# Doctoral degrees beyond 2010: Training talented researchers for society

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**It is talent more than technology that society or business needs from universities.**

Research and the people trained in it inspire many of the ideas, aspirations and actions that contribute to the vitality of society and its capacity for bold creativity in responding to whatever the future might bring.

The prime function of leading-edge research is to develop new understanding and the creative people who will carry it into society.

Most European researchers are trained in universities, and have their attitudes and perceptions formed in them. Universities' productivity in fundamental research, the seed corn for the whole research base, has been prodigious, assisted by their access to the best talents of the rising generation and the creative influence of the irreverent young.

It is crucial that some of the best intellects in each generation continue to be attracted to research careers, and are given every opportunity to grow in confidence, capacity, ambition and creativity.

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## Summary

This paper sets out the League of European Research Universities' (LERU) vision for doctoral education beyond 2010.

- Doctoral programmes at LERU universities aim to train researchers to the highest skill levels to become creative, critical and autonomous intellectual risk takers in pushing the boundaries of frontier research.
- The modern doctorate is at its core determined by an interplay between professional research experience and personal development, the most important outcome of which is an individual trained to have a unique set of high level skills.
- Doctoral graduates must make a significant original contribution to knowledge as judged by a panel of experts.
- The modern doctorate is an excellent training for those who go into roles beyond research and education, in the public, charitable and private sectors, where deep rigorous analysis is required.
- The business of research and innovation in the knowledge economy is international, interdisciplinary and increasingly intersectoral. Doctoral graduates should be trained in this context. If Europe is serious about its objective 'to become the most dynamic knowledge society in the world' strong support of doctoral education is a vital.
- In order to provide a fertile research experience, doctoral training should be concentrated in research-intensive environments where excellence is fostered. This can be in single institutions or in collaborating groups of institutions.
- We provide recommendations for employers, national governments and the European Parliament and Commission, for universities and for doctoral candidates.

## The role of doctoral training in advanced knowledge-based economies

1. Frontier research is recognised as a key factor in success for advanced knowledge-based economies (Bruegel, 2008; European Commission, 2009; LERU, 2009; LERU, 2006). The Lisbon Agenda and its successor, the EU 2020 Strategy,[1] seek to strengthen the research basis in Europe to develop an advanced knowledge-based economy.

2. As was stated in the European Research Area Board report 'Striving for excellence is the only choice Europe has' (European Commission, 2009, p. 25). To fulfil Europe's aspiration to become 'the most dynamic knowledge society in the world' frontier research must be developed in an environment that promotes excellence. Such high ambitions require an environment in which universities are able to decide how and where to strive for excellence among the diversity of roles and missions they carry: excellence in research, in teaching, in regional innovation, in lifelong learning, and in community interaction. Doctoral education, because it provides the highly talented human resources that are necessary to undertake the ambitious research and innovation plans, is a vital element in making this ambition happen.

3. Doctoral programmes prepare researchers to the highest level to make important contributions to frontier research. In addition, doctoral graduates are well-prepared to take up roles in driving complex changes in society: to explore unknown frontiers of knowledge, to anticipate the questions that will matter in tomorrow's world, to take the intellectual risks by which major breakthroughs come, and to take action on the basis of these insights. Doctoral graduates deliver the advanced research skills necessary in professional sectors beyond frontier research and education: in applied research, in policy making, in management, and in many other leadership roles in society.

1 An overview of the European Commission's policy initiatives related to the Lisbon Agenda and EU 2020 Strategy can be found at: European Commission. 'Lisbon strategy for growth and jobs. Towards a green and innovative economy.' http://ec.europa.eu/growthandjobs/index_en.htm

4. PhD graduates progress to a very wide range of careers as shown in a number of case studies in this report.[2] While historically it was seen as a qualification for an academic career, in many countries and among many employers the doctorate is now seen as a high level qualification that trains people to think deeply and rigorously about a subject and to translate this knowledge into novel opportunities for society. However, this view is not yet sufficiently appreciated by all employers. This document aims to clarify the vision that LERU universities have for their doctoral education and to highlight the particular unique set of skills that our doctoral researchers develop in the course of their training.[3]

5. Doctoral education is at the centre of the mission of the members of LERU and of other research-intensive universities. The 22 LERU universities produce more than 11,000 doctoral graduates each year, which constitutes around 12% of the 96,000 produced in Europe's 4,000 doctorate awarding universities (European Commission, 2007; Bruegel, 2008). Training of researchers is a key part of the mission of all LERU members and the doctoral candidates themselves are part of the engine of the research that we pursue.

6. The big intellectual challenges which confront the world do not recognise boundaries. Knowledge is developed, marshalled, and disseminated in international fora and congresses. Cross-fertilisation between disciplines breeds much of the new thinking in the modern world. Major challenges for society feed research in our universities, and findings of university research are tailored and exploited in society. The business of research and innovation in the knowledge economy is therefore international, interdisciplinary and increasingly intersectoral and this must be reflected in the organisation of doctoral education.

7. Doctoral education must be embedded in a strong research environment and culture to ensure that the opportunities for cross-fertilisation between disciplines can foster the necessary breadth and interdisciplinarity. For this reason we believe that doctoral education is best undertaken in research-intensive institutions or in partnerships where the benefits of a wide range of research activities can be exploited.

8. Our purpose in this document is twofold:
   - to present our vision for the PhD degree (and its equivalent) at research-intensive universities going forward beyond 2010,
   - to create a better picture for employers of the skills that doctoral graduates from LERU universities have and how they can help drive change.

9. The document is aimed at:
   - potential PhD employers (large and small) especially those beyond academia,
   - governments and government departments as drivers of innovation policy and as funders of doctoral education and as employers,
   - politicians, their advisors and their policy discussion support organisations and think tanks,
   - all public and private funders of doctoral candidates and research training,
   - management, staff and students of universities who provide, or aspire to provide, doctoral programmes,
   - student unions and the student body.

10. The paper discusses the purpose of a research degree, the needs of graduates and employers, the characteristics of PhD graduates, a model of the modern doctorate, the key role of skills development within this model, and implications for universities. The paper contains a number of case studies highlighting some of the specific skills that our PhD graduates exemplify and ends with recommendations for employers, governments, universities and doctoral candidates.

## The purpose of a doctorate

11. Research degrees at doctoral level aim to take bright Masters graduates with an excellent academic track record (sometimes with work experience) to become

2 In this report we use the title PhD to refer to all research-led doctoral degrees where the primary measurable output is the doctoral thesis. Of the many alternative titles used throughout Europe this is the most universally recognised one. We use the term PhD graduates or doctoral graduates to refer to those who have obtained a PhD or equivalent.

3 We use the term doctoral researchers to refer to those who are engaged in doctoral training the intended outcome of which is a PhD degree as defined in footnote 2.

creative, critical, autonomous researchers. [4] The evidence of success of the doctorate is a thesis which contains a significant original contribution to knowledge in the chosen field, with the arguments successfully defended by the candidate through questioning by experts. Detailed characteristics are described in (LERU, 2007).

12. The process of doctoral education develops in the candidate a range of skills to a very advanced level. These skills relate not only to the research process itself, but also to a broader personal and professional training and development. The latter skills are often labeled as 'generic' or 'transferable', because they are valuable not only for the successful completion of the doctorate, but also for career development after the doctorate in a wide range of professional sectors.

13. By training inquisitive, independent doctoral graduates European universities fuel the objectives of the Lisbon Agenda and its successors for an advanced knowledge-based economy. Since many doctoral graduates seek careers beyond the EU, either by returning to their country of origin or seeking career options abroad, Europe's universities are proud to contribute to the advancement of knowledge in other parts of the developed and developing world. Taking into account that 16.9% of doctoral students in the EU's universities come from third countries (European Commission, 2007) and that within LERU universities the number can be as high as 35%, it is clear that the research efforts of the European Union benefit from the choice of some non-European doctoral graduates to stay and work here.

## Needs of doctoral graduates and their employers

14. People embark on a doctorate for professional advancement or for personal interest in the topic, or a combination of both. Some graduates will go on to become established independent researchers. Others will become professionals in complex and often multidisciplinary settings where they will creatively apply their doctoral expertise, skills and experience. The number of doctoral graduates that go into non-academic careers is high, although it varies significantly among EU countries, and continues to grow, indicating a strong demand for the skills that a doctorate instils beyond the education sector.[5]

15. *University academic staff*. This is where the traditional demand for PhD graduates used to reside. Most universities, whether or not research-intensive, require a doctorate for recruitment to academic positions. A doctorate is necessary in order to pursue a research and teaching career, but also is seen as usually necessary for those planning to teach only at Bachelors and Masters level as staff are expected to keep up with research trends to keep curricula fresh and current and to fulfil their role as 'stewards of the discipline' (Walker, Golde, Jones, Bueschel & Hutchings, 2008). The age distribution in Europe's universities and the planned expansion of higher education indicates stronger demand from this sector in the future (Bruegel, 2008; OECD, 2007). The focus on both discipline-specific and generic skills in the doctorate is also seen as beneficial by universities since staff are expected also to fulfil administration, management and knowledge transfer roles which require diverse skills.

16. *Research in the public sector, charities, industry and commerce*. The number of research jobs in these sectors, especially in the light of EU research spend targets, is expected to grow. Changes in doctoral education have come about in some countries particularly as a result of the influence of these sectors. Employers in the public sector, charities, industry and commerce seek trained researchers who can apply their research skills to new areas necessary for their business development in industry and commerce, or where social change drives the public and charitable sector to change its focus. The need for rigorous, well-informed, painstakingly executed research is strong in the light of increased public scrutiny resulting from greater disclosure and the explosion of information in the public domain.

4 Some countries allow outstanding Bachelors graduates, or candidates with relevant experience, in some disciplines to enter directly to the PhD. However Masters level entry is the norm. Research Masters programmes aim to introduce candidates to the research process or to prepare them for doctoral study. Although this paper recognises the importance of research Master programmes, it does not deal explicitly with them.

5 For example, in the UK approximately 50% of UK domiciled doctorates enter jobs in the education sector (Vitae, 2009). Doctoral graduates typically move through a range of positions before they settle into a specific career path so accurate figures for those entering academic positions are difficult to obtain.

17. *Non-research jobs.* In some countries there is strong and growing demand for doctorates in areas that have not traditionally been seen as research careers (e.g. law, finance, management, management consultancy). These areas seek employees trained to the highest levels of excellence who can marshal and seek large amounts of evidence for complex decision making. With doctoral education developing these skills, there is a need to highlight to both students themselves and to potential employers the sophisticated transferable skills that researchers develop during their doctorate.[6] Universities recruit doctoral graduates for administrative positions both because of their advanced skills but also because of the greater insights they have into the university core business.

18. *Individual needs*. Many doctoral candidates pursue research degrees for personal development and interest which may or may not have a direct effect on their career. It requires considerable dedication and commitment over many years.

## Characteristics of PhD graduates

19. Doctoral graduates are best known for their analytical power and technical expertise which they have learnt to apply rigorously. However the range of skills they develop is much wider. This is often not immediately recognised by the graduates themselves, although the increasing focus on skills development is helping to overcome this.

20. Research-intensive universities aim to produce doctoral graduates with a broad range of skills. Intellectual and academic skills are developed to a much deeper extent than is done at the Bachelor or Masters level, and doctoral graduates are trained to be more inquisitive and independent. In addition, personal and professional management skills are developed as part of the doctoral experience. Research degrees concentrate strongly on the transferable skills relevant to research and such skills are relevant not only for the research workplace but also for other places of employment. Where appropriate doctoral programmes focus on their transferability to other domains in which a high level of creative thinking and critical analysis are needed.

## Margriet - Head of Collections and Research at the Stedelijk Museum in Amsterdam

Margriet has been trained as an art historian and a philosopher and has obtained a **PhD from the Institute of Culture and History at the University of Amsterdam**. The skills that the PhD trajectory brought her were first put to use for an academic career as lecturer, assistant professor and programme coordinator at the art history and media studies departments of this university. After some years she moved over to the Stedelijk Museum in Amsterdam (the biggest modern art museum in the Netherlands) where she currently holds the position of Head of Collections and Research. With her team Margriet is responsible for the registration, documentation, digitisation and interpretation (in other words: all content production and discursive practices) of the 90,000 art and design objects the museum has in its collection.

*"The skills that the PhD brought me, and that I now use for the Stedelijk, are many. Of course there are the basic ones like the ability to distinguish what is of primary and what of secondary importance, turn everything into a workable project and always remain critical on your findings and conclusions. The most innovative skill I brought to the museum however is the ability to accept that a search for truth (or facts) is important (it is often relevant to know when a painter has created a work, or what kind of technique and material has been used) but it is the interpretation that matters the most. And one can add to this that interpretations can be generated and found in many different formats (from scholarly text to art work, from you-tube clip to educational programme), which means that an open and (self-)critical attitude to that what 'research' is, and what its sources are, is necessary. The PhD research provided me with this attitude."*

6 We use 'transferable skills' in its broadest sense, i.e. skills learned in one context (e.g. research) that are useful in another (e.g. future employment be it research, business, teaching, etc.). They enable subject- and research-related skills to be applied and developed effectively. Transferable skills may be acquired through training or through work experience. This is the definition given in ESF (2010).

**21.** This broad range of skill sets includes:

- *intellectual skills, which comprise the ability to*
- think analytically and synthetically,
- be creative, inquisitive, and original,
- take intellectual risks,
- deploy specific technical, research-related tools and techniques;

- *academic and technical skills, which comprise the ability to*
- understand, test and advance complex theories or hypotheses and to deploy sophisticated concepts, methodologies and tools in the chosen subject to a very high level,
- be able to identify issues and translate them into questions amenable to scholarly enquiry,
- successfully pursue original research in the chosen field,
- use critical judgment in an objective manner based on verifiable evidence,
- apply highest standards of rigour in the proof of ideas,
- manage a high degree of uncertainty both in method and in outcomes,
- develop and demonstrate academic credibility and become recognised as a member of an international scholarly community,
- understand the workings of a specific high level research-intensive environment,
- transfer new knowledge to scholarly communities and communicate it to society,
- work according to ethical principles,
- work in an interdisciplinarity setting or on an interdisciplinary topic;

- *personal and professional management skills, which comprise the ability to*
- persist in achieving long term goals,
- manage projects with uncertain outcomes in diverse settings and organisations,
- take a project through all its stages: from developing the original idea, to developing a plan, garnering the evidence, and communicating the results and their significance,
- be self-motivated and autonomous,
- work to achieve results with minimum supervision,
- be flexible and adaptable in approaching complex and uncertain problems,
- communicate very complex concepts,
- network internationally,
- work in a team,
- speak and present effectively in public;

The following skills are sometimes also developed:
- the ability to lead other researchers,
- the ability to teach and train others,
- the ability to organise conferences and workshops.

**22.** These skills should enable and enhance the doctoral graduate in three complementary domains:
- competence: acquiring specific expertise, knowledge, technology and methodology to conduct and understand research within a discipline and across disciplines;
- achievement: gaining personal effectiveness, time,

## Stijn - Project Manager Simulation R&D at a Belgian design engineering software company for the mechanical industry

Graduated at the University of Twente (Netherlands), Stijn joined the company as EC Marie Curie research fellow, and was asked to stay on as key researcher upon finishing the grant. While full-time employed at the company, he enrolled in a **PhD programme in vehicle noise and vibration engineering at the K.U.Leuven**, with whom the company has a long-standing cooperation. After completing the PhD in 2008, his responsibilities expanded to research management, including the establishment of a research roadmap for his department, the management and definition of R&D projects in regional and EC context, relations with universities and coaching of current research engineers, several of which also pursue a PhD degree. For Stijn it is thanks to the unique opportunity to pursue a PhD in an environment that truly bridges between industry and academia that he has obtained all the necessary skills to be successful in his current position in research management.

*"The industry-academia bridge is crucial for current and new projects, ensuring that new technologies answer the industry needs, in addition to complementing the academic state-of-the-art with insights from the state-of-the-use. I can leverage my network and industrial PhD expertise to our current researchers."*

project, and self management, developing a problem-solving attitude and assuming a leadership role;
- relationship: developing a team work attitude, collaborating and communicating with specialists and non-specialists.

## A model of the modern doctorate

**23.** Doctoral training should be based on the following principles:

**Doctoral researchers are the drivers of their professional development…**
In order to develop as autonomous researchers, doctoral candidates should be the drivers of their project. They should take responsibility at a very early stage for the scope, direction and progress of their project, and this should allow them to make a demonstrably novel and independent contribution to their subject of study. The degree of autonomy which they take on at different stages will vary between disciplines.

**while being immersed in a research-rich environment…**
Programmes in specific areas should be developed in the context of a strong research environment with critical mass of researchers, equipment, and administrative and personal support.

**where boundaries to other research fields are highly permeable…**
It is recognised that many of the significant advances are developed at the boundaries of disciplines. Researchers must have the opportunity to be able to cross these boundaries according to the needs of their project. The environment should provide access to these opportunities and support the candidate in exploring new avenues.

**and in which connections to the external world have a global outlook…**
Research is an international business. Doctoral programmes should encourage experience of the research world at least through attendance and presentation at seminars and conferences in other countries and institutions. However they should also seek to provide opportunities for candidates to spend longer periods away from their home institution (potentially outside their own country and some outside Europe (European Commission, 2009) in order to be exposed to fresh ideas, to different research cultures, and to have access to different facilities and techniques. This is an area where European higher education has significant experience and resources. This could be further encouraged as a key feature of European doctorates.

**and link to other sectors of society…**
Through conferences and other professional activities doctoral candidates should make links with society

### Sabine - Associate Scientific Director CMC for a major pharmaceutical company

Sabine completed her MSc and **PhD in Chemical and Biochemical Engineering at University College London** after qualifying for her Diploma in Chemical Engineering in Germany. As part of the PhD project she worked at NASA in the USA giving her important international experience and successful collaboration in an international environment. She was involved in developing the case for funding from the European Commission and from NASA giving her an understanding of the research funding environment right from the start as well as the regular reporting structures of different funding bodies. The PhD built her confidence in planning and executing a major original project which she has put to use in her subsequent roles. Since completing her PhD she has been working in management consultancy and project management in Germany and the Netherlands working on diverse projects in the chemical, oil, biotechnology and pharmaceutical sectors. Today Sabine holds a highly rewarding position as associate scientific director CMC for a major pharmaceutical company. There she leads the most important drug development programme of the company in its final stage for global submission negotiating and in aligning with the various functions and over the operating regions.

*"The experience of frontier research has helped me to strip problems in the projects I have been involved in right back to first principles. I have used the quantitative and computational skills from my research, allowing me in my management positions to communicate swiftly with scientists. In addition, my understanding of international perspectives has greatly influenced my mode of working."*

beyond academia to seek fresh ideas for their research, to develop ways of communicating their ideas and results, and their significance, to a wide variety of audiences, and to develop broader career perspectives.

**so that the skills the new doctors develop are highly valuable to the knowledge society.**
The doctoral education process should be seen as one of skills acquisition as well as developing experience and expertise in a particular field. This is developed in more detail below.

## Skills development as the cornerstone of the modern doctorate

**24.** In order to develop the characteristics outlined above, the modern doctorate should be the intersection of two complementary processes: professional research activity and personal development.

**25.** *Professional research activity* refers to the doctoral candidate as an early stage researcher. As such s/he will not only learn the tricks and tools of his/her discipline, but s/he will also conduct original research that materialises as tangible output: a thesis with a mix of papers, books, patents, and presentations.

**26.** *Personal development* refers to the transformation that the early stage researcher undergoes during the doctoral process. S/he will gradually develop into an independent researcher or professional who is ready to take the next career step and capable of working in complex and knowledge-intensive professional environments inside or outside academia.

**27.** The common theme between professional research activity and personal development is the acquisition of a very sophisticated level of skills, both for furthering research and also for personal development. Skills development is therefore at the heart of the doctoral process.

**28.** The learning environment for skills development is in the first place the research group or laboratory of the doctoral student. Indeed, research-based training via formal and informal meetings with the supervisor and peer researchers is the core of doctoral education. As such the doctorate is first and foremost a research-based training endeavour. In addition, this is complemented by research-based training with more structured training events such as seminars, workshops, meetings and courses, often embedded in graduate schools or doctoral schools.[7]

### Anna - Project Leader for a global non-profit organisation undertaking TB drug development

Anna has a **PhD in biochemistry and molecular biology from the University of Oxford**, and spent several years as a post-doctoral fellow at the Rockefeller University. But for her the PhD (which included a spell at a major pharmaceutical company) was crucial to her subsequent career.

*"Subject knowledge, connections gained and the ability to read critically all continue to be extremely important. My ability to manage projects, multi-task, solve problems and think in an analytical way were developed during my doctorate. I can manage my time effectively, motivate myself, and deal with difficult people. Perhaps these things are the most important transferable benefits gained from my doctorate."*

7 Graduate schools are usually organised across the whole of a university to provide strategy, regulation, financial support, generic skills courses, and often admission processes for doctoral education. These are common in the USA and increasing in Europe. Doctoral schools (or centres) are usually organised along thematic lines crossing disciplines but focused on specific broad topics. They may bring together researchers in the field from a number of different disciplines. They may also bring together a number of institutions creating stronger critical mass in the field.

## Implications for doctoral education in research-intensive universities

**Interdisciplinary training structures**

29. Doctoral education must be incorporated in a strong research environment and culture to ensure the opportunities for cross-fertilisation between disciplines. For this reason we believe that doctoral education is best undertaken in research-intensive institutions or in partnerships where the benefits of a wide range of research activities can be exploited.

30. Doctoral education should have a high profile in research-intensive universities. Doctoral programmes often transcend traditional disciplinary boundaries on which universities are usually structured. University-wide structures are necessary to enable proper support of doctoral candidates, such as graduate schools or doctoral schools.

31. Both these types of structures offer added value to doctoral education by creating a supportive environment that complements the informal research-based training between supervisor and doctoral candidate. First, they can create multidisciplinary and integrated programmes where doctoral candidates can broaden their scientific horizon and deepen their expert knowledge. Examples of such learning platforms are thematic programmes such as 'Cancer', 'Systems Biology,' or 'Cultural Studies'. Second, they can also promote personal skills development by offering a wide range of training modules, preferably with hands on experience and interactive sessions in small groups, focused on 'Academic Writing', 'Information & Publication skills', 'Managing your PhD', 'Career Development', 'Research Ethics' etc.

32. In addition to organising training activities graduate and doctoral schools often assume additional responsibilities. For example, they can serve as a vehicle for mobility of doctoral candidates via international recruitment schemes or by mutually recognising the doctoral programmes and joint degrees with partner institutions. Finally, by supporting a learning environment that encourages doctoral candidates to reflect on personal strengths and interests, they can foster a culture where doctoral candidates start thinking proactively about future career options and how to develop such a professional path.

**Links to the professions**

33. The increasing needs of the knowledge economy mean greater demands for doctoral graduates who can bring new ideas and drive them forward throughout all parts of society particularly in the professional world. This means ensuring that all doctoral graduates also have awareness and thirst for making this contribution.

## Peter - Member of the Permanent Representation of Belgium to the European Union

Peter completed his **PhD in the field of history of international relations at the K.U.Leuven** in 2001. He is currently a Belgian diplomat. He joined the Belgian diplomatic service in 2001 and served successively at the Organisation for Security and Cooperation in Europe (OSCE), NATO and the United Nations in New York, during Belgium's 2007-2008 membership of the UN Security Council. As a member of the Permanent Representation of Belgium to the European Union, he is responsible for preparing the Belgian EU Presidency in the second semester of 2010. Both his PhD and the doctoral programme he undertook turned out to be a useful preparation for his diplomatic career. Multilateral diplomacy was an important aspect of Peter's PhD research, and the doctoral programme, which took place both in Belgium and abroad, made it possible to establish many international contacts which are still useful in his current job. During this programme, he also performed consultancy tasks for the Belgian Foreign Ministry and participated in the Model United Nations programme.

*"The strong focus of the doctoral programme on synthetic writing and presentation techniques has proven to be an important asset in my current job."*

34. Universities cannot do this alone. They must retain their unique position of being able to challenge dogmas and conventions. However they must also work in partnership with the professional world to ensure that doctoral graduates are attuned to and prepared for these challenges.

35. Universities should seek to encourage greater collaboration on doctoral education with the private and public sectors, both on the projects that we tackle but also in working together on the training, particularly the generic training, that we provide. The EUA's DOC-CAREERS project (2009) has explored good practice in this area.

36. Doctoral research is sometimes taken within a professional setting (the professional doctorate) where research is undertaken based on evidence obtained while practicing in the professional world. These settings create their own challenges such as the difficulty in undertaking controlled experiments when the particular conditions of the research study cannot be tailored to any great extent. We support this model but it must still meet the standards of originality that we set for the traditional PhD. This model could provide opportunities for greater involvements with the professions.

**Finance**

37. Bruegel (2008) has made a strong case for increasing the funding from private or public sources for universities in Europe, and particularly for doctoral education which is at the heart of the education and research mission of research-intensive universities. Doctoral education, it was concluded, should be a central focus for the channelling of new public resources directed towards higher education, and the indispensable critical mass will only be reached if these new resources are targeted very selectively. Doctoral education is necessarily expensive to run. Not only does it require experts with time to devote both to their research and to the doctoral candidates, it also depends on well-equipped and up-to-date research facilities such as libraries and laboratories. Thus, the structures to oversee the excellence of the doctoral experience require dedicated financing schemes.

38. There is heavy pressure on public finances at the moment. This means careful use of resources is paramount. For doctoral education investment should be focussed in environments which can provide the best research training experience. It also means that research-intensive universities must devote resources to providing doctoral scholarships, to ensuring a strong research environment, and to providing the best possible research training. This will require creative use of resources, continually seeking new sources of funds to support research and doctoral training. An important aspect is to ensure that teaching opportunities are provided for doctoral candidates since this helps link the research with teaching by

## Eeva - Science Adviser at the Academy of Finland

Eeva completed her **PhD in biochemistry** at the Helsinki Graduate School in Biotechnology and Molecular Biology of the **University of Helsinki** in 2002. She left the university to become a lecturer in polytechnics but returned shortly to work in science administration, as a graduate school coordinator. In 2008 Eeva started as a science adviser at the Academy of Finland, the main funding agency for basic research in Finland. Now her main task is to coordinate the Academy's responsibility of the Finnish graduate school system. Besides organising the graduate school calls, Eeva's responsibilities include active and systematic development and follow up of doctoral training at national level, executed in collaboration with the Ministry of Education, universities, graduate schools and the private sector.

*"I cannot imagine being able to deal with the graduate schools and the system without my own subjective experience. Especially for the development of the system it is crucial to understand how the system functions. I fully agree with what has been said of the added value in doctoral degree: it provides a way of analytical thinking and capacity to master large entities, applicable in any sector independent of the scientific field of the degree."*

those involved at the sharp end of research, but also helps to share around the important work of teaching. Many research-intensive universities deploy such investment strategies very effectively.

**Internationalisation**

**39.** Research-intensive universities should seek to expand their global role as research training hubs. We should seek to educate doctoral candidates from around the world in the areas in which we specialise. This strengthens our reputation and helps create opportunities for researchers from other countries to partake of the research excellence in Europe. International doctoral candidates will also contribute to European research activity and to the Lisbon Agenda (and its successors), either through the research they undertake as part of their PhD, as researchers who remain in Europe, or as collaborators who return to their country of origin. Collaboration within Europe should also be strengthened as this adds to the depth of the doctoral experience.

## Dominic A. - Law Firm Associate

Dominic completed a **PhD in zoology at the University of Cambridge** in 2000, and went on to take a Diploma in Intellectual Property Law and Practice in 2004, and is now an associate with a major London law firm where he specialises in contentious intellectual property matters, primarily in relation to patents but also trade marks, registered designs and copyright. His PhD has equipped him for working a range of sectors from pharmaceuticals to consumer goods.

*"There was no real "epiphany" in which I realised I should do law and not science. Rather it was a gradual process of change of emphasis, assisted by careers guidance and skills support."*

## Recommendations

**Employers should:**

- engage with universities to recognise the significant changes that have occurred in doctoral education,
- work closely with universities to help provide suitable research environments and training, and funding for projects of mutual interest,
- recognise that universities are the primary locus of frontier research remaining able to freely challenge the status quo and acknowledge that it is this aspect that makes universities crucial to society's positive development.

**National governments and the EU should:**

- increase the investment in Europe for doctoral education,
- encourage concentration of doctoral education in research-intensive institutions or organised groupings of institutions able to provide a strong research environment,
- promote Europe as a strong environment for doctoral education,
- support mobility of doctoral candidates within and without Europe during their programme.

**Universities should:**

- ensure that research remains the cornerstone of the doctorate,
- develop doctoral graduates who are creative risk takers with a rigorous approach to the research questions they tackle,
- develop the confidence of researchers to be independent and autonomous,
- promulgate the unique skills of doctoral graduates,
- work more closely with employers to ensure that the doctorate is a suitable preparation for the world of work,
- ensure that doctoral graduates are capable of demonstrating their unique skill set persuasively,
- ensure that structures are configured to support doctoral students through graduate schools or doctoral schools or some similar organisation to support both candidates and their supervisors,
- promote mobility of researchers during the doctorate,
- tailor recruitment procedures and appropriate internal support for international students,
- seek new sources of funding for doctoral candidates.

**Doctoral candidates should:**

- use the doctorate to take intellectual risks,
- take responsibility for developing personal career goals during doctoral training,
- develop and use scholarly and professional networks,
- communicate research and the disciplinary context to society beyond academic fora.

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## About LERU

LERU was founded in 2002 as an association of research-intensive universities sharing the values of high-quality teaching in an environment of internationally competitive research. The League is committed to: education through an awareness of the frontiers of human understanding; the creation of new knowledge through basic research, which is the ultimate source of innovation in society; the promotion of research across a broad front, which creates a unique capacity to reconfigure activities in response to new opportunities and problems. The purpose of the League is to advocate these values, to influence policy in Europe and to develop best practice through mutual exchange of experience.

## LERU publications

- Harvesting talent: strengthening research careers in Europe *(January 2010)*
- Developing the European Research Area: note to the European Commissioner for Research *(December 2009)*
- How research can inform policy *(November 2009)*
- What are universities for? *(September 2008, Geoffrey Boulton and Colin Lucas)*
- The future of the European Research Area *(September 2007)*
- Doctoral studies in Europe: excellence in researcher training *(May 2007)*
- Universities and innovation: the challenge for Europe *(November 2006)*
- Commentary on the purpose, structure and functions of a European Institute of Technology *(May 2006)*
- Competitiveness, research and the concept of a European Institute of Technology *(November 2005)*
- Growth, research-intensive universities and the European Research Council *(March 2005)*
- Unlocking Europe's intellectual potential - universities and a European common market for research *(April 2004)*
- Research-intensive universities as engines for the "Europe of Knowledge" *(May 2003)*
- The European Higher Education and Research Areas and the role of research-intensive universities *(August 2002)*

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