University research scientists as knowledge workers:

contract status and employment opportunities

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Abstract

University research scientists epitomise knowledge workers who are positioned to avail of the employment conditions associated with 'boundaryless careers'. Yet while employment flexibility has been hailed as a positive feature of knowledge work, relatively little is known about the forms such flexibility may take or its impact. This article considers the factors shaping the employment conditions of 40 research scientists working in five university research centres in Ireland. The findings suggest that, for knowledge workers such as research scientists, contract employment can deny them access to many of the employment conditions and opportunities that govern their long-term success as researchers.

Introduction

The recent focus by European governments on the creation of 'knowledge' economies has resulted in extensive investment in scientific and technological infrastructure, including the education and training of research scientists. These scientists in many ways epitomise 'knowledge workers' given the intellectual nature of their work and their high levels of education (Starbuck 1992; Alvesson 2000). One consequence of this high knowledge and skill base is an expectation that research scientists would be in a position to avail of and enjoy the types of employment conditions associated with 'boundaryless careers' (Arthur and Rousseau 1996). Such employment conditions have been noted as including: temporal flexibility, opportunities for the management of personal career development and influence over working arrangements (Knell 2000; Pink 2001). However, while the employment flexibility that is said to characterise the boundaryless career has been hailed as a positive feature, relatively little is known about the forms such flexibility may take and its impact on employees (Guest 2004).

This article considers the impact of contract employment on the experience of work and access to work opportunities of 40 knowledge workers employed as research scientists in five University Research Centres (henceforth URCs) located in Ireland. This is an important population to consider as – while much has been written about knowledge workers in professional service firms and high-tech industries – the increasingly significant knowledge worker population of universities has largely been ignored (Akerlind 2005; European Science Foundation 2009). The findings suggest that, for knowledge workers such as research scientists, contract employment may deny them access to many of the employment conditions and opportunities that are crucial to their long-term success as researchers. In addition, the impact of this exclusion may be detrimental to the innovation and creativity that are core to the mission of the URCs themselves, as well as to the Irish Government's commitment to positioning Ireland as a knowledge-based economy. The study responds to the call for research to understand more about the nature of

knowledge work, and the response of knowledge workers to different types ofHRpractices

in differing contexts (Currie, Tempest and Starkey 2006; Swart 2007; Donnelly 2009).

The article begins by considering the nature of URCs as knowledge-intensive firms

and the types of employment conditions that are purported to be most suitable for the

successful management of these types of firms. The methodology is then detailed prior to

documenting the findings, which examine the factors shaping the employment conditions

of research scientists in this context. The article concludes by summarising the

contribution and detailing policy implications.

University research centres as knowledge-intensive firms

In Ireland, the government has followed the impetus of the EU'Lisbon agenda' by investing

heavily in science and technology as pathways to future economic prosperity.The importance

of this agenda was recently emphasised by Government agency Science Foundation Ireland:

A significant internationally competitive Principal Investigator (PI) base, coupled with

sustainable, high-quality production of trained researchers, particularly PhD graduates, is at

the core of Ireland's development as a knowledge society. Only such human capital can

generate the knowledge capital needed to drive Ireland's economic growth and development.

(Science Foundation Ireland 2009, p. 24)

As part of this vision, universities and other higher education institutions are now

considered to play a strategic role not only in the creation, but also in the transfer and

capitalisation of scientific knowledge by repositioning themselves in collaborative

arrangements with industry partners (Etzkowitz,Webster, Gebhardt and Terra 2000; Hernes

and Martin 2000). This changed focus has implications for the structuring of URCs. Rather

than being engaged in research that is simply the sumtotal of its collective efforts,URCs have

become in many cases small- and medium-scale organisations attentive to industry agendas,

competing for international and national funding and employing large numbers of research

scientists. In manyways, they typify what have been described as knowledge-intensive firms (KIFs), particularly given Starbuck's (1992) view that employees within KIFs must comprise at least one-third 'experts' defined as 'someone with a formal education and experience equivalent to a 'doctoral degree' (p. 719). In addition to their 'expert' status, the knowledge employees who are core to KIFs are said to 'apply their valuable knowledge and skills (developed through experience) to complex, novel and abstract problems in environments that provide rich collective knowledge and relational resources' (Swart 2007, p. 452). This definition captures various aspects of the knowledgework in which research scientists within URCs are engaged, namely the 'embrained' or theoretical knowledge; the complex problem-solving capabilities that are applied to unfamiliar situations and the interaction that takes place with other knowledge workers based on the interdependence of tasks (Benson and Brown 2007).Given these characteristics, it is perhaps unsurprising that the specific nature of human capital deployed in this domain has also received some consideration.

Scientific and technical human capital and knowledge work

Whereas the term 'human capital' is generally usedwithin the business literature to describe human resource capabilities within knowledge-intensive firms, the term 'S&T[scientific and technical] human capital' is more commonly used to describe human resource capabilities in university research centres. S&T human capital takes stock of scientists' and engineers' capacity (Bozeman and Mangematin 2004, p. 566). Notably, the definition of S&T capital emphasises the sum of researchers' professional network ties and their technical skills and resources (Bozeman, Dietz and Gaughan 2001).Consequently, Boardman andCorley (2008, p. 903) propose that 'university research centres are strategic exercises in S&T human capital enhancement that may be used as policy tools to foster collaborative networks that create cross-disciplinary and cross-sector synergies to further a field of research and development'.

The management of human capital within a knowledge-based context presents a number of challenges. The opportunity to undertake interesting and challenging work has been found

to be the most powerful motivator of knowledge workers, including scientists

(Alvesson 2000; Finegold and Frenkel 2006). Finegold and Frenkel (2006, p. 5) suggest

that the 'star' approach to managing people which combines 'attachment to the firm based

on intrinsic work satisfaction, selection for long-term potential and professional norms for

oversight and control' is a key factor distinguishing medical- and science-driven research

firms and other high-tech companies. This need to adopt specific strategies for the

management of knowledge workers is embedded in an HR architecture model proposed by

Kang,Morris and Snell (2007). This model identifies HR practices, employment modes and

employment relationships for different employee cohorts based on 'the extent to which their

human capital is strategically valuable and unique' (Lepak and Snell 1999;Kang et al. 2007,

p. 243). Here, a key distinction is made between core knowledge employees, external

partners, internal employees (traditional employees) and contract workers. Core employees

are said to be those who 'possess valuable and firm-specific human capital' and 'provide the

core knowledge base which is a primary source of competitive advantage'. In contrast,

contract workers 'have knowledge that is neither of particularly high strategic value to a firm

nor unique, thus becoming prime candidates for outsourcing' (Kang et al. 2007, p. 243). As a

result, it is advocated that sophisticated HR practices are not homogenously extended to all

employee groups but instead are focused on the core employees with the aim of improving

their ability to combine and integrate others' knowledge. Indeed, in explaining their model,

Kang et al. subsequently ignore the role of contract workers on the basis that they 'generally

offer noncore and low-level skills and knowledge, and thereby have relatively little potential

to help modify and renew core knowledge bases of a firm' (p. 244).

While the omission of contract employees from Kang et al.'s analysis of the

management of human capital raises a number of issues, one is particularly pertinent to this

article: given the low status afforded to contract workers, from what employment

opportunities might such types of employees be excluded and to what extent should such

contracts therefore be regarded as disadvantageous? Recent reviews of flexible employment

contracts (Guest 2004) and temporary employment (De Cuyper et al. 2007) are both

inconclusive in this regard, with factors such as the type of worker and the organisational

and wider context indicated as important considerations in any analysis of their effects. In his

review, Guest indicated that

The body of research is limited but sufficient to challenge the assumption that workers on

flexible contracts are invariably disadvantaged. Those on contract of choice, particularly

knowledge workers who may be pursuing boundaryless careers, are especially likely to report

positive outcomes. (2004, p. 1)

However, other accounts of flexible work are less optimistic with indications that such

structures may deliver 'job insecurity, labour intensification/workaholic life-styles and the

erosion of autonomy through the proliferation of short-term targets and auditing activities'(Legge

2007, p. 132). The key issue for consideration here may be the notion of 'contract of

choice' and whether or not it is in line with individual expectations (Arnold andCohen 2008).

This is one element that, asGuest (2004) suggests, needs to be incorporated into any analysis

of flexible employment. In addition, there is also evidence that experience of an organisational

career may need to be a critical precursor to a contingent career(Mallon and Duberley 2000).

Views on the nature of contemporary careers connotated by the terms 'boundaryless'

(Arthur and Rousseau 1996) and 'protean' (Briscoe, Hall and DeMuth 2006) have typically

depicted positive benefits for employers and employees alike. However, recent reviews have

identified several different sets of needs for success in these types of careers, these include

such elements as career counselling and mentoring, socioemotional support and collective

voice (Arnold and Cohen 2008; Zeitz, Blau and Fertig 2009) and that a distinction should be

made between workers who actively choose boundarylessness rather than those who are

pushed into it (Zeitz et al. 2009). Likewise, with respect to fostering knowledge sharing and

creation, Swart, Kinnie and Purcell (2003, p. 2) highlight a necessary infrastructure of

challenging projects, participative cultures, coupled with adequate recognition and career development opportunities. Consequently, there have been calls for more nuanced and critical assessments on the impact of boundaryless and protean careers and requisite institutional supports (Sullivan and Baruch 2009).

The remainder of this article examines the impact of contract employment on research scientists working in five URCs located in Ireland. Kang et al.'s (2007) analysis excludes contract employees from consideration of human capital in knowledge-based context on the basis of the likelihood of their low-level skills and knowledge. However, research scientists are educated to PhD level and possess a range of specialist skills. Their exclusion from core organisational activities therefore raises substantive issues about the impact, not only on their own working lives, but on the innovation and creativity of the URC itself.

Research methodology and research context

In order to provide in-depth insights into the nature and experiences of employment conditions, interviews were conducted with 40 scientists working in different types of researcher positions within five URCs in Ireland. The interviews form part of a larger study of knowledge sharing and transfer in URCs that is being undertaken in Ireland. A semi-structured interview schedule was designed to explore three broad themes identified from the literature as being of particular significance for URCs: (a) collaboration, (b) knowledge creation and innovation and (c) leadership and management processes. The interviews lasted between 45 min and one-and-a-half hours and were taped and transcribed to address issues of credibility and confirmability (Duberley, Cohen and Mallon 2006, p. 1137). As the interviews unfolded, issues associated with employment status were identified by all the interviewees as making a crucial impact on their work, their careers and their lives. These themes emerged strongly in the analysis of the transcribed interviews undertaken by two researchers working independently.

The interviewees included 16 tenured academics; 13 postdoctoral fellows (PDs) and 11 Researchers working in a variety of research officer (RO) positions. All the tenured academics were in permanent positions and were situated at various positions on the academic career ladder, stretching from lecturer to professor. The majority (14) were working as principal investigators (PIs). The term 'principal investigator' is applied to those who have won grant funding that enables them to undertake research in their particular area of expertise, generally with a team of researchers, including postgraduate research students. While both tenured and contract staff can hold the position of PI, it is much more commonly found among those who are tenured because of the contract restrictions that are typically imposed by funding bodies. The PIs were working on research projects for which they or their colleagues had won funding and they sometimes used this funding to buy out teaching commitments so that they could devote more time to their researcher roles. In these roles they would supervise postgraduate research students, postdoctoral researchers and research officers.

All the PDs were on contracts that ranged in length from one to three years. Apart from their role as full-time researchers attached to specific projects, they also supervised teams of PhD students in lab-based work. The position of postdoctoral fellow is associated, as the title suggests, with early-stage career and is not expected to last for more than four years. However, many researchers are forced, from a lack of permanent positions, to continue to work in a succession of postdoctoral contract positions. In practice, therefore, PDs frequently bridge the traditional EU distinction between early-stage (less than four years) and experienced researchers.

The research officer (RO) position encompasses a wide range of scientific, administrative and managerial responsibilities; in our research we encountered titles such as 'research officer', 'research manager', 'education outreach officer', 'integration manager' and 'project manager'. These are generally contract positions as they are attached to specific research projects, although there are some permanent positions within university

research offices. RO positions are usually better paid than those of postdoctoral researcher as they are usually held by scientists who have already accumulated experience through postdoctoral fellowships. The 'officer' position tends to include administrative and funding responsibilities as well as research, while the 'manager' role is usually entirely administrative with responsibility for the management in all its aspects of the research grants. However, despite the responsibility levels attached to their roles, all of the ROs we interviewed were on contract and some held contracts of only one year's duration.

The URCs were located in the areas of science, engineering and technology. Four of the centres were nationally based and drew their membership from cross-institutional collaborations while one was based in one HEI, but included membership from several faculties. The numbers of staff employed in the centres ranged from 20 to 61. However, in addition to these research staff, each centre was also responsible for large numbers of postgraduate students who were attached to each of the research projects and who were engaged in pursuingMasters or PhD level qualifications. Although these students were not staff, they were all on grants of some description which had to be managed as part of the centre's administrative tasks and their performance as postgraduate students also had to be assessed. In addition to research activity spanning national and international boundaries, the centres were also engaged in various outreach activities that included educational responsibilities as well as liaison with industry. Thus, the centres were complex organisational structures with several layers of management, including executive and advisory boards.

Research findings

The findings are organised under three areas that emerged from the analysis as having a particular impact on the employment status and opportunities afforded to research scientists; access to funding, an emphasis on commercialisation and the role of the PI. Notably, these are specific manifestations of the broader themes of collaboration,

knowledge and creation, and leadership and management processes which were used to sensitise the research interviews. The final section considers these three elements in the context of their implications for contract researchers' work and non-work lives, and how they inform their ability to avail of employment practices governing working conditions.

Access to funding

The amount of research funding brought into a university has now become a key metric in assessments of a university's success, particularly in the various rankings that are now applied to universities worldwide. This focus has, in turn, become an internal mechanism within universities for estimating the success of URCs and has filtered down as an important metric in the promotion paths of scientists themselves. In addition, a key factor underpinning and shaping the career paths of research scientists is the competitive processes by which funding is now allocated rather than the long-term institutional block grants of old (Heinze 2009). Given these factors, it was not surprising that the critical importance to URC researchers of success in winning grant funding emerged throughout all the interviews. The material reality of all activities is ultimately dictated by university, national and international funding opportunities and rewards. Thus, URCs were trying to meet the demands of a range of stakeholders: 'we are trying to balance everything. We have got too many pay masters' (PD#6). Three funding issues emerged as particularly significant: grant applications, salaries and funding cycles.

The elitism of grant applications

The interviews revealed that the winning of funding grants, some of which run into several million euro, is the remit of a relatively small elite. Gaining access to this elite was said to be an arduous process and one that is nearly impossible as a contract researcher. In addition to technical ability and ideas that would leverage returns, a key aspect of successful grant proposals was the 'management of the grant'. The reality was that to meet these criteria,

applications for funding were best put forward by tenured PIs. In addition, some funding

agencies allow only the name of one person on the grant application. Contract researchers

do not necessarily have the right to make such applications and much may depend on the

length of contract that they have – many grant stipulations rule out those on contracts of

less than three years. At the same time, the PIs were cognisant of the fact that grant funding

was of crucial importance to the research scientist's career and several (PI#4, #5, #7) spoke

of the ways in which they encouraged grant applications in the name of the contract

researcher. In the end, though, there was always the problemthat 'you need to have sign off

from your supervisor. You can't do it independently. So they can't compete on an even

basis with a tenured academic' (RO#4). As a result, as one RO ruefully stated, 'the PI gets

all the credit' (RO#1). Overall, the unfairness in the system in the ways in which it

maintained the status quo in rewarding tenured academics was summarised by one PI:

So if the peer review sees your big name on it, well it could get funded maybe, you know what

I mean. If it sees my name on it, well nobody's ever heard of me, so what's the point in that

anyway ... So you didn't do anything to get the money but your name did contribute, and

then when the money come back into [Centre x] so let's say we are successful, you are the

manager of the money. Ok? Your name was on the grant, the contracts come to you – as far as

the university is concerned you're the responsible person. So, you know you're still in the

driving seat in terms of the research. (PI#4).

The impact of grant applications on researcher salaries

The PIs who are heading up the grant applications need to be in a competitive position to

win the funds at the lowest possible cost. The coupling of this with the desire of funding

agencies to minimise project costs means that the salaries offered under research contracts

are frequently at the lowest point on the researcher scales that have been adopted by the

Irish Universities Association (IUA). Indeed, in some cases, the IUA scales are ignored by funding
bodies and researchers are employed at salaries that are significantly less than

those set by the IUA. The contracts may also be of one, two or threes years' duration,

depending on the funding allocation and/or the need to maintain flexibility within the system. Thus, not only is access denied to the reward systems and incremental scales that govern the salaries of tenured academics within universities, but salaries may be well below national guidelines and with no incremental potential, no matter the duration of the contract. The issue of salary emerged in many of the interviews and was a source of tension in managing grant applications to the funding agencies as one PI described:

'So if they've got no experience we'll start them off the basics and we'll work them up. But I have no problem incrementing something twice. Now I'll get into trouble because they'll come back and say 'why did you give this person such a big pay increase?' I said 'because they weren't being paid enough for two years and this is to counter balance'. (PI #3)

The short cycle of research activity

The short term and cyclical nature of funding also had an impact in shaping the planning and timescale of projects. Most researchers are employed on research grants that are of limited duration, generally between one and five years. Apart from the duration of the grant itself, the short cycle of research activity is a factor that militates against tenure for contract researchers with the research in many cases geared up to the two or three years' duration of postgraduate degrees. One PI described the way in which he viewed research activity:

My fundamental quantum unit is two or three years of research. That's the timescale of a Masters or PhD student, roughly ... If a company is not interested in doing that, 'good bye'. That may sound arrogant but it actually costs me time and money. It is of no use to a student; it is of no use to research institutes. (PI# 2)

The contract researchers who were interviewed also recognised this tension;

'Research needs a lot of money but on the other hand money is not provided for a period longer than the duration of the project' (PD#3). This was most obvious in that the duration of research contracts was explicitly tied to the funding for projects: 'Actually

whether I can stay depends on the funding, not totally depending on me' (PD#1).

One interviewee also pointed out that the push to increase the number of PhD students at Government level has also meant that PIs have a greater choice in those they employ on research projects:

You know it's a bit like poacher turned game keeper in the fact that academics want a large supply of researchers into the research environment so that there can be a picking and choosing, OK. And the idea of doubling the number of PhDs and having a lot of early stage researchers coming through the system, that you can kind of pick and choose, got the best guy there, keep him get rid of the rest. That's not an effective strategy because, you know, whose going to go into that environment? (PI# 4)

This combination of factors created major job security issues for research scientists on contract employment which then impacted on their motivation within their current positions:

I got a 12 month contract. I think the biggest problem I have is the whole idea of job security ... I don't know whether I'm going to stay in Ireland, whether I can buy a house here, whether I can get my own funding. I mean you're very, very limited in what you can do .. . After one year or after two or three years you want to do this and whereas I'm thinking 'well, I may not be here for year two so it's hard to get motivated ... and in terms of your feelings of involvement, it's hard to feel that you're only going to be here for 12 months'. (PD#2)

In addition, there was evidence that short funding cycles constrained innovation by limiting the risk taking that may be a crucial element in new discovery: 'I dare not make a big risk in research because I only have a two year contract and I do not want to screw it up so I will use a more safer way' (PD#6). Thus, paradoxically, the impact of funding can have positive, unintended and undesired consequences.

The emphasis on commercialisation

The onus on URCs – from both government and funding bodies, to commercialise and bring in additional monies through patents and spin offs – has radically changed traditional views of university research. In particular, the push to commercialise has ramifications for the type of work undertaken and the opportunities for publication. One problem highlighted by respondents was the nature of the work that might be required as a result of the collaboration with industry and the commercialisation process:

The trouble was the work that was undertaken was completely unpalatable. You know that was the problem. It was the nature of the work and what was performed really was not, was not of any academic value whatsoever, and that was a real concern. (PI #4)

In addition, the need for secrecy to protect the ideas or product from the research also delayed opportunities for publication. In some cases there was an embargo on publication; in other cases a delay clause was built into the contract, with between 28 and 90 days lapse between discovery and publication in order that intellectual property rights could be identified. As one PI explained:

Those industry contracts are such that the company paying for them gets full access to all of the intellectual property ... So we have researchers who work on those kinds of projects and we have to tell them: 'you're doing really interesting work; it's very interesting research but you don't own it – the company owns it. And we can't publish it'. (PI#1)

While the loss of publications from a particular project can have negative repercussions on the careers of all scientific researchers, this loss is particularly problematic for contract researchers who are reliant on building up a good publication output in order to improve their position in competition for the next research contract:

What they demand is not exactly what we need to do because we have conference deadlines and we need to publish journal papers on topics that we have already set up but what they want may be a small subset and they are quite happy with this but it's just it's not the total so we just

don't have enough time to spend on their demands. (PD#1)

The importance of developing early publications was further evidenced from commentary on the careers of successful PIs, termed 'heavy hitters', who were said to have had 'the academic reputation first and the big research group and more lately then they're moving into the commercialisation' (RO#2). The interviews therefore suggest that success in the former is a necessary condition for the latter. It follows that for research scientists for whom developing expertise in a niche area of research is important, working on industry projects that are uninteresting or of limited or very specific importance will prove problematic.

Finally, it is currently the case that commercialisation, intellectual property and patents are not considered particularly highly in academic promotion criteria. While the comment from PI#4 below illustrates the dilemma for tenured staff, the same principles also apply to contract researchers seeking to gain a foothold on the academic career ladder:

The metrics that govern academic success do not involve commercialisation, OK? They involve publication; they involve you know your international standing in an academic environment. That's where your success lies. If you want to go from being senior lecturer to professor, that's the metrics you're going to be working on. (PI#4)

The role of the senior PIs

As indicated, PIs are, in general, tenured staff and are critical to the success of the URC. Their roles encompass an external focus, in their ability to obtain and manage grants, but they also play a critical role internally in the impact they can have in guiding and developing the careers of scientific researchers. Factors such as reputation, networks and mentoring were mentioned by the postdoctoral researchers as key elements in the

relationship with the PIs. As one researcher indicated:

We usually have a meeting once in a week so even though we can go anytime to him we can approach him even though he's busy, he never refuses. So, this kind of thing is here, you can go any time and discuss, say you got this idea so he listens and gives his side. (PD#2)

In their teaching and facilitating learning, dictating but also granting autonomy, the PDs viewed the PI as a 'role model' (PD#3) and good 'safety harness' (PD#4): 'he has been watching us and encouraging me and I know that he has talked to me about the process of being a post-doc and gradually moving it along and trying to improve with my reflections on that' (PD#4). Many PIs played a mentoring role for teams of PDs. However, the enactment of this role was an expression of individual personality and resource availability rather than something that could be assumed as a given:

It just depends on whether their PI or supervisor is interested in their post-docs career development, or if they are interested or aware of how to do it, how to help them....not to just presume that the researcher knows everything themselves or that they are on top of things. In my experience that is rarely the case and often the PIs are not aware of that either, or don't care (PD#5).

Indeed, such was the crucial factor of the impact of the relationships with PIs that for many of the contract researchers it was the key determinant in taking up their current position and critical in informing their future employment choices. At the same time, as illustrated by the discussion of elitism in grant applications, relationships very much echoed traditional hierarchies with a prominent undertone of dependency.

Those who were in contract research officer roles had more research experience and were therefore less dependent on the mentoring role provided by PIs. At the same time, they also recognised that 'success and progression is both discipline dependent and personality dependent' (RO#1). They were also in many cases working at the whim of the PIs in seeking their agreement to cooperate with the new directions in which many URCs were positioned:

The research programmes are very much driven by the PIs themselves, which is right as they're the people who have the vision to push a particular research programme. The effectiveness of the integration manager is dictated almost entirely by the willingness of a PI to allow the integration manager to help them in a particular research programme. (RO#6)

The impact of contract status on researchers

Both the contract and the permanent research scientists who were interviewed remarked on the negative impact of contract status on researchers' careers. It was acknowledged that being a researcher can be a 'rocky road' (PD#4) and that researchers 'can't compete on an even basis with a tenured academic' (RO#4). Many researchers felt their role was ill defined in terms of both content and direction (Nerad and Cerny 1999) with uncertainty underpinning the whole of the contract's duration: 'the project is finished in theory in August of next year, whether I'll be kept on or not, I can't answer that, I don't know' (PD#7). This uncertainty was also true for those who had been contract researchers for several years, particularly in relation to promotion and future career opportunities:

I'm on a year-by-year contract so it's certainly not a stable environment to be in; you're basically relying on the next funding. Whatever funding comes in, that's what pays your wages. If no funding comes in, there's no job. (RO#3)

The rights of contract workers are technically protected by the Protection of Employees (Fixed Term Work) Act 2003 (FTWA) that offers the rights of full-time employment to those who have served multiple contracts. While such legislation might seem at first to offer the potential to improve the position of contract researchers, it has simply made HR departments much more wary of allowingURCs to renew contracts in case this leads to the creation of a large number of permanent research positions – a situation that has also been reported in the UK (Ackers and Oliver 2007). As a result, researchers who might have previously enjoyed at least the continuity of contract positions find themselves in a

position where contracts have a predetermined start and finish date:

Weare and will continue to lose good people and lose the knowledge that they have built up in the centre because we can't offer them longer term positions you know and I think it's going to reach a head kind of any day now whereby people are going to be let go because we can't hold them for four years because of the contracts of indefinite duration. (RO#2)

The uncertainty created by this contract status impacted negatively on many aspects of respondents' work and non-work lives. In the first place, they were denied access to many of the HRM practices that govern the employment relationship. Thus, only very limited induction programmes were provided while training was largely ad hoc. As a result, many contract researchers simply grew into their roles by learning from peers and gaining experience. There were generally no formal performance evaluation systems for contract researchers – as one respondent noted 'silence is presumed to be positive' (PD#1) – and no personal development planning. One research manager acknowledged: 'It's something we know we should be doing. It would probably be beneficial to people and to peoples' careers if it were more formalised' (RO#4). This lack of access to forma lHRM systems meant that all the contract researchers were likely to be particularly powerless in the face of any grievances or disquiet (Ferber 1999; Sullivan and Baruch 2009). There was also an acknowledgement that temporary, short-duration contracts made things difficult, particularly as lives moved on, and there was a clear sense of frustration at these conditions:

Because of HR I have a one year contract and now I have to interview for my own job to get a further extension of my own contract to fill out the three years if you like. But it's the lack of stability would be a major thing that makes me uncomfortable. (PD#5)

Further ramifications included the fact that while the contract researchers clearly identified with their career and professional norms, much less reference was made to a reliance on the university or URC as a basis for their occupational identity or feelings of self-worth.

Concern about short-termcontracts not only affected the researchers. From the perspective of URCs, the risk was a continuous 'brain drain' and limited opportunities to exploit 'economies of experience'.

Despite the problems of contract employment, the contract researchers who were interviewed were generally enthusiastic and positive about their work within URCs. Some of the PDs commented on being part of 'the most hot, active topics of research' (PD1), highlighting the importance of gaining the experience of working with experts, coupled with the value of a flow of people in creating a dynamic environment (PD#4).ADarwinian self-selection logic may even hold that only the brightest and best win further contracts and access to funds and so the model is successful. One of the dilemmas for university research scientist is that employment in Irish industry, while offering permanency, hold out very few interesting prospects for researchers keen to pursue a research career: "Very small number of individuals will successfully make it as academics. Industrial outlets for these types of position, certainly in Ireland, are still few and far between, and poor quality, you know don't let anybody kid you that there's lots of jobs for researchers out there. What they mean is, if you get with a degree and you want to go and you want to pipette some stuff in a lab somewhere, that's the job they're talking about. (PI#2)"

Discussion

This article has examined some of the key factors shaping the employment conditions of research scientists working in URCs. In particular, drawing on the conceptual anchor of Kang et al. (2007), it has considered the extent to which contract researchers are denied access to the employment conditions that underpin the operation of knowledge-intensive firms such as URCS and whether or not such exclusion, if it occurs, is disadvantageous. The research is limited by the fact that it was confined to 40 research scientists working in Ireland. Nevertheless, the consistency in the views that were articulated suggests that the

issues that emerged are of key importance to both researchers and URCs.

The research found that contract researchers were excluded from the key elements of the employment conditions that govern research work. The implications of the findings are discussed at two inter-related levels. First, from the perspective of the individual researcher and, second, from the perspective of the URC as a knowledge-intensive firm. Finally, the conclusion section considers some of the implications of the findings at a national level for Ireland's positioning as a knowledge economy.

The implications for the contract researcher

The findings indicate that contract research scientists experience a 'Cinderella- like' status as university employees (Ackers and Oliver 2007, p. 62). Thus, while their high levels of knowledge and skills and the intellectual nature of their work classify them as knowledge workers (Alvesson 2000), their contract status means that they are not in a position to avail of the HR practices that govern promotion, performance management or career development. This is despite the fact that such practices have been found to be crucial to the management of knowledge workers (Swart et al. 2003; Collins and Smith 2006). In effect, many of the PIs filled some of this void through informal mentoring. Nonetheless, such guidance was typically administered in an unstructured fashion and as such was frequently determined by the demands and personality of the PI as an individual (Akerlind 2005).

A recent review of factors likely to determine the nature of boundaryless careers (composite of knowing why, knowing whom and knowing how) helps in framing the realities for the contract researchers interviewed (Tams and Arthur 2010, p. 634). In terms of motivation and identity (knowing why), the problems identified above are exacerbated by the lack of access to a recognised salary scale and formal performance appraisal process, even though rewards and recognition systems have been highlighted as an

important element in motivating knowledge workers (Swart et al. 2003). Moreover,

researchers may also be faced with the prospect of undertaking commercially focused

research which in some cases may not be particularly interesting or of relevance to them.

This links to the second aspect in shaping the potential for boundaryless careers, reputation

and relationships (knowing-whom). Here, for research scientists, the emphasis on meeting

commercial obligations and expectations may present barriers to the publication

opportunities, which are key to building a national and international research profile. At

the same time, because of the short tenure of their contracts, researchers are frequently unable to
apply for the funding that is crucial to securing their longer-term standing. The

final constraint to boundaryless careers relates to skills and expertise (knowing how),

whereby contracted researchers are not privy to formal career planning and typically only

receive limited training opportunities and/or the provision of ad hoc advice by PIs.

Thus, for university researchers, contract work does not provide them with the

expected ability to influence their working arrangements or career prospects, but instead

risks being disadvantageous to their longer-term aspirations. In this context at least, the

realisation of self-directedness and autonomy assumed of protean careers in knowledge-

intensive domains is tempered by the nature of employment contracts and the broader

funding systems. In contrast to the recent reviews of flexible work (Guest 2004; De Cuyper

et al. 2007), these findings are therefore pessimistic about the nature of contract

employment for certain types of knowledge workers, but at the same time confirm Guest's

warning that the notion of 'contract of choice' needs to be built into any analysis.

The findings also support prior research that identifies key criteria that must underpin the

ability of knowledge workers to engage in the types of unstructured working arrangements

associated with boundaryless careers (Mallon and Duberley 2000; Zeitz et al. 2009).

The contract researchers who were interviewed had none of these prerequisite elements on

which to draw. Instead, they inhabited positions in organisational hierarchies that, despite

career ladders that spanned from postdoctoral researcher to research officer and beyond,

were overshadowed by overtones of impermanence and continual change. While such hierarchies mirror that found within academia, they might best be described as ephemeral as their inhabitants seek more stable careers outside their domains. These inhabitants present an enormous diversity of situations, both personal and work-related, with some researchers still on contract although over 40 years of age and with all the trappings of family and financial commitments that are common to such a stage in their life cycle. It follows that understanding of concepts such as boundaryless and protean careers must be both contextually and temporally located (Van Buren 2003; Tams and Arthur 2010).

The implications for the URC as a knowledge intensive firm

In their model of the HR architecture for a knowledge-based context, Kang et al. (2007) view contract and non-core workers as interchangeable terms and consequently ignore any role that they might play in their 'potential to help modify and renew core knowledge bases of a firm' (p. 244). In such a model, there is relatively little chance of a divide between contract and permanent staff as each is contributing in quite a different way to the success of the firm. However, in the current research, operating as knowledge workers, contracted scientific researchers offered contributions to the URCs which were valuable, if not unique. This counters the idea that those in non-standard jobs are necessarily in low-skilled positions (Felstead and Gallie 2004). Consequently in the URCs investigated in our research, a divide between permanent and contract staff was noticeable in the access that each type of staff might have to employment conditions. In particular, the PIs were in powerful 'star performer' (Groysberg, Lee and Nanda 2008) roles as they wielded power in decisions over the recruitment of staff, the length of the research contract they chose to offer, the salary and increments they decided to award and the mentoring in which they might engage. In addition, they were also responsible for determining the type of research undertaken as well as publication and funding opportunities. The contract researchers at the receiving end of these decisions were very much at the whim of the particular PI in

terms of their access to opportunities that might be accorded (Ferber 1999, p. 1516). Thus, while URCs may present an external image as collaborative networks (Boardman and Corley 2008), differences in contract status have the potential to cause a major fracture in

the social climate deemed critical to fostering innovative activity (Collinson 2000; Collins and Smith 2006). In addition, as the interviews revealed, contract researchers may be less inclined to undertake the 'frame-bending research' (Brown and Duguid 1991) that is core to the innovative process and therefore of crucial importance to an URC's continued existence.

Conclusions

The findings point to the limitations of research which focuses exclusively on crude metrics (e.g. increased funding) that are reported to impact on the effectiveness of innovative activity at the expense of acknowledging the working conditions, social processes and institutional contexts that underpin and enable such activity (Bozeman and Mangematin 2004; Cha, Youngbae and Tae-Yeol 2009; Heinze 2009). A more critical interpretation would hold that the development of precarious workforces is symbolic of a neo-liberal agenda infiltrating into universities and their management to the detriment of more traditional enterprise (Callinicos 2009, p. 19). While fixed term contracts and opportunities for mobility can be important aspects of researchers' development (Storey, Quintas, Taylor and Fowle 2002) over the longer term this contractual status can invite vicious cycles and prevent researchers from accessing employment opportunities and working conditions that are core to their professional careers. As a result, Government investment in the domains of science and engineering risks being countered by the unattractiveness of research careers so that the best and brightest potential candidates are deterred from even entering these careers to begin with (see also ESF 2009). Clearly, there is scope for much critical reflection and empirical investigation rather than presupposing a predetermined impact as a result of a knowledge-based agenda and/or new modes of working (e.g. Currie et al. 2006; Donnelly 2009; Sullivan and Baruch 2009; Rodrigues and

Guest 2010).

Suggested policy implications include the need to pay due attention to the contracts underpinning the employment of research staff. In Ireland, issues concerning the development, rewarding and retention of postdoctoral researchers have been identified at a national level, and there is now a move to try and ameliorate these through deciphering clear and better research paths (Forfas 2008). However, the current economic environment might prove to be an obstacle to these attempts. Other suggestions include guidelines requiring universities to specify the number of postdoctorates likely to be given tenured positions and to monitor the total time spent in these positions, while also providing more systematic performance appraisal and researcher career counselling and development, including training in transferable skills and job searching capabilities (Nerad and Cerny 1999). From the perspective of researchers, responses have included collective mobilisation in the form of associations and unions, although gaining sufficient recognition and legitimacy from university authorities can be a key difficulty. At the same time while improvements in employment contracts might ameliorate working conditions, it is not immediately apparent how such improvements would alter the hierarchical power relationships that currently govern mechanisms such as funding applications and industry collaborations (Tams and Arthur 2010). In sum, the findings raise questions about the rhetoric of a Government policy that posits a knowledge economy fuelled by increased numbers of research scientists, and the reality of the working conditions that are experienced by the scientists themselves.

Acknowledgements

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