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ENDORSEMENT
TO THE IBM WHITE BOOK
ON HUMAN FACTORS
OF HUNGARIAN COMPETITIVENESS

THE DUAL FLUE EFFECT:
A MODEL AND AN ACTION PLAN TO INCREASE KNOWLEDGE-BASED EMPLOYMENT

LÁSZLÓ Z. KARVALICS

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Editorial assistant:
Orsolya Süveges

Designe and typography by
Etelka Szőnyi

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INTRODUCTION

"Funding more science employs more people"
(John Timmer)[1]

„There must be plenty of men and women trained in science and technology for upon them depend both the creation of new knowledge and its application to practical purposes. More and better scientific research is essential to the achievement of our goal of full employment."
(Vannevar Bush)[2]

As soon as we take a step back and look at the Hungarian labor market from a "historical" perspective, it becomes quite clear that the only way to stop or slow the peripheralization of Hungary's economy and culture (their degradation, to borrow Ferenc Kozma's term), even just in the medium term, is by transforming the country's labor force. **Quality labor must become the norm, to the extent and in the structure it is found in other developed countries[3].** In today's thoroughly interlinked world, work tends to

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[1] Quantifying Success of Science Stimulus Spend is Challenging, Ars Technica, June 4, 2009 . június 4. http://arstechnica.com/science/news/2009/06/quantifying-success-of-science-stimulus-spend-is-challenging.ars.

[2] Science. The Endless Frontier. A Report to the President by Vannevar Bush, Director of the Office of Scientific Research and Development, July 1945 (United States Government Printing Office, Washington: 1945) http://www.nsf.gov/od/lpa/nsf50/vbush1945.htm#ch3.2.

[3] Hungary's lagging behind is, in a way, a natural end-result: with the system change and with the transformation of the economy, the wealth of knowledge Hungarian society had amassed over decades, adapted to the world economy of the times then, became devalued essentially overnight. Some examples: specialized knowledge tailored to now-defunct industries, a radical devaluation of Russian language knowledge, and a lack of contacts to link the country to international scientific and technological centers.

flow to wherever it may be performed under the most favorable conditions. A globally integrated economy attracts expertise and capital. There is a "race to the top" – differentiation intensifies along knowledge and skills. If someone enters a "race to the bottom," they may kiss their chances of being a winner of the world's economic processes good-bye.

Once we accept this tenet, we begin to see Hungary's structural deficits in the field. The majority of the most highly skilled segment of the labor force works in research and development: that is just over 50 thousand people, accounting for 0.9–1% of the total labor force. Somewhat eerily, this figure matches exactly the share of GDP this area receives – 0.9–1%[4] The thirty thousand instructors teaching in higher education institutions augment, at least in theory, the number of individuals involved in research. The reality, however, is that Hungary's law on higher education, as well as most institutions' obsession with performance evaluation (with a few exceptions), denigrate them, statistically speaking, to "hobby researchers." The latest OECD country report on innovation policy, published in September 2009, also paints a gloomy picture of Hungary. Innovation based on research and development is the weakest area. Businesses' endowment of R&D activities is low. Very few medium-size companies possess a strong drive for innovation. Research and development activities are focused on Central Hungary.

Nonetheless, **radically increasing employment in research and development** (**doubling** it in the medium term, over 10–15 years), an area critical for business, innovation, higher education and the political, economic and media elite, would be timely and could serve as a strategic

[4] In 2009, Hungary will spend approx. 250–270 billion HUF on **research and development,** which is just less than 1% of the country's GDP. The EU average is almost twice as high.

point of departure in and of itself; at the same time, this same goal already forms a part of certain key European Union programs.[5]

That goal is, indeed, already present in the documents; yet Europe's self-image is also on the **decline in global education and research, as well as in technological and innovation races and the content industries.** The figures of the Lisbon criteria now also seem quite ambitious: along with a 3% increase in GDP, **the amount put toward R&D must be no less than 3% of the GDP,**[6] two-thirds of this amount should, if at all possible, be produced by the business sector. Success must be accompanied – and supported – by an employment "boom," **creating 20 million (!) new workplaces** by 2010. The failure of the program, however, did not marginalize or surpass these "Lisbon figures": the official goal of the reform programs continues to be "competitiveness, a knowledge-based society **and employment,**" with major components being **the strengthening and mobility of the European research community, making research and development the number one priority and fostering innovation.** The **elderly, and other members of society who may be integrated through a process of life-long learning,** are also important participants of a **labor market** that is more flexible and is more "inclusive."

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[5] The creation of the European Research Area (ERA), the mid-1999 manifesto of the European Commission (Towards a Europe of Knowledge) and the Lisbon **Agenda** (for the European Union to emerge as the world's most competitive and most dynamic knowledge-based economy of the world over the next ten years).

[6] Various fringe documents and expert opinions mention, from time to time, aiming for 4% as the only viable proactive program – jumping to the lead, as opposed to merely catching up.

There is, thus, a very real drive from the European Union, which may be translated into the number of those employed and into the increase of spending on research (as a percentage of GDP). This is what shall later on be referred to as the **primary flue[7] effect.**

Supporting a greater role for value-added activities seems, at first sight, to confirm the economic efforts of Hungary's previous governments at attracting working capital. Yet this view can be criticized from another point of view, since increasing the efficiency of technology-implementation[8] can exclude from employment all those who are not able to join this "new order." This can also serve to increase regional differences.

Let us acknowledge, however, that this so-called Kuznets-Williamson hypothesis may be applied to the trap of attempting to conform to the interests of foreign capital. But tressing the institutional and societal positions of autonomous Hungarian science opens up the door toward launching and reinforcing certain **knowledge-production**

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[7] Flue = The vertical passageway in a chimney through which the hot gases flow. A chimney may contain one or several flues.

[8] All of this leads to a widening of the so-called Kuznets-Williamson gap: "The Kuznets-Williamson hypothesis deals with a characteristic of economic advancement observed almost everywhere in the world: the increase of income disparities. In early phases, the more developed regions and social classes of a country develop at a faster pace than more backward areas and groups, because they are able to capitalize on their existing and more developed skills and opportunities. Unless proper action is taken, the gap may become so wide as to eventually threaten the economic progress of the country, since more and more funding is required to support the less developed layers of society, leaving less for other development-related tasks." See Péter Róna: Playing to Lose (Vesztésre játszottunk). http://www.ecovast.hu/ronap_vesztesrejatsz071221.doc.

cycles which are able to strengthen competitive characteristics. Accordingly, effects are manifested not directly, but through true diffusion, through secondary and tertiary employment phenomena: should a breakthrough be achieved in research and development at the top of the value chain, in accordance with EU principles, that would provide new momentum for the entire labor market, in several steps. To quote András Inotai[9]: *"Structural vulnerability (focusing on modern sectors) can be mitigated not by abandoning the production chains of transnational companies, but by entering the higher segments of this value-producing chain. To that end, it is important to systematically establish a viable Hungarian supplier network and to strengthen the educational and training as well as research and development infrastructure. … Increasing employment is one of the most important tools for relieving the tensions resulting from the dualities in today's system."*

Such a large-scale project clearly requires much planning, thorough preparation and a series of professional debates; it is no coincidence that the OECD report recommends **increasing the knowledge-intensity of Hungarian research and development,** along with the **development of the knowledge infrastructure.** It is clear that the country cannot simply drop everything else and start to increase the relevant numbers; all this is only possible in a gradual process that starts out slowly and picks up speed later – to match the pace and cycles of the entire process.

On the other hand, higher education must face a transformation not in terms of quantity, but of quality. The required influx of researchers will only stand a chance of entering the system of employment if universities and colleges are able to make themselves competitive – or are at

[9] András Inotai: "The Crisis Following the Crisis" ("A válság utáni krízis") http://nol.hu/lap/hetvege/20090815-a_valsag_utani_krizis.

least able to establish islands of competitiveness. The issue is very much topical in light of the **boom of higher education graduates** in 2009: this year, instead of the usual approximately 50 thousand graduates, almost 100 thousand young people entered the labor market with a diploma in their hands[10], further increasing the number of unemployed recent graduates (45 thousand previously) registered by the Public Employment Service. In view of this volume of job-seekers, creating 50 thousand new workplaces does not seem like an arbitrary undertaking, even if the effects of such a program would only trickle down to this generation years from now, further increasing the number of unemployed recent graduates (45 thousand previously) registered by the Public Employment Service. In view of this volume of job-seekers, creating 50 thousand new workplaces does not seem like an arbitrary undertaking, even if the effects of such a program would only trickle down to this generation years from now[11]. Gábor Szabó, the new chair of the Hungarian Rectors' Conference, has gone as far as suggesting that the capacity of Hungarian higher education ought to be expanded from today's 380 thousand students to 500 thousand, partly through a significant increase of foreign student numbers.

The following is a list of possible components for achieving an "employment renaissance" in Hungary's resource-strapped science sector:

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[10] In addition to students graduating after studies pursued in the old system of five-year university education, the first "Bologna-process" classes also graduated this year (with students completing three years of studies).

[11] The target set in the New Hungary Development Plan was 75 thousand new workplaces.

- **Dynamically increase the number of research positions in higher education[12].**
- **Significantly increase, in several stages, the number of students enrolled in state-funded PhD studies[13].**
- **It must be made easier for academic research institutions to subscribe to and apply atypical structures that allow them to employ researchers in significantly greater numbers than today.**
- **While maintaining and modernizing the tender process, prominent research studies, infrastructural studies and strategic studies must be financed in a normative system.**
- **Increased financial support distributed through the tender system (National Office for Research and Technology – NKTH, Hungarian Scientific Research Fund – OTKA) must be regrouped, targeting new employment areas as opposed to directing them to subcontractors.**
- **A research incubation program, modeled after business incubation services, should be introduced to support the start-up – and operation during the initial few years – of new research groups or small institutions active in cutting edge projects; the program would provide the necessary infrastructure, services, assistance and access to other necessary resources.**
- **All possible forms of incentives and support structures must be utilized to encourage business entities**

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[12] This would go a long ways toward alleviating the unavoidable institutional conflicts inherent in the transition from an outdated status economy to modern performance evaluation.

[13] On a related note, it must be made easier to launch doctoral programs in areas which had thus far not been covered by such independent and advanced programs or subprograms due to administrative restrictions; also, following on the example of Oxford, the core staff of doctoral training programs must be "rescued" from the daily grind of higher education.

in their activities related to innovation and research, which may later translate into employment opportunities.

All of this requires, naturally, a political turn, at least in part (higher level government representation for **science policy**), as well as the commitment to make the issue **a priority for the government**[14]**.** The steps outlined would require resources on par with highway-construction – and would in fact involve more than just financial resources.

The success of a comprehensive and carefully implemented program would, however, immediately lead to **a secondary flue effect.** Increasing the number of individuals employed in research and development brings with it, naturally, an increase in the number of people working as research assistants or in a similar capacity. Conference-tourism, with an influx of visitors, also increases, as does the number of professional events and the number of publications. All of this makes it possible to involve a higher level of resources both from within the European Union – on a higher level – as well as from beyond the EU, and to reach a level of interoperability and "exportability" vis-à-vis the scientific centers of the world.

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[14] Unless this is done, no decision can be made to allocate additional resources in today's difficult budgetary situation, and there is no chance of once again modifying the higher education law (which would be necessary to finally solving the situation of the research sciences). (Let us not forget: the relatively low growth seen in Europe, as well as Hungary's backward position compared to the rest of the world, is closely connected not only to the percentage of GDP put toward research, but also with the **low levels of investments targeting higher education** (as a proportion of GDP: EU: 1.1%, United States: 3%). And let us add: as the European Universities' Charter will only classify an institution of higher education as a university if there is research conducted at the school, a review and modification of Hungary's law on higher education is long overdue.)

At the same time, science can also act as a **client,** creating plenty of new workplaces also for activities where the value added is lower. An extensive **wave of digitalization** (with business partners or even through employment programs) could ensure long-term employment, for years, for "digitalization specialists" who are easily trained; it would also make readily available, online, masses of primary sources for the expanding community of Hungary's researchers[15]. This role as a "client" would not only drive supplier capacities, but could also translate into production: the 3D cell microscope, for instance, which started out as a scientific sensation developed by Hungarians, is now the focal point of production processes involving serious export activities.

And we have not even touched on the fact that through the results of research findings, by turning them into **product and tool development,** utilizing them commercially and **establishing manufacturing centers,** society may hope for additional benefits. With appropriate support from science policy, new – and at least partly targeted – research findings may provide further momentum for industries that are already competitive to begin with and build on the existing capacities of the country. These include the **energy sector, medical and wellness tourism centered around water, new medical treatments and medicines, high value-added agrarian innovation, irrigation activities, the "white chemical industry," and related**

[15] A similar opportunity would present itself in potential programs to support the hiring of archeological assistants and data collectors as the highway-construction boom of the present continues for several more years; this kind of work is critical to archeologists and helps the entire construction move along more quickly. Laying down the necessary physical infrastructure for broadband networks (owned by the communities) also presents an opportunity for the employment of large numbers of low-skilled laborers, in the framework of a public works project.

specialized IT and technology-machinery development. All of these bring with them competitiveness-increasing effects and contribute to increasing revenues and employment. All of this serves to direct attention at the critical idea that fiscal tools alone will never be able to produce the kind of **additional capital** that would provide mass employment for low-skilled laborers[16]; **the industries listed, however, could do just that if they are allowed to take off[17].**

[16] This train of thought often meshes with, and in some cases builds upon, Péter Róna's discussion and analysis.

[17] The likelihood of this scenario is confirmed by the indirect observation, as mentioned in the foreword already, that the overwhelming majority of companies working in the business sector belong to the „de novo" segment of the Hungarian economy – that is, were established following the transition and did not exist in the old system. It would not, then, be any different from this model if economic and employment growth were to be achieved in the competitive fields, but could at the same time still rely on the organic experiences and traditions of regional, historical and cultural elements, as well as knowledge, amassed over centuries.

Since the unique natural resources ensuring the economy- and employment-stimulating effects of new developments provided by scientific research **do not necessarily overlap with the geography of economic development,** this may actually contribute to an alleviation of regional inequalities and to a move toward a healthier labor market structure. All of this may also improve the generally unfavorable situation of **older members of the labor force.** On the one hand, the elderly of the future will be much better qualified than their counterparts currently. Significant changes are expected to reach this area in 10–15 years. A more highly skilled population has an easier time on the labor market, on the one hand, and on the other, a drop in the numbers of young people joining the labor market may also act as an attractive element for increasing the number of elderly who are employed. This kind of employment, when seen in the context of the elderly and as a form of reintegration, may certainly be more of an atypical tool. Yet several broad and lengthy scientific survey programs may be able to create such opportunities.

This secondary flue effect is supported by an **abundance of labor,** which can also act as a strong driving force for acquiring new skills and knowledge, as well as the **flexibility and openness of the Hungarian labor force:** two-thirds of employees would be happy to take on **new and different challenges** in the workplace[18]. Ninety-three percent of those surveyed in a study responded that they would be willing to participate in **further professional**

[18] It is no coincidence, and speaks to the flexibility and adaptability of the Hungarian labor force, that this structural transformation was manageable and – apart from a few regions finding themselves in uniquely unfavorable circumstances – was able to take place without any major repercussions.

training. Eighty-seven percent of them find it important to acquire additional skills outside the company; 60% hope to participate in some kind of **training program.** Language courses appear to be the most sought-after, with 73% of respondents professing a willingness to participate in such a course. According to the aggregate results, 38% of respondents hope to take a **language** course; this is only slightly less than the percentage of those who would be willing to participate in some kind of professional course (48%). The lack of **digital literacy,** which at the present greatly inhibits the increase of employability, is explained by the following two seemingly contradictory statements. Firstly, significant parts of the population are still excluded from this sphere, and secondly (according to the best practices of the past several years), this **disadvantage can only be overcome through the implementation of appropriate programs[19].**

In the long term, public schools must also adapt to the need to foster advanced-level scientific activity and a greater receptivity toward research in general. In addition to the tried and tested methods of looking after gifted children, the educational process must be adapted to include the novel implementation of the methodological apparatus and practice of scientific learning (from the introduction of critical thinking, through involvement in active science projects, to encouraging the adoption of innovative forms of scientific literacy[20]). An appropriate foundation

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[19] According to the lessons of the Wi-Fi Village program, interest and demand can be roused even in the apparently most hopeless and backward regions and communities.

[20] For the principle itself, see: Claeson, Bjorn et al.: Scientific literacy, What It Is, Why It's Important, and Why Scientists Think We Don't Have It: The Case of Immunology and the Immune System. In: Naked Science. Anthropological Inquiry into Boundaries, Power and Knowledge. Ed: Laura Nader 1996 Routledge pp. 101–118. In Hungarian, and including a review of the Zalabér action study, see József Zsolnai: All of Science (A tudomány egé-

for all of this may come from the **high social respect science and scientists enjoy, as well as the popularity of new and old means of disseminating scientific knowledge.** There are, furthermore, areas of science which "traditionally" have strong professional positions (including mathematics and neuroscience). There is also a kind of "staking of claims" taking place in certain new scientific areas which offer potential for the future, as well as in inter-disciplinary, hybrid fields (from bio-IT to the general science of networks, for instance). It is quite telling that in this year's so-called Talent-index survey[21], examining the countries of the Central European region, Hungary made it to fourth place even despite lagging far behind other countries in terms of foreign language knowledge, mobility and capital attraction force; this is counterbalanced by the country's second-place as far as providing capital attraction ability the right conditions for talent to thrive.

Similarly to the scientific field, the secondary flue effect is also able to mobilize the so-called **creative industries** as well, since those working with high value-added activities as well as those "aiming high," whose numbers continue to increase, are also serious **consumers of culture,** and through their projects are also in constant contact, as clients, with **innovation, product development and content development.** Those making their living from artistic activities (musicians, theatrical artists, film and photo artists, crafts workers, literary figures), will be joined by several thousand additional individuals involved in the same work, primarily as a result of an increase in the

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sze) Műszaki Kiadó, 2005.

[21] A joint study of the consulting firm Heidrick & Struggles and the Economy Business Unit groups thirteen Central European countries into seven categories based on economic, social, labor market and educational criteria. http://www.heidrick.com/NR/rdonlyres/3A4073FE-11BB-409F-ABE6-8E6A6C884D38/0/CEETIbooklet_screen.pdf.

numbers of those able to study at artistic colleges. The flue effect of the mainstream will push the best of these individuals, like in the world of science, toward success and toward revenues realized from abroad. From design to animated motion pictures, there is reason to hope that transforming Hungary's artistic higher education institutions into international schools, attracting an increased number of foreign students, will provide plenty of new and exciting opportunities (especially in the world of music).

SPECIAL TARGET GROUPS

One of the terms encountered most frequently when discussing the extensive growth of individuals employed in the field of sciences is brain gain, used to denote efforts to bring highly skilled professionals back to Hungary; yet this actually indicates a "regaining" of experts previously "lost," and does not actually contribute to decreasing the number of skilled professionals waiting in the wings. From a scientific perspective, certainly, this is a critical area; from an employment point of view, however, this is only significant – through a primary flue effect – when an internationally acknowledged and competitive scientist is able to **apply him- or herself** in Hungary in a variety of jobs thanks to resources either provided to them or secured by them[22]. And while we are, typically, afraid that the best minds will seek professional fulfillment elsewhere in the scientific centers of the world, a certain kind of internationalization ensuring interoperability and the application of the highest standards is inevitable, as are research visits or research projects (long or short term) completed abroad. Experience shows that from the perspective of enterprises and research work, favorable conditions in the "mother country" go a long way toward retaining and attracting professionals. The labor market itself would be especially favorably affected by a kind of twenty-first cen-

[22] This is exactly how the Momentum – Young Researchers Program of the Hungarian Academy of Sciences works; the first six winners of the program, announced in June 2009, will continue their work in Hungary at least for the next five years, forming independent research teams. According to the Academy, the projects submitted are of such high quality that – in possession of the necessary financial resources – it would be possible to immediately lunch another dozen research groups of a similarly high standard.

tury **"peregrination policy":** it would be able to remove tens of thousands of individuals from the current labor market for two-three years while at the same time alleviating the pressure young graduates face to find employment, and delaying the start of their careers by a few years. In the interim the young people would become better integrated into global processes and would ultimately become more competitive internationally. This, too, is an interesting form of mobility, which also carries with it a complementary flue effect: it encourages mobility and increases turnover at scientific workplaces in the country, while at the same time placing the burdens of "supporting" the individuals into the hands of foreign scientific institutions, advanced schools, companies and foundations – at least partly and at least temporarily[23].

Children raised in **out-of-home care** could be emblematic beneficiaries of a scientific and knowledge-based strategic transformation. Currently in Hungary, **17 thousand** children live in out-of-home care, and it is well known that the present system destines many of them to emerge as losers after their care. Hypocritically, the relevant institutions and public policy in general have resigned themselves for years to simply sustaining and operating the institutions already in place, with minimal funding, instead of raising entire generations of young people able to enter the labor market equipped with modern knowledge and able to compensate at least partly for the psychological hurt and trauma they had experienced. Yet the fact that today, these children are taught not at dedicated educational institutions (but are integrated into the regular regional system of schools) does not mean that looking after

[23] Countries like Malaysia, with ambitious modernization goals, rely on this solution very consistently; many believe China also uses the same approach for strategic reasons (but no reliable sources exist to confirm as much).

them with conscious skills development and talent programs would not be able equip them with the necessary pedagogical and didactical opportunities that the profession is theoretically prepared to provide. By doing so, the children raised in out-of-home care would have the opportunity to become "winners," and full participants of the labor market (today's experience, however, is that these young people, after exiting out-of-home care, pose a burden on the social welfare systems of the state)[24]. Not to mention that such a comprehensive program would mean that a knowledge-centered transformation of out-of-home programs would be able to draw in, in addition to the current staff and others involved in the maintenance of the organization, plenty of excellent professionals (including elderly individuals). This kind of methodological culture and professional network (through appropriate expansion and the "multiplication" of best practices) could be involved in the alleviation of another type of acute social and employment policy problem: that of seriously underprivileged children unable to enter secondary school, whose situation could be advanced through targeted programs intended to improve their chances in life.

The secondary flue effect could also make its effects felt in areas such as **Roma policy.** As a primary chimney effect, the goal could be for Hungary to become Europe's – or indeed, **the world's – acknowledged and recognized center on Romani studies.** This would require an increase in the number of researchers and other professionals, and through a series of secondary benefits, transactions and ripple effects, it could also include an independent capa-

[24] This concept could also include the suggestion that "extra" opportunities (comprehensive digital learning and communications environment, modern tools and reliable digital literacy, foreign language studies, etc.) could be coupled with the goal of directing individuals toward professions facing a shortage of labor and competitive knowledge areas.

city for obtaining additional resources. Such a reinforced professional staff, stronger in numbers and equipped with new methodological skills, could do much to promote secondary flue effects among the Roma. Some of the possible avenues: education, training, continued professional training, ensuring digital literacy continues to spread, providing motivation by designing, launching and operating appropriate learning and integration programs, increasing the number of Roma students studying in secondary and higher level education, organizing and orienting large numbers of Roma students toward creative industries (e.g. music and visual arts), and by providing solutions to support Roma students in launching their careers.

Professional workshops are also critical – yet are few and far between, and therefore need to be reinforced in their numbers. These deal with science itself as a subsystem, research and development, innovation, knowledge management, exploring and developing methodological cultures to support strategic planning, technology assessment, future research, micro-simulation, government advising, science policy and higher education policy. Contributions from the disciplines listed above are critically important to so-called environmental scanning, establishing priorities, finding junctions to join programs and establishing appropriate action plans[25].

[25] The National Technological and Research Authority understands as much. Several documents maintain that there is a lack of appropriately trained professionals (who would be able to distil information into decision-making processes) working in the oversight of science and technology policy, research and development, and innovation.

WHAT DO WE TAKE AWAY FROM ARRA?

In the United States, one key element of the American Reinvestment and Recovery Act package (ARRA), launched in response to the economic crisis, was the **supplemental support to be given to the sciences**[26]**,** in the form of billions of dollars provided to various scientific agencies.

This support was granted based on the conviction that the **new value produced as a result of scientific activities serves as the basis of economic growth and results in the creation of new workplaces.** Decision-makers were convinced that investing in science[27] leads to more competitive firms, as well as **more and better workplaces.** Naturally,

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[26] Julia Lane: Science Innovation: Assessing the Impact of Science Funding Science, 2009 Vol. 324. no. 5932, pp. 1273–1275.

[27] Certainly, science is not the only "target area" where the equation "employment from investment" may ring true. In addition to the survey, already mentioned, by the Information Technology and Innovation Foundation, another study prepared together with the researchers of the London School of Economics and Political Science claims that 15 billion GBP can create up to 700 thousand new jobs. To do so, however, the funding must target the three main ICT infrastructural elements of the United Kingdom: broadband networks, smart transportation and delivery systems and smart power grids. The concept is, in a way, similar to the dual chimney effect: the first outcome is the immediate and direct creation of new jobs, while the secondary result is the establishment of network effects leading to long-term impacts and the creation of additional jobs (this becomes manifest, in addition to increasing employment, in cutting costs, increasing productivity and raising quality of life). The two directions for development do not exclude each other – and are, in fact, complementary: without reliable broadband access, there is no collaborative science, and the other two areas also require and attract knowledge-intensive activities. Lienebau, Jonathan et al. 2009: The UK's Digital Road to Recovery http://eprints.lse.ac.uk/23830/1/UK_Digital_recovery.pdf April, 2009 Accessed: July 11, 2009.

they were able to rely on forecasts from organizations such as the Information Technology and Innovation Foundation; ITIF's report suggested that an extra investment of **20 billion USD in the sciences leads to the creation of over 400 thousand new jobs within one year.** Julia Lane, in her article referenced in the previous footnote, quotes a study showing that **50 thousand new jobs in the biotechnology and electronic sectors** – in the high-tech zone outside San Diego – may be traced back to the work of **four (!) scientific researchers** at the University of California in San Diego.

It is stunningly insightful that the real questions for Lane are how money can be well spent and how its use may best be measured. Given, however, that sufficient information was not yet available to answer these questions, or to explore the subtle correlations between scientific development and economic growth, an NSF program was immediately established to provide scientific policies with appropriate input in the matter[28].

All of this is complemented, logically enough, by the latest – and ambitious – strategic announcement of the Obama administration, which the president himself underscored in an article appearing in the Washington Post[29]. According to Obama, the major question is how employees

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[28] Research studies conducted in the framework of Grants for Rapid Response Research (RAPID) to Study the Impact of the Economic Stimulus Package and to Advance the Scientific Understanding of Science Policy program (http://www.nsf.gov/pubs/2009/nsf09034/nsf09034.jsp) must seek to answer questions like the following:

- What was the contribution of the science investment to the creation and retention of jobs?
- What was the contribution of the science investment to science and technology industries?
- What scientific or technological advances were achieved?
- What was the impact on the scientific workforce?

[29] Obama, Barack: Rebuilding Something Better http://www.washingtonpost.com/wp-dyn/content/article/2009/07/11/AR2009071100647.html Sunday, July 12, 2009.

are able to benefit from the kinds of skills and abilities which will ensure their competitiveness in the labor market of the future. According to forecasts, **the number of jobs requiring higher education degrees will increase twice as fast as the number of jobs not necessitating such qualifications;** therefore, says Obama, it has never been more important to ensure that learning continues past the secondary school stage. The goal, then, is for the **United States to be the world's leader in advanced professional training by 2020.** Thanks to an impressive development program providing schools with funding for infrastructure development, asset purchases and online courses, the number of students graduating from the community colleges of specific states will increase by five million. The schools themselves will become 21st century job training centers.

Great Britain also found a similar point of departure, reaching eerily similar conclusions[30]. They simply placed their basic structural data from the past forty years next to each other. The figures indicate that the percentage of the population employed in knowledge-based sectors increased from 25% in 1970 to 50% today. This sector was also the creadle of new job creation, increasing the share of value-added activities and exports (specifically: business, finances, high-tech services, creative and cultural indus-

[30] Based on the latest report (The Knowledge Economy Programme) of the strategic U.K. think tank Work Foundation; the report outlines plans to resotre and develop the knowledge economy of the United Kingdom by 2020. http://www.theworkfoundation.com/research/keconomy.aspx Another important report by the foundation (Recession and Recovery: How UK Cities Can Respond and Drive the Recovery, July 2009, authors: Alexandra Jones, Neil Lee, Katy Morris) has shown, in connection with the recession, that **low skill cities are faced with unemployment on a much higher scale than towns with a more highly skilled population.** http://www.theworkfoundation.com/research/publications/publicationdetail.aspx?oItemId=220&parentPageID=102&PubType=.

tries, advanced technology manufacture, education and healthcare). In 1970, the share of investments in intangibles was only 40% of the amount put toward buildings, vehicles and machinery. In 2004, investments in design, software, databases, research and development, as well as human and organizational capital have reversed the previous figures, and – at 120% – have taken the lead. In 1970, 60% of the labor force did not possess appropriate qualifications; their numbers dropped to 10% by 2005. For Great Britain, the findings led to the following results: **the launching of business and employment development programs centered on the pivotal role of the knowledge sector, together with the increase of the numbers and quality of higher education programs and graduates.**

Ireland's latest action plan, Technology Actions to Support the Smart Economy, aims to create 30 thousand new jobs in the next decade. These would all be created in the field of **smart economy** – digital industry and network technologies[31]. The International Content Services Center, to support over one thousand Irish companies, is expected to create ten thousand new jobs by 2020, primarily in the key area of the "secondary flue effect" – the world of **creative digital arts** (film, games, music and animation) and in communications, legal and other services.

It is hardly surprising that the same focal points are seen in China's latest initiatives in the field of scientific policy: new and improved innovations capacities are expected to support economic restructuring and transform development practices. China's State Council augmented its fifteen-year medium-term science development plan[32],

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[31] Making the Smart Economy Real http://www.dcenr.gov.ie/Press+Releases/Making+the+smart+economy+real.htm.

[32] Jiabao, Wen 2008: Science a Driving Force for China's Modernization. Chinadaily.com.cn (The short article was compiled originally for the American magazine Science.) http://www.chinadaily.com.cn/china/2009focusonchina/2008-

adopted in 2006 for the period 2006–2020, with a fifty-year long-term plan adopted in July 2009 (and compiled by the Chinese Academy of Science)[33].

The long-term plan was designed in the understanding that the next **10–20 years will see yet another "technological and industrial revolution"** in many areas of science, and that these must be identified in due course. The plan recognized the **fostering of innovation as the strongest possible answer to the global economic crisis.** The plan points to 18 focus areas, demonstrating a strong "green" commitment: agriculture, ecology, environment, health, oceanography and "clean" and renewable energy resources are in the center. Certainly, the areas selected are not limited to the specific supporting sciences: multidisciplinary teams stand the greatest chance of arriving at solutions to particular problems (in the case of healthcare, for instance: biology, environmental sciences, psychology and social sciences)[34].

The two most important motives are **talent programs and institutional reform.** The central question as far as China's scientific and technological future is concerned is how talented young people can be drawn toward the sciences and how their talents may best be used. The answer

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10/31/content_8302743.htm Updated: 2008–10–31 06:36 Accessed: July 9, 2009.

[33] Kuang Peng 2009: China Issues 50-Year Science Strategy http://www.scidev.net/en/news/china-issues-50-year-science-strategy-.html?utm_source=link&utm_medium=rss&utm_campaign=en_news 6 July 2009 | Accessed: July 9, 2009.

[34] Previously, the medium-term plan divided the world of research into "basic sciences" and "cutting-edge technologies," and focused primarily on the areas of energy, water and environmental protection, as well as the uses of biotechnology in industry and health care. Information technology and new materials (especially nano-technology) was discussed in the context of intellectual property rights; 16 "mega-technology projects" served as the basis of the framework.

is fairly general, but certainly points in the right direction: the kind of **fertile environment** must be created for them which will bring forth their "best creative thoughts."

In Japan, the state has shown extraordinary planning and care in its expansive central developments of the past decade (science towns, intellectually creative society, "ubiquitous Japan"); the efforts of Japanese companies also point in much the same direction. A survey of 253 large Japanese companies showed[35] that despite difficulties in sales, **companies keep their contributions to research and development activities high.** Much of these funds go toward alternative energy and environmentally friendly technologies; and while unemployment has increased in virtually every sector, research and development has continued to see high rates of employment.

Finally, wrapping up a brief international overview, we must mention the fact that even prior to the current economic crisis, several countries seen as "success stories" have made their futures dependent on proportionally increasing support for **science and education, consistently and even in times of financial depression.** In Europe, it is enough to mention Finland (clearly no coincidence that the country is a leader in rankings of R&D spending and employees, as well as funds put toward scientific research, performing above the EU average in almost every respect). In Asia, South Korea has, since the 1960s, laid special emphasis on its modernization and information society programs on the development of education, science and digital culture.

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[35] Rowley Ian: Japan Inc. Continues to Spend Big on R&D Despite the Recession. Business Week, August 5, 2009. http://www.businessweek.com/globalbiz/blog/eyeonasia/archives/2009/08/japan_maintains.html.

AND WHAT DO WE DO HERE, AT HOME?

For the moment, Hungary's economic stimulus package does not yet include **motivators for science.** Hungary, at this point, is still lacking even as far as studies are concerned which would foster dialogue about policy steps needed to support the dual flue effect. It is extremely difficult to plan proactive strategic steps in a political culture focusing only on the short term: already at the starting line, one encounters a series of long-unresolved and acute problems, which must all be solved at the same time to succeed. It is an important question whether the recession is, in and of itself, enough of a motivator to bring about a real change in attitudes[36]. If, in the past, **a lack of prioritization hindered an overhaul of the subsystems of education and science which would have established a vision for the future and a competitive edge, and these areas were continuously underrepresented in national policy-**

[36] Earlier, even without the pressures of the economic crisis, plans had been launched which called for, and outlined an operative plan for, a set of tools and operative means to institute knowledge-centric reforms in strategic areas, education and research (without, at that point, coalescing into a comprehensive and proactive set of programs reminiscent of the dual chimney effect). In 2002, the Ministry of Education prepared a working paper entitled *"Knowledge is the Driving Force – For the Competitive and Intellectually Rich Hungary of the Future."* Its eight-part outline of necessary steps was, however, ultimately not adopted. A similar fate befell the Hungarian corollary to the European Union's 2005 document, i2010. An internal version of the Hungarian document, containing an action plan for government priorities, listed as priority number two "Increasing human resources and institutional investments in ICT research and development." It would have created a primary chimney effect in info-communication research projects, which are closely related to a multitude of other fields. Ultimately, it met the same fate as the Hungarian Information Society Strategy chapter dealing with research, completed in late 2004: it was never even debated by policy makers.

making and fiscal planning, what would it take for the attitude to change now? Such an overarching strategic, political and employment program may only come about with high-level support (from the prime minister, minister or president), at least a partial consensus among the parties and with significant social backing[37]. The OECD country report quoted earlier also stipulates a need for governance focusing on effective specialized political areas, which is open to the international arena, is predictable and is based on facts and analyses. In light of the scarcity of resources, it is critical to involve all stakeholders when determining the priorities.

Higher education, which has seen a decline in quality and is caught in a trap of financing, yet still boasts at least some cutting edge centers of teaching, could and should contribute the most to the launching of such flue effects. One avenue to doing so would be to broaden its cooperation with the corporate sector. The flue effect, however, is not an automatic one: the right decisions require preparedness, background institutions and appropriate programs for working with the available knowledge. The senior

[37] "Public thinking," here, could also be taken to mean a fair amount of resistance. As Gábor Szabó, rector of the University of Szeged pointed out in the interview cited earlier: "Hungarian society must accept that today, a bachelor-level education is required to fill positions which earlier only required a high school diploma. And higher education institutions are not training students to enter specific workplaces – they provide employers with the opportunity to hire and shape these educated graduates, equipped with foreign language knowledge and a multifaceted background, to their specific needs." It is typical that the greatest opponents of steps pointing forward, in the direction of competitiveness, are often those directly affected. In July 2009, the Association of Hungarian Parents, for instance, took issue with the "unethical" and "discriminative" practice of only granting students their diploma after they have presented proof of foreign language knowledge. Oftentimes, teachers are the fiercest opponents of the transformation necessary for public education to conform to international practices.

leaders of higher education and the elite of science management, like top-level politicians, need to join a system of organized education and training, so that they may transform into a real elite.

Instead of "quasi-incubation" projects that are inevitably turned into real estate deals, Hungary must turn to true incubation practices involving both the corporate sphere and science. Instead of innovative rhetoric and a burgeoning institutional system, the country needs viable and effective support mechanisms, coupled with increased resources and novel innovation schemes involving the creative talents of society. It is clear that science policy and higher education strategic coordination will be necessary on the very highest level[38]. The professional support available for decision-making will need to be reinforced, and the traditional mechanisms for distribution systems and tenders (traditionally mirroring old interest groups) must also be modified to prepare for additional resources.

The opportunity is here and the road to be traveled is known. It is open, mapped and ready to be planned. In what context will responsibility be discussed if revenues are not realized or if the necessary steps are not taken?

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[38] The "Research and Social Policy Council," in the process of being established, is not expected to deliver concentrated, top-level political backing. It will have an advisory role, and will not be a kind of steering committee at the apex of the government structure, bestowed with decision making and management authority. It will instead be a bureaucratic body overseeing any areas of responsibility not yet covered and ensuring a "deployabilty" of certain specific legal oversight areas.