CHAPTER 10

How and where are dominant funding models steering HE & Research?

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INTRODUCTION AND CONTEXT

We are living in a time of great economic uncertainty where governments are providing our universities with less resource, yet at the same time expecting to exert greater influence, through increasing regulation and a more and more forensic focus on impact and value for money. At the same time, the world is facing a set of grand challenges that research-intensive universities, working with industry, are in a unique position to solve.

Focussing on examples from the United Kingdom, the European Union and the United States of America, I will reflect on the present funding environment, in particular for research, and explore the clear push we are seeing from funders to drive research in a more top down and programmatic way, putting a premium on multi-disciplinarity and collaboration. The nature of the funding environment and, more importantly, the challenges we face as a society mean that links with industry and business are increasingly essential. However this traditional relationship must be redefined.

This unique combination of circumstances means that universities have to learn to be more responsive to funders and to look beyond traditional national and subject boundaries. In this way, we can ensure the breadth of expertise and the capacity exists to deliver relevant research in a sustainable way.

The response of universities to the changing demands of research funders is part of higher education's long track record of facing new challenges and find-

ing a way to respond, while remaining true to our mission and purpose. Before I focus on changes to research funding and how these have affected us all, it is worth reflecting on how radically higher education and the influence of its funders, especially in the U.K., have transformed over the lifetime of many of today's academics.

Universities were traditionally rather elite institutions educating only a very small minority of their national populations. As we know, there was then a transition from this elite system to a mass system of higher education. In so far as how higher education was publically provided, this, of course, placed ever-increasing claims upon the public purse. As the need for these resources grew, so governments began to examine the purpose of this investment. If one adds into this the growing recognition over the last 20 years that higher education is an important component of global economic competitiveness, then one produces the circumstances for a radical change in the relationship between universities and the state. This can perhaps best be summarized by stating that it was once the role of governments to provide for the purposes of universities, but it is now the role of universities to provide for the purposes of government. It can be argued that governments increasingly regard universities as delivery agents for public policy goals. This, we will see, is particularly true of research funding.

And now, in the 21st century, it could be argued that we find ourselves given the role of transforming education. It is our responsibility to educate, engage, empower and energize the next generation of problem solvers. It is research universities that drive a robust international and collaborative research agenda designed to identify, invent, test and deploy solutions designed to address the formidable challenges that we all face. At the same time we must build both disciplinary depth and trans-disciplinary breadth of research and education, connecting the science, engineering, technology, mathematics, social sciences, arts and humanities disciplines in service to society. And finally we need to assess the need for societal action, to transmit authoritative information to stakeholders and then take ownership of the process of transition of knowledge to application, working in new partnerships.

How we carry out these responsibilities is clearly driven by the funding environment, and specifically the research funding environment, that we face.

The funding environment that we see across the E.U. and the United States, whilst obviously exhibiting clear differences, also has many similarities. Public funding from governments for research, while decreasing and being unpredictable, is being driven by what I will call the grand challenge agenda. As we will see, in order to access public funding, research must help answer questions in areas of strategic and societal importance, more than ever before. Increasingly there is a realization that the traditional relationship with business and industry must change. Arguably this relationship should evolve

into a more peer-to-peer nature, stressing collaborations in areas of joint interest rather than the traditional customer-supplier relationship in which business procures graduates and intellectual property from universities.

I will draw out these themes by looking at the U.K., Continental Europe and the U.S. in more depth.

THE U.K.

In the U.K., investment in universities generally and their research in particular, has grown on the back of expectations about the transforming power of higher education and the contribution of research-driven innovation to the economy. Universities have grown enormously in number and size in the past 20 years and expansion has arguably placed the system, at least in part, in the role of service-provider with the resulting impact on the distribution of resource, activity and outcomes. Whilst universities in the U.K. remain autonomous institutions, increased public investment, both through grants and fee income, has made them more visible and more accountable. Meanwhile, many research fields have grown, diversified and matured to an enormous extent. Within the U.K., public perceptions of research outcomes have changed from discovery to utility, reflected particularly in the overt objectives of policy instruments.

In the U.K. there is a strong tradition of research in all subjects, and most of the U.K.'s long-term, curiosity-driven and strategic research is carried out in HE. The U.K. continues to punch well above its weight and our research remains the most productive and efficient of all the G8 countries. Crucially, in the current economic climate, the U.K. offers the best value for money. We now rank first among the G8 nations on the number of citations in relation to public spend on R&D.

U.K. HEIs receive billions of pounds annually to fund research. This comes from four main sources:

1. The research councils, who provide grants for specific projects and programs on a competitive basis. The councils also make a contribution to the overhead costs of research, and from 2006 have paid 80% of the full economic cost.
2. The four HE funding bodies, who provide block grants to support the research infrastructure — for example, building and IT costs. When combined with research council funding, this is known as the "dual support system".
3. Charities, which are particularly important in funding medical research.
4. Various other sources, including industry, the European Union and U.K. government departments.

The "dual support system", which combines block grants from the HE funding bodies with research council funding, forms the bedrock of research funding in the UK. This approach is distinctive to U.K. HE and is defined by being highly selective and competitive. Funding through the four U.K. HE funding councils is distributed according to the quality and volume of research measured and assessed periodically through a national exercise (formerly the Research Assessment Exercise, now the Research Excellence Framework – REF). The main feature of this QR ("quality related") funding is that HEIs are free to invest it in accordance with their own strategic priorities. This flexibility of bloc grant funding is much valued by HEIs in that it can support the research areas most important to them, while allowing them to integrate this funding into their own resource allocation systems.

Research council funding is allocated competitively, and is highly selective. The common objectives of these funding councils are to:

- Fund basic, strategic and applied research involving project or program funding.
- Support post-graduate training.
- Support science in society activities.
- Contribute to economic competitiveness, the effectiveness of public services and policy, and the quality of life.

While QR funding promotes freedom within HEIs, the competitive approach to grant funding by the Research Councils promotes discovery that has a clear social and/or economic impact.

The U.K. government recently (2011) launched its Innovation and Research Strategy, setting the direction of travel moving forwards, and giving universities a clear understanding of the government's priorities. What stands out is the very strong push towards collaboration and consortia. There is now a clear set of principles governing the treatment and submission of multi-institutional funding bids, and global collaboration is firmly on the agenda. Importantly the research funding paradigm of funding excellence is here to stay with a strong commitment shown towards that, the Research Excellence Framework, the dual support system and a balance between fundamental and user-led research.

What is clear, again to echo the themes that we see across the E.U. and America, is that there is, and will continue to be a programmatic approach to solving the grand challenges. Research Councils U.K. (2011), in their strategic vision, state that in order to foster economic growth and ensure the prosperity and well-being of the U.K., the strategic delivery of focused research programs, alongside nurturing innovative fundamental research, will be vital. It is recognized that public investment in research is an investment in the nation.

Six major themes, similar to the E.U.'s grand challenges, and America's national goals, have been identified that will provide the framework for all research council funding. These themes are:

- Digital economy
- Energy
- Global food security
- Global uncertainties
- Lifelong health and well-being
- Living with environmental change

A clear strategic goal of the research councils is to maximize opportunities for breakthrough research that crosses discipline and domain boundaries which it is hoped will result in solutions which can be exploited to the advantage of the U.K.

A key element of this is the relationship between universities and industry. Many civic universities traditionally had strong industrial links in the past, forged through a theme of relevance to and their origins in the local economy. Inevitably these particular links have weakened over the last 30 years or so, although wider networks have diversified. Between 1995-07, private research contract income to higher education rose from £170 million to around £300 million. But, at the same time, it fell as a share of total grant and contract income from about 11% to about 8%. To meet the legitimate expectations of wider society, it could be argued that public and private sector partners need a larger stake in a relationship of "mutual confidence". Changing knowledge balances and growing financial accountability will cause the higher education research base to reconfigure its external relationships, with stakeholders inside the U.K. and with international partners in Europe and elsewhere. Such partnerships will not only involve HEIs, but also governments, research funders and other stakeholder bodies, including industry and local and regional policy-makers seeking support for innovation and economic regeneration.

A good example of the U.K. HE infrastructure adapting to this approach is the Research Partnership Innovation Fund, launched in 2012, which supports universities involved in major collaborations with industry on a project-by-project basis. We at Liverpool are a beneficiary of this fund, having recently bid in conjunction with Unilever for funds to support the development of a Materials Innovation Factory on our campus at a total cost of over £40m.

Clearly internationalization will become, if it has not already, a core element of successful research and an integral part of remaining globally competitive. U.K. higher education research works well when it works with partners. However, it will be necessary for those partnerships to be more active than in the past, with clearer strategic investment, engagement and feedback. U.K. researchers must become more mobile between sectors and between countries,

and Government must look to stimulate more effective engagement from industry than it does currently. The challenge then for all involved is to identify innovative ways in which the wider academic, commercial and social communities can combine together to deliver useful outcomes.

So, as in America and the E.U., it is clear that there will be many difficult discussions and decisions to be made in the U.K. Increasing selectivity will lead to tough decisions about the future of the research base. Meanwhile universities must do everything they can to access the funding that is available, whether from government, the European Union, industry, charity or other sources. The nature of much of this funding means that we must demonstrate impact and ensure value for money, a drive that is recognized by the weighting given to impact in the REF, the recently launched government "Gateway to research" (a portal to allow access to publically funded research across the U.K.), and the push towards open access publishing. The programmatic nature of this funding ensures that we are expanding interdisciplinary activity and collaboration between a number of stakeholders.

Although there are always uncertainties and challenges with higher education policy and funding, the relatively stable approach of funders in the U.K. ensures that, at least for the time being, there is a clear direction of travel for research in HE.

EUROPE

In this section I will predominantly focus on the European Union as a funding body and how the direction that they are taking is having a fundamental effect on national governments and universities. If nothing else, the E.U. is worth dwelling on as one of the few funders of research that is looking to increase the amount of funding for R&D. While in one sense, this, by definition, is good news for higher education, the E.U.'s programmatic approach means that universities have to continually respond to changing priorities so that they can access more and more of this funding.

The traditional European model of higher education emphasizes centralized planning, state control, state funding, little competition and a focus on research and advanced training. However there is starting to be increased competition that is inducing a process of differentiation across universities in many member countries. Some universities are on the way to become truly internationally orientated, research-based universities, while others are developing their strengths in a national or regional context. Others still are focusing on their role as teaching institutions. In short, higher education in the E.U. has become more open, more international and more stratified.

This effect is enhanced by the European governing bodies' view that Government ministries and agencies responsible for science and innovation across Europe

need to develop more effective policies to address societal challenges, and to stimulate competitiveness, through intervention in research, education and innovation. Policies to promote knowledge triangle linkages remain problematic. Government bodies increasingly recognize the need to promote excellence by increasing competition for public research and innovation funding, but are confronted by limitations of doing this at a purely national level. More and more, they stress value for money and impact as key funding aims, and look to transnationally coordinated programs and projects as an important channel for achieving them.

In this context, the E.U. is seeking to use its power as a funder to tackle a number of perceived structural problems related to HEIs and research in mainland Europe.

Primarily it is felt that there should be a greater contribution of research and innovation to tackling societal challenges. Although many major societal challenges will have the same profound effects on all E.U. countries, there is still a relatively weak coordinated response at a pan-European level in the field of science and innovation. It can be argued that, to be successful, Europe must stimulate coordinated research aimed at addressing these challenges and improve the way it is transformed into new products and processes.

Likewise, while Europe has a historically strong science base, when it comes to highly cited science or top ranking universities, it often lags behind the U.S. For example, 15% of U.S. scientific publications are among the top 10% most cited publications worldwide, only 11% of E.U. publications fall into this category. Furthermore, the E.U. faces increasing competition from emerging countries. If Europe is to strengthen its scientific and technological performance, and to provide the basis for future competitiveness, it needs to increase its spending — in "Blue Sky" frontier research, in associated infrastructure, in training and education — and to make this spending more effective.

Finally there is insufficient cross-border coordination. Europe's research and innovation system remains constrained by national borders. Research funding is often dispersed, leading to duplication and inefficiencies. In spite of the benefits of coordination, almost 90% of R&D budgets are spent nationally without coordination across countries.

The European Union's response to these problems is captured in Horizon 2020 (European Commission, 2011), its new funding program for research and innovation. By bringing all E.U. research and innovation funding into a single research and innovation framework, it is hoped that participation will become easier, that collaboration will be encouraged, that there will be an increase in scientific and economic impact and that value for money will be maximized.

The programme's objectives are now presented as the broad themes:

1. Excellent Science, to raise the level of scientific excellence in Europe to protect Europe's long-term competitiveness.

2. Industrial Leadership, to make Europe a more attractive location to invest in research and innovation. It also seeks to stimulate the growth potential of European companies, and SMEs in particular.
3. Societal Challenges, to develop new and convincing solutions to today's important societal problems.

And the framework identifies six societal challenges as priorities for funding:

1. Health, demographic change and well-being
2. Food security, sustainable agriculture, marine and maritime research and the bio economy
3. Secure, clean and efficient energy
4. Smart green and integrated transport
5. Climate action, resource efficiency and raw materials
6. Inclusive, innovative and secure societies.

Horizon 2020 follows on from the multiannual Framework Programme, which up until the inception of Horizon 2020 was the E.U.'s main programme for funding research, technological development and demonstration. We are now within the final phase of Framework Programme 7 (FP7 – 2007-2013) and spending is expected to have reached €50bn by 2013.

The Framework Programme has traditionally focused on supporting transnational research collaborations in industrially relevant areas and underpinning E.U. policy-making — although support for research mobility, transnational access to research infrastructure and coordination of national programs has been added over the years. FP7 currently funds around 5% of overall E.U. civil investment in research and innovation (the rest coming from national governments and the private and charitable sectors).

The evaluation of FP6 concluded that it had contributed to increased industrial competitiveness; generated extended networks and strengthened the knowledge infrastructure in Europe. FP6 included world-class projects with the best researchers, contributing to improved researcher mobility, internationalization of research teams, and to Europe performing internationally-competitive research at the frontiers of science and technology in areas of social and industrial importance. The interim evaluation of FP7 has demonstrated that funding is going to leading researchers engaged in high-quality projects and that the new European Research Council has succeeded in funding world-class research and is playing an important role in attracting and retaining research talent within the E.U.

The largest proportion of the current Framework Programme is allocated to specific programs which fund a number of thematic areas relating to challenges, technologies and sectors mostly awarded on a "top-down" basis to cross-border consortia of researchers from academia, research institutes and

industry. This has been underpinned by a commitment to supporting demonstrable excellence in research, through competition at a European scale, which in turn has led to word-class outputs.

The Grand Challenge programmes, at the heart of Horizon 2020, such as climate change and the need to pool resources to meet the demands of internationally competitive research, will mean that collaboration, between universities, industry and others, becomes an increasingly frequent part of normal business. The concept that individual E.U. countries might split the agenda seems absurd, but the idea that there should be some specialist hosting of shared, major facilities is a realistic extension of established institutions such as the European Organisation for Nuclear Research (CERN), and the European Molecular Biology Laboratory and the Institut Laue-Langevin. The European Commission's research budget is expected to increase after 2013 and, particularly in light of the current funding environment, U.K. universities will need to continue to work strategically and collaboratively with universities in other E.U. member states in order to maximize their funding opportunities.

It is clear then that through the implementation of Horizon 2020, and the previous Framework Programme, the E.U. is taking a programmatic approach to research funding, while, for universities, operating in a difficult funding environment, the approach to European funding is becoming increasingly important. It is likely that the nature of the grand challenges will ensure that universities look at strategic partnerships in terms of long-term research commitments, rather than only academic exchange and short-term student recruitment mechanisms. These strategic partnerships will increasingly involve industry and measurement of impact will continue to dominate the agenda. However, there is still a need to ensure that "Blue Sky" research is appropriately supported and that the mix with applied research is appropriately distributed, a fact recognized by the E.U. following feedback on its initial announcements around Horizon 2020; we will see to what extent when the budget for the European Research Council is set.

To finish my overview of the impacts of E.U. funding with an aside, underlying all of the factors I've just mentioned will also be the drive for economic efficiency, as European funding continues to bring with it issues around administration (particularly around reporting and the accountability burden) and the reimbursement of indirect costs. Again, the E.U. is responding to feedback on this area, and is now being positive about "simplification", and making it easier for universities to access and manage research funding.

THE USA

Much like the United Kingdom and the European Union, in the USA, the approach of funders is shaping higher education research. It feels like America

is at a turning point in its approach. A recent report commissioned by the U.S. Congress — "Research Universities and the future of America" — reflects this view, and I will use it as a basis for discussing the impact of research funding in America. Importantly this report looks forward and the recommendations made indicate the potential for making change in the new world we are in.

In the American ecosystem there is significant diversity among research universities in size, geography and mission. The sector is characterized by decentralization, pluralism (public and private universities), diverse funding sources (endowment, federal, state, tuition), high levels of competition and a hybrid model that includes undergraduate education, graduate study and research in the same place, done by the same people, frequently at the same time. The report argues, as you would expect, that research universities are drivers of renewal and producers of knowledge. They create a pipeline of talent that is upwardly mobile and this in turn creates prosperity. Yet, despite this, America, along with the U.K., has been cutting funding for research as part of its response to the global financial downturn, when it would appear most of the world, especially the BRIICS countries, are increasing funding.

For example, since the report was published, we have seen a process of "sequesterization" introduced in the U.S. since March, with automatic cuts in funding being applied to research as part of wider budget cuts. The National Science Foundation, for example, is slated to lose more than $280m this year, and expects to fund about 1,000 fewer research grants than last year. The National Institute of Health is expected to lose about $1.6bn in funding this fiscal year.

In addition to this, American research universities are also facing other pressures such as record reductions in state funding, erosion of endowments, soaring tuition costs reaching unaffordable limits, and, in some cases, a loss of political and public confidence in the value of university-based research.

Despite this, the expectations for university-based research to produce creative solutions for a growing list of complex problems have never been higher, forcing institutions to be more strategic about applications for research funding.

The report goes on to identify two other key issues in the partnership between federal government, states, business and universities:

1. Business and industry have largely dismantled the large corporate research laboratories that drove American industrial leadership in the 20th century, but have not yet fully partnered with research universities to fill the gap at a time when they need to more effectively translate, disseminate and transfer into society the new knowledge and ideas that emerge from university research.
2. Research universities need to be responsive to stakeholders by improving management, productivity and cost efficiency in both administration and academics.

Importantly, the current approach to funding and policy is having a negative impact on the operations of universities. There has been under-investment in campus infrastructure, particularly in cyber infrastructure, that can lead to long-term increases in productivity, cost effectiveness and innovation in research, education and administration. Universities have to cross-subsidize research from other sources because research sponsors do not pay the full cost of research they procure — an issue not restricted to America. Finally, there has been a burdensome accumulation of federal and state regulatory and reporting requirements that increase costs and sometimes challenges academic freedom and integrity.

The current approach to research universities is fragmented, with no coherent national plan or rational strategy to support university-based research.

What is clear, regardless of government policy, is that the nature of the grand challenges is helping to drive the actions of research-intensive universities. The grand challenge agenda is not unique to Europe. In America it is expressed through national goals:

1. Advances in medicine and health care
2. A sustainable, healthier environment
3. Energy security
4. Improved standards of living
5. Education for our children and adults
6. Enhanced security

To enable impact-orientated research that addresses these significant social challenges the need to increase inter-disciplinary collaboration within and between other universities and with industry is essential, and it is clear that federal funding is driving research in these areas, forcing universities to be more strategic in applying for research funding when faced with a reducing pot.

With federal funding comes a new level of expectation and scrutiny. Accountability measures mandated by the American Recovery and Reinvestment Act of 2009 have placed new demands on universities to ensure they demonstrate quality and value added outcomes of their research. "Quality" and "value" are terms commonly used to rank all types of activities, and research programs are no exception. As has been done with other publicly funded functions, academic research is entering a time of greater political accountability. In this time of increases in performance and results planning and reporting, the scientific and academic leadership are looking for ways to be more responsive, while at the same time mindful that programmatic and funding decisions must be scientifically sound, relevant and responsive to public need — a theme echoed across the U.K. and Europe.

In the absence of a national research strategy, the competition between such disparate universities in the U.S. has begun the trend of consolidating

academic research into fewer but larger institutions. It could be argued that as this trend continues, the overall research enterprise loses out. Furthermore the need for universities to use their own resources to subsidize sponsored research contributes to the consolidation of university research into fewer but larger institutions, and benefits those who have larger endowments. It seems likely that a number of universities at the margins will not be able to bear the costs of supporting competitive research efforts. Cuts in state support to universities are not evenly distributed when viewed as a percentage of the overall budget. Many will not have the internal funds necessary to support their academics at a level where they can be competitive for external funds, without which there is essentially no ability to maintain a significant research enterprise.

The central problem, then, which brings the future of academic research into question, is inadequate funding. Simply put, the current size and scope of the academic research enterprise cannot be sustained in the absence of additional financial support. Furthermore, research is among the most complicated aspects of higher education. There are many points of possible failure, making it more difficult for institutions to adjust and succeed. The financial resources of an institution, if high, will tend to favour its structural competitive advantage over an institution dependent on public resource.

On the face of it, it would appear that there are different issues in America to those seen in the U.K. and Europe, with not only major concerns over the approach to funding of research, but also more widely to what appears to the a lack of strategy moving forward. However, there are similarities too. Like the U.K. and the E.U., there is a rising level of accountability. Public funding bodies are ensuring that the research they fund contributes to solving the strategic challenges that are faced. Likewise, the nature of these challenges results in new partnerships being formed, across universities, disciplines and across sectors.

The impact on American universities is clearly profound. With uncertain funding streams and increased global competition, many are facing difficult choices about their future direction. Research continues to be cross-subsidized from other activities, directly affecting the ability of universities to invest strategically. Without a grand unifying plan in sight, somehow a new, more sustainable direction must be found.

CONCLUDING THOUGHTS

In drawing my contribution to a close I want to recap and reflect on the direction in which research-intensive universities are heading. From the three groups that I have cited, the U.K., the E.U., and the U.S., I hope it has been clear that there are many similarities, in particular the expectation by funders of impact from research, the expectation of interdisciplinary approaches to pre-identified themes and the need to engage with industry and other partners

outside HE. However, there are also many differences. The lack of a coherent approach in the U.S. compared to a clear direction of travel (like it or not) in the U.K. Increasing funding for research in the E.U., compared to a more austere approach in the U.S. and U.K. These positions become starker as we find ourselves living in a time of economic austerity, where any amount of funding cannot be guaranteed. We are also all living in a time of global competition that is continuing to shape the response of governments and individual universities.

It is clear that we must all strive to demonstrate impact and value as a necessary consequence of spending public money. However, we must also strive to lead the agenda and ensure that, as individual universities, we are able to shape our own futures. Of course this is easier said than done. And even harder than this is the challenge for universities to retain some of their original identities and original raisons d'être in amongst the demands for more impact and a more immediate product. And that challenge is of course to strike the right balance between "Blue Sky" research, where results and impact cannot be predicted, and applied research, that is driven by utility and often by industry. Getting this balance wrong, either one way or the other, will be to the detriment of the sustainability of the research base and to society at large. It is clear that we must all work hard to diversify funding streams so that we can shape our universities as we see fit. The HE sector is being driven in a clear way by the funders and models that they implement. As has been demonstrated, the approach of research funders can be characterized by increasingly becoming more top down, programmatic and with a clear focus on grand challenges that can only be solved by forming collaborative partnerships between disciplines, institutions and industry.

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