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Facilities Council

# Delivering World Class Skills: Impact of STFC-funded Postgraduate Training

April 2010

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# Delivering World Class Skills: Impact of STFC-funded Postgraduate Training

## Acknowledgements

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# Executive Summary

## Background to the study

Delivering the current and future STEM skills needed to build the UK economy through innovation and knowledge intensive activities is one of the three strategic goals of STFC. In 2009, our postgraduate training programme supported a stock of 800 students, with funding amounting to £16 million. It is important for us to understand the impact of our investment in terms of the career paths of our students and the skills they developed during their PhDs. In 2009 we commissioned DTZ to find out about the career paths of students whose funding ended 6 to 9 years earlier and how useful their PhD training had been. Case study material was also collected from former students who were then 12 to 14 years into their post-PhD careers.

## Career paths

97% of the sample were in employment and only 1% were unemployed. Just under half were working in higher education. Of these, a third held an academic appointment as lecturer or senior lecturer. Just over a quarter of the sample were working in the private sector. Of these three quarters were working in business or financial services. A further 23% were employed in the public or voluntary sector and were almost evenly split between roles in research establishments and public or non-for-profit organisations.

## Value of a PhD

Approximately 62% of the sample were earning a salary similar to or greater than the average for workers in professional occupations in the UK. Just under three quarters believed that their PhD training had been very useful in developing their career and 58% considered their PhD to have been essential.

Unsurprisingly, almost all those employed in higher education considered their PhD to have been very useful and essential to their career. However, nearly 90% of those in the private sector considered their PhD to have been very or quite useful and 80% felt it was essential or of some importance.

The five most mentioned skills gained from the PhD that were used in current roles were: writing software/ programming, problem solving, subject-specific knowledge, quantitative data analysis and communication/team working. Over 90% of the sample would choose to undertake a PhD again.

## Impact

Respondents reported having gained several high-level skills that are important in driving a high-value, innovative economy and are transferable to many occupations. A common feature of many of the roles was that they require high-level mathematical, computer modelling and information technology skills which are key components of most STFC PhDs. For many in the private sector, a PhD was not strictly necessary but the skills developed have helped to build worthwhile and satisfying careers. Furthermore, these skills appeared to be underpinned by the ability to communicate and to work with a wide range of people.

# Delivering World Class Skills: Impact of STFC-funded Postgraduate Training

## Introduction

Delivering World Class Skills to meet current and future demand for the STEM skills needed to build the UK economy is one of the three strategic goals of STFC. Our ambition is to make a unique contribution to the delivery of strong and sustainable scientific and technical skills that support the growth of the UK economy. One of the ways we do this is by funding PhD students to develop high quality, relevant skills to maintain the health of our core disciplines and meet national skills demand. In 2009/10, we funded 260 new studentships in particle physics, astronomy, space science and nuclear physics, as part of a rolling cohort of 800.

We periodically survey former students in order to improve our knowledge of the impact of the PhD training that we fund and to inform future developments in the training. Previous surveys were undertaken in 1995 and 2003. In 2009 we commissioned DTZ (with Swift Research) to survey former students whose PhD funding had ended 6 to 9 years earlier. A sample of 658 people from 20 universities was identified for inclusion in the survey, representing 86% of all students whose funding ended in 2000, 2001, 2002 or 2003. University alumni offices and departments were used as intermediaries to send questionnaires (paper and electronic).

The survey asked former students about the career paths they have followed, the skills they developed during their PhDs and the impact on their career. Respondents were also invited to provide material for short career profiles to

explore more fully career paths followed, the impact of skills and what their current role involved.

DTZ also re-contacted those who had responded to the 2003 survey, seeking information about how their careers had developed since then. This work focused in particular on people who were working outside of higher education in 2003, as knowledge of non-academic career paths is less well developed. In total, 86 former students, who are now 12 to 15 years into their post-PhD careers, were re-contacted and 14 career profiles were produced.

This document summarises the key findings from the study. The full report and a collection of career profiles are available from the STFC website ([www.stfc.ac.uk](http://www.stfc.ac.uk)).

## Profile of respondents

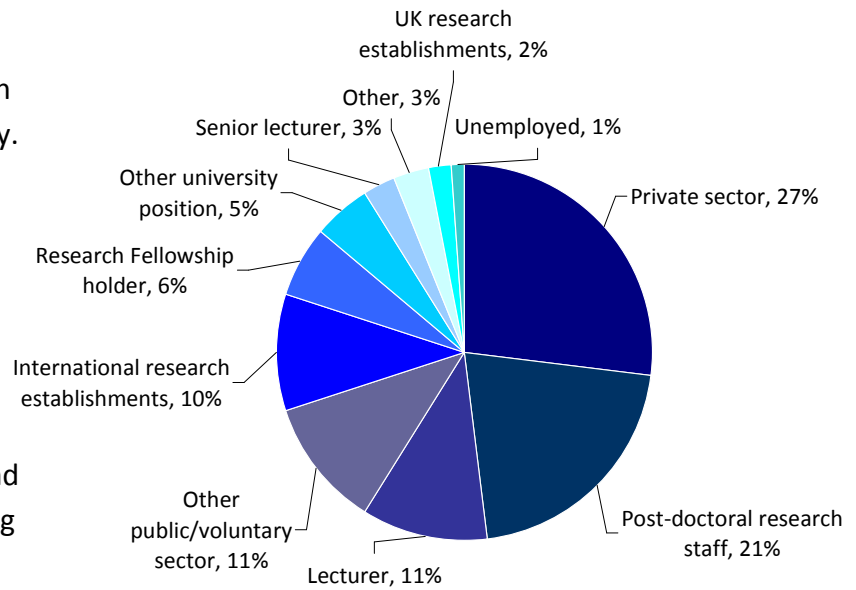
A total of 209 responses were received. 21% of respondents were women. The majority (85%) were in their early thirties. The subject area split of PhDs was 49% astronomy, astrophysics & cosmology, 33% particle physics and 18% planetary science & solar research including space physics. 29% worked outside the UK. All but nine had been awarded a PhD.

## Overview of career destinations

97% of the 209 people who responded were in full or part-time work at the time of the survey. 1% were involved in family care, 1% were undertaking further study or training and 1% were seeking work. Most of the respondents were working full-time (88%), 5% part-time and 4% self-employed.

46% of those who were employed had jobs in higher education, 27% in the private sector and 23% in the public or voluntary sector (including government research establishments).

71% were still engaged in scientific research: 54% in a subject area within the remit of STFC.



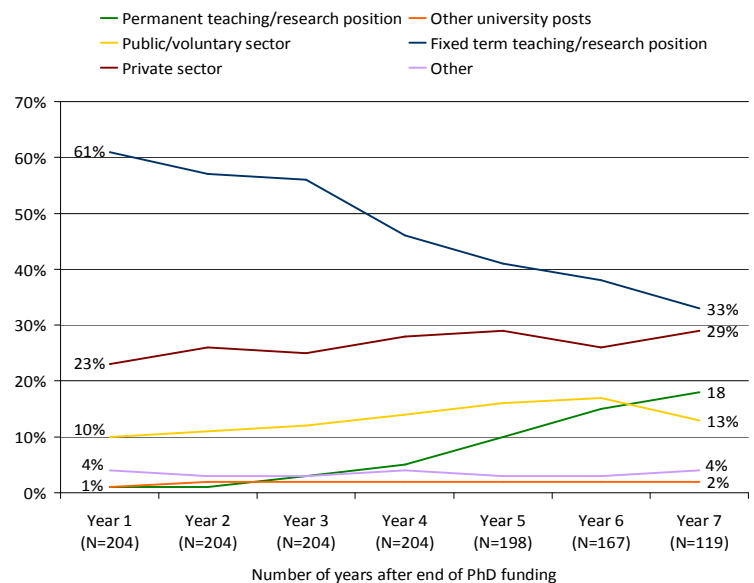
Overview of employment patterns

*“During my PhD I significantly expanded my skills and confidence outside pure academic study through teaching, collaborations and presentations.”*

## Time series analysis of careers

All respondents were asked to complete a ‘diary’ providing details of the jobs they had undertaken since the end of their PhD award. Data are only presented for up to seven years after the end of a PhD award because, after this point, the sample base becomes smaller and potentially unreliable.

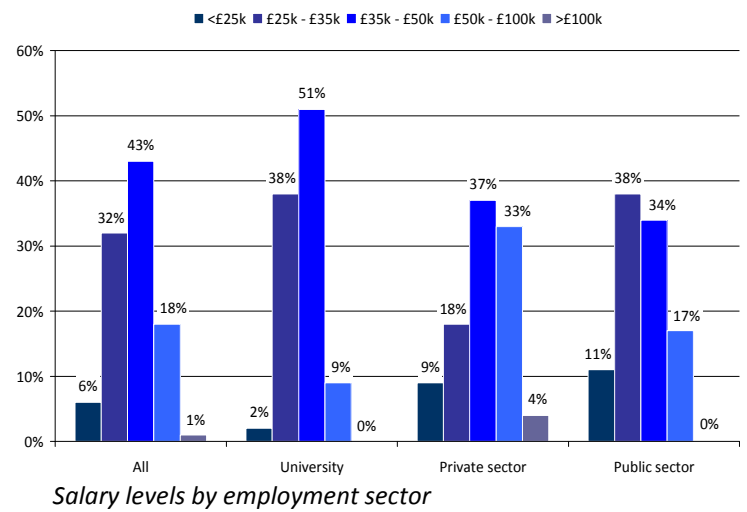
There is a steep decline in the proportion of respondents employed in fixed term teaching / research positions in universities over time. The gradient falls sharply after three years which reflects the typical duration of a post-doctoral research position. At the same time, the proportion of respondents with permanent positions rises significantly after 3-4 years.



Time series analysis of employment

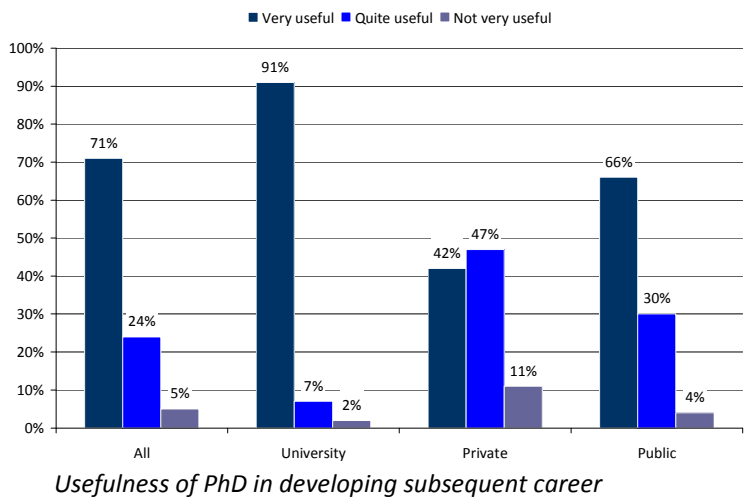
## Earnings

Salary is often used to indicate the value placed on employees and, by proxy, the qualifications and skills they have acquired. The average full-time salaries in 2009 for all workers in the UK, non-manual workers and for workers in professional occupations were £25,816, £29,244 and £36,260 respectively. Approximate comparison with these averages shows that over 90% of respondents earned more than the average worker in the UK. Approximately 62% of respondents earned a salary similar to or greater than the average professional worker. In the private sector, this figure is over 70%, reflecting the careers that respondents have pursued, particularly in the financial and business services sectors where salary levels tend to be high.

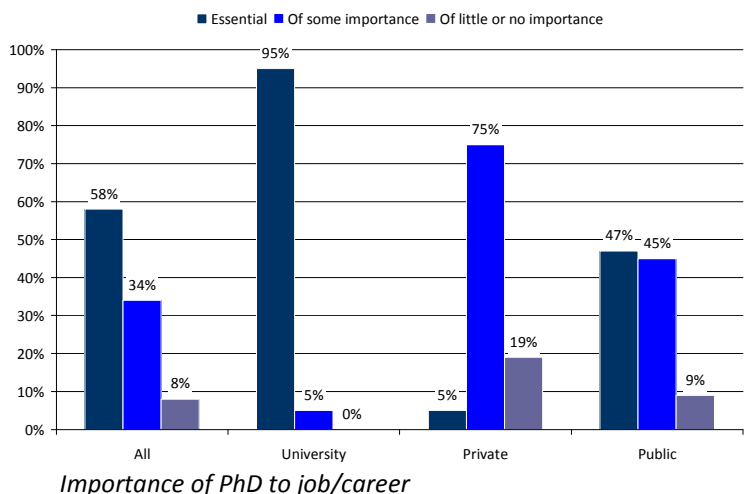


## Usefulness and importance to career

The majority of respondents believed their PhD training had been useful in developing their career. Unsurprisingly, PhD training was perceived as most useful by those employed in universities. However, almost half of those employed in the private sector considered their PhD training to have been very useful. About half of the small group that did not consider their PhD to have been useful are respondents who have not been awarded a PhD.



Almost all those employed in universities regarded their PhD to have been essential. In contrast, only 5% of those in the private sector perceived their PhD as essential to the career path they have followed. However, three quarters say that it has been of some importance. The situation is more mixed in the public sector, reflecting the split between research and non-research roles.



## Skills

Respondents reported having gained several high-level skills that are important in driving a high-value, innovative economy and are transferable to many occupations. For those working in universities, subject knowledge was the most mentioned. Private sector employees also highlighted project management skills. Those in the private and public sectors mentioned team working and communications skills more than those in higher education.

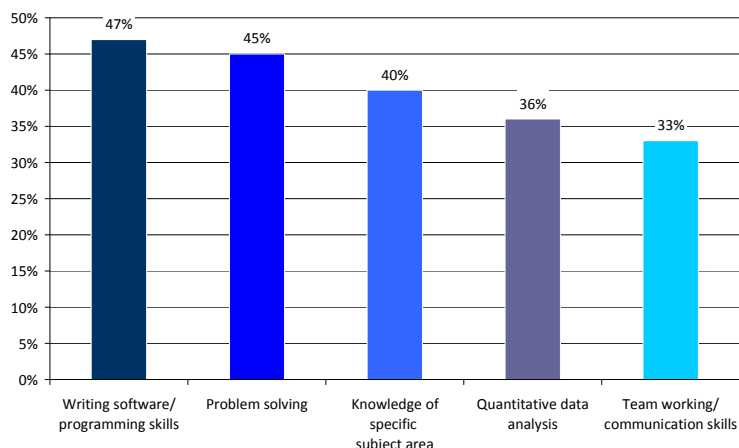
Respondents were also asked whether there were any skills or competencies that could have been given greater emphasis during their PhD to prepare them for work. Four areas that stood out were:

- career planning,
- knowledge of the process for funding research,
- project management
- building/ maintaining networks of contacts.

These areas fall under the heading of transferable skills which, as a result of the recommendations of Sir Gareth Roberts' *Review of the Supply of Scientists and Engineers* in 2002, have since been the focus of considerable investment.

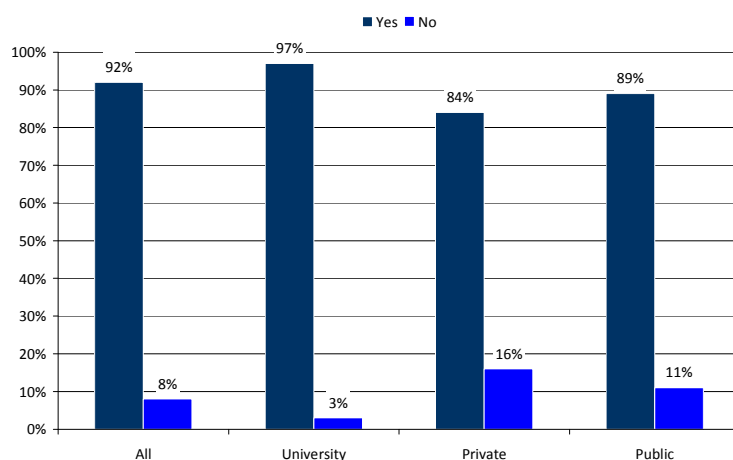
### Would respondents do a PhD again?

The overwhelming majority of respondents would choose to undertake a PhD again. Even 84% of those working in the private sector, where a PhD is not usually an essential requirement, would undertake a PhD again.



Five most mentioned skills/competencies gained from PhD in relation to current job

*“Apart from the specifics of learning new physics, my PhD trained me to approach all problems, be they mathematical, scientific or managerial, in a logical and rigorous manner.”*



Whether former students would choose to undertake a PhD again

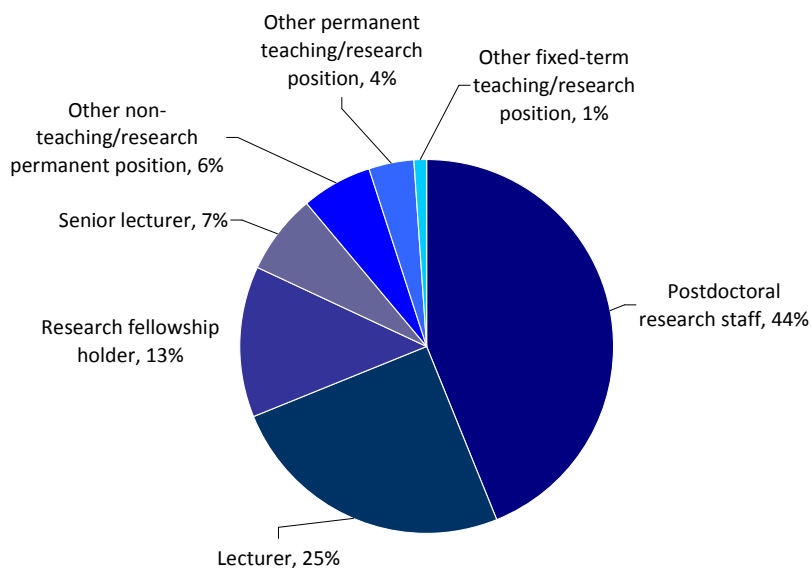


## Academic careers

Of those employed in higher education, 32% were lecturers or senior lecturers. This represents a marked difference from the picture in 2003, when only 17% of respondents had secured a position at or above the level of lecturer. The proportion employed as fixed-term postdoctoral research staff in 2009 was similar to that found in 2003.

Men and women were equally likely to be working in this sector. 33% were working outside the UK and 98% were still engaged in scientific research.

Only 2% were not happy with their current job and 93% intended to continue to pursue a career in academic research.



*Employment in higher education*

### EWAN O'SULLIVAN: PhD in Astronomy, University of Birmingham, 1998 to 2002

Now: Marie Curie Fellow, University of Birmingham

After my PhD, I took a postdoctoral fellowship at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, working on X-ray observations of galaxies and groups of galaxies. The Chandra X-ray Observatory is largely operated from the Center for Astrophysics, so it is one of the main centres for X-ray astronomy worldwide. After three years as a post-doctoral research fellow, I had built up enough NASA funding to support myself in a full staff position for another four years, during which time I broadened the reach of my research to include some optical and radio work.

I have now moved back to the UK, taking up a Marie-Curie Fellowship at the University of Birmingham to work on feedback processes in galaxy groups, using a combination of radio and X-ray data. I am still working closely with my collaborators in the USA, and I expect to travel out to the Giant Metrewave Radio Telescope in Pune, India, to work with colleagues there who are helping with the radio side of the project. The fellowship lasts for two years, after which I hope to move to a permanent (or at least long-term) position either at a UK university, or perhaps in the USA or Canada.

As I'm working as an astrophysicist full time, many of the skills I acquired through my PhD are still directly applicable to my job. Over time the technical side of the job changes, with different observing capabilities and new analysis techniques becoming available. However, the underlying approach remains the same. The skills I gained in critical thinking, making presentations, communicating ideas clearly and working with or leading a team are all core skills that I continue to use in my job today.

**RACHEL STREET: PhD in Astronomy, University of St Andrews, 1998 to 2001****Now: Project Scientist, Las Cumbres Observatory, USA**

My PhD research linked to the Wide Angle Search for Planets (WASP) consortium. Afterwards, I found a post-doctoral position with Queen's University Belfast, which was also involved with the WASP project. A year later I was awarded a PPARC Post-Doctoral Fellowship to continue my work on WASP. After this, I was successful in getting a position as a post-doctoral scholar with Las Cumbres Observatory in affiliation with University of California, Santa Barbara. I moved to the USA and worked at Las Cumbres Observatory since then.

Las Cumbres Observatory is a private operating foundation, building a global network of telescopes for scientific research and research-based education. My position allows me to spend 100% of my time on research into exoplanets, using the observational facilities provided by the Observatory and contributing to the monitoring, quality control and calibration of the data coming from the telescope network.

My current position is a fixed term contract, and any future extensions will depend on my US visa status. I would like to continue working at Las Cumbres Observatory, but the recent drastic funding cuts to UK astronomy make remaining aboard particularly attractive at the moment.

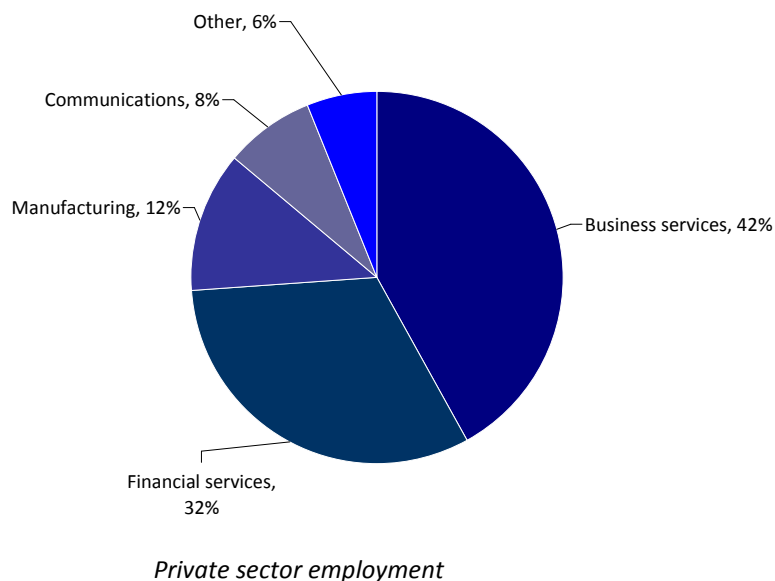
The skills I acquired during my PhD are essential in my daily work, since I am active in the same field of research. I have gradually diversified my research and the skills I gained through my PhD have helped me to do this. Since I am primarily an observer, the experience I gained in conducting observations and in data reduction techniques during my PhD have been essential.

The importance of good programming skills is perhaps somewhat less obvious, but I have found the skills I developed in this area during my PhD to be invaluable. I have had to develop custom software for a variety of data handling and analysis, and these skills have come in particularly useful in an era where telescopes are becoming more robotic, and data volumes are increasing dramatically.

## Private sector careers

Three quarters of those working in the private sector had jobs in financial or business services. Employers in the latter category were mainly specialised information technology or software companies. These sectors are high-value and knowledge intensive and are critical to the future competitiveness of the UK economy. The concentration of employment in financial and business services is similar to that found in 2003.

60% of those working in the private sector are employees of large companies (250+ employees). A greater proportion of male respondents (30%) were employed in the private sector than female respondents (16%). Only 15% in this sector were working outside the UK and 24% were still engaged in scientific research. Job satisfaction was not quite as high as among those in other sectors, with 8% not happy with their current role. 72% intended to stay in their current area of work.



*“The skills that were particularly important were computer literacy (being able to use a wide variety of computer applications without training), analytical skills, and the ability I developed through my PhD of being able to work with a range of people, especially across different nationalities.”*

### COREENA LOFTING: PhD in Space Physics, Imperial College London, 1994 to 1997

#### Now: Senior Patent Attorney, British Telecom (BT)

After my PhD I trained as a patent attorney. I worked in small private practices for 2-3 years before joining Nortel Networks where I stayed for another 2-3 years. In 2003, I joined BT and qualified as a professional UK and European Patent Attorney. I am now a Senior Patent Attorney at BT. My job now involves leading a small team of attorneys who all liaise with research and technology teams to identify and protect patentable inventions. It is a mix of science and law.

The Patent Attorney profession certainly has a preference for people with a PhD because the skills you acquire through a PhD are highly relevant to the job. For example, I need to be able to understand complex technical information and research. Many of the people I deal with are global experts at the forefront of research and development in their field and I am able to do this through the high-level of training I received as part of my PhD. A key part of my job is analysing technical literature for a new invention and the experience I gained in reviewing academic papers during my PhD has been really useful for this, as have the general analytical skills I developed from working independently on assembling and distilling information as part of my PhD.

**MARTIN MILLMORE: PhD in Particle Physics, Imperial College London, 1992 to 1995****Now: Director, Oracle Corporation**

After my PhD I got a job with Oracle Corporation and have remained there ever since, progressing from a junior developer to a Director. My current job involves running a team that is designing Oracle's next generation Human Resources applications. The kind of analysis in mining data and presenting it in an easy to understand and business-focused form involved is quite dauntingly difficult, but is exactly the kind of complex evaluation for which my PhD prepared me.

My job requires a great degree of innovation as this is a very competitive and fast moving part of the market. The ability to think laterally and to be creative is essential in being able to produce new products that are better than the competition. My PhD taught me a great deal about finding novel solutions to problems and instilled a mentality of always looking for opportunities to innovate. Thus, it provided an excellent training for what I do now. I also work with a large number of different people around the globe. Working with lots of international collaborators as part of my PhD was an excellent introduction to this - teaching me to work with people from different cultural backgrounds, in different locations around the world.

**BRUCE FAIRLEY: PhD in Observational Astronomy and Cosmology, University of Birmingham, 1997 to 2001****Now: Project Manager / Software Engineer, Tessella Plc**

The company designs bespoke scientific software. We diagnose problems that clients in the scientific sector are experiencing and write bespoke software to address them. Thus, there is a consultancy role as well as a programming / delivery role. I joined the company as an associate analyst programmer and now I work as a project manager / software engineer taking greater responsibility for all aspects of client projects.

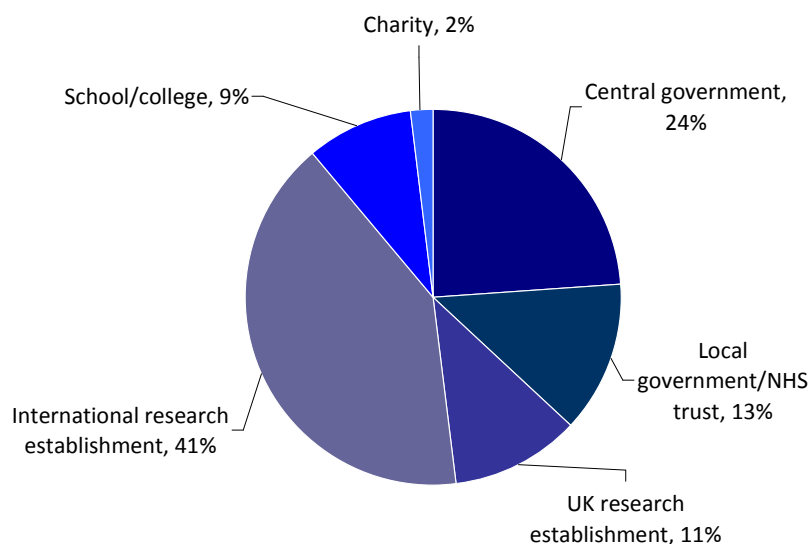
The technical side of my PhD training, such as analysing images from telescopes is of limited relevance to my current job. However, I still use many of the other more general skills I developed through my PhD, in particular, analytical, programming, proposal writing and presentation skills. As a cosmology PhD student you spend a lot of time writing proposals for telescope time. This type of experience is highly relevant in the private sector, where a lot of time is also spent writing tenders and proposals.

My experience is that there are interesting, rewarding jobs for STFC postgraduates in the private sector but you have to put time into finding them yourself.

## Public and voluntary sector careers

Half of respondents working in this sector had jobs in research establishments. In particular, 40% were working in research establishments outside the UK. This is a considerably higher proportion than in 2003, when 27% of those in the public and voluntary sector were employed in such organisations. The proportion working in central government is similar to that found in 2003.

A greater proportion of women (30%) were employed in this sector than men (19%). 74% were still engaged in scientific research. All respondents reported being happy or quite happy with their current job and 87% intend to continue pursuing a career in this sector.



*Public and voluntary sector employment*

### HEIDI MUNN: DPhil in Particle Physics, University of Oxford, 1995 to 1998

#### Now: Civil Servant, Department for Business, Innovation and Skills

After my DPhil I spent two years as a post doctoral research fellow at Oxford University working on the same experiment as I had worked on for my DPhil – the Sudbury Neutrino Observatory in Canada.

While I was completing my DPhil I attended a graduate training course. It was excellent and opened my eyes to non-academic career options. In the end I applied to the Civil Service Fast Stream, more for the challenge of the application process than because I actively wanted the job (at that point I was still fairly committed to an academic career). However, the final stage of the process was an assessment centre and I absolutely loved the different exercises we were set. I decided that if the job was only half as interesting then I wanted it. And the rest, as they say, is history. I deferred entry for a year to complete my post doc but then, in 2000, I started my new career in what was then called the Department for Trade and Industry (now Department for Business, Innovation and Skills).

It is now almost 10 years since I left academia and I am convinced it was the right decision for me. Academic research can be rather narrow and I find as a civil servant in a Government department, I am stretched in far more ways and find opportunities to use and develop more of my skills. I have worked on science policy, environmental issues, international trade, digital television, better regulation and consumer policy.

**CHRIS LITTLEWOOD: PhD in Particle Physics, University of Cambridge, 1997 to 2000****Now: Investment Policy and Analysis Manager, Office of the Rail Regulator**

I became a strategy consultant on completing my PhD, because I saw it as being based on problem solving, which is at the heart of my love for physics.

My current role is as an Investment Policy and Analysis Manager at the Office of the Rail Regulator. My job looks at how to set investment policy to produce a good outcome for rail users and taxpayers. Recently, I also co-founded a company that helps individuals and companies to develop effective business spread sheeting skills. It provides online training in Microsoft Excel, tailored to individual knowledge and ability.

My experience is that a PhD which develops high-level mathematical, computational and quantitative skills is highly valued by a range of non-academic employers. Besides these skills, my PhD gave me experience of communicating complex technical information to non-specialists. This is perhaps the most important skill I developed through my PhD as it is fundamental to my job.

*“People who have developed a range of transferable skills during their PhD such as computer programming, quantitative analysis, team working, communication and self-motivation will always be in demand.”*

**IAN BRAWN: PhD in Particle Physics, University of Birmingham, 1992 to 1996****Now: Electronics Design Engineer, Rutherford Appleton Laboratory**

After finishing my PhD, I won a fellowship in Applied Physics at CERN, in Geneva, and I worked there for two years. I then moved back to the UK in 1998 and accepted a job at STFC Rutherford Appleton Laboratory, where I still work. Today I work as an electronics design engineer, designing data-acquisition systems for particle physics, nuclear, and medical experiments.

This work is in much the same field as my PhD and thus the skills I acquired in that period are crucial for my current job. Whilst much of the technical knowledge I acquired during my PhD is now dated, it provided the essential foundation of the knowledge I use today. In addition, the communication and organisational skills and self-sufficiency I developed during that period have proved invaluable.

The most important achievement in my career to date is my contribution to ATLAS, one of the Large Hadron Collider experiments at CERN. I developed a number of complex and technically challenging electronic systems that are essential to the operation of that important, high-profile experiment.