

ACADEMIC CAREERS AND THE VALUE OF THE PHD DEGREE: AN INTRODUCTION TO THE SPECIAL ISSUE

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Introduction on Academic Careers³

Career paths of PhD graduates have become an emphatic issue since the middle of the first decade of the 21st century both in terms of scientific research and policy-relevance (Goldman 2000). On the one hand, professionals in Research and Development (R&D) are claimed to enhance economic and societal development. On the other hand, there is a growing competition among PhD holders stemming from the significant increase in the number of PhD holders in developed and in developing countries alike (Cyranoski et al. 2011) creating a negative feedback on scientific career selection. Based on the above trends, a fast growing literature discusses the factors behind successful scientific careers and focuses on institutional and managerial issues, as well as gender inequalities and collaboration networks (Leslie et al. 2015; Penner 2015).

Hungarian legislation gave the universities the right to issue PhD degrees only after the demise of state socialism and abolished the soviet type system of scientific qualifications as the issue of the PhD equivalent Candidate of Sciences (CSc) degree was discontinued (Bazsa – Szántó 2008). However, the economic downturn and structural changes of the 1990s resulted in a declining demand for R&D professionals and the number of available academic or private sector jobs in the field has not increased significantly since then. Nevertheless, considerably more students take part in doctoral courses without having adequate job opportunities, which triggers

further tensions (Fábri 2008). This problem is not solved by the recent post-doctoral programmes of the Hungarian Academy of Sciences and contrary to EU tendencies, a PhD degree is often a disadvantage in the Hungarian private sector. Thus, Hungarian PhD holders face similar but even fiercer difficulties than their counterparts in Western Europe. As a result, emigration became a dominant way among those young professionals who aim to start a scientific career (Pálinkó – Mosoniné – Soós 2010) and this brain drain is a major problem that science policy should tackle.

Since scientific competition is predominantly international, we have to understand how successful Hungarian scholars have achieved their international reputations in order to tackle the major problem of the brain drain towards more developed countries. It has been demonstrated in previous research that mobility of scientists is a crucial element in forming and embracing social and collaborative networks and thus it is vital to further scientific quality, research development and knowledge diffusion. Lawson and Soós (2014) found that mobility of researchers to other countries enhance their individual scientific performance, research quality and public funding procurement when it is organized by thematic considerations. However, it is less understood how collaboration networks and especially international collaboration networks emerge.

Though mobility is a key element of research success, not every scientific actor enjoys equal access to this tool. Whereas the international mobility of researchers does not differ significantly in terms of genders during PhD education, the gender gap becomes visible during later career stages (CDH 2012). Women's career advancements usually become slower than their male counterparts, and they often experience potential incidents of discrimination and unfair treatment: the "glass ceiling" or the "maternal wall" effect are existing processes within the field of research and innovation (Kim et al. 2010; Williams 2005; Wilson et al. 2010). As a result of labour market inequalities impacting women, on average not more than one third of researchers were women in the European Union in 2012, and women are especially underrepresented

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in the field of engineering. Moreover, women are under-represented in higher-level research positions (only one fifth of professors are women), as well as in decision-making positions and boards. The gender gap, measured by various indicators, in the Hungarian R&D field was consistently wider than the European average, especially for the proportion of female-led higher education institutions and women's representation in scientific decision-making positions (EC 2016).

Furthermore, research has already called attention to the gender inequality in R&D (Etkowitz – Kempelgor – Uzzi 2000; Paksi 2014), most significantly in the field of science, technology, engineering and mathematics (STEM). Though a high level of gender inequality in these fields is already present during early education, women's horizontal segregation is the most salient in the case of higher education and the labour market (Engler 2013; Fényes 2010). Male and female career paths – as human life courses – differ, partly because women's employment is "linked with (usually unpaid) family work in the household and care over the life course" (Kohli 2007). Increasing the number and the proportion of women in science has become a significant economic issue. However, a headcount increase on its own does not represent a solution for those already present in education or on the labour market against the problems that make most women change their careers (Xie – Shauman 2003; Barnard et al. 2010). There is a need for revealing the reasons why STEM careers and training resist trends that point towards the equalisation of genders. The problem must be examined through a complex social-cultural approach on structural and individual levels as well (Gill et al. 2008).

At present there is no up-to-date knowledge on the different PhD career models, career paths and labour market opportunities in Hungary. Moreover, research usually does not differentiate between fields of science and sectors. Furthermore, the macro-level characteristics of the scientific career path of Hungarian PhD holders have not been examined yet by means of scientometric tools. Concerning organisational enabling and hindering factors, relatively few research studies have addressed family-friendly and diversity management practices in the field of R&D with their inter-linkages with other aspects of human resource policies and organisational culture. In addition, the patterns of interaction between innovation, corporate social responsibility (CSR), and gender equality have not

been examined yet in the field of R&D. From an individual point of view, relatively little research exists on work-life balance studied across different fields of science, and focusing on both junior and senior researchers, as well as personal networks.

The research project

The "*Career models and career advancement in research and development. Different patterns and inequalities in labour market opportunities, personal network building and work-life balance*" research project supported by the National Research, Development and Innovation Fund (NKFI K 116102, NKFI K 116099, and NKFI K 116163) aims to provide innovative research in the above mentioned areas. For this purpose, we identified four main streams of research with different research focuses and methods.

Stream 1: PhD career models and the utilisation of the degree in the Hungarian and European labour markets

The main research objective of stream 1 is to explore the different career paths that are available for PhD holders in R&D, and understand the gender-related mechanisms of researchers' recruitment. Former initiatives by our research group, somewhat foregoing international trends, have been revealing the topics of the utilisation of the degree on the labour market, satisfaction with the content of PhD training and the attitudes of graduates, with the help of longitudinal and follow-up analyses since the year 2000. The main research question investigates the present available career paths for Hungarian PhD holders, and the gender differences between STEM and SSH (social sciences and humanities) recruitment and selection in Hungary. Furthermore, the status of PhD graduates on the transforming labour market is examined, in particular in view of the new opportunities in academic jobs and those outside of academia, in EU contexts. Our surveys process the labour market data of EU countries (relevant databases of OECD, ILO, ESS), and during the focus group interviews we assess the respondents' knowledge and perceptions in the above field. Their theme concentrates on recruitment and social integration peculiarities of STEM subjects, expressly the specialities of scientific female career paths. Therefore, we examine the relations of family

life and professional career, and we also reveal institutional, stereotypical and relevant motifs during previous educational and personal life paths and potential professional careers that determine the actual gender rates and life strategy choices in these fields.

Stream 2: Scientometric–quantitative analysis and models of academic careers

The main goal for this stream of research is to uncover macro-level characteristics of the scientific career path of Hungarian PhD holders, in interplay with various social and career factors (speciality, gender, age, institutional and personal environments etc.), based on the mining and analysis of large-scale scientific metadata.

The post-socialist transition has had a significant impact on scientific careers in Hungary (Grabher – Stark 1997; Petryna 2005) because new opportunities opened up for international research collaboration. For example, we have shown previously that patenting has become increasingly controlled by foreign assignees (Lengyel – Sebestyén – Leydesdorff 2013). Internationally recognised research is the primary aim of Hungarian science policy. Therefore, research questions pay special attention to the above problems: Which types of scientific careers are distinguishable in Hungary by means of scientometric tools? What was the typical Hungarian way of increasing the volume of international co-publications during the post-socialist period?

Individual factors (gender, age) as well as institutional features (location, speciality, and environment) have been crucial in shaping career paths and probably had a decisive effect on the scale of international co-publications as well. The study focuses on the following research lines in an exploratory manner: the characteristics of academic careers of Hungarian PhD holders in terms of scientometric dimensions; the potential scientometric taxonomy of the target population in a Hungarian context; uncovering career models; statistical modelling and mapping of the relationship of different career dimensions and dynamics of scientific productivity, success, professional networks, research profiles, mobility, international co-publications in the Hungarian sample and comparison with established results for other populations; the relation of industry-oriented career paths and scientometric career characteristics of the Hungarian sample.

Stream 3: Institutional Innovations Effecting Scientific Careers

This stream of research is focusing on the organisational factors affecting scientific careers, and is composed of two sub-streams.

Stream 3.1: Gender equality, family-friendly and diversity workplace policies in the field of research and innovation

Workplaces have an important impact on the extent of labour market inequalities, vertical segregation, and degrees of social exclusion and inclusion. Workplaces in the field of research and innovation are no exceptions to the general rule. Recent research on family-friendly and diversity policies revealed that high quality workplace family-friendly policies correlate with lower levels of discrimination of women in organisations, especially those with children, and thus contribute to a higher female employment rate (Tardos 2014). However, correlation between higher standards of family-friendly and diversity policies and better gender balance at the top ranks of the organisation could not be demonstrated. Another study comparing US and Finnish jobs in academia came to the conclusion that similar family-friendly policies were not coupled with similar gender balance in the two countries, thus there must be other factors explaining gender imbalance (Mayer – Tikka 2008). Therefore, we aim to investigate employers in the R&D field and study how their workplace equality, diversity and human resource policies and practices affect gender equality with a special attention on the STEM areas where gender balance is traditionally poor. Our research aims to answer the questions: How do workplaces in R&D support gender equality and diversity among researchers? What kind of diversity and human resource management policies do those organisations have that perform well on gender balance within the STEM field? What is the innovation potential for new, more inclusive human resource management practices in the field of R&D?

Stream 3.2: Innovation and cooperation between academic and business enterprise sector

The current EU and Hungarian research, development & innovation (RDI) strategic and policy documents emphasise the importance of cooperation between the academic and business enterprise sectors in various ways (Partnership Agreement, Investment in the Future, S3). Therefore, we ex-

amine the present conditions and frames of the collaborations both in the academic and corporate sectors, and managerial institutions, too. Our aim is to identify the elements necessary to deepen these collaborations and to make them more effective. Our work involves the interpretation of the term "innovation" as used by the academic and corporate management and personnel (RDI products/processes, methods) and their attitudes towards cooperation in RDI projects. In connection with the organisational innovative processes we raise the question of the interaction between innovation and corporate social responsibility (CSR), especially gender equality. Our aim is to figure out the patterns of the interaction between innovation and CSR, especially gender equality. According to the international findings on the positive connection between innovation and gender equality (Ubius – Alas 2012; Dezső – Ross 2012), we gather preliminary information to define hypotheses for this relationship in Hungary.

Stream 4: Networking and work-family life balance in the field of engineering

Recent research has called attention to the importance of applying a life-course approach in order to understand individuals' career related decisions more thoroughly (Xie – Shauman 2003). It was shown that during the early tenure track employment family and especially childbearing related difficulties and *work-family life imbalance* have the most significant negative impact on career advancement (Nagy – Paksi 2014). The thesis of the motherhood penalty (Ridgeway – Correll 2004) explains well how women with children find themselves in a disadvantaged labour market position, often being pushed towards the so called 'mommy track' (Wolfinger – Mason – Goulden 2013). Achieving research success from this mommy track is quite difficult for researchers with children. Women often experience disadvantage in mobility and network building (Gersick – Bartunek – Dutton 2000), especially in relation to their work-family life issues (Song 2012). Women – especially young mothers – often have less chance of conference and project participation, therefore of less professional collaborations and publications (Hewlett 2007). Moreover, women are often excluded from informal – mainly male dominated – networks, thus women are prevented from receiving fundamental professional information (Benckert – Staberg 2000). This "men's or boys' club" phenomenon (Phipps 2008)

contributes to the so called chilly climate in academia that can also alienate women from doing science (Maranto – Griffin 2011). In sum, the issue of *work-life balance* and *networking* have recently formed the core topics of "women of science" research (Barnard et al. 2010), but research has also started to focus on the issue of men's work-life balance (Geszler 2014). Nevertheless, little research focuses on how professional women build their personal networks and on how childbearing affects this process. There is little knowledge on individual (age, preferences) and institutional (region, sector of employment, field of science) factors, nor on their deeper mechanisms and interrelations.

In Stream 4, we explore the special features and micro-level mechanisms of male and female researchers' network building and work-family life balance in the field of engineering, as well as the obstacles women encounter during their career breaks in relation to them. With regard to the above, we raise the following questions: What are researchers' preferences for work-family life balance and what are their attitudes towards the necessity of network building? How do researchers build their networks and balance their work and family life, and what are the relations between them? What are the differences according to gender, age, sector of employment and regions? How do childbearing or other career breaks affect researchers' personal network building? What are women's needs, opportunities, tools and strategies for networking during and after their inactive periods?

The Special Issue

This Special Issue on "Academic careers and the value of the PhD degree" is a collection of five articles related to the *Career models and career advancement in research and development* research project. The first three articles are literature reviews of a special topic area of the research project, whereas the two other articles consist of a secondary analysis of previously existing databases.

The *first article* of the Special Issue, written by Anna Kiss, reviews the various methods of scientometrics to model academic careers. Scientometrics has a growing importance in academic career analysis and evaluation. Anna Kiss thoroughly analyses this process, which is "pushed" by rapid development of electronic databases as well as mathematics and network science, and "pulled" by policy ma-

king analysis and career planners. In her literature review, the author contrasts the *traditional* research method of personal-life academic productivity (CV and mobility analysis) with the *new* methods of assessing academic careers, among others, electronic databases that offer a rapidly increasing set of personal data for analysis. Anna Kiss demonstrates that statistical analysis of bibliometric data offers new possibilities to evaluate not just the personal, individual trajectories, but the importance of topics or institutional changes, too. The author concludes that in the future *agent based modelling*, founded on databases or expert opinions, could be an important tool for the estimation and forecasting of different events on academic productivity.

The Special Issue's *second article* studies the female academics' (teacher-researcher) career path from the point of view of work-life balance. The authors, Ágnes Engler, Márta Takács-Miklósi, and Zsuzsa Zsófia Toronyi focus on work-life balance in the public sector that has obtained relatively little attention until now compared to the business sector. As the authors point out, the interest in the higher education field started approximately one and a half decades ago, mainly in the international (overseas) literature. Ágnes Engler, Márta Takács-Miklósi, and Zsuzsa Zsófia Toronyi in the first part of their literature review assess the historical and social background of the work-life balance agenda, then study the Hungarian context of work-life balance in academia, finally illustrate innovative practices and solutions for work-life balance within academic institutions based on international examples.

The *third* literature review of our Special Issue evaluates theoretical and empirical studies on women's networks in academia. In their paper, Veronika Paksi and Katalin Tardos highlight why the role of networks has been gaining utmost importance in research excellence in the past decades. However, the authors demonstrate that access to both formal and informal networks is often unequal for researchers which difference could be caused by discrimination and minority group memberships, such as being a woman or a person of colour. This paper on women's networks in academia firstly provides a short overview on the significance of formal and informal networks in science and how they are gendered, secondly, introduces the different segments of networks in scientific research and activity, namely, the gender differences in the usage and access of these networks. Though adequate net-

working is one of the main elements of a successful academic career, organisational contexts produce constraints on women, causing different networks to be established. Thus the article of Veronika Paksi and Katalin Tardos will highlight the process how research examining networks in organisations shifted from being gender-blind to being gender-aware, particularly in academia.

The *fourth* article in the Special Issue addresses the value of the PhD degree in the Hungarian labour market based on a longitudinal study conducted in three waves (in 2002, 2006–2007, and 2014) among PhD holders. The principal investigator of the empirical research, György Fábri considers the PhD training system in Hungary a real success story on the basis of the doctoral degree holders' opinions. The research shows that they are satisfied with their professional careers and their doctoral degrees both professionally and financially. According to the study, the PhD holders perceive their studies to be useful, however, they enter the labour market with deficient self-management skills. The statistical analysis reveals that it is primarily in the academic and higher education sphere that we can observe a readiness to hire doctorates. In the business sector, according to the article, there is still insufficient knowledge about the usefulness of the knowledge and skills developed during the PhD degree.

Finally, in the *fifth* and last article of our Special Issue, Fruzsina Szigeti and Hajnalka Fényes analyse the European trends for PhD holders in the labour market based on the European Social Survey (ESS). According to the ESS data, women are underrepresented among PhD graduates. Interestingly, the authors found no significant difference with regards to the family status of the two genders, which is not necessarily the case in all other European countries, where, like in Hungary women with PhD degrees have fewer children and are less likely to be married. Furthermore, the study found that women with a PhD degree were more likely to come from families with mothers with high educational level. Concerning career paths, the ratio of paid employment was similar for both genders, while no significant difference existed in the type of labour contract (fixed or undetermined) and in the type of position (employee or entrepreneur) on the European level, although men were significantly more frequently present in managerial positions in accordance with the glass ceiling phenomenon. Consistently, the paper demonstrates that men

with a PhD degree can reach higher income levels compared to women.

To conclude, our Special Issue and the research project itself promote new academic knowledge and policy-relevant lessons in both the Hungarian and in the international contexts. We propose that widening the labour market opportunities for young PhD holders, eliminating gender-related and work-life balance barriers in academia, and further enhancing international collaborations will not only improve scientific performance, but will increase the subjective well-being of researchers, and thus will also have a positive indirect influence on economic and societal development.

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