

UNDERSTANDING AND IMPROVING THE CONTRIBUTION OF DOCTORAL GRADUATES TO INNOVATION AND THE ECONOMY: DEVELOPING THE STATISTICAL EVIDENCE

Final conference - KNOWINNO project on Careers of Doctorate Holders

3 December 2012

Conference report

By Beate Scholz (consultant to the OECD Secretariat)

Conference aims and objectives

The conference aimed to disseminate the findings of recent work carried out by the OECD to improve the evidence base on the careers of doctorate holders (CDH) and their contribution to science, innovation and the economy as a whole. The evidence is of high relevance to policy makers who finance the specialist training of researchers and support their integration in the innovation system; prospective employers in search of specific skills in their workforce, and the individuals themselves who consider whether to pursue doctorate studies and proceed with research or unrelated careers.

The CDH final conference presented the key findings of the OECD project on the Careers of Doctorate Holders (CDH). This project is part of a wider joint initiative started by the OECD, the UNESCO Institute for Statistics and Eurostat under which internationally co-ordinated data collections have been carried out among participating countries to address the traditional lack of statistically reliable data on doctorate holders. Based on the latest available results from the 2010 CDH data collection, the project has gone beyond the analysis of aggregate indicators across 25 participating countries to undertake a co-ordinated analysis of micro data from dedicated CDH surveys. Expert teams from several government agencies and research institutions have collaborated with the OECD to carry out econometric analyses on the factors that shape the labour market experience and performance of doctorate holders across different countries.

1. Welcome to participants: Setting the scene.

The conference was co-hosted by the OECD and the European Commission (EC). On behalf of the EC **Stefaan Hermans**, Head of the Skills Unit at DG Research and Innovation, welcomed the participants and described the policy context. Specifically, he addressed the future role of doctorate holders in the European Research Area. At the beginning of his talk he pinpointed the correlation between R&D investment and GDP growth. Recent EU data shows obvious discrepancies between the leading countries, mainly in the North and West of Europe, as compared to moderate innovators in the South and East. The innovation performance is closely linked to the openness, excellence and attractiveness of the respective research systems, whereby the increased degree of open competition seems to foster innovation in many countries. Currently, approximately 1.6 million researchers worked in the EU-27 countries. Yet, the expected rise of up to 3% of GDP investment in RTD demands for an additional million of researchers, considering that the EU is still significantly lagging behind the United States and Japan in the number of researchers per thousand active labour force. Therefore, it is imperative to create attractive working conditions to retain researchers, especially in industry. As compared to the US, Japan and China the majority of researchers in Europe work in the public sector. Inter-sectoral mobility is to be increased, given that, according to the MORE study, on average only 17% of researchers in the EU indicated they have been employed both in the public and the private sector. However, Europe is in the lead considering the share of new doctoral graduates per thousand population, followed by the US.

In the second half of his talk Stefaan Hermans described the policy implications of these findings: in the Innovation Union project research is one of the flagships and in preparation of Horizon 2020 the political leaders had underlined their interest in research. Of course, all measures have to take account of the main elements driving researchers: an attractive environment providing stimulation and gratification as well as the availability of research funds. Consequently, the EC urges research funding and research performing organisations to give researchers more access to national funding. In its Communication 'A Reinforced European Research Area Partnership for Growth and Innovation' of 17 July 2012¹ the EC defined the subsequent key measures: open recruitment, mobility (including more openness to 3rd country nationals), further implementation of the charter and code for researchers, gender/equal opportunities as well as innovative doctoral training based on best practice. According to the EC seven principles are to be seen as crucial for innovative doctoral training, namely: research excellence, an attractive institutional environment, interdisciplinary research options, exposure to industry and other relevant employment sectors, international networking, transferable skills training and quality assurance. In this respect Stefaan Hermans underlined the value of the KNOWINNO project in that it based its analyses on micro data, which allowed exploring if doctorate-holders envisage a career path, upward mobility and could contribute to economic development.

In his welcome address on behalf of the OECD **Fernando Galindo-Rueda**, Senior Economist at the Economic Analysis and Statistics Division, provided a short overview of the conference programme. He also described the interrelated activities of the OECD's work on science, technology and innovation statistics: measurement guidelines provide the basis for international data collection, leading to the publication of indicators that are used for data analysis, feeding into policy evidence and briefs, thereby contributing to the refinement of measurement guidelines. The CDH project is part of the OECD's Innovation Measurement agenda which aims at developing comprehensive STI indicators linked to measures of economic performance; investing in a high quality and comprehensive statistical infrastructure to analyse innovation at the micro level; promoting measures of innovation in the public sector and for public policy evaluation; defining new and interdisciplinary approaches to capture knowledge creation and flows; and it promotes the measurement of innovation for social goals and of social impacts of STI.

The work on the current project, the preliminary results of which were to be presented and discussed at this conference, was carried out in 2011/12 under the auspices of the OECD's Committee for Science and Technological Policy, specifically the Working Party of National Experts on Science and Technology Indicators (NESTI). It resulted from a joint initiative of UNESCO (UIS), EUROSTAT and OECD. Besides the Careers of Doctorate Holders, the FP7 funded KNOWINNO project also addressed R&D and Innovation in Services as well as Intellectual Property Rights and Knowledge networks and markets. The KNOWINNO project on the Careers of Doctorate Holders contributed to building the CDH indicators and database, to developing and improving the existing methodologies. It expanded the base for comparisons, e.g. including early destination surveys, and provided deeper insights by use of comparative micro-data analysis. These show, for instance, that gender biases are still visible on the labour market. By using other data sources, doctorate holders could also be seen in context, e.g. compared to similarly educated individuals.

2. Session: What do we know about doctorate holders and their careers? Findings from the CDH and related projects

Chair of this session was **Philippe Laredo**, Professor at the Université de Paris-Est (France) and the University of Manchester (United Kingdom). The session provided an overview of the main findings of the KNOWINNO project on the Careers of Doctorate Holders. By bringing together the results from international projects using different methodological approaches, the session aimed to build a consensus on key salient facts that describe the patterns of labour market and mobility among doctoral graduates and researchers.

¹ Cf. http://ec.europa.eu/euraxess/pdf/research_policies/era-communication_en.pdf.

New evidence from OECD statistics and research on the Careers of Doctorate Holders: Findings from the CDH-KNOWINNO project

The presentation by **Laudeline Auriol** Project Coordinator at OECD, was followed by contributions and remarks by leads of the international project team. In her part of the contribution Laudeline Auriol first presented the background and organisation of the project. Most importantly, the project aimed at addressing evidence gaps. In addition to the analysis of aggregate indicators across 25 participating countries, a co-ordinated analysis of micro data from dedicated CDH surveys had been undertaken. Expert teams from ten government agencies and research institutions collaborated with the OECD to carry out econometric analyses on the factors that shape the labour market experience and performance of doctorate holders. Four key areas of work had been selected for detailed investigation: 1) early career of doctorate holders, led by NISTEP/Japan; 2) job-to-job mobility, led by DGEEC/Portugal; 3) international mobility, led by CSIC/Spain and 4) competences and skills of doctorate holders, led by ECOOM/University of Ghent/Belgium. Based on a data coding guide provided by the OECD, ten volunteer countries harmonised their micro data sets in order to implement tabulations and econometric analyses using a common programming code developed by CSIC and NISTEP. The OECD secretariat also carried out a comparative analysis of micro data on doctorate holders and individuals holding other postgraduate qualifications for the United States and the United Kingdom, using the US Current Population Survey and the UK Labour Force Survey.

As a second step Laudeline Auriol presented some key findings of the project:

- The supply of new graduates has increased raising the share of doctorates in the population, with Switzerland, Sweden, Portugal, France and Germany being the top five.
- At the same time the employment and earnings ‘premium’ revealed the high demand for doctorates.
- Higher education and academic careers are the main destination of doctorates, but demand is apparent in other knowledge intensive sectors.
- The probability to work as researcher depends on the field in which the doctorate was achieved; women are still less likely to work in research.
- Earnings vary across countries, gender, research premia, experience, sector pay, field of study, part time and temporary work.

Subsequently, **Toshiyuki ‘Max’ Misu**, representing OECD and NISTEP showed selected results from the Early Career analysis: special focus of the analysis had been on research vs. non-research careers, academic vs. non-academic careers and temporary vs. permanent research positions. Overall, the employment rates of doctorate holders within five years after graduation is significantly beyond 90% in most countries under comparison, with the exception of Israel (approx. 85% employed). The data suggest that in Israel, postdoc-type positions are not as common as in other countries. The concern about temporary positions for new doctorates appears to be much concentrated within the higher education sector. Exceptions are France and Israel. The incidence of permanent contracts among recent doctoral graduates engaged in research is highest in the business sector, again with the exception of Israel. The business sector primarily attracts those specialized in engineering as well as chemical scientists in Japan and the United Kingdom three years after graduation. Gender differences are consistently observed among recent graduates. The employment rates and the share of permanent contracts among researchers for male doctorates exceed those of their female counterparts.

Joana Duarte, from the Directorate for Statistics on Education and Science (DGEEC) in Portugal presented major findings on the Job-to-Job Mobility of doctorate-holders: In all countries under consideration doctorate holders who work as researchers are found to have been less mobile than their counterparts who do other types of jobs (percentage of doctorate holders who changed jobs in the last 10 years, 2009). Not surprisingly, job changes were mainly induced by the search for permanent contracts. Obviously, mobility seems to be highest from all sectors to the higher education sector. Moves to the higher education sector are mostly likely to occur in Portugal, followed by the US and much less likely in Spain or Belgium.

Koen Jonkers from the Scientific Research Council (CSIC) of Spain reported on the international mobility of doctorate-holders: the analysis of the past International Mobility Experience in four countries (Belgium, Portugal, Russia and Spain) revealed: the groups with the highest level of international mobility experience are natural scientists (vs. all other fields of science), can be found in the higher education sector (vs. government and firms), are engaged in research (vs. other occupations), are mainly early career researchers with temporary contracts, specifically recent doctorate holders (with the exception of Spain and Russia) and have a recent international mobility experience. In addition, the analysis of Spanish micro data showed that past international mobility experience is negatively related with having a permanent position. Furthermore, the group of “Female Doctorate Holders with dependents” is less likely to have the intention to move.

Eventually, **Laudeline Auriol** presented the conclusions and prospects of the project: the analyses underline the potential of CDH data to inform policy questions, notably through the use of micro-data based econometric methods. This makes a strong case for improving researchers’ access to data on doctorate holders with a view to promoting the coordinated use of micro-data across countries and conduct more in-depth analyses. Therefore, forthcoming survey collections should foresee future analytical and research intended uses of the data. Utilising mainstream household data sources such as census and labour force data proved to be important. In the future, this requires an explicit effort to capture information on the educational attainment of individuals at a sufficiently detailed level. With respect to the prospects of the CDH project, the revised methodological guidelines and model questionnaire include proposals for capturing new information such as competencies and skills.

In the **Question & Answer session** following the presentation the following issues were raised:

- Q: It might be assumed that the results differ if you consider recent doctorate holders or those at a later stage in their career. In which way could CDH data be used to conduct analyses at different career stages and how could this complement the use of longitudinal surveys:
 - A: The current micro data analysis has focused on the early stage but similar analysis could be conducted for subsequent career stages (sample size permitting); longitudinal surveys might also be considered in the future.
- Q: Are doctorate holders not permanent because they don’t move or might this be due to labour market regulations? Is mobility related to choice or necessity (e.g. need to find employment)?
 - A: As yet, both questions cannot be answered based on existing data. Especially, the causality between mobility and permanency of contract is not entirely clear.

How to track researchers’ careers? Recommendations by the ESF's European Alliance on Research Career Development

Ulrike Kohl, Senior Programme Manager at the Fonds National de la Recherche (FNR) in Luxembourg and **Beate Scholz**, Director of Scholz - consulting training coaching jointly presented the conclusions and recommendations from the European Science Foundation’s (ESF) Member Organisation Forum ‘European Alliance on Research Career Development’ on tracking and monitoring researchers’ careers.

In the first part of their talk Beate Scholz presented the background to the European Alliance on Research Career Development (EARCD) as well as the empirical evidence that the Forum had gained on career tracking among its member organisations. The ESF set up Member Organisation Fora as output-oriented strategy platforms with the aim to address and put into practice the actions described in the ERA Roadmap by ESF and the European Heads of Research Councils (EUROHORCs) of 2009. Member Organisations are supposed to develop joint actions and common procedures on specific issues, based on identified good practice. In this respect the EARCD has addressed item 2 of the ERA Road Map, namely to promote European research careers. It is composed of 21 member organisations from 19 countries and 7 European level observers (including the European Commission and the European Research Council (ERC)) and has aimed at adopting a common strategy to ensure the attractive-

ness of research careers in Europe, based on an evidence-based policy approach. Results and recommendations have recently been published in the report ‘Research Careers In and Beyond Europe’². In 2011 the EARCD conducted a survey³ among its member organisations, which addressed major fields of its activities, such as career tracking, continuous professional skills development, new concepts of mobility and peer review. On career tracking the survey revealed that ESF’s member organisations lack a common understanding of career tracking and, thus, missed a common denominator. Therefore, it seems more appropriate to speak about career surveys rather than career tracking studies. Yet, some commonalities could be found: the studies mostly referred to doctorate holders and widely ignored other career stages of researchers. They were mainly programme evaluations or monitoring reports, based on surveys or database analyses. The level of study was either national or organisational.

These results induced the EARCD to conduct an international workshop on ‘How to track researchers’ careers, held in Luxembourg on 9 and 10 February 2012 and co-hosted by the ESF and FNR. In the second part of the talk Ulrike Kohl presented key elements and results from the workshop. She especially referred to the workshop report that is now available online⁴. A major contribution of the workshop was to provide a typology of approaches to career tracking and to present a number of examples of good practice, namely:

- International undertakings, such as the OECD CDH project,
- Large-scale national or regional initiatives, e.g. US NORC Survey of Earned Doctorates; US-NSF Survey “PhDs-10 yrs later”; US Ford Foundation’s “Social Sciences PhDs – 5+ Years Out”; UK „Where do researchers go” ; German „ProFile” panel survey,
- Register/Administrative Data: examples from Flanders, Denmark, Norway,
- Institutional Initiatives, such as Wellcome Trust (United Kingdom); CIFRE Fellowships (France); FWO Senior Researchers Survey (Belgium); Alexander Von Humboldt Alumni Survey (Germany); European University Association (International/TRACKIT).

The workshop also resulted in offering practical guidance on how to set up a career tracking study including a definition of the different phases of the implementation process of respective studies. At the end of the workshop conclusions were drawn, e.g. researchers’ and PhD holders tracking studies should complement national statistics or data registers as well as programme evaluations and indicator based follow-up studies. In the future, terminological and methodological concerns should be addressed, integrating novel approaches to career tracking, especially using social media. One of the major outcomes of the workshop was the recommendation to set up an International Platform for Research Career Tracking and Monitoring, which is now being developed under the auspices of the ESF.

Mobility Patterns and Career Paths of EU Researchers (MORE)

Miriam Van Hoed, Senior Consultant at IDEA Consult in Belgium, presented selected findings from the MORE2 project, which aims at a continued data collection and analysis concerning mobility patterns and career paths of researchers. She focused on presenting the objectives and set-up of the MORE2 project and on preliminary results of the higher education institutions (HEI) survey (work package 1 of the project). The objectives of the MORE2 project are “to provide internationally comparable data, indicators and analysis in order to support further evidence-based policy development on the research profession at European and national level”.

The HEI survey targeted researchers currently working in academia, including PhDs, in the EU-33 (i.e. EU-27 plus associated countries). The thematic scope of the survey encompassed different forms of mobility, namely geographical mobility (short term, long term and non-mobility), inter-sectoral (private industry sector), virtual mobility (and its influence on geographical mobility) as well as barriers, motives and effects of mobility with special attention to the attractiveness of the EU. It also considered researchers’ collaboration, career path and working conditions, PhD qualification (including

² Cf. <http://www.esf.org/activities/mo-fora/european-alliance-on-research-careers-development.html>.

³ Cf. http://www.esf.org/fileadmin/links/cssd/mo_fora/careers/MOF_RC_surveyreport_final.pdf.

⁴ Cf. <http://www.esf.org/activities/mo-fora/european-alliance-on-research-careers-development.html>.

training, working conditions and mobility) and awareness of EU policy initiatives. Statistically, 10,547 valid observations were included in the final sample, thereby representativeness could be achieved at country level for all EU-33 countries.

Subsequently, Miriam Van Hoed presented selected preliminary survey results with respect to:

- **Gender:** 38% of researchers in Europe are female. Female researchers are less represented in higher career stages, but more represented in part-time work, and they are less confident about their future career prospects. A lower share lives in couples or with children, which might be due to either age factor or to difficulties of combination with an academic career. To some extent they are less mobile than men for all types of mobility under consideration.
- **Job insecurity in early career stages:** Satisfaction with job security proved to be lower in earlier career stages, especially R2 (post-doc or equivalent). R2 researchers are most dissatisfied with the degree of independence and opportunities for advancement they are facing. Fixed-term contracts overall account for 34% of researchers, but are most pronounced in early career stages. Stable positions are reached only in late career stages; there is an increasing share of permanent positions in higher stages. Thus, R4 (leading) researchers are more satisfied with job security and opportunities for advancement than R1 (PhD or equivalent) and R2 researchers.
- **PhD and structured doctoral training:** 90% are enrolled in PhD programmes. Doctorates are more likely to reach a research career when they have followed a structured doctoral training, but there are marked differences between fields of science with lowest amounts in the natural sciences and highest amounts in the social sciences. Content-wise the training is not substantially targeted to intersectoral mobility or non-academic labour market entrance. Yet, a high degree of satisfaction can be observed with respect to the relevance of qualification. The Scandinavian countries rank high in terms of all aspects (number of researchers, amount, relevance). 22% of doctoral candidates have work experience outside academia during their PhD (1/5 in private industry; 2/5 in the private not-for-profit sector).
- **Mobility:** Regarding the geographical mobility, increasing PhD degree mobility can be observed over time: researchers who are currently in their doctoral stage (R1) are substantially more mobile than their counterparts in later career stages. When a high share of researchers moves to a country to obtain a PhD there, the share of researchers that are mobile during their PhD in this country is lower and vice versa. Destination for mobility during PhD is mainly the EU (70%), with the United Kingdom, Germany, France and Italy being the most important destinations. For post-PhD geographical mobility the MORE2 HEI survey observations are in line with the three main findings on destinations based on the CDH 2009 data: Europe (as a whole) is the main destination region, but the United States are systematically among the three first destination countries, and the three largest European countries (France, Germany and the United Kingdom) appear among the favourite destinations, as well as those countries that have strong historical, cultural or linguistic links with the reporting country. Indications of differences in mobility culture can be found between fields of science: In the humanities and, in particular, in agricultural sciences, long term mobility is relatively less occurring than on average while short term mobility is more common. Natural sciences are the field with relatively high rates of both short and long term mobility. Concerning the effects of geographical mobility, the evidence points to increased output due to mobility; effects on career progression, job opportunities and remuneration are most obvious for researchers at the R2 stage. Regarding virtual mobility, it should be noted that 66% of collaborations are with EU partner(s) and 50% with non-EU partner(s), such collaborations are often the result of mobility. Collaboration is more likely to occur within academia, in later career stages and when the partners had been at least once long term mobile.

In the **Question & Answer session** following the presentation the following issues were raised:

- Q: How was the sample composed?
 - A: Based on the EU MORE database and web search. It did not include researchers in the private sector. The sample is representative of countries and fields of science.
- Q: What did the questions about intersectoral mobility refer to?
 - A: If the researchers have been mobile, between which sectors, if they held dual positions and which types of contract they had signed.

Roundtable 1: Implications for the training and the supply of doctorate holders

Roundtable moderator was **Luis Sanz**, Director of the CSIC Institute of Public Goods and Policies in Spain. The starting point of the roundtable was the observation that doctoral graduates hold a degree at the highest end of the educational spectrum having undergone a period of dedicated training to develop research and related competencies. The supply of graduates depends on individual and policy decisions, which may benefit from better evidence on the private and social returns from such investments. The roundtable was, thus, asked to consider questions such as: What is the value of information on research careers to prospective doctorate students? How does doctorate training align to current and expected demand for researchers? Is it meaningful to talk about too few or too many doctoral graduates being trained?

In his statement **Fernando Galindo-Rueda**, Senior Economist at the OECD, first referred to his own experience in doing a PhD in labour market economics. At the time, he lacked information about future career opportunities notwithstanding his own mobility experience. He then reported some findings of the micro data analysis for the United Kingdom and the United States, considering doctorate holders and similarly high qualifications: women are catching up in both countries, despite the fact that real earnings are declining overall. Concerning the wage premium, the willingness to pay for doctorate holders is increasing. However, the current surveys do not yet allow exploring the reasons. Salary increases can be found in relation to the career trajectories. Yet, in the United Kingdom, opportunity costs for doing a doctorate seem to be higher than in the United States: doctorate holders in early stages of their career are lagging behind on the salary scale. This is no issue in the United States. With respect to the use of their skills, it was observed that access to other sectors that had not been on the individuals' agenda at first glance became possible.

Sveva Avveduto, Director of the Institute for Research on Population and Social Policies at the National Research Council in Italy, focused on the value of information on R&D careers, the alignment of demand and supply and the question whether too many or too few doctorate holders are being qualified. She pointed out that all of these questions are inter-related. Yet, it is difficult to generalise in so far as doctorate holders are concerned, e.g. a person in their 20ies doing a PhD in mathematics could hardly be compared to a historian in their 40ies. In addition, there might be quite different motivations to do a PhD. Some surveys stressed negative aspects of doctoral careers: many persons in starting a PhD might do so with the intention to become a professor. Consequently, the necessity to move to other sectors is still seen as failure, yet this might change over time. Therefore, labour market information is essential for the decision to start a doctorate and for making better career choices. The need for training to prepare for a career outside academia is obvious. The importance to develop better professional skills has been underlined by the CDH project. The question whether too many or too few doctorate holders are being trained is impossible to answer, one could only state that too many are being trained if all should pursue an academic career, but when trained for other sectors there will be never enough.

Emilda Rivers, Programme Director at the National Science Foundation in the United States, also stated that from her point of view the lead questions of the round table discussion seemed inter-related: the value of information on research careers could not be over-estimated. However, data needs are still to be clarified, depending on what the community wants to convey and what students understand. There has been a constant focus on tenure track, but more doctorates are now moving in non-academic sectors. Are skills changing with the diversification of careers? This has to be reflected in data collection efforts. Additionally, it seems necessary to shift focus in conversations: from the paradigm of 'pipeline careers' to 'career pathways'. Furthermore, information on generic or professional skills is paramount, e.g. considering whether the doctorate has been achieved in a lab or outside, whether a leadership experience was linked to it. Issues such as diversity, creativity and teamwork also matter, expectations on the side of the doctorate holder may be different from those on the side of

employers. Another issue relates to whether postdocs should be considered in a training phase or in employment. Regarding the question whether too many or too few are being trained the focus has always been on the supply side. Recent data show a declining number of PhD recipients in the humanities and social sciences, whereas numbers are on the rise in the biomedical sciences. In this respect she also referenced a survey on the biomedical workforce, which was carried out by the National Institutes of Health in the US.

Janet Metcalfe, Chair and Head of Vitae in the United Kingdom, started off by asking, what is a PhD for? Traditionally, the PhD was seen as a vocational qualification for academia, increasingly it has become a generic qualification for other professions. This development has been fostered through professional PhD programmes. In the United Kingdom a 38% increase in PhDs could be noted and employment rates suggest that there are never too many. The supply of doctorate holders depends on funding. Here, the value of public investment needs to be better acknowledged. On the supply side, also the attractiveness of doctoral degrees counts, i.e. if the brightest could be found in PhD programmes. It could be shown that the thought to achieve a PhD develops during the undergraduate phase and is linked to research experience gained during this formative period. The decision to go for a PhD is mainly taken because of the interest in the topic and affinity for the subject, whereas the question “What am I going to do afterwards?” is only raised very late, mostly in the final year of the doctorate. Hence, data are important to help doctoral candidates make a decision and also for supervisors to help with career advice. On the demand side, UK analyses based on the labour force survey proved the high employability of doctorate holders. Interviews showed that more are actually doing research than statistics suggest. When considering the impact of doctoral programmes, analyses need to ask, where do PhDs make a difference, e.g. in terms of innovation and spillover, increasing the impact and performance of people around them? Regarding the personal impact, the quality of life and how contributions to social circumstances develop needs to be taken into account. On the employers’ side the perceptions of which skills and attributes doctorate holders should bring along varies. There is a clear dichotomy between those who are exposed to doctorate researchers and those who are not. In conclusion, no differentiation should be made between doctoral programmes preparing for academia or for other career options. In conclusion, the set of EU principles hold and both the knowledge base and the professional skills are important.

Following the four statements a **general discussion** took place addressing the following issues and raising subsequent arguments:

- Quality of doctoral candidates’ results and quality of research environment: it was felt that the focus of surveys was too much on input, rather than on the quality of results at the completion of the doctorate. Doctoral candidates are urged to become professionals within 4 years maximum and are supposed to provide new contributions to knowledge; they also need to learn how to teach and the competence to define their own research topics.
Panel members argued that the level of supervision, the quality of infrastructure and the acquired competencies have proved to be most valuable for employability. Research environments will change in the future. In line with these developments the definition of what is a researcher will evolve. Therefore, it will be essential to try to anticipate and train to what is needed in 10 years time.
- Need for signals to markets on quality of supply of PhD candidates: accreditation and rankings of doctoral programmes would be helpful. Here marked discrepancies can be observed between the US and Europe. What impact of rankings could be expected at national level?
This discussion on this issue was quite controversial: one argument was that the question of rankings needs to be seen in line with the question of evaluation of doctoral programmes, which is still lacking in many countries. Another panel member warned to be careful about the use of such information: which are the right institutions to do such rankings? Based on which information: publications or contributions to individual firms in the region? Focussing on publications might evoke negative reactions by employers, for instance the expectation that doctorate holders might be over-focused and, thus, lead to negative expectations with respect to running a company. Another panel member suggested considering rather the quality of supervisors and institutions, which are vital

for doctoral candidates' choice. In the US rankings of doctoral programmes exist. Yet, employers seem to be more interested in the person of the doctorate holder and the area they are interested in and they only take a second look at rankings. A participant from the audience pointed out that career tracking surveys might help to identify where the successful institutions are, given that some institutions tend to appear more frequently on the CVs of successful people. Another participant advocated that there is no obvious correlation between the quality of an institution in general in relation to the level of quality it achieves in a certain field.

Round Table 2: The global competition for talents and diversity of career paths: what use is being made of doctorate holders' competencies?

Moderator of this roundtable was **Hans Borchgrevink**, Special Adviser at the Research Council Norway and Chair of the Working Group 'Monitoring' of the ERA Steering Group on Human Resources and Mobility. The starting point of this round table was the expectation that transferable skills help researchers pursue varied careers and contribute to better research outputs. These skills can ultimately enhance research and innovation performance. However, the context in which doctoral graduates disseminate knowledge through mobility and collaboration is rapidly changing, becoming increasingly internationalised. Against this background the roundtable was asked to consider the evidence on the most valued competencies among doctorate holders, the impacts of mobility and collaboration on their career prospects. It was also asked to reflect upon policies that are being designed to promote the use of doctorates' skills.

Hugo Horta, Researcher at the Centre for Innovation, Technology and Policy Research (IN+/IST), at the Technical University of Lisbon in Portugal, reminded the audience that different countries are in different stages of development: in some countries, e.g. developing countries, the need is first and foremost to have their faculty trained. There are countries where only 50% or less of faculty hold a doctorate. In such contexts doctoral training has to serve the purpose to improve teaching, rather than qualifying for jobs outside academia. With respect to mobility he emphasised that the impact is different for different stages of the career and that national specificities need to be acknowledged. In Portugal and Spain mobility is rather low as a consequence of the regimentation of sectors. Such differences underline the necessity to look at the CDH results from a national point of view, in that the respective national research teams are able to contextualise and interpret trends. Yet, it needs to be noted, that it may be difficult to acquire data for all sectors as some are not easy to access and response rates may be considerably low. Looking to his own country he saw room for improvement considering the exploitation of CDH data.

Rosa Fernandez, Economic Adviser at the Department for Business, Innovation and Skills in the United Kingdom, reported on some of the results of the work on transferable skills by the OECD Working Party on Research Institutions and Human Resources (RIHR). She advocated to remove barriers from knowledge production in academia to be used outside academia and vice versa. More focus on the transferability of results was needed. Some companies allow their researchers to spend 25% of their time on own projects. Current surveys on the transferability of results reveal persisting discrepancies between countries. Some countries have well-structured programmes in place to foster transferability, whereas this is not the case in other countries. With respect to mobility it is essential to understand the types of skills that are related to moves as well as the patterns of moves between academia and industry. Affiliations, which are mentioned in publication records, could be used as additional source of information to follow the careers of doctorate holders over time. Yet, evidence is still poor regarding the incentives for moves as well as regarding obstacles to mobility. In this respect it would also be important to know what the benchmark for mobility could be and when mobility could be too much: international mobility of researchers is seen to have a positive impact on productivity, but sometimes the mobility experience might not be long enough, which could be detrimental to the stability of working relations and eventually the quality of results. With respect to skills development it would be interesting to understand specifically how the academic sector uses the skills of researchers.

Karen Vandevelde, Senior Researcher at the Centre for Research and Development Monitoring, ECOOM at the University of Ghent in Belgium, stated that we only have anecdotal evidence on the value of doctorate holders to the economy. Results of the CDH project indicated that some countries produce just enough doctorate holders to meet higher education sector demands, whereas others produce far more. However, universities should not be there to produce doctorates just to meet the needs of the economy. A far more visionary approach is needed. There may be several returns on investment before economic effects appear in the longer term. Doctorate holders should be considered as pool of “passionate talent”, given that they stand out regarding teaching abilities or team management. Their competencies do not differ so much whether they are used in the academic sector or outside. Do we make the most of these competences? In the same sense the notion ‘innovation’ should not only be linked to economic innovation, e.g. newspaper writers could contribute to the dissemination of scientific results. International statistics on competencies require the development of a new approach to the use of data, combined with anecdotal evidence. Interpretation of statistics needs to be linked with interpretations by other stakeholders. A recent survey in Flanders has shown that the failure to meet the first career choice does not necessarily lead to disappointment, even if 75% originally wanted to do research.

Laura Cruz, Senior Researcher at the Scientific Research Council (CSIC) in Spain, started off by pointing out that mobility is important for creativity. Already a single mobility experience can bring more to an individual than some programmes can achieve. To organise a move, own initiative is required, e.g. in order to get hosts interested, communication and cooperation skills are essential to the same extent as time management skills. All these aspects should be seen as side effects of mobility. In essence, mobility improves the human capital of the individual and this should be acknowledged. Evidence from the MORE and the CDH projects show that early career mobility leads to further mobility. However, persisting mobility barriers are related to labour markets, which often penalise mobile researchers. In any case the assumed positive correlation of productivity and mobility needs to be checked with a control group. On the issue of skills, policies are needed to make better use of acquired skills. In the recent past there has been too much emphasis on soft and transferable skills. These should not be over-emphasised vis-à-vis technical and research skills, which has become a problematic trend in some doctoral programmes. Especially, PhD qualification should not be tailored to short-term market needs. Another problematic trend is that the validation of research is very much focused on output data, namely publications, but does not take into account skills that are not necessarily associated with outputs. These should be seen as individual asset, as they lead to social returns. Hence there is a gap to be filled in between the skills and the outputs and the institution represents the missing block. More policy attention should be devoted to institutions.

Following the four statements a **general discussion** took place addressing the subsequent issues:

- Aspirations for a research career: What induces graduates to do a PhD other than aspiring at a research career?
The survey in Flanders showed that even if 75% of doctoral candidates originally indicated their principal interest in a research career, they did not necessarily want to pursue an academic career, but expected that this qualification will open new opportunities. Similar results were achieved in the UK with about 80% aspiring at a research career, 50% staying in academia immediately after the doctorate and 5-10% remaining in academia in the long run. Another remark referred to the benefits of industrial PhD programmes which allow companies to attract PhD candidates aspiring at a career outside academia at an early stage.
- Benchmarks for mobility: A recent survey from Portugal in cooperation with Japan has shed light on the relation between job-to-job changes and publications. Already three to four changes of institutions pointed to a decreasing level of engagement of an individual within the new institution. At the same time the expectation on the institution’s side regarding a candidate’s commitment would decline with the number of moves the candidate has previously undertaken. In this respect part-time leaves on time-bank basis can be useful, as they do not force a researcher to actually leave an institution.

- How to measure skills that can't be measured in terms of output? This issue raised a controversial discussion: one statement advocated not to oppose soft and hard skills as they go hand by hand. The difficulty to measure certain skills does not imply they are not important. In this respect skills development should be seen as a lifelong task. It was questioned whether skills should be seen as by-product of doing research or whether they should be developed in specific contexts and by means of human resource development measures. Looking at the employers' side outside academia there seems to be special interest in technical skills rather than additional competencies. If this should be the case it seems legitimate to question the rationale for public investment in skills development and related social returns. A counter-argument might be that skills developed during the doctorate might not prepare for the specific requirements of a given company. That is why many companies invest in additional training-on-the-job measures.
- The self-evaluating approach of the British Researchers' Development Framework (RDF): The RDF focuses on supporting the self-understanding of skills and raising the awareness of employment opportunities. In line with this approach, the CDH project has included an assessment of competencies from the doctorate holders' point of view. A question referred to the extent to which institutions have adopted this holistic skills approach. Janet Metcalfe from Vitae pointed out that institutions analysed findings from the RDF at the policy level in order to decide to which elements resources should be allocated, which fields to train researchers in and where to provide career advice.

Concluding round table: Towards an evidence base on researchers and doctoral graduates to meet future policy needs

Ward Ziarko, from the Federal Science Policy in Belgium and Chair of the OECD Working Party of National Experts on Science and Technology Indicators (NESTI), was moderator of the concluding round table. The starting point for the round table was that the CDH project has highlighted a number of opportunities and challenges for developing an evidence-base, which policy makers can use for informing their decisions. This evidence can also be of high value to individuals and employers. The purpose of this session was, thus, to identify key steps that can be adopted to improve the quality and impact of these studies, identify new relevant sources, improve the statistical infrastructure and, in particular, by integrating and linking various sources facilitating access for research and analytical purposes.

Peter Witten, Policy Officer at DG Research and Innovation at the European Commission, underlined that as a result of the CDH and the MORE projects as well as of diverse tracking studies, indicators and bibliometrics analyses, better data were available. He announced that the EU Researchers Report is now available online on the Commission website. However, it seems necessary to ask how the different exercises could complement one another and how mutual learning could be achieved while at the same a certain "survey fatigue" needs to be avoided. The asset of the CDH project is to provide many policy relevant data and to fill existing gaps, e.g. in that it allows for comparison with the US. In addition, through the KNOWINNO project it has been possible to add countries like France or Japan. Future challenges that need to be addressed refer to the time-lag of data and to the dissemination of results. Open questions are, for instance, how to get other countries to carry out CDH surveys and use complementary resources? How to get other countries to make micro data available online? And how to get more academics to do more studies on data?

Peter Elias, Professor at the University of Warwick in the United Kingdom, came back to the question that was formulated earlier during the conference: "What is a PhD for?" Given that the original purpose had been to train staff for the highest level of the higher education system and given that more and more doctorate holders do not follow a research career the question may come up on the extent to which public investment in PhD training is justified. In this respect, it is clearly helpful to receive information, advice and guidance from career tracking studies. Yet, the impact side is more difficult to capture as evidence is either weak or not existent: how could the assumed link between PhD training,

growth and innovation be proved? Still, the impact of mobility is not fully understood. Usually, the data allow only for a backward look while the impact can only be understood 10 to 15 years later. He argued that information should be manageable and digestible. With this, he formulated a wish list:

- to obtain more information on PhDs in their institutional context (charity, company, research institute), as not much is known about the nature of organisations and employers often do not know how many PhDs they employ; in this respect linked employer-employee databases would be useful,
- to conduct more tracking studies, as the existing ones tend to suffer from bias and attrition, i.e. those who are tracked are usually the successful;
- to reflect on alternative approaches: here the Brazilian Lattes platform could serve as example of good practice,
- to get better evidence on how research funders distribute funds between different fields: what is scientific evidence regarding the impact of the different fields according to which funds are allocated?

Luis Sanz, attending this session as Chair of the OECD Committee for Science and Technology Policy, mentioned the considerable amount of initiatives to provide us with empirical and bibliometric information. Yet, he saw room for improvement referring to principles and methodologies. Especially, the harmonisation of categories and terminologies seems crucial. In addition, some kind of guidelines for data collection will have to be defined. Open access to micro data is also crucial. It is evident that policy statements are sometimes based on weak evidence, from which political principles are then derived. Therefore, it needs to be asked what is actually precluding from moving to a single market for researchers? What are the policy needs? How to make choices, also for funding? Attracting policy-makers to discussion is paramount in order to measure the impact of policies and choices or non-decisions. In addition, complementary approaches are needed that allow for much deeper institutional analyses. Overall, there is a need to consider the contextual environment of research careers, especially in times of crises in order to uphold governments' investments e.g. in doctoral training measures.

Ken Guy, Head of the Science and Technology Policy Division at the OECD, started by looking back in history. Fifty years ago at the founding of the OECD the need for a directorate for science and technology had earnestly been questioned. Nowadays, it is beyond doubt that governments have own interests in evaluating their programmes and the human resources element is critical to any input to decision. However, the actual evidence base in this field is still meagre, but policy-makers seem to have understood the relevance of basing their policies on evidence. The Innovation Union Communication has highlighted this. The OECD's Working Party on Research Institutions and Human Resources (RIHR) have expressed their continuous interest in this field and will in the future pay special attention to such issues as impact assessment, e.g. the economic impact of PhD training, changes in science, e.g. new emerging areas, that require new skills or new combinations of skills and thus different training settings.

With the closing of this round table the conference ended.