of transformation has been lately conceptualized in different ways, starting from the idea that it is a change in the "*social contract*" between the university and society, to the consideration that it a shift in the way of imparting knowledge[4].

In comparison with the EU developed countries, Romania universities face many problems in terms of their transformation into entrepreneurial universities. There is an inadequate public funding of education and scientific research and most universities do not have their own income, which could supplement the government funds. The unavailability of adequate funds causes difficulties for universities in fulfilling their mission and objectives.

Thus, universities have difficulties in:

- education quality assurance;
- procurement of equipment and materials for research;
- ensuring modern information and communication technologies.

The future entrepreneurial changes in universities and the coalescence of the academic and economic world has been a subject of intense debate in recent years[5]. These emerging forms should be studied for a deeper understanding of how to foreshadow their impact both on science and entrepreneurship. In doing so, the old model of university researcher will be replaced by the model of academic (university) contractor, in which the university teacher is a researcher and an entrepreneur alike.

Why should we promote the entrepreneurial university? In order to answer this question it is necessary to show which is the finality of such an activity within the university. The entrepreneurial activity is intrinsically linked to intellectual property, through the development of inventions, of utility models or trademarks, of scientific or literary and artistic works. Therefore, this paper addresses the means used for upgrading the university by adapting knowledge, the results and capabilities obtained in university research centers in order to make them compatible with the socio-economic requirements.

2. ANALYSIS OF INVESTMENST IN EDUCATIONANDRESEARCH

The international productivity and competitiveness of a country depend on the rapid accumulation of knowledge and the effective transfer of technologies and good experience. Peters L. Daniels tried to find a dependence between the expenditure of scientific research, technological development and innovation (RDI), and the variation of world exports.[6]

According to the conclusions of this study, which were developed based on the statistical data between 1978 - 1988, it is shown that *there is not an explicit relationship between RDI expenditure and GDP variation.*

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[4] MARTINELLI, Arianna, MEYER, Martin, TUNZELMANN von Nick, (2008), Becoming an entrepreneurialuniversity? A case study of knowledgeexchangerelationshipsandfacultyattitudes in a medium-sized, research-orienteduniversity, JOURNAL TECHNOL TRANSFER 33, 2008, p. 259–283.

[5] JAIN, S., et al. (2009), *Academics or entrepreneurs? Investigating role identitymodification of universityscientistsinvolved in commercializationactivity*, RESEARCH POLICY 38 (2009), p. 922–935.

[6] PETERS L. Daniels, *Translating National R & D Investment into Trade Succes: An explorationintosomedynamiclinkages*, SCIENCE AND PUBLIC POLICY, Vol. 24, April 1977, p.113 – 122.

The dimensionlessindices of GDP and RDI variation are defined as follows:

$$\partial_{GDP} = [\ (GDP)_f - (GDP)_i\ ]\ /(GDP)_i$$

$$\partial_{RDI} = [\ (RDI)_f - (RDI)_i]\ /\ (RDI)_i$$

theindiceshavethemeaning:
i – *at thebeginning of the test period*;
f - *at the end of the test period.*

With the help of these relationships and the statistical data[7], [8]we calculate the variations in GDP and RDI between 1987 – 1997 for a group of ten countries, including Romania.

Fig. 1 shows the variation in GDP, variation correlated with RDI expenditure in these countries during a decade (1987-1997).

After a period of 10 years, for the group of strongly industrialized countries (USA, France, England, Italy) it is found that, although the allocations for the RDI (% of GDP) fell, the GDP increased, its index of variation having values lower than 0.3. For Germany, although the allocations for the RDI fell more sharply, the GDP increased significantly, its index of variation being $\partial_{GDP} = 0.5$. Instead, the RDI expenses for Japan and Canada rose, while the GDP also increased, the ∂ being 0.34 for Japan, 0.25 for Canada respectively. More obvious is the case of New Zealand, which for an $\partial_{RDI} = 0.38$ has a correspond of $\partial_{GDP} = 0.73$, so a fairly important GDP growth. South Korea presents an $\partial_{RDI} = 1.2$, that is a large increase in the RDI expenditure, which corresponds to an $\partial_{DGP} = 1.16$, which means a high increase in GDP. As far as Romania is concerned, the index variation of the RDI has a value of $\partial_{RDI} = 0.54$ which corresponds to an $\partial_{GDP} = - 0.46$. These variations show that if the RDI costs have fallen sharply, the Romanian GDP has fallen sharply, too. Based on these calculations and observations, we can estimate that there is not an explicit dependency relationship between the RDI expenditure and the GDP variation, which means that we should also take into consideration other factors of influence.

[7] *** Main Science and Technology Indicators, OECD1998
[8] *** National Science Board, Science & Engineering Indicators – 1998, Arlington, VA: National Science Foundation, 1998 (NSB 98 – 1), SUA.

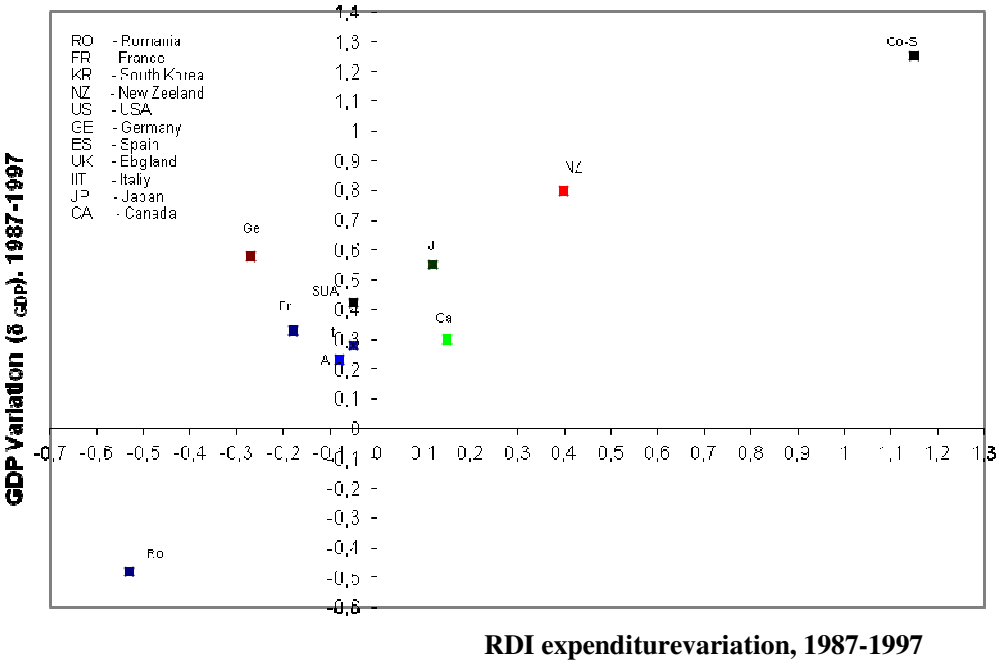

Fig. no. 1 –GDP variation in correlationwith RDI expenditure

Such an influencing factor could be the *social capital*. As a social influencing factor, it suggests that its ownership and efficient exploitation depend greatly on the set of common values and sociability. Other factors that influence the GDP could also be identified with a view to finding the explicit dependency relationship, a relationship in which the investment in RDI has a significant percentage. It requires in-depth research because innovation as a process is more than a means to redress the problems of transition and development, through the balance of payments. With a first approximation, we can assess that *the mere investment in RDI does not automatically solve the problem of raising the GDP*. This should be associated with capital investment, innovative capacity and other factors of influence.

The innovativeproductivity index isdefinedbytherelationship:

$$\partial_i = (E_1 - E_0) / (E_1 + E_0)$$

where: E_1 – representstheexpenditure for a researcher, lei / researcher.

E_0- representstheexpenditure for a patent lei / certificate.

The values of theinnovativeproductivity index havebeencalculated for a group of sevencountries, including Romania. Thesecalculatedvalues are plotted in Figs: 2a, 2b and 2c.

Figures 2a, 2b and 2c showsthetrends, in time, of thethefollowingparameters of developmentbymeans of the RDI:

- GDP per capita, considered as a welfare indicator.
- RDI expenditure.
- Innovativeproductivity index.

It canbenoticedthat for countrieswithhighlevels of GDP per capita, correlatedwith RDI expenditures, there are correspondingvalues of ∂_icloserto zero.

Typically, the $E_0 \geq E_1$and, therefore, the ideal case isgivenby$E_0 = E_1$, in which case $\partial_i = 0$.

Thus, the USA, whichhasthehighest GDP per capitaandallocateshigh RDI expenditure, achieves an innovativeproductivity index withvaluesrangingfrom - 0.77, to - 0.83, while South Koreaachieves ∂i = - 0.19 ..... - 0.5.