The PhD Ethos-Mythos: What Chances do Have Young Talented Researchers in Reality?

Bernard Wallner
Department of Anthropology, Department of Behavioural Biology, University of Vienna
Vienna, 1090, Austria
Helmut Schaschl
Department of Anthropology, University of Vienna
Vienna, 1090, Austria
Martin Fieder
Department of Anthropology, University of Vienna
Vienna, 1090, Austria

ABSTRACT

The nuclear tasks of universities did not change in the course of time. However, new responsibilities are added mostly depending on the *en vogue zeitgeist*, which does not necessarily facilitate strategic planning in an easy way. Because changes following the ideology of the spirit of the time are frequently not really adaptable to established structures. The classical parameters of university achievements are research and its output as well as teaching concepts to educate young scientists. Both, teaching and research, represent the major performance columns for universities and are dependent from each other and cause each other mutually. Many institutions proclaim that research-led approaches of scientific teaching generates the best academically trained graduates, who succeed competitively in the working environment and in the research world of universities. However, during the last 100 years the developments in the academic world showed that teaching and research do not cause each other like Castor and Pollux in order to be successful.

Keywords: PhD, Employment, Scientific Career, Age, Academic Future

1. THE DOCTORATE: A CASE FOR THE PIED PIPE?

Germans Max Plank society (MPG) shows impressively that (more or less) pure research institutions can successfully operate on basic research programs and are acknowledged world-wide for their achievements. A view of the society's web page shows that presently the concept based exclusively on basic research is re-defined. The MPG claims that demographic changes force the society to reconsider their academic strategy directions on a large scale. Declining graduate numbers in engineer and natural sciences are responsible to develop supportive programs for high-school upper stage trainings. Beyond that the society cooperates with universities in so called *international Max Planck Research School programs*, in order to be able to promote increased PhD numbers of talented young researcher [1].

The MPG main arguments for such programs are *the number of talented young researcher is currently too low for a country like Germany*. Are such initiatives up-to-date or naive? Interestingly, from 1998 to 2008 increased the number of PhDs by almost 40% in the OECD states [2]. These numbers are based on the rationale that excellent educated people represent the key factor to reach economic growth. However, in reality the example of Japan illustrates that PhD graduates do not find easily adequate jobs at universities or in the economic world as well. From 1350 PhD graduates in science only 162 found work in scientific or technological professions. The remaining numbers of these were distributed as follows: 250 positions belonged to industry, 256 entered the field of education and teaching and 38 found a job in public administrative areas [2]. Data of the University of Vienna [3] showed the career paths of university alumni in top industries (synonymous for top entrepreneurs) after five years of graduation. In a sample of about 8 000 people, 61 % found jobs in various non-identified fields. In the overall analyses the term science is not existent as an occupational category; 21 % of all alumni find a job in the public sector, 11.5 % in the field of education and teaching, and 6.2 % in trade industries. A more detailed analyses of the data provides the following figures: the proportion of PhD graduates is approximately 10 % of all alumni and these individuals find mainly jobs in public service and education areas (Table 1). Results for the fields of Biology, Chemistry and Physics revealed that the vast majority of PhDs do work in branches of education and teaching (Table 1). However, PhD alumnae in biology and chemistry find considerable numbers of jobs in research and development.

(The above-mentioned industries are defined by Statistic Austria and have several subcategories. For example the field of education and teaching is divided into kindergartens and pre-schools, primary schools, secondary schools, tertiary and post-secondary, tertiary education, and the provision of services for classes, etc.)

These two examples illustrate that the utmost academic qualification, a PhD whose learning path needs the highest investment of resources in higher education, seems not lead to adequate jobs after graduation.

Table 1. Employments in % of graduates from the University of Vienna: all graduates, all PhD graduates, PhD graduates in Biology, Chemistry, Physics; for detailed analyses see Mitterauer [14].

	graduates	PhDs	Biol	Chem	Phys
public service	21.86	14.59			
education, teaching	11.50	29.45	37.79	39.22	30.00
trade	6.20			7.84	
research, development		10.09	27.04	16.67	
pharmaceutical industry			7.14		
data processing					15.00

2. ACADEMIC CAREER: A RANDOM GAMBLING ADVENTURE?

The ethos of PhD education programs at universities is to train students to be able to do scientific work "independent", e.g., being able to carry out each step of scientific knowledge production on own responsibilities (including publishing, writing project proposals, teaching etc.). The basis of such trainings is to learn the state of the art methodological approaches and to rise new and creative research questions. Generally, PhD student numbers are low per unit and the knowledge transfer between their supervisors is based more or less on a one to one interaction. Remarkably, faculty members have very seldom professional experience away from their academic career. One big problem of such a specific structured academic training environment could be the fact that high quality people will be produced, but these people are over qualified or better qualified *aliens* for normal job demands in the existing economic or industrial world. This could be the reason why a relatively high percentage of graduated PhDs find only low-grade jobs compared to their education. In this context, surprisingly, graduates in the field of natural sciences from the University of Vienna do better compared to their international colleagues, but at least find also no satisfying job conditions. Coming back to the question, "is it useful to increase the number of PhD graduates to guarantee enough young scientists for national and international universities", as the MPG points out in their homepage? A comparison of PhD graduation numbers between 1998 and 2006 shows a clear global increase: China 40 %, Denmark 10% or US 2.5 %. However, world-wide less than 6 % of permanent academic jobs are available at universities [2]. These figures demonstrate clearly that the notion of, "young scientists must be mobile and flexible at all to find an adequate job in research", is a cynical illusion - like the dream where the dishwasher becomes a millionaire. In fact this illusion is not based on real empirical analyses but relies mostly on case studies of individual success. The very low number of available academic jobs in research at universities must necessarily raise the issue, "whether one succeeds or not - is it a question of the much vaunted scientific quality or is it simply luck – being at the right time on the right place with the right allies"? Increasing PhD numbers within the OECD and in some economically emerging countries such as India, China, Brazil, and Turkey will tighten the foreseeable competition in the scientific area world-wide in the near future. In comparison to that Austria and Germany have stagnant annual PhD graduations. During the last 20 years especially Germany did a good job by re-structuring its doctoral studies [2]. In addition to train PhD students very successful in basic science advanced training programs were introduced, which allow graduates to be very attractive for other than university jobs. The national secret seems to lie in target orientated education plans along with the stagnant or slightly increased numbers of PhDs. Currently, the strategies of the MPG and the University of Vienna work sufficiently good for doctoral trainings. However, the emerging global development of PhD rates in economically strong growing nations will create a global competitive situation in the academic and labor market and therefore, at the national level as well. In this respect, the challenges for universities, which represent traditional and old institutions, will increase significantly. Such organizations (e.g., University of Vienna since 1365, University of Paris since 1096 or University of Bologna founded in 1088) developed over hundreds of years their academic profile facing now the pressure to adapt their PhD curricula, the economic efforts of student education and most of all the resource distribution within each institution to succeed globally. These institutions have to shift their national academic acceptation into a global to succeed in the future.

3.PHD PROGRAMS: A REMEDY FOR GLOBAL COMPETITION BETWEEN UNIVERSITIES?

Currently, the developments of structured PhD programs are booming. This international strategy pursues the objectives to produce more pre-docs, respectively, post-docs for the science market. These funded programs differ substantially to former PhD supervisions because ideas and work process descriptions defined by a submitting person (commonly identical with the supervisor) already exists for prospective candidates. There seems to be little room for PhDs to develop their originality and creativity in research approaches since most programs have to end after three years. During that period the candidates have to publish a certain amount of manuscripts as well. Although, being part of the program facilitates a regular income for pre- and post-docs and enables them to work in a team. As mentioned above the resource "time" is general a very import variable in the career of young scientists. Surprisingly, the average age of PhD graduates is about 30 years internationally and nationally [4, 5]. What does this mean for the medium career paths of a group of people who competes for a world-wide job pool of 6 %? Economically priced, this competition can be a win-win situation, where the very best are qualified for the best jobs in research and other available workspaces and thus give more financial and other resources back as the "system" invested. Realistically, the number of PhDs will increase as well as the amount of job seekers. Internationally, postdoc – vagabonds will struggle for time limited and inadequate jobs within universities and in other work places. The majority of those, who don't get into the 6% pool will be in trouble latest after 10 - 15 post-doc years. The time-factor makes them unattractive for most available jobs - simply they become too old. The fate of this remaining quantity will probably fall from any statistics, because their career paths and their remaining jobs will not be traceable anymore.

For Austria such a scenario would mean, more people will hold a PhD and will therefore seek for jobs in education and teaching areas. This development leads to a cycle where less paid work maintains a dramatic loss of lifetime earnings. Currently, it is completely unclear how dangerous the mentioned programs are for career perspectives of graduates and their prospective job chances.

In addition, the implementation of structured funded PhD programs, at least in the area of natural sciences, requires costly laboratory equipment. Usually, a significant part of laboratory resources is financed by the universities themselves. The promotion of human resources - pre-, post-doc and laboratory - will be held by the allocation of funds at a national or international level. In any case the way to get such money is highly competitive. The magic formula is to accomplish growth by more third-party funding coupled with university resources to recruit temporarily more apprentices, in order to produce temporarily more PhD graduates. In some academic units bonus payments are billed for scientists who are able to allocate high amounts of funding money [6]. In this respect the question needs to be asked, are actually "the best" young scientists on strict time-limited jobs or flee "the best" in areas where continuous career paths are available? Cost transparency is missing here! What is the price for individuals and the national economy to have established a system of temporary employment that is publically funded and settled in a competitive environment? At least in Europe even the so called welfare state is not interested in such analyses and does not argue for the much-lauded work-life balance. Sooner or later in research institutions a "permanent generation of trainees" or a two class society will be established.

4. WHOEVER HAS, TO HIM SHALL BE GIVEN ...
(MATTHEW 25:29)

In this context, it is obvious that a few scientists are able to hold fixed positions and monopolize the majority of human and financial resources. Merton called this university phenomenon the *Matthew Effect* [7, 8]: *For to everyone who has will more be given, and he will have an abundance. But from the one who has not, even what he has will be taken away* [9]. Amazingly, a study about NIGMS grants documented that more external funding is not related to any substantial increase in scientific productivity, measured in publication output [10]. The results of this study remind on Lotka [11] who suggested that the majority of scientists do have a low scientific productivity. Price [12] argued only 5 % of all scientists publish 50% of all articles. Apparently, scientific institutions are in a way organized where both resources and production rates are skewed distributed, bizarrely, these distributions are not positively related.

5. WILL EVERYTHING REMAIN AS IT IS?

Perhaps, the current situation represents a period of a transition to a global change of the academic system *per se*? It is likely that the system of higher education and research will develop beyond the presently existing institutional limits. Future structures of research and teaching will change dramatically and will be less linked to traditional structures. The first messengers of this development are the free access to scientific knowledge (open access publications), freely available data (open data), and curricula of a global character to teach and educate outside the classroom by using state of the art technologies [13]. These and other tools will allow students and scientists to learn, to analyze to advertise education programs or write publications in environments beyond traditional institutions. For graduates of any level new ways to earn money will be discovered. The boundaries between learning, teaching, basic and applied research will be blurry and traditional university hierarchies will lose their meaning.

In summary, global economy will necessitate global university developmental strategies. Isolated university decisions has to be interlinked with a world-wide competitive network of higher education. Whether we are friends of a global world or not it happens and therefore, the representatives of higher education have to react adequately.

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