cultural science

Arts and Humanities Research in the Innovation System: The UK Example

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ABSTRACT

Innovation is the successful exploitation of new ideas. It is about adding value to products and services, to ways of undertaking tasks, and developing policies through the application of ideas that are new in a particular context. The importance of innovation flows from an understanding that the future of advanced economies lies in exploiting knowledge. This application of new ideas is essential in creating and maintaining high-value products and services which are prized within global markets. Policymakers increasingly recognise that their ability to address urgent social issues also rests on a wholesale commitment to innovation. Solutions to social problems such as terrorism, climate change, public health issues and ageing populations will require fresh thinking and the combined use of technological, cultural, social and economic change. The aim of this paper is to investigate the role that arts and humanities research plays in innovation and the challenges faced in making the most of its knowledge. It then goes on to explore the public funding structures that support this research in the UK, and the work of the Arts and Humanities Research Council (AHRC) in particular.

Introduction

The increasing importance of innovation

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The aim of this paper is to investigate the role that arts and humanities research plays in innovation and the challenges faced in making the most of its knowledge. It then goes on to explore the public funding structures that support this research in the UK, and the work of the Arts and Humanities Research Council (AHRC) in particular.

A systemic perspective

Innovation does not happen in isolation. It requires cooperation between a diverse set of actors – government, universities, third sector organisations, entrepreneurs, businesses and consumers. Knowledge is produced and spread by all of these actors. Performance is dependent on the relationships between them and on the quality of the overall system (Smits and Kuhlmann, 2004).

An increasing number of policymakers are embracing this systemic approach. Such a perspective has characterised innovation policy in Scandinavian countries for a number of years (Sharif, 2006). The Organisation for Economic Co-operation and Development places a systemic approach to innovation and economic performance at the heart of its evolving Innovation Strategy (OECD, 2007i).

In the UK, the increased emphasis on systems can be seen in recent government reports related to innovation – such as *The Lambert Review of Business-University Collaboration (HMT, 2003)* and *The Race to the Top: A Review of Government's Science and Innovation Policies* by Lord Sainsbury (HMT, 2007). The most striking illustration of the acceptance of the systemic approach in the UK can be seen in the creation of the Department for Business, Innovation and Skills in 2009, and the publication of *Innovation Nation* (DIUS, 2008), a national strategy for stimulating and harnessing innovation.

Lundvall (1992) classically defines a national innovation system as "the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge…either located within or rooted inside the borders of a nation state". Studies of the national innovation system stress the importance of people, enterprises and institutions in the flow of knowledge within the innovation process. This national focus is a pragmatic and flexible way of showing the links between component parts of a system, while acknowledging the nation state as a political entity with its own innovation agenda (Lundvall et al, 2002).

The systems approach embraces the vast range of actors needed for innovation, where knowledge activities and institutional structures need to be mutually supportive. In this way, innovation is best enhanced by a strong knowledge base – most obviously the nation's higher education and research infrastructure – and a wider tolerance of new and diverse ideas. It also requires a sound education system that supplies skilled workers and managers capable of giving those new ideas practical value.

A healthy innovation system needs a supportive competition regime that rewards innovations, together with flexible labour and financial markets that can quickly free up and allocate resources to more productive uses. More broadly, it needs a stable macroeconomic climate conducive to long-term planning and a reliable system of welfare and security to assist individuals displaced by change.

From this panoramic perspective, the network of actors necessary for innovation is complex. They are geographically dispersed and have dissimilar viewpoints, and yet are ultimately interdependent and closely knit. Their interactions may be predatory or cooperative, extended or brief; but an understanding of each other's differing interests is of vital importance for effective interaction.

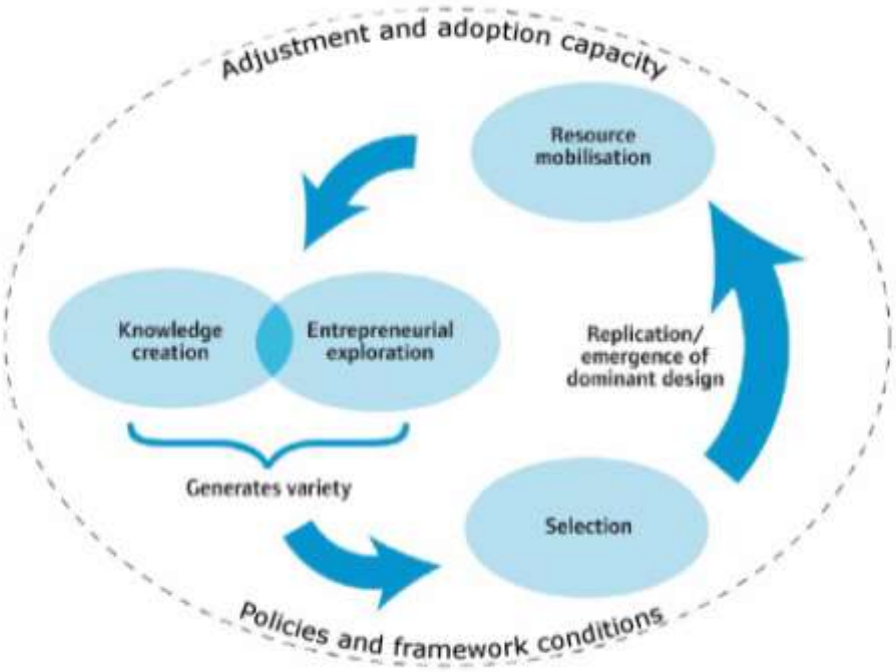
As the components of the system are interrelated, payoffs from efforts to support one area are unlikely to occur unless other areas are functioning adequately. Indeed, even if each of these areas is individually working in the right direction, it is still possible that each can interfere with the effectiveness of another. This tension is explored with respect to knowledge creation and diffusion later in this paper.

Individual actors have different cultures, interests and motivations. They may speak in different languages, have different missions, and work to different timescales. Policy, therefore, needs to bridge gaps which would otherwise hinder the creation and diffusion of innovations.

A model of innovation system dynamics

A system relies on its internal dynamics. The components of a well-functioning innovation system are in a state of continual change (Ziman ed., 2000). Knowledge creators and entrepreneurs experiment with different ideas and technologies, and so generate variety. Evaluation mechanisms select between 'good' and 'bad' ideas. As a result, 'successful' projects flourish, while 'unsuccessful' ones fold. Successful projects tend to get replicated, draw more resources and expand. As a dominant design emerges, attention switches from exploring new alternatives to exploiting economies of scale. Figure 1 is a stylised depiction of the various functions of this innovation system.

Figure 1: A functional model of an innovation system



Adaptability cuts across all of these innovation functions. Social systems have a tendency towards inertia or stability; as a result, once a particular practice is established, it can become embedded.

Systems can sometimes collapse, when their dynamics assume unsustainable behaviour, or if they are affected by external shocks, which can in turn allow new ideas and innovations to appear. Yet it is more often frustration with existing products or services that leads people to search for new solutions. This constantly creates losers who may have a vested interest to block change. Policy can either help or hinder the process of adaptability, depending on how swiftly and smoothly its focus is directed at new and emerging priorities, and how supportive the infrastructure is.

Systems have their own history and memory that must be understood when examining the role of policy (Arthur, 1994; Pierson, 2004). Even the most effective innovation systems face the dilemma that where an expensive investment has been made in a particular solution, that solution tends to maintain itself and reinforce connections with other parts of the system.

Incentives to identify and stick with a single option can be strengthened by the presence of three factors:

- learning effects – the tendency to learn and become more accomplished through use;
- coordination effects – where individual actors derive increased benefits from an option, if others also adopt it; and

- adaptive expectations – the belief that unless choices are made based on what has happened in the past, there will be drawbacks later on.

These tendencies may all conspire to reinforce the standing of an industry within a region. But while this inclination to permanence can keep the system together and ensure its efficiency in more stable times, it significantly raises the costs of exit from existing arrangements (Hamalainen and Heiskala, 2007). Over time, this continuity may be less about current benefits and more about concerns around the costs of adopting alternatives – a calculation that again leaves the system vulnerable to gradual or sudden shifts in tastes, trade and technology. A region with an over-reliance on a declining industry could therefore suffer. This is one danger of using all one's resources to address the current requirements of the innovation system, rather than investing in more medium- and long-term exploration.

The innovation system must also deal with a high degree of uncertainty and risk. There is risk not only in the initial discovery of ideas, but also in the costs and timing of their development or commercialisation. There are potentially unintended and undesirable consequences, and there is the ultimate uncertainty about user acceptance.

The effects of uncertainty and risk will be felt most where actors are unwilling to make innovation-related investments because there is little perceived need or market for new endeavours. Yet demand for innovation is unlikely to materialise spontaneously unless users are confident that change is desirable (Georghiou, 2007). As a result, new relationships may not be established in the absence of clear benefits, where actors prefer to wait and observe others' experiences. Yet if everyone behaves in this way, innovation will be impeded.

This reluctance to form relationships can have a damaging effect on the innovation process, which is increasingly a network – not an individual – activity. These networking activities are built on trust, a complex social phenomenon with expectations of consistency in behaviour, as well as proximity, iterative engagement and 'social capital'. The strength and the nature of trust in the innovation system will determine the degree of interactive learning that takes place (Lundvall et al, 2002).

Intermediaries can bridge the gaps between the different actors. They are crucial in the creation of networks, particularly where there is a lack of information on the benefits of participating, or where it is hard to identify potential partners or to engage with them. Intermediaries can also stimulate new possibilities and dynamism within the system. They can 'cross-pollinate' – spread ideas – between previously unrelated or unconnected groups, and can help to link actors to new knowledge created elsewhere (Howells, 2006).

The growing role of consumers and users in the innovation process means that intermediaries also need to manage the connections between producers and those users. They do this by raising awareness and stimulating demand with tailor-made strategic information (Smits and Kuhlmann, 2004). Intermediaries can also influence other agents within the system by undertaking connecting roles and by acting as standard setters or as evaluators of what works in the innovation process.

The credibility of intermediaries in the eyes of partners is crucial if they are to facilitate these networking activities successfully. They require sufficient legitimacy to have an influence, but they must also be at an adequate distance to offer something distinct to the interaction. When communities are particularly developed – notably in academic contexts – they require a fluency in a number of languages, and an ability to translate back and forth across them. There is a danger that the valuable role of effective intermediaries can be missed in the innovation process as their activities are essentially nomadic.

Knowledge is at the heart of innovation

The importance of knowledge

Knowledge, whether wholly new or adapted from existing resources, provides the base for the discovery process. It provides the novelty and variety that drives innovation onwards.

In the endogenous growth literature, knowledge is seen as the key input with labour and capital in determining output (Romer, 1986, 1990; Lucas, 1988; Aghion and Howitt, 1998). The non-rival aspects of knowledge, where the accumulation of public benefits is not reduced by an individual's use, means that the overall stock of knowledge can increase quickly over time. As the government, universities, firms and others invest in knowledge creation, they generally raise everyone's productivity. In other words, investments in knowledge creation in one part of the system can have positive spillovers – even if unintended – on other parts of the system.

Universities provide a vital source of fundamental knowledge through their educational and civic roles and through open, declarative methods of research dissemination. While competitors, customers, suppliers and private research providers have often been viewed as the most important sources of commercial innovation, the growing tendency of universities to look outwards and seek ties with firms and other organisations means that they are of increasing importance in the exploitation of knowledge (Cosh et al, 2006; Yusuf and Nabeshim, 2007; Abraham, Harrison and Simpson, 2007). Higher Education teaching is also a significant source of knowledge transmission, and the nexus between research and teaching is central to providing students and society with the skills needed to engage with the growing complexities of the modern world.

The strength of the innovation system also depends on the effectiveness of institutions in disseminating this knowledge to others who have the capacity to utilise it (Furman and Stern, 2004). Knowledge created by academic researchers, for example, can in principle be carried in at least two ways: embodied, with its emphasis on tacit knowledge, interaction, and the movement of people through the system, and disembodied, based on publications, manuals, patents, databases and other forms of written information.

When researchers collaborate with others to innovate, new knowledge is typically created in bi-directional knowledge transfer. Novelty is created when people with different knowledge, skills, competences, incentives and values come together in new combinations. This means that any assimilation strategy based on making the operational principles of universities closer to those of firms may be counter-productive, as innovation-stimulating diversity will be reduced (Kaufmann and Tödtling, 2001; Page, 2007).

Nooteboom et al (2007) describe how 'cognitive distance', the different ways that actors interpret, understand and evaluate the world, can stimulate and stretch knowledge to bridge and connect. This process creates new combinations of complementary resources for all participants without underestimating the uncertainty and complexity inherent in language and understanding. Translational activities are needed to maintain this diversity, and this new language can in itself bring new perspectives to existing problems.

The relationship between universities and businesses has traditionally been seen by policymakers as a linear model of technology transfer. This model is shaped around science, technology, engineering and mathematics (STEM) activities, and is based on a mechanically literal understanding of the flow of research outputs from the laboratory to the market. It has been increasingly criticised in recent years, for example in the *Lambert Review* in the UK (HMT, 2003), as it does not explain or capture the innovative links required even within science and engineering disciplines.

The linear view also risks marginalising research areas such as the arts and humanities in the innovation system. Its view of technology transfer and science and technology conception of R&D has had a damaging effect on the innovation system. Knowledge – broadly defined – is at the heart of innovation.

The importance of arts and humanities knowledge

The disciplines included in the arts and humanities research base, as described by the AHRC, are: archaeology; classics; community arts; cultural policy and arts management; dance studies; design; drama and theatre studies; English language and literature, history, history and theory of art and architecture; law; librarianship, information and museum studies; linguistics; media; modern languages; music; philosophy; theology, divinity and religious studies; and visual arts.

At a broad level, arts and humanities research contributes to a constantly growing body of knowledge on human experience, agency, identity and expression, as constructed through language, literature, artefacts and performance. This knowledge nourishes the UK's cultural existence, and informs relationships, provides substance and inspires creative behaviour, goods and services in the innovation system.

The arts and humanities have a particularly strong affiliation with the creative industries. There is growing evidence showing that arts and humanities research helps to fuel these industries (Crossick, 2006; Oakley et al, 2008, KEA, 2009) and that the creative industries in turn stimulate and support innovation (Bakhshi et al, 2009, Muller et al, 2009).

The sciences, technologies, arts and humanities complement each other and are not hierarchically ordered. Their interdependence has been highlighted in a number of texts, from John Dewey's 1934 essay *Art as Experience* and Jacob Bronowski's *Science and Human Values* to Martin Kemp's classic *The Science of Art* and most recently David Edward's *Artscience: Creativity in the post-Google Generation.* The distinctions between what is and what ought to be – between factual description and value judgement – show the difficulty in making sense of what is good purely on

the basis of scientific verity (Habermas, 2003). Science may allow us to evaluate whether a proposed change will secure its intended goals. Yet when it comes to deciding those goals, science has no monopoly on expertise. Innovations occur at a faster rate when technical feasibility is allied with cultural acceptance (Hargrave and Van de Ven, 2006). Thus, the possibilities opened up by biotechnology, for example, are not necessarily the same as what is acceptable to society. The social sciences can offer methods of understanding the social dynamics and economic realities of technological and social change, while the arts and humanities provide frameworks and languages that address the need to understand and explore the human condition in relation to society.

In this sense, the arts and humanities provide a foundational understanding of the effects of change on society. If innovation generally develops when there is cultural acceptance, ethics can comprehend and create the spaces for public understanding of scientific and medical advances. For example, developments in stem-cell research and cloning require a dialogue on what it means to be human and on the acceptable boundaries of scientific progress (Harris et al, 2005; Plomer, 2005; Savulescu, 2006).

The ethical principles behind this dialogue are analysed through philosophy, legal theory, theology, political thought and other disciplines with historical perspectives and an understanding of beliefs and attitudes (Bauer ed., 1995; Bijker, 1997). Such research interrogates and communicates the impact of scientific and technological developments on wider society.

The arts and humanities can also help translate science to the wider public. Insights from the cognitive sciences suggest, for example, that people think in terms of metaphor, rather than with logic (Lakoff and Johnson, 2003; Zaltman,2003).

The arts and humanities create languages that can communicate complexity in a comprehensible way. For instance, the great policy breakthroughs in the nineteenth century around the welfare state and the provision of public goods such as health and education occurred partly because of changes in people's sensibilities towards the poor. The long-standing attribution of poverty to idleness, debauchery and ill-character gave way to a more sympathetic view that the poor were hardworking victims of circumstance, rather than 'undeserving'. The catalyst was not empirical discoveries or new arguments but imaginative literature, such as *Hard Times* by Charles Dickens. This can also be seen in the portrayal of the structural plight of the poor in Adam Smith's *Theory of Moral Sentiments* and *Wealth of Nations* (Fleischacker, 2005).

Visual art and design research can also make complex information intelligible. Movement, colour, form and light are all intrinsic attributes of animation and computer imaging, for example, and they can offer alternative perspectives when conveying information and translating knowledge. The synthesis of these qualities creates aesthetic images that can connect to people, while communicating complex meaning. Research in this area can, for example, help medical practitioners consider how they construct images to improve their own and their patients' understanding of disease.

Arts and humanities research also provides an understanding of the legal and social construction of knowledge. Research in law and philosophy underpins the efficiency of Intellectual Property as a way of rewarding innovation. The AHRC Centre for Studies in Intellectual Property and Technology Law at the University of Edinburgh, for example, is involved in understanding and responding to innovation, technological development, regulation, human interaction, human rights and the law. The Centre brings together researchers concerned with Intellectual Property law, biotechnology, ethics, medical jurisprudence, and the regulation of electronic commerce, the internet and virtual society.

Arts and humanities research similarly explores the construction of knowledge through research in Information Studies. This provides a fundamental understanding of how technologies transform and re-order knowledge by exploring how information is collected, stored and retrieved. Information Studies are concerned with how people interact with systems and how those systems can be improved. The growing simplicity of internet search engines, for instance, relies on mastering their underlying complexity, based on a research-based understanding of indexing systems. Information underpins much of the innovation system.

History can provide a better understanding of contemporary problems. Historians can present the long-term background or historical precedents, and their insights help to challenge policies that are based on false assumptions. Historical research can also generate 'data' which social scientists and other researchers use to improve their own understanding (think of the importance of research by historians such as Charles Kindleberger in understanding the cause of financial crises).

Modern languages play an integral part in the globalised innovation system, where there is an increasing need to understand, and potentially collaborate with, other cultures (Bound et al, 2007). There is, for example, a strong business case for modern language skills, where languages are growing in importance as firms increasingly operate in a global marketplace. The modern language research community has a role in underpinning the development of language skills and in the understanding of other cultures. A key area of growth in applied modern language research in the UK, for instance, has been in intercultural communication, translation and interpreting skills (Kelly et al, 2007). This supports the UK's ability to converse on a global scale.

Emerging research areas such as design often offer imaginative solutions to social problems. The Design Against Crime Research Centre, based at Central St Martins, University of the Arts London, shows how practice-based design research can have a direct impact on modern society. The Centre is concerned with designing out the opportunities for crime, and uses a practice-based methodology that is qualitatively different from traditional anti-crime projects.

The Centre's approach is that design should address security issues without compromising functionality and other aspects of performance or aesthetics. This research-based design is human-centred and addresses user experience, and utilises an iterative process where designers test out design hypotheses in real-life contexts (Gamman and Pascoe, 2004). This approach also feeds into public policy, and the Centre works with, for example, the Metropolitan Police and the Home Office to develop innovative methods to stop crime. Design research brings new perspectives to social problems that can transform contemporary environments and related policy actions.

The contribution that some forms of arts and humanities research make to innovation of an aesthetic nature is both direct and at the same time complex. Intellectual opinion on what constitutes groundbreaking and innovative art helps to inform society's views on what is considered 'good' art (Galenson, 2005). Importantly, research-based understandings of what is and is not innovative may be a significant factor in determining which art forms receive public or philanthropic financial backing.

The arts and humanities make vital contributions to the innovation system, even though some arts and humanities researchers may not perceive themselves as part of this system, and may resent attempts to assess the relevance of their work in this way. This reluctance may therefore reflect the same misconceptions of arts and humanities knowledge, and offers one explanation for why it is excluded from extant discussions of innovation.

Arts and humanities researchers have often taken a robustly independent line in this area, and there is generally less of a tradition of societal problem-orientation than found in other disciplines. Yet we have argued that the arts and humanities already offer new and innovative approaches that can have profound effects on society. The arts and humanities have the critical and analytical capacity to challenge assumptions and ways of working, while providing a sense of the historical context, traditions and cultural setting in which society and the economy function.

Dilemmas for knowledge accumulation

This paper argues that innovation analysts must give due consideration to the role of arts and humanities research in the innovation system. Policymakers also need to understand the barriers that exist to knowledge creation and transfer in this area.

Specialisation

Academic research disciplines arise for good reasons. The complexity of the world requires researchers to specialise because no individual can possibly know everything, even within a particular field or discipline. No one person could, for example, have a strong research interest in every period or in every branch of historical study.

Reducing aims to match capacities – specialisation – is a standard way of increasing efficiency, even if it requires greater coordination between individuals. Thus, the number of journals has grown exponentially: in 1900, there were fewer than 700 different peer-reviewed academic journals, by 1950, this number had climbed to 3000, and by 2000 it had topped 17,000 (Dodgson et al, 2005). In history alone, the literature produced between 1960 and 1980 appears to have been on a par with the entire output from the time of the Greek historian Thucydides in the fourth century B.C. to the year 1960 (Dill, 2000).

Specialisation allows for the concentration and critical mass needed to address complex issues. It also rationalises the storage of acquired knowledge and presents it in a manner suitable for academic institutions and for the reporting of research.

There are, however, some subjects that are inherently inter-disciplinary.[i] Design, for example, normally involves itself in multiple problem contexts in combination with other disciplines. In the UK's Research Assessment Exercise (RAE) 2001, Art and Design submitted 820 refereed journal articles from almost 500 journals. These journals represent a great diversity of disciplines, and highlight the inter-disciplinary nature of design in particular (Rust et al, 2007). The Design Against Crime Research Centre at Central St Martins mentioned earlier for example, brings together the methodologies and practices of situational crime prevention, social anthropology, cognitive psychology and user-centred design in its research.

It has even been argued that design is the 'last liberal art', and that it needs to maintain its breadth and applicability to many contexts, rather than seeking to move towards a narrow disciplinary specialisation (Buchanan, 1992). In the context of collaborative innovation, designers have also increasingly evolved towards being facilitators of change among different groups (Thackara, 2005).

Yet it can be said that highly educated groups with common interests may join together, inventing a specialist language, establishing a status hierarchy and limiting entry to their ranks. This is a beneficial process as it ensures that quality control is maintained, but it can reduce the overall effectiveness of the knowledge base, where real world problems and needs are largely indifferent to the internal structures and disciplines of universities or professional associations. Over time, the mismatch between narrowly-focussed research and the challenges faced in society may grow.

Gibbons et al (1994) argue that outmoded disciplinary structures ('mode 1') have been replaced by inter-disciplinary, problem-orientated approaches ('mode 2') in modern societies. In 'mode 2', knowledge is produced within the wider context in which problems arise, methodologies are developed, outcomes are disseminated and uses are defined. 'Mode 2' knowledge is considered to have a much greater diversity of knowledge production locations than that found in 'mode 1'. Inter-disciplinarity is also seen as a key factor for innovation in the 'triple helix' model of academia-industry-government (Etzkowitz, 2008).

Both of these models emphasise the need for different disciplines and actors to come together to pool their knowledge so that they can stimulate innovation and address pressing societal challenges. Organisations that support multi-disciplinary and inter-disciplinary research and bring together different actors in the innovation system will add to the overall diversity of the knowledge base, enhancing novelty and bringing new perspectives.[ii]

Tensions with knowledge sharing

The incentives to create knowledge in society frequently conflict with the incentives to share it. The non-rival characteristics of knowledge described earlier create the potential for system-wide gains. But this lack of exclusiveness – once I provide the idea to the world, it can be difficult for me to deny others access to it – hinders knowledge creation.

The value chains in the arts and humanities and the creative industries can be particularly long and diverse because patents cannot capture the results of much of their knowledge. So much of it is informal and tacit: it is common and beneficial within the creative industries to have an open dialogue in ideas between practitioners.

The value chains may be particularly widely spread in areas of 'soft innovation' where changes in goods or services are based on sensory perception and aesthetics (Stoneman, 2009). Changes in clothing fashions, new musical recordings and the publication of new books cannot be patented but they do strengthen the dynamism of the creative industries and the arts and humanities. Yet if actors who do not contribute to the creation of knowledge – 'free riders' – can benefit from it on equal terms with those who do contribute, how do we motivate knowledge creators?

Traditionally, intellectual property (IP) rights have been the main solution: in return for IP rights, inventors are required to disclose information about the invention to the rest of the world. More generally, knowledge may be shared to create reciprocal relations with others: in particular, where an actor needs to tap complementary knowledge or resources, it may be necessary to share one's own findings to keep conversations going, even among competitors (Stein, 2007). It is particularly likely to occur in circumstances where there is an advantage in having standard-setting powers or the possibility of capturing network benefits (Shapiro and Varian, 1999).

The priority rule encourages researchers to release knowledge speedily by identifying themselves as the author of a finding as soon as it is published (Dasgupta and David, 1994). The reputational benefits that accrue from identification improve their chances of obtaining grants and peer recognition, though they can also encourage reputation-hungry individuals to focus on solving fashionable, challenging problems that exhibit their technical virtuosity rather than nitty-gritty problems that may be no less important in ensuring a well-functioning knowledge creation community

(Sunstein, 2001; Lerner and Tirole, 2002). Individual researchers may concentrate on activities that have no intrinsic value other than they attract a large peer audience, or they may inherently obtain private benefits that are attached to the development of knowledge.

This last consideration may be understood as a preference for research, perhaps, because individuals value creative control or care about the project's goals and their discipline (Benz, 2007). This means, however, that it may be more difficult to control intrinsically-motivated actors and direct them towards more systemically valuable activities, such as engaging with the public and knowledge transfer, or to direct them towards the activities of others (Frey and Jegen, 2001). In this case the task becomes how best to match actors with similar missions (Besley and Ghatak, 2003).

Absorptive capacity

Sometimes it is not a question of voluntary or involuntary knowledge transfer, but of whether there is sufficient ability to use or even to understand the potential use of knowledge by other actors in the innovation system (Cohen and Levinthal, 1990; Zahra and George, 2004).Knowledge is not the same as the algorithmic properties of information or its Aristotlean and Cartesian representation as unbendable and unbending nuggets of reality. It is, therefore, not easily absorbed, interpreted and translated into new contexts.

So its exploitation can be long and scrambled. This largely reflects the trade-off between basic and applied research: basic research may generate new knowledge that has a far greater long-term impact than applied research, but it may be harder and slower to turn it into well-defined innovative outcomes. Exploitation may also be hampered by the problems with collaboration between partners from different backgrounds: while such partnerships can generate novelty by forcing partners to look beyond established boundaries, their differences in outlook can hinder mutual understanding.

There is some evidence that these problems are less acute in the arts and humanities where many researchers already target their work at the general public: in literature, up to 75 percent of publications address non-scholars (Nederhof, 2006).

Still, the imperatives of translation and understanding cannot be ignored. They partly explain the importance of proximity in, for example, city- and regional-based innovation networks, where universities undertake work with local firms and organisations in clusters. It has been argued that the more individuals lack a common communication system or shared values, the more geographically concentrated innovation becomes (Hussler and Rondé, 2007)

These interactions enhance absorptive capacity, and, in turn, create an environment where useable knowledge is increasingly sought out by different actors. This demand has a significant effect where users can and know how to exploit useful research and are able to adapt or reject innovations – a process that can involve an element of reinvention, where the innovation is changed when it is adopted by a user.

Rogers (1995) sets out five attributes needed for the rapid diffusion of research knowledge and innovations through the system: relative advantage over alternatives; compatibility with current values and existing needs; the level of complexity and the ease by which it can be understood; the extent to which new ideas can be tested; and how obvious their use and benefits are to others.

Tensions can exist in this process where, for example, the reinvention inherent in the adoption process is seen by researchers as a distortion of their work. This is where intermediaries play a vital role in the diffusion of knowledge by assisting in the navigation through the dissimilar values, experiences and attitudes of different actors in the system, and by articulating the benefits of collaboration.

Organisational culture and a lack of effective structures and knowledge management practices may also act as a barrier to the spreading or diffusion of ideas. Risk-averse officials, for example, may be less willing to use controversial or groundbreaking research. Government departments may have a tendency for short-run, choreographed specific projects, using consultancy firms rather than academic research.

The *Sainsbury Review* (HMT, 2007) recognises that all government departments in the UK can make a significant contribution to innovation in their interactions with companies, but that these opportunities are not always realised because of 'short-term political and operational problems'. There is a role for public bodies to stimulate the absorptive capacity for research in the innovation system.

Small firms in the creative industries, in contrast, may be more likely to be drawn towards the cutting edge. Yet they will face particular challenges in absorbing knowledge if they lack the relevant in-house management and capabilities to utilise research (Bougrain and Haudeville, 2002).

Knowledge Modes: the distinctiveness of arts and humanities knowledge

Overcoming these dilemmas requires an understanding of the distinctive nature of arts and humanities research. As we saw in Section 3.2, the arts and humanities seek to understand human experience, agency, identity and expression, as constructed through language, literature, artefacts and performance. Because of this affinity, arts and humanities research frequently revisits sources of evidence that are often ambiguous and fragmentary. After all, social phenomena and human behaviour are more nuanced than the operation of physical artefacts, such as the motion of colliding billiard balls (Kline, 1995). Dominant paradigms do emerge with their own particular methodologies and assumptions, validated by procedural authorities and epistemic communities (i.e. peer review) and so create a degree of stability where researchers refine rather than reject what came before (Dworkin, 1986). But this process is generally less binding and aims for lower levels of generalisability.

This pluralism and dissent is a vibrant and creative element in the arts and humanities, and is often concerned with the different ways of making fragmentary and ambiguous evidence comprehensible. This differs from many areas of scientific tradition, where knowledge is more cumulative and rooted in discovering increasingly predictive and universally applicable insights. In particular, the sciences are able to repeat experiments under exact conditions, so they can examine a particular state of affairs from whatever new perspective is necessary to isolate or disclose its ultimate cause of failure or success (Nelson, 2005; Foray and Hargreaves, 2003).

This means that knowledge in the arts and humanities is not generally superseded in the same way as found in the cumulative, sequential nature of many scientific discoveries. Garfield (1980), for example, points out that once Watson and Crick published their article on the double helix structure of DNA, the structure had been discovered and nothing more had to be said; and so scientists moved on from this point. Yet if a book was published on Bach, for instance, this would not preclude further research as nobody could ever have the last word about Bach and his music. The arts and humanities form an inheritance that can be re-evaluated from new perspectives and new contexts.

The universalistic tendency of the sciences also means that the background to a problem is more likely to be accepted without the need for long clarifications, while the arts and humanities are more particularistic and interpretive, with more time needed to define the context and to explain the interpretation being taken. Becher and Trowler (2001) describe the difference between subjects with 'contextual association', where assumptions have to be developed from the beginning at greater length, and subjects with 'contextual imperative', where much of the background argumentation is already established. The longer form of the book is considered as the primary mode of communication in the humanities because of this need to elaborate on context and interpretation, coupled with more complex forms of obsolescence and the need to interrogate literature over longer periods.

As a result, journal articles are less important in the humanities as a means of disseminating research. In the UK's Research Assessment Exercise (RAE) 2001, for example, only 31% of submissions in the arts and humanities overall were journal articles, compared with 67% in the social sciences and 96% in the natural sciences. Journal articles in Art and Design were particularly low at 9%, which in this case is linked to a high level of research outputs that are not text-based, with over 40% of submissions in this area consisting of exhibitions.

Where journals are used, they are also less likely to use an online open access model (Antelman, 2004). There is a less intense pace of scholarly exchange that might limit the incentives for immediate and free online access to the latest journal articles. Nevertheless, the use of online journals in the arts and humanities is growing, and this is set to continue (Heath et al, 2008).

The cumulative nature of many knowledge advances in the sciences lends itself to economies of scale; larger research teams may make greater advances at the margin than researchers working alone. It should not therefore be surprising that collaborations in the sciences often take the form of large-scale capital projects. The cost of running scientific 'experiments' to test formal hypotheses – sometimes repeated many times under identical conditions - is a further reason why scientific work is often costly. Bigger collaborations can help researchers spread these fixed costs. Where they are funded by grants, the need to ensure that neither time nor money is wasted may in turn give rise to enhanced mechanisms of dialogue, interaction and supervision.

The generally higher fixed capital costs for research in the sciences compared with the arts and humanities are reflected in the relative cost weightings used by the four UK national Funding Councils for research funding purposes. The Quality Related (QR) research formula multiplies funding allocations – which include elements based on Research Assessment Exercise (RAE) ratings and research volume (i.e. number of active researchers) – by a subject cost weighting for each Unit of Assessment (UoA)[iii]. So, for example, the QR calculation for England in 2008/09

weighted subjects such as clinical medicine and engineering at around 25% more than for design and creative arts, and 60% more than for the humanities (See Annex 1).

These differences give rise to the 'lone scholar' view of the arts and humanities researcher: the academic working alone and publishing independently. The individual researcher does remain a reasonable description of how research in some areas of the arts and humanities is done. For instance, one bibliometric study of Australian publications finds that 80 percent of the natural and life sciences papers are multi-authored, a figure that drops to 50 percent for social science papers, and only 12 percent for humanities papers (Bourke, 1997).

The critical role of interpretation in arts and humanities disciplines – particularly in those that utilise archival research – is a characteristically individualistic process, where the synthesis and analysis of material comes from the critical and reflective process of the individual mind. In modern languages, for instance, individual research remains the most widespread form, where its predominance is grounded in literary and critical traditions, which typically depend on close reading and critical analysis of a limited range of texts (Kelly et al, 2007).

Yet the 'lone scholar' is an increasingly outdated view of the arts and humanities researcher. It ignores the associations in which all research is conducted. And it does not apply, for example, to situations where arts and humanities researchers come together with scientists to tackle complex societal problems. Nor does it apply to arts and humanities researchers who work increasingly in teams and who collaborate outside academia. Nor is the 'lone scholar' characterisation relevant to much practice-based research, such as design and the performing arts, where the fixed costs of producing knowledge can be just as high as in many science settings.

It is instructive to consider these qualitative differences between different disciplines in a simple model of three types or modes of knowledge:

- a **scientific mode**, that is predictive and universalisable;
- a **research-oriented humanistic mode**, that is interpretive, explicit and analytical;
- a **practice-oriented humanistic mode**, that is interpretive, intuitive and adaptive.

Lest this appears simplistic, we should see these three modes less as exclusive categories than as discrete points along a continuum.

Thus interpretation is not a unique feature to the arts and humanities. In the sciences, especially in fields that are close to the knowledge frontier, significant intellectual work can depend on individual insights and structured hunches, and where trained judgement is central in uncovering the scientifically significant from the merely background (Kline, 1995; Daston & Galison, 2007). . Similarly, there is great variety within the arts and humanities: thus, some branches of archaeology exhibit properties of the scientific mode in that they endeavour to create precision on the nature of the claims they make, in part because they rely on many scientific techniques to do so (i.e. carbon dating).

On the surface the finding that researchers are methodologically eclectic sits uncomfortably with cognitive theories, such as Howard Gardner's multiple intelligences that view the individual as possessing a small number of relatively independent intelligences – linguistic, musical, logical
-mathematical, spatial, bodily-kinaesthetic. But as neuroscience is beginning to uncover, the brain is not balkanised into functionally warring regions, as popularised by the "left brain/right brain" opposition. Rather, most disciplinary skills require the coordination of millions of neurons that are distributed throughout the brain (OECD, 2007ii). This suggests that different skills are in fact closely interconnected. In his intriguing review of scientist-composers, a roll-call that includes Edward Elgar (a chemist), Hector Berlioz (a physicist) and Ernest Ansermet (a mathematician), Robert Root-Bernstein observes that "skills associated with music - pattern forming and pattern recognition, kinaesthetic ability, imaging, aesthetic sensibility, analogising and analysis (and indeed an understanding of music itself) – have often been important components of the correlative talents of many famous scientists…correlative talents represent harmonious ensembles of skills that enable musical scientists to 'duet' better" (Root-Bernstein, 2001).

Knowledge bases, moreover, are not frozen in aspic but follow paths that change over time. For instance, more practice-led research in art and design is in the process of transformation as researchers incorporate features of the other two modes such as greater documentation of the research process with elements of analysis and critical reflection.

Practice-led research in many areas can still be considered as emergent within universities, although there is a growing recognition of its distinctive contribution to knowledge, as discussed in Section 3.2. It is likely that this type of

research will maintain some characteristics of the more practice-orientated humanistic mode as it develops. This will require a delicate balance between explicit and tacit elements, as the critical role of uncertainty and open-endedness needs to be maintained if the practice integral to the research is to be meaningful. This is combined with a reflective consideration of the process (Rust et al, 2007).

To the extent that the distinctions between the different knowledge modes are valid, they do suggest important differences in how knowledge from the research base is held and, crucially, the speed at which it is created. Thus, scientific modes of knowledge creation insofar as they rely on more stable and standardised languages are easier to transfer, pick up and build on than research-oriented humanistic modes which, in turn, are more readily codified than practice-oriented humanistic modes.

For those actors within the innovation system who have made the expensive initial investments to learn and maintain a language, codification generates significant benefits. It permits activity to be distributed and organised widely, thereby encouraging collaborative research; by contrast, deeply tacit knowledge must be accumulated and transferred gradually between individuals. Likewise, without an explicit base of knowledge to build on, the same breakthrough will be repeated *ad infinitum* or made in isolation of other breakthroughs, thereby reducing efficiency. So, codification strengthens the embedded memory and retrieval capacities of the system; knowledge that is largely tacit or *sui generis* to individuals, teams, networks and organisations risks being dissipated where there are long development times and high rates of turnover.

But this is not the whole story. Ease of codification is not the only factor determining the productivity of knowledge creation. For instance, competition both provides actors with incentives to generate new knowledge and compels others to imitate or adopt knowledge created elsewhere in order to stay competitive. The resulting infrastructure then becomes a powerful mechanism for capturing the knowledge benefits (or spillovers) of others' research (Foray and Hargreaves, 2003).

It would also be a mistake to ignore the costs associated with codification. During periods of change, excessive codification can obstruct the creation of radically new knowledge by raising the costs of 'unlearning' defunct codes and developing new ones in order to make sense of that knowledge (a pattern discussed in Section 2). From this perspective, the fact that that the arts and humanities are less amenable to codification should be seen as a strength rather than a weakness, as they are better placed to disrupt and challenge standardised practices and conventional wisdom (Kenway et al, 2004). The inclination to codify everything – what Daniel Dennett calls 'greedy reductionism' – can have the perverse effect of leading research towards areas that are easy to codify, rather than areas that are crucial (Lester and Piore, 2005). The hubris of spurious precision is particularly acute where activities take place under genuine uncertainty and there is limited evidence upon which to build probability distributions (Knight, 1931).

There may also be a trade-off in some forms of collaboration between the need to exploit complementarities among individuals with different knowledge and the loss of room for individuals to pursue independent work (Sunstein, 2006). This may in some cases stifle variation as people defer to the informational signals given by others rather than follow their own private views. Joseph Roux, the eighteenth century French cartographer and hydrographer, captured the subtle balance to be struck in the following terms: isolation kills, solitude vivifies.

An understanding of the arts and humanities' distinctive nature is important if the innovation system is to make the best use of its knowledge. The arts and humanities are part of an integrated research landscape, and offer distinctive approaches to the understanding of human experience and activity that adds to the overall diversification of knowledge creation. This has implications for how arts and humanities research is supported by public funding.

Public funding for arts and humanities research in the UK

The AHRC and Innovation

The Arts and Humanities Research Council (AHRC), a Non-Departmental Public Body sponsored by the Department for Business, Innovation and Skills (BIS), provides public funding for research, postgraduate training and knowledge transfer in the arts and humanities. It was established in 2005, and is the successor body to the Arts and Humanities Research Board (AHRB), which was formed in 1998. The creation of the AHRC marked the final stage in the UK of placing the arts and humanities on an equal footing with the sciences, where there has been long-established Research Council support (Herbert, 2008).

The establishment of the AHRC should be seen in the context of historically limited external funding for research in the arts and humanities. In part this no doubt stemmed from the persistence of the 'lone scholar' view, where the

individual arts and humanities researcher conducts low-cost research. As we have discussed earlier, this view is based on an outdated assumption that the fixed costs of conducting arts and humanities research are in all cases low.

It also stemmed from the perception of limited social relevance in what has traditionally been a technology-heavy understanding of knowledge, one that we have critiqued in Section 3.2. The more nuanced conception of knowledge modes outlined in this paper begins to demonstrate the deeper role that the arts and humanities play in the innovation system. In supporting team-based collaboration, encouraging different disciplines to work together, and facilitating a culture of knowledge transfer with other actors, the AHRC can help arts and humanities researchers make wider contributions to innovation.

The AHRC funds a wide range of projects across the arts and humanities research base through a combination of strategic programmes and responsive, open competitions. In 2007/08, AHRC-funded projects involved a total of 2,400 researchers across these three areas. It also made funding awards of over £58.7 million for new research awards and £3.1 million for new knowledge transfer awards. Collaborative projects accounted for 85% of these new awards. There was also support for 885 new doctoral and 739 new Masters students. See Annex 2 for the distribution of AHRC awards by subject area for 2007/08.

The AHRC funds a diverse range of disciplines, and supports the many distinctive ways in which arts and humanities research contributes to innovation, as described in Section 3.2. In 2007/08, the subjects that accounted for the largest amount of AHRC research funding were (in order): history, visual arts, modern languages, archaeology, and English language and literature.

A good deal of the collaborative research supported by AHRC is multi-disciplinary and inter-disciplinary (Table 1). This is beneficial as the recombinations and new approaches inherent in these types of research add to the overall diversity of the knowledge base, as described in Section 4.1. The AHRC main Research Grants are for periods of up to five years, and this support sustains large, multifaceted research projects.

Table 1: Completed AHRC Research Awards that reported multi and/or inter-disciplinary research, 2007/08

	Completed Research Awards	*%*
Projects involving multi-disciplinary research	222	*43*
Projects involving inter-disciplinary research	313	*61*
Total AHRC Research Awards	514	

Note: AHRC awards-holders are asked to indicate whether their project included multi- and/or inter-disciplinary research on Final Reports.
Multi-disciplinary research activity is defined as that which involves researchers from two or more different disciplines.
Inter-disciplinarity research applies the methods and approaches of several disciplines.

Efforts to stimulate multi-disciplinary and interdisciplinary research are particularly relevant in the development of joint strategic initiatives with other Research Councils. For example, the AHRC has set up a variety of joint strategic schemes, such as:

- *Designing for the 21st Century* with the Engineering and Physical Sciences Research Council (EPSRC) to support design research which tackles contemporary challenges;
- *Religion and Society* with the Economic and Social Research Council (ESRC) to further understanding of religion in a complex world; and
- *Global Uncertainties*, which brings together all seven Research Councils to advance understanding of conflict, crime, environmental degradation, poverty and terrorism

These collaborative schemes illustrate again how arts and humanities research increasingly challenges the ‘lone scholar’ view.

The AHRC also funds research in museums, galleries, archives and libraries, a vitally important sector for arts and humanities research, both through collaboration with Higher Education Institutions and through Independent Research Organisations. These organisations – The British Library, The British Museum, National Museum Wales, Royal Commission on the Ancient and Historical Monuments of Scotland, Tate, the Victoria & Albert Museum, amongst others – are able to apply directly for AHRC grants. The AHRC Museums and Galleries Research Programme 2008,

for example, awarded over £3 million to thirteen individual projects. This funding allowed museums, galleries, archives and libraries to participate in high quality research that enables them to better interpret, communicate and present their collections to a wider public

Aside from its research funding streams, the AHRC also funds postgraduate study at doctoral and Masters levels. This has obvious implications for the innovation system: aside from the skills that are central to arts and humanities research, the AHRC also supports training in transferable skills, such as project management, communication, problem-solving and team working. Support for this latter training is provided for all Research Council doctoral students. Special funding was set up in response to the recommendations of the Roberts' Review *SET for Success* (HMT, 2002), particularly around the need to improve transferable skills and employability.

The AHRC and knowledge transfer

The sharing of knowledge – knowledge transfer – is fundamental to the innovation system. It is through the exploitation of knowledge that innovation happens. This importance is reflected in the AHRC's growing support for knowledge transfer projects (Table 2).

Table 2: AHRC New Knowledge Transfer Awards

	2005/06		2006/07		2007/08	
	Projects	Amount Awarded	Projects	Amount Awarded	Projects	Amount Awarded
Knowledge Transfer	4	£188,206	21	£1,714,185	34	£3,327,569

Note: Knowledge Transfer schemes include Knowledge Transfer Fellowships, Knowledge Catalyst and the AHRC/BBC Pilot Knowledge Exchange Programme, plus the AHRC co-funded Knowledge Transfer Partnerships with the Technology Strategy Board.

This increasing support for knowledge transfer is based on an understanding of the distinctive forms of knowledge creation and transfer in the arts and humanities, as discussed in Section 5. This support has been developed to address specific perceived barriers in the arts and humanities and the non-academic sectors they underpin, and will help to overcome the dilemmas for knowledge accumulation outlined in Section 4. For example, the *Knowledge Catalyst* scheme supports partnerships between the research community and non-academic partners that do not have the capacity to participate in the larger *Knowledge Transfer Partnerships* by allowing shorter project durations. This responds to the particular challenges faced by small firms in utilising research, as described in Section 4.3.

The AHRC knowledge transfer support encompasses interactions and partnerships with business, engagements with exhibitions and performances, media content, and the new learning that flows into public policy. Because AHRC knowledge transfer schemes are co-funded they have placed the partnerships between academic and non-academic organisations on a more strategic level, meaning that they are more likely to create sustained forms of knowledge transfer.

The AHRC also acts as an intermediary between other actors within the innovation system. It has, for example, an important strategic role to play in encouraging knowledge transfer from arts and humanities research to the creative industries. This involves bridging activities between the other main interests in this area – including BIS, the Department for Culture, Media and Support (DCMS) and the Technology Strategy Board (TSB).

In this intermediary role, the AHRC also acts as a standard setter and an evaluator of good practice in knowledge transfer. As a public body, the AHRC's evaluation techniques ensure accountability by considering the quality, value for money and impact of the activities it funds. The AHRC also uses evaluation to investigate how collaborations develop and whether funding schemes are providing the right opportunities for researchers and non-academic partners, given the motivation of researchers described in Section 4.2.

The AHRC in the funding environment

The UK Government funds research through a dual support system. This involves funding in two streams: one as part of the core grant, which includes funds for both teaching and research from the four national Funding Councils, and the other by project grants from the seven UK-wide Research Councils.

The Funding Councils provide Quality-Related (QR) Funds for research, allocated by formula to individual Higher Education Institutions (HEIs), and based on the results of the recurring Research Assessment Exercise (RAE). This QR funding is generally for basic research infrastructure, including researcher salaries, support staff, equipment and libraries, as well as for some blue skies research. The Research Councils in contrast provide a competitive stream for

project-specific funds. Both sides of the dual support system aim to support excellence. Funding decisions rest on retrospective results for QR, determined by the RAE, and on the prospective results of project applications for Research Council funding, based on peer review.

There is a crucial interface between the two sides of the dual support system. QR funding provides the flexibility for HEIs to drive new initiatives and to react quickly to emerging priorities. It allows institutions to develop local strategies and to allocate funds internally in response to external stimuli. In addition, because QR is funded by formula, it brings continuity and predictability to research infrastructure and so supports forward planning. The concept of block grants also sees institutions as autonomous bodies and allows for academic independence.

The RAE has shaped academics incentives to a large extent. It has contributed to the quality and visibility of research and research universities, inspiring other models designed on similar principles. Thus, Hong Kong and New Zealand have used RAE evaluation principles. Still there are abiding concerns that the RAE has led to a retreat from collaboration with industry and community towards purely academic issues; devalued the status of teaching in academia with dubious uses made of results for the choice of undergraduate education; created ''just-in-time hiring'' in which trophy professors are drafted in to improve funding chances at the expense of younger academics who lack research and funding records, raising questions over the sustainability of the research base; and caused undue bureaucratic strain for the sector. The RAE is in the process of being replaced by the Research Excellence Framework due for completion in 2013 which will adjust the criteria of assessment to take account of some of those concerns.

Research councils are a useful corrective to some of these tendencies. They provide guided strategic support that more directly takes account of wider policy requirements, and can react to cross-institutional and UK-wide priorities for the research base. Research Councils can identify vulnerable areas of research that need particular assistance, and can support research that is considered to be a strategic priority at the national level. Research Councils also provide a focal point for their research communities, supplying a national voice and strategic leadership, as well as support and advice.

A well-functioning dual support system allows for a diversity of judgements and decision points, which has a clear benefit to the innovation system. It is this plurality and flexibility that are the major benefits of dual support, as both local and national perspectives are sustained.

In the arts and humanities, AHRC funding accounted for only 23% of the dual support system in 2006/07, compared with the natural and physical sciences where Research Council support was in the region of 65-70%. And overall, only 5% of total Research Council expenditure on Research and Postgraduate funding was allocated to the arts and humanities in 2006/07, despite representing 25% of UK academic researchers (Table 3).

Table 3: Dual Support Figures, 2006/07

	Funding Council Quality-Related Research Funds[1], £ million	%	Research Council expenditure on Research and Postgraduate funding[2], £ million	%	Research Active Staff[3]	%
Arts and humanities	273.7	*19*	82.4	*5*	12,200	*25*
Other subject areas	1,143.4	*81*	1,590.3	*95*	35,819	*75*
Total	1,417.1	*100*	1,672.7	*100*	48,019	*100*

Notes

[1]Funding Council data are constructed from apportioning 2006/07 funding by Unit of Assessment to Research Council subject umbrellas.

[2]Research Council data are taken from Annual Reports, 2006/07

[3]Research Active Staff relates to 'Category A/A* Research Active Staff (FTE)' from RAE 2001

The arts and humanities' limited support from the Research Council side of dual support stems in part from the - increasingly outmoded – perception that arts and humanities researchers work as 'lone scholars'; an implication being that the potential for exploiting economies of scale is lower than in other disciplines. But we have argued that in highly collaborative research areas, such as design and performing arts, the associated fixed capital costs can be very high indeed, and so the potential for economies of scale is that much greater.

Of course some HEIs may use their QR funding to support collaborative projects in areas of strategic importance. But they do not always have strong incentives to do so. The benefits of collaborative work are shared by all participating

HEIs, but the costs of initiating that collaboration may fall on one institution in particular. Coordination may be weaker as a result. By setting strategic initiatives that guide research towards urgent challenges, Research Councils offer some insurance that such research is conducted. While Research Council funding gives a significant amount of flexibility and autonomy to researchers in areas such as project definition, management, and in the particular forms of dissemination of research outputs, it requires researchers to have an awareness of their wider environment, to engage with the general public, and stipulates that researchers must exploit their research results where appropriate (RCUK, 2008).

More importantly, the proportionately low Research Council funding relative to the sciences may not adequately resource the increasing strategic importance of arts and humanities research to the wider economy and society, discussed in Section 3. This is a general point beyond the situation in the UK: arts and humanities research needs to be adequately supported and funded to ensure that the innovation system can make the most of its knowledge.

Conclusions

A systematic understanding of innovation, coupled with the growing importance of creative production and cultural consumption in the economy, leads to a fuller understanding of the role of non-technological knowledge. This is where most of the arts and humanities research is situated. In the UK, the AHRC has a strategic leadership role in ensuring that policy takes account of the distinctive role and nature of arts and humanities research and related sectors through its discussions with government and with other organisations interested in innovation.

Arts and humanities research broadens our knowledge and provides new ideas that can be applied directly in innovation. It also illuminates the ethical foundations for the innovation system as a whole. If good ideas are to be picked up by society, then they must be mindful of different systems of culture and governance as well as respecting local structures of motivation and belief.

However, for that research to be valuable to the participants in the innovation system, several conditions have to be satisfied. So there must be:

- an awareness of the costs as well as the benefits of specialisation and decentralisation;
- incentives for actors to create and spread knowledge;
- a demand for new knowledge emanating from the research base and the capacity to use it; and
- robust mechanisms to transfer and circulate arts and humanities knowledge given its generally lower levels of standardisation.

While there is no substitute for actors preparing the ground by creating their own knowledge and scouting the terrain for ideas, specialist and institutional intermediaries can help them do so. While there is no fixed model, the AHRC's funding of collaborative, team-based research, its joint strategic initiatives with other Research Councils and its experience-based approach to knowledge transfer provide a distinctive and increasingly effective approach. The level of funding the AHRC receives may, however, restrict how successful it can be in supporting arts and humanities research in the UK.

Ultimately, the success of intermediaries such as the AHRC will depend on this process and its impact on academic culture and the appetite for arts and humanities research more generally. As the benefits arising from connections between researchers, businesses, other organisations and government become more established, increasingly consistent expectations within those communities should emerge. This does not mean there should be a consensus. To try to achieve one risks unworkable expectations, with an emphasis on manageability over relevance, and the devotion of increased time and resources to reducing conflict. Rather it suggests a greater awareness of participants' interwoven fates and consequences of their actions for others. This would give everyone in the innovation system a truly systemic perspective.

Annex 1:
An example of the relative cost weightings used by a Funding Councils for research funding purposes

This table shows that the Quality Related (QR) research funding formula assumes that, for example, Clinical Laboratory Sciences have costs 1.6 times more than that needed in History.

Higher Education Funding Council for England (HEFCE) assignment of units of assessment to research cost bands as used for the 2008/09 allocation

	2001 RAE unit of assessment	Research cost weight
1	Clinical Laboratory Sciences	1.6
2	Community Based Clinical Subjects	1.6
3	Hospital-Based Clinical Subjects	1.6
4	Clinical Dentistry	1.6
5	Pre-Clinical Studies	1.6
6	Anatomy	1.6
7	Physiology	1.6
8	Pharmacology	1.6
9	Pharmacy	1.6
10	Nursing	1.3
11	Other Studies and Professions Allied to Medicine	1.6
12	Biochemistry (discontinued)	
13	Psychology	1.3
14	Biological Sciences	1.6
15	Agriculture	1.6
16	Food Science and Technology	1.6
17	Veterinary Science	1.6
18	Chemistry	1.6
19	Physics	1.6
20	Earth Sciences	1.6
21	Environmental Sciences	1.6
22	Pure Mathematics	1.3
23	Applied Mathematics	1.6
24	Statistics and Operational Research	1.6
25	Computer Science	1.6
26	General Engineering	1.6
27	Chemical Engineering	1.6
28	Civil Engineering	1.6
29	Electrical and Electronic Engineering	1.6
30	Mechanical, Aeronautical and Manufacturing Engineering	1.6
31	Mineral and Mining Engineering	1.6
32	Metallurgy and Materials	1.6
33	Built Environment	1.3
34	Town and Country Planning	1.3
35	Geography	1.3
36	Law	1
37	Anthropology	1
38	Economics and Econometrics	1
39	Politics and International Studies	1
40	Social Policy and Administration	1
41	Social Work	1
42	Sociology	1
43	Business and Management Studies	1
44	Accountancy	1

45	American Studies (Canada, the Caribbean, Latin America and the USA)	1
46	Middle Eastern and African Studies	1
47	Asian Studies	1
48	European Studies	1
49	Celtic Studies	1
50	English Language and Literature	1
51	French	1
52	German, Dutch and Scandinavian Languages	1
53	Italian	1
54	Russian, Slavonic and East European Languages	1
55	Iberian and Latin American Languages	1
56	Linguistics	1
57	Classics, Ancient History, Byzantine and Modern Greek Studies	1
58	Archaeology	1.3
59	History	1
60	History of Art, Architecture and Design	1
61	Library and Information Management	1
62	Philosophy	1
63	Theology, Divinity and Religious Studies	1
64	Art and Design	1.3
65	Communication, Cultural and Media Studies	1
66	Drama, Dance and Performing Arts	1.3
67	Music	1.3
68	Education	1
69	Sports Related Subjects	1.3

Source: HEFCE Analytical Services Group

Annex 2: New AHRC awards made and amount awarded by subject and programme for 2007/08

Research

Subject	Awards made	Amount awarded (£)
History	73.2	11,128,082
Visual Arts	53.3	6,303,594
Modern Languages	45.2	5,175,406
Archaeology	26.3	4,581,544
English Language and Literature	48.8	4,446,141
Theology, Divinity and Religious Studies	31.5	4,381,205
Philosophy	26.8	3,439,993
Music	26.7	3,174,068
Librarianship, Information & Museum Studies	18.8	2,385,630
Law	15	1,886,697
Drama and Theatre Studies	16.3	1,828,152
Classics	10.8	1,528,065
Media	16.7	1,486,975
Dance Studies	5	1,367,060
Linguistics	7.5	1,310,140
Design	6.2	1,210,712
History and Theory of Art and Architecture	7.7	574,220
Cultural Policy, Arts Management & Creative Industries	2.7	537,933
Community Arts (including Art and Health)	2	190,071
Other	12.5	1,271,130
Not Known	9	496,756
Total	462	58,703,573

Knowledge Transfer

Subject	Awards made	Amount awarded (£)
Media	9	864,840
Music	2.5	531,474
History	5	531,089
Librarianship, Information & Museum Studies	1.5	276,470
Philosophy	1	230,502
Community Arts (including Art and Health)	2	221,725
Visual Arts	1	165,929
Design	4	143,658
Cultural Policy, Arts Management & Creative Industries	1.5	102,173
History and Theory of Art and Architecture	1	11,182
Other	0.5	13,707
Total	29	3,092,747

Based on award dates of between 1 April 2007 and 31 March 2008.
Where projects cover more than one subject area, awards and award amounts have been apportioned across subject areas giving a notional value.
Knowledge Transfer Awards do not include the AHRC co-funded Knowledge Transfer Partnerships with the Technology Strategy Board.

Postgraduate Awards

Subject	Doctoral Competition	Collaborative Doctoral Awards (CDA)	Project students	Total Doctoral Awards	Research Preparation Masters	Professional Preparation Master	Total Masters	Total
English Language and Literature	143	3	0	**146**	74	10	**84**	**230**
History	140	16	0	**156**	73	0	**73**	**229**
Modern Languages	64	0	0	**64**	43	23	**66**	**130**
Philosophy	70	2	0	**72**	46	0	**46**	**118**
Visual Arts	29	1	0	**30**	16	63	**79**	**109**
Music	39	2	0	**41**	20	41	**61**	**102**
History and Theory of Art and Architecture	44	14	0	**58**	26	11	**37**	**95**
Media	25	2	0	**27**	14	50	**64**	**91**
Archaeology	42	8	0	**50**	21	17	**38**	**88**
Librarianship, Information & Museum Studies	12	6	0	**18**	0	49	**49**	**67**
Theology, Divinity and Religious Studies	32	3	0	**35**	15	0	**15**	**50**
Drama and Theatre Studies	14	6	0	**20**	4	13	**17**	**37**
Law	13	1	0	**14**	7	15	**22**	**36**
Linguistics	19	0	0	**19**	12	0	**12**	**31**
Classics	17	0	0	**17**	10	0	**10**	**27**
Design	6	1	0	**7**	4	15	**19**	**26**
Cultural Policy, Arts Management & Creative Industries	2	1	0	**3**	0	5	**5**	**8**
Other	22	6	0	**28**	27	15	**42**	**70**
Unknown	0	2	78	**80**	0	0	**0**	**80**
Total	733	74	78	**885**	412	327	**739**	**1,624**

Based on start dates between 1 April 2007 and 31 March 2008.

Notes

[1] Inter-disciplinary research involves the combination of two or more academic disciplines or fields of study to effectively produce a new discipline or field of study.

[2] Multi-disciplinary research involves the coming together of two or more separate disciplines or fields of study to conduct joint research

[3] A full discussion of Funding Councils and QR is included in Section 6.3.

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