

Understanding High-Impact Research Through Mode 1 and Mode 2 Research Approaches.

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Abstract: *For many academics in the UK the current Research Excellence Framework (REF) has pulled the notion of impact and impactful research into focus. This paper explores the notion of high impact research and how this relates to traditional notions of research activity and quality. With a focus on the UK and how it fits into Europe it also takes a practical approach describing through case studies how academics can adopt a mixed economy of both 'pure' or Mode 1 research and knowledge transfer, knowledge exchange or engagement activities often described as Mode 2 research. The argument here is that the combination of these types of research can result in a virtuous circle of activity leading to high impact, excellent research. The paper ends with an analysis of the practical challenges and opportunities of this approach for both individual academics and also institutional units, departments or research centres.*

1. Introduction

Publicly funded research, either through grants or direct governmental funding of institutions such as universities has always been the subject of scrutiny. This is necessary and welcomed, as researchers why should we spend taxpayers money without checks and balances? The nature of these balances has changed over the last 50 years from a very loose set of constraints in the 1960s when research funding was relatively plentiful (for the smaller number of research institutions and academics working at that time). As the number of academics and academic institutions involved in research in the UK increased this was matched by a decrease in research funding [1] and greater competition for funding and tighter controls and evaluation on research activity.

This change in the funding landscape saw a shift in the way funding was allocated, from a very closed doors, peer to peer approach in the 1970s to the establishment of the University Grants Committee (UGC) in 1986. The UGC adopted a more transparent and selective position on evaluation of research, recognising that not all institutions or research should be equally funded. By current standards this evaluation was very general. This saw evaluation of 'cost centres' with their five best papers being taken into consideration along with 7 or so other measures. This was strongly criticised at the time [3], and it is interesting to see parallels between

this criticism and current attacks on the Research Excellence Framework (REF) our current method of evaluating research.

For the UCG process in the 1980s the strongest criticism was focused on a perceived bias towards larger cost centres [2]. This is seen both explicitly in measures such as comparing total funding for research councils and the number of research students to more implicitly for example, the five best papers produced by the centre where a large overall number of researchers is likely to result in better 'best' papers. This criticism was exemplified by Keith Minogue in 1986 when talking specifically about his research of politics. He argued, *'Like anything else academic, the study of politics is an act of intelligence, and like all such acts, it can only be judged in terms of response to it; it cannot be heaped up to see how big it is'* [3].

This reaction against an aggregate or 'voluntaristic academic tradition' approach as it was described at the time [4] is significant as it marks a shift away from institutional evaluation towards finer and finer detail eventually looking at individual academics' work in some of the most recent evaluation exercises in relation to the impact of their research. This move towards more nuance and detail informed the evaluation frameworks that followed the UCG process, in the form of two RAE (Research Assessment Exercises) and the current REF (Research Excellence Framework). In the present REF individual academics are rated for the quality of their research with between 10% and 12.5% of academics in an institution (depending on the size) having to describe the impact of their research outside academia in detail.

Some argue that this trajectory of more and more detailed and (hopefully) sophisticated evaluation has already gone too far in terms of introducing a bureaucratic and financial overhead. The last RAE was estimated to cost up to £100 million [5]. Responding to the scale and complexity of the process, Ben Martin argues strongly that research evaluation in the UK has become a 'Frankenstein Monster', indeed it is hard to argue against this when he states

'an assessment costing of the order of £100 million, and involving the evaluation of some 50,000 individual researchers and nearly 200,000 publications, is a rather complicated and expensive way of determining how to divide up the government university research budget between 100 or so universities!' [6]

The aim of this paper is not to argue for or against the current evaluation of research in the UK. Rather the intention is to look more broadly at the notion of impact and how this can be used to help academics embrace impact as a way of enhancing research directly while they also indirectly address the political agenda that is currently very strong but will undoubtedly evolve in the future. The aim is

also to challenge the assumptions sometimes still prevalent in academia that 'outward facing' or Mode 2 research is separate, and of lower quality than pure or Mode 1 research. The argument here is that Mode 2 is different but no less valid and further that moving between these Modes gives an academic a very robust base to build *both* new theory and impactful research.

2. Impact in Research

While impact is more directly in the spotlight in the current REF, an element of recognition of the effect research has outside academia has always been part of research evaluation. We can see this in the agenda promoted by the Jarrett Committee tasked to look at the overall management performance and efficiency of the universities in the 1980s. In a Green paper produced by the committee in 1985 this government committee argued that it was '*vital for our higher education to contribute more effectively to the improvement of the performance of the economy*' [7]. It went on to say that there was a '*need to increase the effectiveness of the money spent in universities on research*' [7]. This emphasis was reflected in the UGC process where impact was included within the research effectiveness key performance indicator [2]. In the 1990s with the trend for more academic institutions looking for research funding and a general decline in the amount of funding available impact and value for money became more important. In 1993 the governmental White Paper *Realising Our Potential* government science policy specified an impact imperative for UK scientific research [8]. The Council for Science and Technology, went further recommending 'a future system for quality-related funding must . . . acknowledge the diverse roles that universities play in the economy and society, rewarding a greater range of activity' [9] while the Science and Innovation Investment Framework criticized the RAE for its lack of follow-through on the intention 'to reward excellent user-focused research in the same way that it rewards excellent curiosity-driven research' [9]. Smith, Ward and House [9] argue that this explicit framing of impact, application and value for money is a positive step, making the value placed on the effects of research outside academia (that has always been present implicitly) more directly acknowledged.

This move towards a policy of impact with successive governments in the UK of widely differing ideologies lends credence to the assertion that impact will not be dropping off the research agenda very quickly.

3. Defining Impact

As we have seen above, impact has been part of the thinking about funding research for quite some time. This focus has been framed in a number of ways, including knowledge transfer, third stream activities, social benefits, public values and knowledge exchange [10]. The HEFCE (Higher Education Funding Council for England) the body that determines funding for universities in the UK defines impact as

'any identifiable benefit or positive influence on the economy, society, public policy or services, culture, the environment or quality of life'. [11]

Stepping away from the literature, a simple everyday definition of impact could be *'the degree that research has changed the world outside academia for the better'*. Framed in this way many academics warm to the idea of impact and actively aspire to this beyond a tactical engagement with politics or funding priorities. Many academics are keen to see their work having a wider resonance beyond academia.

4. High Impact Research

There is not a causal link between research excellence and high impact research. There is a great deal of highly regarded research that either has not yet found an application or is inherently not applicable. Lutz Bornmann illustrates this effectively by comparing two case studies of research. As he describes,

'scientists would think of the original work on apoptosis (programmed cell death) as high quality, but 30 years after it was discovered there has been no measurable impact on health'. In contrast, there also is research—for example, "the cost effectiveness of different incontinence pads" that is certainly not seen as high quality by the scientific community but has immediate and important societal impact' [10]

4.1 Defining Mode 1 and Mode 2 Research

There is a new way of thinking about and describing research emerging from the sociology of science and management fields. Both of these fields are building a theoretical position that distinguishes between traditional and new 'outward facing' research. Mode 1 research has a focus on new knowledge as defined by a set of peers within a particular discipline, Mode 2 research focuses on new Modes of academic activity that are cross disciplinary, outward facing and problem solving without a well defined body or peers. This distinction was first conceived of by Gibbons et al in *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies* 1994 [12]. They regarded Mode 1 research as focused on theory building, traditional and disciplinary. Ernø-Kjølhede and Hansson describe it as aiming *'to accumulate centrifuged, true knowledge as an end in itself, whereas Mode 2 research seeks knowledge for application'* [13]. They go on to express the motivations for the emergence of Mode 2 research (also described as non-linear or post-normal science).

'The concept of Mode 2 research is becoming more widespread and used within universities, largely due to growing political pressure to make research more readily applicable and to improve cooperation between public and private players' [13]

Publications such as the Journal of Research Evaluation rather than this paper is a proper venue for a detailed exploration of Mode 1 and Mode 2 research but there is one aspect of the differentiation between these that is especially interesting when thinking about impact. Mode 1 research is closely associated with peer review, where broadly like-minded academics determine the quality and relevance of research through mechanisms such as accepting papers for journal publication or conference presentation. Mode 2 research has a more complicated relationship to peer groups. This is very often cross-disciplinary so the potential group of peers is considerably larger and also very heterogeneous and not well defined. Further than this relevance is not determined by fellow academics but rather by the 'extra-mural' stakeholders in the research process.

'the objective of Mode 2 is not scientific excellence and theory-building as such but rather the production of a result that is relevant and applicable for the users of the research; in other words, the result should be socially relevant, socially robust and innovative' [14]

In their exploration of the implications of Mode 1 and 2 research with a focus on policy Ernø-Kjølhede and Hansson [13] focus on two case studies. The first of these case studies is the Danish research evaluation system. Here they describe a tacit acknowledgment in research evaluation that Mode 2-type approaches are important but this is outweighed by a desire for simple indicators with a Mode 1 focus. This is contrasted with the UK REF, the authors strongly support this approach as an *'exciting and relevant novelty in research policy'*. They go on to say

'this initiative seeks to render concrete some of the elements we have outlined as being relevant for assessing research that falls within the scope of Mode 2 research...the coming UK Model seems to support the desire of Modern research policy for promoting problem-solving research without being at the expense of the traditional, more discipline- oriented university research which continues to hold the most important position in the Model' [13]

This is a refreshing contrast to the normal discussion of the role of impact in research in UK academia, rather than seeing impact as a driver of perverse behaviour as described by Ben Martin in terms of the REF specifically [6] and more generally by Goodhart's Law that identifies the skewing effect criteria can have on behaviour [15] here we see impact described as a bold attempt to recognise Mode 2 research and value imperatives that are motivating applied research.

5. High Impact (Mode 2) Research in Practice

As Ernø-Kjølhede [13] recognises Mode 2 research is not a panacea, in fact there are significant challenges in undertaking this type of research. One of the

underlying causes of these challenges is a lack of agreed criteria or evaluation for Mode 2, this makes it difficult to assess the quality of Mode 2 research. This inherent uncertainty (that may be a defining feature of this type of research) is highly problematic to traditional research institutions. In academia research is often still valued in terms of Mode 1 outcomes and frames of reference. Often the most highly rated journals have a strong disciplinary focus, similarly promotion criteria are often based on Mode 1 outcomes (sole authored journal articles, monographs, conferences with a tight disciplinary focus) rather than collaborative working across disciplines or applied research. In addition to these traditional criteria, if an academic is undertaking this type of activity in addition to undertaking more outward facing activity this sharing of effort inevitably reduces the effort that can be put into Mode 1 activity. It is noticeable that even in the 'bold experiment' of the REF academics providing an impact case study are still measured on their M1 research evidenced through publications as well as having to describe their M2 activity.

The way that REF is treating impact on the ground is realising an interesting issue, as things stand at the moment impact activities are not transferable between institutions, so a strong impact case study undertaken in university X cannot be taken to another university if that academic moves. The reason for this is fairly pragmatic, REF did not want institutions buying in impact in the same way some buy in traditional research. The lack of portability however moves the problem around, it is highly likely academics with strong impact case studies will be in demand at the start of the next REF cycle with institutions looking to seed strong impact activity in time for the next evaluation. Impact is likely to be more important in the next REF in 2020, certainly influential publications such as the Witty Report [16] call for an increase in the number of academics submitting an impact case study from between one in eight or ten up to 25% of all academics.

5.1. Why Undertake High Impact Research?

On the face of it the motivation for academics to undertake high impact, or Mode 2 research is not clear. It has significant disadvantages in terms of career progression, publications and attracts an additional burden both in the long-term REF cycle and day-to-day, especially in institutions with a focus on traditional Mode 1 research.

There are however significant advantages to high impact research. A great deal of RCUK funding requires research projects to describe their pathways to impact as part of the application. This gives academics with an ability (and track record) of high impact research a significant advantage. As an academic comfortable with working outside the 'ivory tower' and understanding pathways to impact its clear the strong dual outcomes of this approach make it easier to attract research funding. The RCUK funding bodies (including EPSRC, AHRC, ESRC, STFC) are increasingly looking for real contributions from external partners, a move that in effect is match funding. This shift is evident over time from the support required

from external agencies. It used to be acceptable to get a fairly generic supporting letter from external organisations, then there was a requirement for a detailed letter, now there is often a requirement for a cash value to be placed on this support.

The direction of development is clear as RCUK move from funding research to enabling research. Having a strong understanding of research frameworks that are relevant and accommodating of external partners is critical in attracting real, financial support from external partners. This is demonstrated in the way the UK research councils regard the transition from pure research to impactful activity. These pathways to impact span all the research funded by the Research Councils so they are necessarily broad. All of the pathways not described as academic impacts map to Mode 2 type activities for example wealth creation, R&D investment, policy making. This is reinforced by researchers such as Lutz Bornmann who explicitly connect Mode 2 research with societal impact [10]. However actually attaining the described impact and then providing good evidence for this impact is a very difficult and complicated proposition beyond the scope of this paper. A full description of the RCUKs pathways to impact can be found in the document 'What do Research Councils mean by "impact"?' [17].

6. A European Perspective

Looking towards Europe there is a dramatic change in the way research is considered and funded by the European Commission. Until recently there used to be very rigidly defined silos for research and business support funding. Very broadly these fit into 3 categories (with many smaller scale initiatives and possibilities set to one side for the sake of simplicity).

Research: These 'framework projects' were very much in the traditional, collaborative research mould, with academic institutions and companies of all sizes across Europe collaborating together to create new knowledge. This was often technically-led resulting in demonstrators, conference papers and other publications. These outcomes were the prime mechanism of transferring knowledge from academia into others in the field and so influencing innovation.

Business Support: This structural funding, through programmes such as ERDF (European Regional Development Fund) and ESF (European Social Fund) focuses on infrastructure support. Since 1975 ERDF has provided support for the creation of infrastructure and productive job-creating investment, mainly for businesses; the ESF, set up in 1958, contributes to the integration into working life of the unemployed and disadvantaged sections of the population, mainly by funding training measures [18].

In addition to building physical infrastructure, bridges, business incubators or innovation centres for example, this often involves the transfer of knowledge from academic partners (or other knowledge sources) into companies with the aim of producing measurable economic value for the companies (e.g. jobs created or safeguarded). ERDF is not intended to fund research although it does fund innovative forms of knowledge exchange and their dissemination across Europe through its INTERREG programme currently changing its name to INTERREG EUROPE [19].

As we will see in the case study below, these categories are being relaxed somewhat in an overall move to help the research undertaken across Europe to have a stronger benefit to business and the economy. The most visible effect of this change of emphasis is the radical changes that research funding has undergone. Starting in practice in Autumn 2014 Horizon 2020 is a 7 year program replacing the research Frameworks that have described the EU's commitment to research. With a total budget of just less than €80 billion the new call moves away from a hoped for link to innovation through disseminating new knowledge to a more active engagement with impact. In fact the aim is

'coupling research and innovation, Horizon 2020 is helping to achieve this with its emphasis on excellent science, industrial leadership and tackling societal challenges' [20]

Underpinning these aspirations, the Commission Staff Working Paper Executive Summary Of The Impact Assessment describes 4 key drivers

- Insufficient contribution of research and innovation to tackling societal challenges
- Insufficient technological leadership and innovation capability of firms
- The need to strengthen the science base
- Insufficient cross-border coordination [20]

We can see three of these four drivers point towards a less isolated, more outward facing approach to research in addition to now also including societal benefits for the first time at this level. We can see both in RCUK and Horizon 2020 a move to extend the spectrum of valid, respectable research activity beyond traditional new knowledge creation into areas sometimes regarded as knowledge transfer or knowledge exchange, consultancy and applied research. This strategic change of emphasis is having a significant effect on the day-to-day activities of researchers and academics.

The following case studies draw out some new practical possibilities partly made possible by the strategic changes outlined above. The first describes an ERDF

project that achieves significant business support throughout the development and deployment of 50 PhD students, taking a very traditional Mode of research and making it relevant and highly beneficial for SMEs. The second case study explores the benefits of individual academics creating a mixed economy, or ecology of research projects that support each other while inhabiting different parts of the pure research/high impact spectrum. Both of these case studies explore the real world benefits (and challenges) of moving between Mode 1 and Mode 2 research. These case studies show that there are huge potential benefits to undertaking research that combines elements of Mode 1 and Mode 2 research. Indeed with the changes in the funding landscape, in the UK but also in Europe this combined approach will be essential for academics seeking funding research.

7. Innovative Project Structures

As we have discussed ERDF structural funding has a focus on providing infrastructure for economic success across Europe. It is quite a large fund at around €278 billion and forms the second largest expenditure within the EU commission. Conventionally this fund is used to *'provide support for the creation of infrastructure and productive job-creating investment, mainly for businesses'* [18]. These aspirations translate into new roads and bridges and into business support, knowledge brokering and other well-established infrastructure development activities. There are however some examples of combining ERDF activity with Mode 2 research.

7.1. Ideas at Daresbury

A small example of this is the Ideas at Daresbury project. IDEAS (Innovation, Design Entrepreneurship and Science) was set up as a means of collaboration between the management schools of Manchester, Lancaster and Liverpool universities along with the design research centre at Lancaster University. Normally great rivals, this collaboration exploited the neutral ground of Daresbury Science and Innovation Campus as a test bed for new ways to take academic research and translate this into useful interactions with the high tech SMEs that occupy the science park. With strong support of the North West Development Agency the Ideas at Daresbury project received £600,000 funding for an 18-month project.

This project is relevant here because of the explicit aim of taking research from management undertaken in some of the leading management schools in the country and translating this into a palatable, useful form that would have a practical value to small companies. The nature of this translation was lead by interaction and experience designers themselves bringing new research to bear on the structuring and design of new events.

Within Ideas at Daresbury, the programme 'Beyond Networking' is an example of this confluence of new research and its translation into effective support for business. This series of five workshops was based on the premise that although companies know they should be networking they almost never know if they are doing this well and all too often think it a matter of collecting piles of business cards. There is a great deal of research on networks and networking but it is not very accessible to companies, it is produced in journals that are not free to access, the research with value to companies is not obviously different from more fundamental research, there is often an element of statistical analysis that is off-putting to the time poor SME manager.

The response to this was to design a new interactive experience for the 25 people on the Beyond Networking platform. This helped them understand and strategically construct their networks and was achieved through a range of fun exercises that produced the data necessary for academic researchers to undertake a formal network analysis and then to reproduce this back to companies in an easily understandable form. Described in more detail in NETS: a design tool for activating social networks in the International Journal of Entrepreneurial Behaviour, [21] this approach is an effective example of the translation of Mode 1 research into Mode 2 research with resulting impact and new Mode 2 research enabled by ERDF funding. Here we see academic knowledge generation both growing from and prompting engagement activity, making both sides stronger.

7.2. The Centre of Global Eco Innovation

IDEAS was a relatively small project, there are examples of much bigger and more ambitious combinations of research and business engagement under the banner of ERDF funding. The Centre of Global Eco Innovation (CGE) is an example of such a project. Launched in 2012, this £9.8 million centre is innovative because it has a very strong conventional research component in addition to more traditional business engagement activities. The use of ERDF funding to facilitate 50 PhD students is highly innovative and a first across Europe.

From one perspective the CGE is a very traditional ERDF project. It seeks to address challenges to business in the North West, these include

- Low levels of SME-investment in innovation to underpin growth.
- Low levels of SME-university collaboration.
- A lack of capacity in SMEs to undertake collaborative research and development.
- The need to produce products and services with significantly improved environmental performance.
- Low levels of export performance in environmental markets.

These are perennial problems for business across the UK and Europe with many projects funded to address such issues. The success of these sorts of projects is

measured in economic terms, for example new jobs or additional value created. For CGE the targets include

- 235 firms becoming engaged in new collaborations with the knowledge base.
- The creation of 318 new jobs.
- 85 businesses with significantly improved commercial performance.
- The creation of 150 new products and services for export.
- £45M in additional GVA (value added to the regional economy) by 2017.
- The leverage of £675K from private sector investment. [22]

These targets are being achieved by placing 'graduate researchers' within companies, these researchers recruited from engineering and environmental science sectors help the companies develop new technology with a specific focus on export. The researchers also are part of a PhD programme and as part of their activities in the company and research training at Lancaster University will obtain a PhD at the end of the project. Financially ERDF cannot pay for PhD fees so in practice companies pay the fees while the CGE project pays the salary of the researchers in the company.

The PhD component of CGE gives this project a radically different position in a university context with dramatic positive effects. There are strong explicit and implicit motivations for academics to supervise PhD students that are not present when considering conventional ERDF projects (in fact quite the reverse). The motivations include an intellectual challenge, co-authorship of peer reviewed publications and enhanced promotion prospects. CGE forms a bridge that spans the worlds of Mode 1 research, Mode 2 research and business engagement and support activity. This benefits academics with funding to do research with PhDs, it benefits companies, they have a dedicated researcher working on an innovation challenge. Perhaps the biggest impact is on the PhD students themselves, they will contribute to a new generation of researchers happy to contribute to new knowledge generation while at the same time speaking to the real world concerns of external stakeholders.

8. A Mixed Research Profile

While the projects described above describe how projects can cross between Mode 1 and Mode 2 research there is another, more personal dimension to crossing between these two research perspectives. As the academic landscape (and the funding opportunities with it) change there are new opportunities and challenges for academics and especially for those academics in the first half of their career. This change can cause tensions between established routes to success and advancement in academia and these new perspectives

The debate around publications, citations and impact ratings of journals exemplifies the predicament of young academics. Such academics are strongly

encouraged to publish in the journals with the highest impact factors, these are almost always firmly within a specific discipline and with a focus on Mode 1 research. Finland is unique in codifying the value of publishing in these key, highly rated journals '*the publication of just one paper in a higher impact journal can boost the budget of a university hospital by about US\$ 7000*' [23]. Highly cited academics are treated like celebrities (or more accurately footballers) for the citations they attract and the funding that follows such notoriety [24]. All this directs the career-minded academic to focus in their early years on getting their head down and writing very much in Mode 1.

However, as the landscape of research changes and funding moves away from peer-to-peer evaluation and towards more impact-based measures as seen in the UK REF the case for the early adoption of Mode 2 approaches becomes much more compelling. In part this paper is a plea to break down the expectation that young academics focus on research suited to publication in core journals with more senior academics, with the promotion process essentially at an end with the awarding of a chair, free to move between disciplines and undertake Mode 2 research without a detrimental effect on career. The argument here is that a mixed economy of Mode 1 and Mode 2 research can have a reciprocal benefit and that the real benefits of such a mix will only be achieved when academics who have worked all their academic lives in such a context grow to maturity.

For the individual academic, Mode 1 research generates new hypotheses, knowledge and perspectives. These are evaluated by peers in the subject area through conferences and journal publications, often in an isolated context that is one step removed from wider reality [25]. Taking Mode 1 activity into a broader real world Mode 2 context allows for a broader and different set of evaluative criteria and 'stress testing'. For example the Nets research described above was evaluated as a piece of Mode 1 research by the International Journal of Entrepreneurial Behaviour. It was also evaluated in a very different manner by the 40 or so high tech SME owner/managers who undertook the workshops and activities that grew out of this research. This real world testing of concepts represents one of the more straightforward but still valuable benefits of crossing over between Mode 1 and Mode 2 research.

8.1. Beyond the Castle

The Beyond the Castle (BTC) project (funded as part of the EU INTERREG project PROUD) is a good example of how an interplay between more academic, Mode 1 research and outward facing, Mode 2 research can strongly benefit both research perspectives. The PROUD project sought to improve public space through co-design. Within this the BTC project aimed to establish the basis of a master plan for a large, greenfield, rough ground site within five minutes walk of the centre of the city of Lancaster on the North West coast of the UK. The funding by INTERREG established a Mode 2 frame, essentially how could local communities actively contribute to the reshaping of this high profile but neglected site. However

the approach developed very much was framed by Mode 1 research and approaches. This was grounded in post structural philosophy, a re-evaluation of hierarchies and disputed power relationships [26]. From this philosophical platform further research proposed the reconceptualization of both the nature of design and the practice of facilitation [27].

In practice BTC resulted in a co-design project with 2,000 participants and 750 active co-designers (a substantial achievement for a project of this type). The results challenged and resulted in change in the City Council's perceptions of how the space should be developed, it has also transformed the way the City Council (and increasingly other public bodies in the UK and Europe) undertake consultation activities which are starting to be enshrined in new policy. These are good, solid Mode 2 outcomes with impact, returning to our initial working definition of impact, there are good grounds to describe this as research that has changed the world outside academia for the better. Indeed this project has been submitted as an impact case study for the 2014 REF. Just as significant though have been the contributions to new knowledge. These include new guidelines for design processes [28] a significant portion of a new monograph on open design and innovation theory [29] and as a springboard for a pending £1.4million RCUK bid. These are all focused on new knowledge creation but draw strength from their grounding in real world, Mode 2 frames of reference and activity.

9. Conclusion

This paper discussed the emergence of impact as a metric for university funding. It tracked the move from an implicit treatment of impact as part of decidedly opaque processes towards a more nuanced, transparent but bureaucratic approach seen in the current REF process. This changing landscape was placed in the context of Mode 1 and Mode 2 research. Here Mode 1 focuses on new knowledge creation within a well-defined (often disciplinary) peer group. In contrast to this Mode 2 research does not have a well defined set of peers, often crossing between disciplines and rather than concentrating on new knowledge creation for its own right it focuses on understanding and addressing challenges meaningful to people outside academia.

Conventionally there has been a polarisation between these two approaches, especially in young academics who are often measured against publications in Mode 1 focused journals and other Mode 1 mechanisms of recognition while this is often less of an issue for senior academics. The argument here is that as impact moves from a novelty in REF 2014 into a more mainstream measure in REF 2020 and beyond a strategic engagement with both Mode 1 and Mode 2 research perspectives will be critically important.

Moving beyond a tactical engagement with REF, it's clear that the landscape of research funding is changing, both in the UK and more widely in Europe.

Academics are increasingly going to be required to place their research in a wider context and understand how it can have a wider impact. Rather than seeing this as a problem (or even a disaster) the argument here is that this can have a strong beneficial effect. Academics, and especially young academics should understand and embrace the differences between Mode 1 and Mode 2 research and combine these in their research portfolio. There are a new generation of PhDs thinking in these terms and starting to thrive in this new funding environment, established and newly established academics need to make this adjustment as well.

References

1. Auranen, O., & Nieminen, M. University research funding and publication performance—An international comparison. *Research Policy*, 39(6), 822–834. (2010).
2. Phillimore, A. J. University research performance indicators in practice: The University Grants Committee's evaluation of British universities, 1985–86. *Research Policy*, 18(5), 255–271. (1989).
3. Minogue, K. Political Science and the Gross Intellectual Product. *Government and Opposition*, 21(4), 396–405. (1986).
4. Bourke, P. *Quality measures in universities* (pp. 1–30). Beiconnen, Australia. (1986).
5. Sastry, T., & Bekhradnia, B. *Using metrics to allocate research funds*. (2006). Retrieved from <http://www.hepi.ac.uk/files/23RAEandmetricsfullreport.pdf>
6. Martin, B. R. The Research Excellence Framework and the “impact agenda”: are we creating a Frankenstein monster? *Research Evaluation*, 23(3), 247–254. (2011).
7. Johnes, J. Performance assessment in higher education in Britain. *European Journal of Operational Research*, 89(1), 18–33. (1996).
8. Henkel, M. Can academic autonomy survive in the knowledge society? A perspective from Britain. *Higher Education Research & Development*, 26(1), 87–99. (2007).
9. Smith, S., Ward, V., & House, A. “Impact” in the proposals for the UK's Research Excellence Framework: Shifting the boundaries of academic autonomy. *Research Policy*, 40(10), 1369–1379. (2011).
10. Bornmann, L. What is societal impact of research and how can it be assessed? a literature survey. *Journal of the American Society for Information Science and Technology*, 64(2), 217–233. (2013).

11. The Research Excellence Framework and the “impact agenda”: are we creating ...: EBSCOhost. Retrieved March 25, 2014, from <http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=3d8093af-1771-4824-af84-0e95881411d5%40sessionmgr4002&vid=2&hid=4101>
12. Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, Sage (1994).
13. Ernø-Kjølhede, E., & Hansson, F. Measuring research performance during a changing relationship between science and society. *Research Evaluation*, 20(2), 130–142. (2011).
14. Nowotny, H. Introduction: ‘Mode 2’ Revisited: The New Production of Knowledge., 41(3), 2003.
15. Goodhart, C.A.E. (1975a) ‘Monetary Relationships: A View from Threadneedle Street’ in Papers in Monetary Economics, Volume I, Reserve Bank of Australia, 1975
16. Witty, A. (2013). *Encouraging a British Invention Revolution: Sir Andrew Witty’s Review of Universities and Growth* (pp. 1–147). Retrieved from <http://dera.ioe.ac.uk/18576/1/bis-13-1241-encouraging-a-british-invention-revolution-andrew-witty-review-R1.pdf>
17. Research Councils UK. (2014). What do Research Councils mean by “impact”? Retrieved May 28, 2014, from <http://www.rcuk.ac.uk/ke/impacts/meanbyimpact/>
18. Europa. (2014). Glossary, Structural and Cohesion Funds. Retrieved from http://europa.eu/legislation_summaries/glossary/structural_cohesion_fund_en.htm
- 19 Interreg4c. (2014). *Interregional Cooperation 2014-2020*. Retrieved from <http://www.interreg4c.eu/programme/2014-2020/>
20. EC Commission. (2014). What is Horizon 2020? - European Commission. Retrieved May 25, 2014, from <http://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020>
21. Cruickshank, L., & Mortati, M. NETS: a design tool for activating social networks. *International Journal of Entrepreneurial Behaviour & Research*, 18(4), 509–523. (2012).
22. <http://www.cgeinnovation.org>, Retrieved May 25, 2014
23. Adam, D. The Counting House. *Nature*, 415(6873), 726–9. (2002).

24. Auranen, O., & Nieminen, M. (2010). University research funding and publication performance—An international comparison. *Research Policy*, 39(6), 822–834. doi:10.1016/j.respol.2010.03.003
25. Cruickshank, L. towers of delusion. Retrieved from <http://imaginarium42.blogspot.co.uk/2012/03/towers-of-delusion.html>
26. Cruickshank, L. The Case for a Re-Evaluation of Deconstruction and Design: Against Derrida, Eisenman and their Choral Works. *The Radical Designist*, (3). (2009).
27. Cruickshank, L., & Evans, M. Designing creative frameworks : design thinking as an engine for new facilitation approaches. *International Journal of Arts and Technology*, 5(1), 73–85. (2012).
28. Cruickshank, L; Coupe, G; Hennessy, D. Co-Design: Fundamental Issues and Guidelines for Designers: Beyond the Castle Case Study. *SVID, Swedish Industrial Design*, 1–10. (2013).
29. Cruickshank, L. *Open Design and Innovation: Facilitating Creativity in Everyone*. London: Ashgate Publishing Limited, (2014).