April 2009/15

Issues paper

This report is for information

This report assesses how third stream funding has secured economic and social benefits, by embedding a culture and capacity within higher education institutions (HEIs) that supports knowledge exchange. 'Third stream' refers to knowledge-based interactions between HEIs and organisations in the private, public and voluntary sectors, and wider society. The report finds there has been considerable progress over the first 10 years of this funding.

Evaluation of the effectiveness and role of HEFCE/OSI third stream funding

Report to HEFCE by PACEC and the Centre for Business Research, University of Cambridge

PACEC
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Economic Consultants

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HIGHER EDUCATION FUNDING COUNCIL FOR ENGLAND
hefce

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Acknowledgements

PACEC and the Centre for Business Research at the University of Cambridge would like to extend their gratitude to the many people who contributed to this project. First and foremost we would like to thank all those higher education institutions that participated as case studies. The interviews with vice-chancellors, pro vice-chancellors, directors of the variety of knowledge exchange offices, heads of faculties and others within these institutions provided the basis for much of the study. We would also like to thank all the academics, external organisations and regional and sub-regional stakeholders who replied to the surveys, which allowed for a systematic analysis of cultural change within the higher education sector and the benefits secured from knowledge exchange to be carried out.

In addition, we are very grateful for the cooperation of Quotec Ltd, which supplied very useful survey data that provided an additional evidence base for the gross additionality calculations. We are also very grateful to all those who contributed to the many discussions on and around the issues of this project.

We would also like to thank Alice Frost, Alex Thompson and all those who have helped on this project at the Higher Education Funding Council for England and the Department for Innovation, Universities and Skills for their contributions and assistance throughout the project. In addition, we are grateful for very informative and useful discussions with Peter Saraga and Graham Reid at the outset of the project. Finally, we would like to thank the Steering Group for their support and guidance during the project.

Executive Summary

X1 Aims and objectives

X1.1 This report presents an assessment of the extent to which Higher Education Funding Council for England (HEFCE)/Department for Innovation, Universities and Skills (DIUS) third stream funding has secured direct and indirect economic benefits, by embedding a culture and capacity within higher education institutions (HEIs) that supports the transfer and exchange of knowledge between HEIs, business and the wider community. The term 'third stream' refers to interactions between HEIs and external organisations in the private, public and voluntary sectors, and wider society. It assumes that some knowledge or expertise flows between HEIs and users through these interactions.[1]

X1.2 The report aims to improve understanding of the benefits of third stream activity in the context of the Government's policy stance as set out in the Science and Innovation Investment Framework in response to the *Lambert Review of Business-University Collaboration*[2] (and, to a lesser extent, in the context of higher education's role in wider society described in, for example, the Dearing Report).

X2 Conceptual framework

X2.1 The study has adopted an innovation systems framework for the purposes of analysis (reflecting the Government's policy agenda that has informed public funding for this activity). This framework has been increasingly emphasised in UK government thinking and is most apparent in the *Innovation Nation* White Paper (DIUS 2008) and in the Sainsbury Report *The Race to the Top* (Sainsbury 2007). Within the innovation system, third stream policy operates at the interface between the knowledge base, sources of new knowledge, networks and collaborative arrangements and firms' ability to absorb knowledge, technology and other expertise. It may be seen as an attempt to address institutional failure reflected in the inability of the innovation system to adapt to changed patterns of behaviour and rules or norms affecting inter-agent transactions which arise from broad underlying technological and other changes in the innovation system.

X2.2 Seen from this perspective, third stream policies are designed to develop linkages and promote networking and other activities to allow the co-evolution of activities and processes in HEIs and external organisations in the public, private and voluntary sectors, and in wider society. Their impact therefore depends on the extent to which the particular policy instruments used affect the pattern and direction of interaction, and on the underlying cultural norms which govern the incentives for individuals to

[1] The term 'third stream' is used throughout the report, reflecting the use of language in HEFCE's original tender document. Terms such as 'knowledge transfer/exchange', 'enterprise', 'outreach' or 'engagement' are more commonly used in the higher education (HE) sector and in Government.
[2] HM Treasury (2003) www.hm-treasury.gov.uk/lambert_review_business_university_collab.htm

engage in knowledge exchange (KE) and related activities on both the supply and demand side of the economy and to integrate HEIs into the innovation process.

X3 Rationale for third stream funding policies

X3.1 The innovation systems framework suggests a number of reasons why third stream policies are necessary in order for the HE sector to achieve greater impacts on the economy and society:

- cultural inhibitions and lock-in problems arising from traditional HEI norms and practices, which may impede or hamper the process of knowledge exchange
- under-investment by HEIs in their capacity and capability to engage in knowledge exchange, because of:
  - inability of the knowledge base to sustain in-house offices
  - difficulties in securing an acceptable share of any benefits
  - cultural constraints
- limits on the ability of the innovation system to adapt to technological and other changes in terms of:
  - the underlying cultural norms which govern the incentives for individuals (on the supply and demand side) to engage in knowledge exchange
  - changing patterns of behaviour and the rules or norms of HEIs and external organisations affecting their interaction (openness versus secrecy)
  - the increasing role of HEIs in the commercialisation of scientific advances
- limited linkages, networking and collaboration by HEIs and other economic and societal agents, reducing the potential contribution of HEIs to the innovation process
- limited financial benefits from engagement with society and the wider community, leading to potentially low levels of knowledge diffusion with these groups.

X4 Empirical methodology

X4.1 The evaluation was carried out during 2008. The programme of empirical research was set within a traditional evaluation framework analysing the relevant inputs, activities, outputs and the resulting impacts. In addition, cost-benefit balance sheets were produced which compared the inputs to the outputs of knowledge exchange where quantifiably possible. A discussion of other qualitative outputs is included in this analysis.

X4.2 Both secondary and primary data were used in the analysis. Secondary data sources included the Higher Education Business and Community Interaction (HEBCI) surveys, Higher Education Statistics Agency and other HEFCE sources such as HEI funding bids and annual monitoring reports. A primary database was also assembled from case study research of 30 HEIs; survey responses from 1,157 academics and from 373 external organisations engaged in third stream activities with HEIs; and from

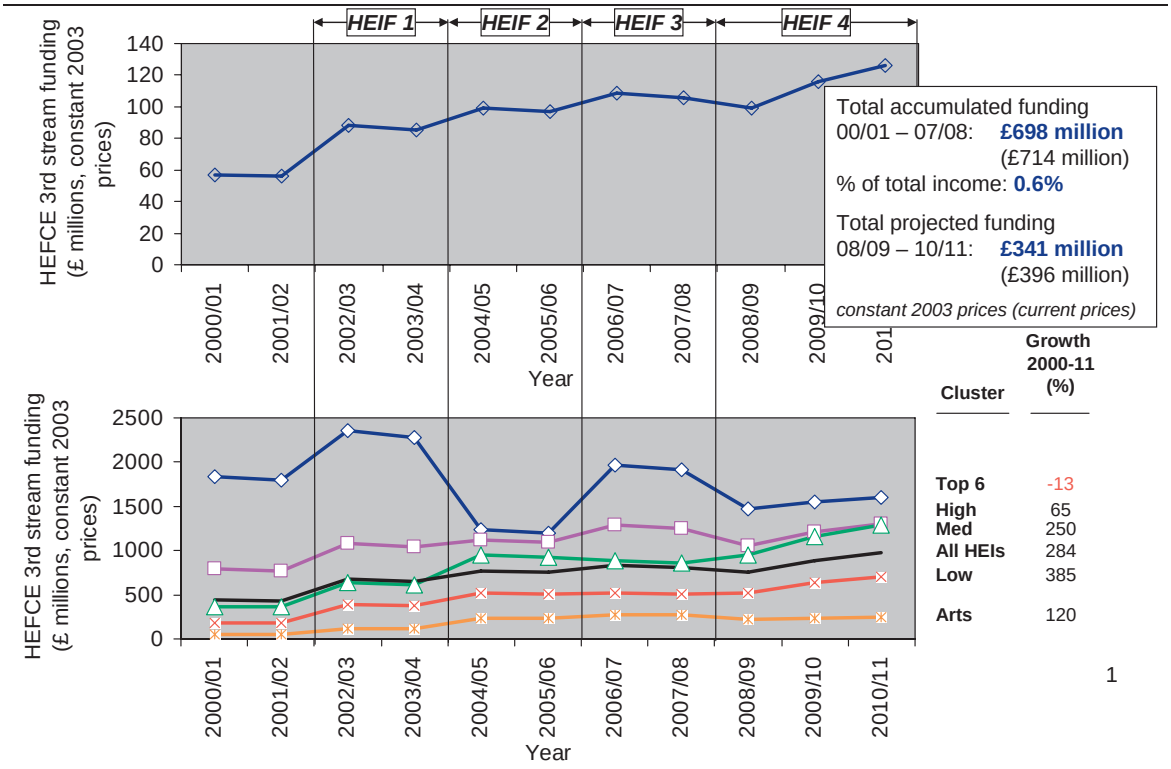
interviews with a range of stakeholders, including central government departments and the Regional Development Agencies (RDAs).

X4.3 The case studies were selected on the basis of a cluster analysis. Six key clusters were identified, largely reflecting the scale of HEIs' research activity: the top six HEIs, high research HEIs, medium research HEIs, low research HEIs, arts HEIs, plus all HEIs.

X5 Evolution and allocation of third stream funding

Total committed third stream funding between 2000/01 and 2010/11 amounts to £1 billion (at 2003 prices) and has increased for all HEI clusters except the top 6, where it has declined by 13% (Figure X1)

Figure X1 Evolution of HEFCE third stream funding 2000/01 to 2010/11 (£ millions, constant 2003 prices)



Source: HEFCE, PACEC/CBR analysis

Dedicated knowledge transfer staff have accounted for the largest proportion of Higher Education Innovation Fund (HEIF) spending, amounting to 31% of funding in the period 2002/03-2003/04 and rising to a planned 52.3% in the latest HEIF 4 funding round

X5.2 The most important allocation of funds has gone to activities concerned with dedicated knowledge exchange staff; the promotion of knowledge exchange units, institutes and research centres; and initiatives and projects connected with knowledge exchange generally. Relatively small elements of funding have been associated with investments in spin-outs and proof of concept (PoC) and seed funding. The most significant difference between the first and fourth HEIF rounds is

the substantial increase in the proportion of funding going to support dedicated knowledge exchange staff, which is 52.3% in HEIF 4 compared with 31.1% in HEIF 1. Support for staff engagement has risen from 1.5% to 14.9%. Seed and PoC funding has also risen from 1.8% to 5.4%, and marketing from 1.1% to 4.3%. The top six research intensive HEIs and the arts cluster spend the most proportionately on dedicated knowledge exchange staff, while the low research intensity cluster spend the least proportionately.

X6 The legitimacy of the third stream mission

There is now strong support from senior HEI management for knowledge exchange activities, and knowledge exchange is now a core strategic aim across all HEIs

X6.1 Successful mutually beneficial engagement with external organisations has required strategic and organisational shifts on the part of HEIs and their partners, and a commitment by senior HEI managers in support of the third stream mission. As a consequence, and as the importance of knowledge exchange activities has increased, HEIs have had to recast their strategic aims and adapt their organisational and institutional structures to acquire new capabilities and capacity to complement those required to fulfil their traditional research and teaching functions.

X6.2 There is now strong support for the third stream mission by senior management across all HEIs, although the emphasis given to the balance between teaching, research and third stream activities inevitably differs across HEIs. These differences are reflected in a diversity of mission statements and strategic aims across the HE sector. Notwithstanding this diversity, the mission statements and visions of most HEIs, across all types – from the top research HEIs to regional HEIs, old HEIs and new ones – now include explicit references to the third stream as an important role for the institution. Such positive change in culture at the senior level of HEIs is an important development for the innovation system as a whole. This is because, while not a sufficient condition for increasing the benefits that HEIs can deliver to the economy and society, it is certainly a necessary development.

There is widespread recognition of the synergies between knowledge exchange activities and teaching and research, with relatively little displacement

X6.3 The analysis of HEIF 4 strategies and the case studies revealed widespread recognition of the synergies between knowledge exchange activities and activities related to teaching and research. The case studies pointed to clear opportunities for creating virtuous feedback linkages between teaching, research and knowledge exchange activities, with each strand supporting and reinforcing the other. Almost all the senior managers interviewed believed that knowledge exchange activities complement the mainstream missions of teaching and research, with little variation across different types of HEIs. There was evidence of some displacement of teaching or research, largely owing to time constraints, and third stream activities became relatively more burdensome when pressures to fulfil Research Assessment Exercise requirements intensified.

Income generation is becoming increasingly important as a long-term goal for knowledge exchange activities

X6.4 Income generation is becoming increasingly important, partly because of the way in which HEIF funding is now being allocated (via a formula which is partially income driven), but also as a consequence of wider financial pressures. For some HEIs the role of HEIF (and other funding) is to pump-prime third stream activities that promise self-sustainability. Such activities must therefore generate some form of income to at least cover their costs.

Government policy, a dedicated funding stream, leadership and financial pressures have been the main drivers of the increasing importance of the third stream mission

X6.5 The emergence of knowledge exchange as a core strategic objective for HEIs alongside teaching and research has been driven by a number of factors:

- Government policy has raised awareness among senior management and staff that the pursuit of knowledge exchange goals alongside teaching and research is a recognised and acceptable goal for HEIs.
- The presence of a dedicated third stream funding programme from HEFCE, combined with a positive and pro-active campaign at government level, has also raised awareness of the legitimacy of such activities, backed by financial resources.
- The leadership provided by a dynamic and supportive vice-chancellor is seen as very important in driving forward the third stream agenda.
- Growing financial constraints facing HEIs mean that institutions, especially those with a large science and engineering research base, are increasingly seeing income from knowledge exchange as a means of greater financial security and a way of decreasing their reliance on public funding.

HEFCE third stream funding has had an impact on the development of knowledge exchange strategies at departmental level

X6.6 The increased profile of the third stream mission and the development of improved knowledge exchange strategies have inevitably filtered down to, and impacted on, individual departments and academic disciplines. Of the academics surveyed, 45% perceived an impact on the development of KE strategies within their departments as a consequence of HEIF funding. In addition, 49% of academics believed that HEIF funding has led to their department developing a strategy for increasing non-traditional sources of funding.

Small and medium-sized enterprises (SMEs) are the most frequent target for third stream activity, but for top six and high research HEIs large corporations and the public sector are important

X6.7 SMEs are the most frequent type of external organisation explicitly targeted in HEI strategies, and are a strong focus for knowledge exchange by HEIs in the medium/low research and arts clusters. Large corporations are of obvious significance for the top six and high and medium research clusters, but much less so for the low research and arts clusters.

X7 Building the capacity and capability to engage

Knowledge exchange offices (KEOs) are becoming more professional and pro-active in generating opportunities with external organisations, but most engagements are still initiated without the involvement of the KEO

X7.1 The extent to which knowledge exchange offices seek out third stream opportunities for academics to pursue varies substantially within the HE sector. At one end of the spectrum is the view that the identification of opportunities should remain the responsibility of academics and that the role of the KEO should be as a facilitator once the opportunity has been identified. Most HEIs adopt this largely reactive strategy towards generating third stream opportunities. However, there is evidence that KEOs are becoming increasingly professional and more pro-active in their interactions with external organisations. This is very much the case in the top six and high research HEIs. In particular, long-term strategic relationships are being developed more actively, along with attempts to map business needs more closely to capabilities within the HEI. High-calibre KE staff who can understand not only the requirements of the strategic partner but also how the academic capabilities within the HEI can help the organisation are increasingly recognised as the lynchpin for developing successful relationships.

X7.2 KEOs are the least frequent mechanism for initiating interactions between academics and external organisations, with only 13% of academics choosing this route. External organisations and individual academics engaging directly is the most frequent mechanism (74%) for initiating third stream activity.

Knowledge exchange offices face a number of constraints on their growth, namely their ability to attract suitably qualified staff, shortage of finance and negative attitudes of academics

X7.3 KEOs face a number of key constraints to their further development. A very severe constraint facing HEIs is the ability to attract KE staff with suitable qualifications and capabilities, given the salary levels on offer. In some HEIs, there was a perceived lack of capability in dealing with the legal side of the KE engagement process. Other key constraints include adverse attitudes towards knowledge exchange by some academics, the inability of KEOs to 'stand up against the research forces', and restrictions on KEO growth to avoid overlap with other KE activities within the HEI.

Considerable scope remains for raising the awareness of the benefits that KEOs can bring to academics and external organisations engaging in knowledge exchange

X7.4 Despite the substantial investments in KEOs and the subsequent improvements made in capability and capacity building, 45% of the academics surveyed had had no contact with KEOs over the past three years, despite most being aware of their services. However, this figure decreased to a much lower level for science subjects (28%) and those conducting user-basic research (32%). From the perspective of external organisations engaged with HEIs, only 37% were aware of the HEI's knowledge exchange office. Companies which spent more on their interactions with HEIs were more likely to be aware of the KEO, as were those located in the Midlands.

Without HEFCE third stream funding many of the knowledge exchange facilities and infrastructure would not exist or would be of a smaller scale and quality

X7.5 HEFCE third stream funding has helped to provide the necessary investment and stimulus to develop the structures – infrastructural and organisational – to better engage in knowledge exchange activities. It has helped to address this clear failure in the innovation system in the following ways:

- It has allowed HEIs to grow their capacity and capability over a much shorter period of time than would otherwise have been the case.
- It has provided the direct resource that has funded, and continues to fund, much of the knowledge exchange infrastructure. Many smaller HEIs would not have been able to fund the development of their capacity and capability had HEIF funding not existed. Even many of the larger, well-established HEIs rely on HEIF to partly or wholly fund particular KE units, such as regional liaison offices and continuing professional development (CPD) units.
- It has helped HEIs to professionalise the process, for example through increased training and hiring high-calibre staff with more relevant industrial and academic experience.
- It has impacted on the breadth of coverage of knowledge exchange capacity and capabilities.
- It has allowed HEIs to target their KE support services internally to a greater number of departments and externally to a greater number of sectors than would otherwise have been the case.
- It has been instrumental in creating an integrated approach to knowledge exchange.

X8 Achieving culture change in the HE sector

X8.1 Implementing strategic change in a large organisation such as an HEI can require more than simply announcing new strategic initiatives, modifying incentive structures and committing resources to develop infrastructure and supporting organisational structures. The persistence of existing routines, norms and values can impede the new strategic direction from being achieved. To fulfil the third stream role demanded of HEIs therefore requires a cultural shift to one that embraces not only teaching and research but also their transformation into benefits for the economy and society. A strong, positive knowledge exchange culture at the senior management level of HEIs is a critical necessity, but not a sufficient condition for cultural change within the rest of the institution. The actions of senior management will, in turn, influence how those in charge of faculties organise their departments and the types of activities they demand from their staff. In addition, all staff – from senior management to academic – will be impacted by external forces that shape their value judgements and, by implication, culture.

X8.2 To identify cultural shift, the study used seven indicators: motivation for knowledge exchange, responses on the role of HEIs in the economy, perceptions of how academics view knowledge exchange, the role of knowledge exchange vis-à-vis teaching and research, criteria for promotion and assessment, incentives for knowledge exchange, and awareness of the value of knowledge exchange.

Overall, there has been a modest change in culture among academics towards a more positive attitude to engaging in third stream activities. Neither the process of cultural change nor its embeddedness is complete, although significant progress has been made

X8.3 Academic support for engaging in KE activities was associated more with the perceived benefits to the academics' research programmes than to their commitment to the third stream mission. Those who engaged in knowledge exchange activities were not motivated by the financial rewards they generate, but rather by the benefits that engagement delivers either to what they perceived as their core activities, or to the wider strategic mission of the HEI (e.g. 47% of academics were motivated by furthering their HEI's outreach mission). This has potentially important implications for the design of incentive structures where academics are engaged in research, teaching and third mission activities.

X8.4 There was wide acceptance among academics that:

- higher education has a key role to play in the competitiveness of businesses in Britain
- entrepreneurship is of vital importance to the British economy
- HEIs have given a much greater priority to involvement with businesses and the local community over the past three years, a view which has become more widespread since an earlier survey in 1995.

X8.5 The cultural attitude towards knowledge exchange activities has become more positive over the period 2001-08, with 76% of academics now perceiving a positive culture compared with 61% in 2001. Academics increasingly disagree with the statement that academia should focus on basic research and should not be concerned with its actual or potential application. However, there was much less consensus on whether HEIs have gone too far over the past few years in attempting to meet the needs of external organisations, to the detriment of their teaching and research roles.

X8.6 The criteria by which academics are promoted and assessed provided a good indicator of the culture that HEIs *would like* to develop in relation to different types of activities. While the importance of the more traditional promotion criteria of research and teaching have remained approximately constant over the period 2001-08, the criteria relating to engaging with external organisations have increased in importance.

X8.7 There is some evidence that HEIs are beginning to alter their recruitment criteria, informally or formally, and that they are increasingly recruiting candidates with greater credentials from the private, public and voluntary sectors. However, there still appears to be limited movement of labour between external organisations and academia, particularly in the higher research intensive HEIs, and an increasing number of academics perceive that taking non-academic sabbaticals damages their careers.

X8.8 Academics appear to be increasingly aware of the value and benefits that engagement with external organisations can bring to their careers. There is also a growing recognition of the need to protect and commercialise their intellectual

property (IP) as well as a better understanding of the issues surrounding commercialisation. At the same time, there is also a growing feeling that academic research and expertise should be made more accessible to the wider public. These attitudinal shifts have combined to help foster a more open-minded approach to participating in knowledge exchange. However, one-third of academics did not feel knowledgeable about the issues involved in commercialising their research, but would be interested in its commercial application. Only a minority of respondents were not interested in the commercialisation of their research or in getting directly involved with its commercialisation.

HEFCE third stream funding has played an important role in bringing about positive cultural and attitudinal change within HEIs towards knowledge exchange activities

X8.9 The HEFCE third stream funding programmes have had a positive impact on the culture of academics towards engaging with knowledge exchange, one of the central rationales for intervention. The sustained, visible government campaign surrounding these funding programmes (particularly HEIF) over many years – and the resources they have provided – has helped to demonstrate the value and legitimacy of knowledge exchange as a core activity to academics. In turn, this has helped to bring about positive shifts in the culture within HEIs towards third stream engagement.

There is a close alignment of academia and non-academic organisations on the importance of HEIs to the economy and society

X8.10 Alignment of attitudes between knowledge providers and consumers on the importance of HEIs to the economy and society, and of knowledge exchange in relation to teaching and research, is likely to improve the effectiveness of the KE process and the benefits that transpire. The study found very similar attitudes towards:

- the role of HEIs in the economy and society
- the key role of HEIs in the competitiveness of British businesses
- academic freedom being of fundamental importance to society
- entrepreneurship being vital to the British economy.

Beliefs differed, unsurprisingly, on the focus of HEIs. External organisations which interacted with HEIs were less likely to believe that academia should focus on basic research and not be concerned with its actual or potential application.

Supply and demand-side barriers constrain engagement between HEIs and external organisations

X8.11 Two-thirds of academics believed that the lack of time to fulfil their HEI commitments is a key supply-side barrier to increasing engagement. In addition, 28% of academics believed that there are insufficient rewards resulting from the interactions. Cultural resistance towards engaging in knowledge exchange ranked last of the constraints perceived by academics to increasing engagement.

X8.12 While HEIF funding is primarily aimed at correcting the supply-side problems that exist within the HE sector, a number of demand-side issues remain to be addressed. In particular, 28% of academics believed that the inability of external organisations to meet the full costs of engagements constrained their interactions. This constraint is particularly acute for micro-companies.

X9 Participating in knowledge exchange

High levels of academic participation in knowledge exchange

X9.1 Approximately half of academics engaged in knowledge exchange activities over the past three years through the 'core' modes of interaction (e.g. contract research, consultancy, prototyping and testing services, CPD provision etc). The participation rate increases to 75% when this definition is broadened to include other forms of interactions with external organisations, such as attending meetings and conferences with external organisation participation, membership of advisory boards and providing informal advice. Results from the HEBCI survey also suggest that HEIs perceive a positive change in the degree of academics' participation in knowledge exchange activities in the private, public and social, community and cultural sectors. The largest change has come in engagements with the public sector, with HEIs in the medium and low research intensity clusters exhibiting the largest percentage point changes over the period 2004 to 2007.

X9.2 CPD, contract and joint research, and consultancy are the most frequent 'core' modes of interaction with external organisations. Attending conferences with external organisation participation and providing informal advice are the most frequent 'other' modes of interaction.

X9.3 Almost one-fifth of academics have formed or run a consultancy via their research, while 13% have taken out a patent. However, very few have licensed their research outputs or formed spin-off companies over the past three years. Licensing research outputs to British-owned companies, forming or running a consultancy and forming a spin-off company in the local area are the most common modes of commercialisation that academics would like to undertake compared with the existing level.

X10 The scale and evolution of knowledge exchange outputs

Knowledge exchange activities of HEIs generated £1.94 billion in income in 2007, growing by approximately 12% per annum over the period 2001-07

X10.1 The overall scale of knowledge exchange income grew from approximately £0.98 billion in 2001 to £1.94 billion in 2007. Contract research made the largest contribution to this income in 2007, with income from collaborative research and courses generating 23% and 19% of total knowledge exchange income respectively.

X10.2 Revenues from intellectual property constitute a very small proportion of the total income derived from knowledge exchange. However, the current revenues generated

by HEIs' intellectual property portfolio will greatly underestimate the net present value of these agreements. This is because much of the value from licence deals may take many years to be realised.

X10.3 The composition of knowledge exchange income is highly dependent on the cluster. Research intensive HEIs focus heavily on contract and collaborative research, while those with a more teaching focus generate large proportions of their income through courses.

X10.4 There is also a correlation between the research intensity of HEIs and the share of regeneration and development income in total knowledge exchange. Those in the medium and low research intensive and arts clusters secure a much greater share of their knowledge exchange income through this type of activity.

Income from non-commercial organisations such as the public sector and charities constitutes the largest proportion of knowledge exchange income, with income from SMEs generating the least income for HEIs

X10.5 Income from non-commercial organisations (such as public sector bodies, not-for-profit organisations and charities) constituted 35% of total knowledge exchange income in 2007, while income from non-SMEs (commercial organisations that are not classified as SMEs) generated 21% of the total. The low share of SME income in total knowledge exchange income (6% in 2007) hides the extent of engagement with this type of company. Of all engagements, 28% were with SMEs; this figure increased dramatically to almost half of all engagements for the medium and low research intensity and arts clusters.

On average, more people attend free events than chargeable events held by HEIs, with the number of attendees for most types of events growing over the period 2004-07

X10.6 The societal outputs of knowledge exchange engagements are much harder to quantify than the more commercial engagements undertaken by HEIs. Social, community and cultural events represent one key area of the societal impact of HEIs. Overall, the number of attendees at most types of events, both free and chargeable, grew over the period 2004-07. Only the number of attendees at chargeable museum education events declined. Exhibitions were the most popular free event, while performance arts drew the largest number of people at chargeable events. HEIs in the top six research intensive cluster attracted the most attendees per HEI to their events, both free and chargeable. They also attracted more people per staff day required to host their free events, followed closely by HEIs in the arts cluster.

X11 Impact on gross knowledge exchange outputs

X11.1 The gross impact is the impact of HEFCE third stream funding on knowledge exchange outputs without taking into account the displacement of third stream activities that would otherwise have been undertaken outside the HE sector (e.g. consultancy by private consultancies, contract research by large corporate research labs, testing by government research establishments etc).

X11.2 Measuring the impact of HEFCE third stream funding on gross knowledge exchange outputs is a very difficult exercise, with the problems exacerbated by a lack of a long time series of data. This prevents the traditional 'control group' approach that either compares periods where HEFCE third stream funding did not exist with periods after its introduction, or compares HEIs that never received any support with those that did receive support. A multi-pronged approach was used consisting of the following five methods:

1 comparison of a 'weak' policy period with a 'strong' policy period, with the former representing the initial years of the funding programme where HEFCE third stream funding was relatively low and fragmented, and the latter representing the period where the many funding programmes were consolidated and the levels of funding increased

2 comparison of HEIs that initially received third stream funding with those that did not

3 comparison of HEIs that received large amounts of third stream funding with those that received relatively less funding over the period

4 estimation of the marginal impact, using multivariate econometric modelling

5 estimation of the average impact, using subjective-based estimates of gross additionality.

X11.3 Given the uncertainty surrounding any one method, the report draws its conclusions based on the complement of evidence from each of the five approaches.

Knowledge exchange income grew faster in the strong policy period compared with the weak policy period, for HEIs that initially received HEFCE third stream funding compared with those that did not, and increased more for those that received relatively more funding over the period

X11.4 The key results from the analyses are as follows:

- Total knowledge exchange income, excluding contract research income, grew more rapidly in the strong policy period (14% per annum) than during the weak period (3% per annum), although there was considerable variation between income streams. In addition, all clusters except the top six research HEIs grew faster in the strong policy period compared with the weak period.
- HEIs that received HEFCE third stream funding in the initial period grew their income by approximately £9.8 million per HEI between 2001 and 2007, compared with £4.6 million for those that did not receive initial support.
- HEIs that received larger amounts of HEFCE third stream funding over the period 2001-07 increased their knowledge exchange income to a much greater degree across *all* income streams than those that received less.

X11.5 The funding enabled HEIs to extend their ability to build their capability and capacity to interact with external organisations. It also allowed HEIs to encourage and enable their academics to engage (e.g. through providing funds to buy out academic time, thus relieving the high time constraints facing academics, or providing proof of concept funding). The funding has helped to bring about a more positive culture towards knowledge exchange engagement. There is therefore a strong presumption that HEFCE third stream funding has had a positive impact on the overall growth of knowledge exchange income.

X11.6 There are also likely to be large time lags between investing in infrastructure and capacity and capability building, and realising increased knowledge exchange income. Those HEIs that received funding initially are likely to have developed their infrastructure to a greater extent and learnt more from their experiences than those that received funding in the later rounds.

HEFCE third stream funding has changed the nature of activities, increased the scale of activities and speeded up the introduction and/or expansion of knowledge exchange activities

X11.7 HEFCE third stream funding has impacted on the nature of the activities undertaken by HEIs. For example, it has enabled HEIs to undertake many collaborative initiatives that otherwise would not have take place, and has allowed them to pursue the exploitation of knowledge, expertise and programmes that previously would have received a much lower priority within their institution (e.g. research that may have high long-term value but very poor short-term returns). Knowledge exchange engagement would likely have been much more geared towards short-term income generation, potentially limiting the types of benefits that HEIs can deliver to the economy, and particularly to society.

X11.8 The scale of knowledge exchange activity in the HE sector has also increased as a result of HEFCE third stream funding, according to the HEIs studied. The funding has enabled the necessary structures to be put in place. It has also stimulated changes to the incentives for engaging with external organisations. These incentives, particularly those relating to promotions and those that relieve the time pressures facing academics, have been very important in helping to increase participation in knowledge exchange activities.

X11.9 Overall, the research suggests that there would have been much less development in knowledge exchange engagement in HEIs without a history of interacting with external organisations, particularly in HEIs with a primarily teaching mission. HEFCE third stream funding has been crucial for providing the initial infrastructure and organisational structures, along with the stimulus for strategic change that would not have occurred to the same extent, as rapidly, or covering the same scope.

HEFCE third stream funding has had a statistically significant marginal impact on knowledge exchange income

X11.10 To estimate the marginal impact – i.e. the effect of an extra £1 of HEFCE funding – a regression equation has been estimated. This relates knowledge exchange income to HEFCE third stream funding, taking into account other factors that might be expected to impact on knowledge exchange income. This objective approach can only control for a limited number of factors owing to data limitations.

X11.11 There is a statistically significant positive impact of third stream funding over the period 2001-07 on knowledge exchange income in 2007, when a variety of other variables that could also impact on total income are taken into account. The

regression analysis suggested that a 10% increase in HEFCE third stream funding in the period would have yielded a 1.5% increase in knowledge exchange income.

X11.12 The regression equation also shows that the size of the HEI in terms of the number of academic staff (full-time equivalents) and the amount of research income received by the HEI are also important for explaining knowledge exchange income. This may be a reflection of the economies of scale in the provision of many KE services, positive feedback on participation by having a large number of staff engaging, and the synergies between research and knowledge exchange activities.

X11.13 Access to on-campus incubators has had a significant positive impact on knowledge exchange income, while the impact of access to seed-corn funding and science parks is insignificant. Surprisingly, access to venture capital is negatively related to knowledge exchange income.

X11.14 A number of external factors have impacted on the current level of knowledge exchange income. A high share of employment in SMEs in the local area of the HEI is linked with lower knowledge exchange income, while the converse is true for HEIs located in areas with a high share of employment in high-technology sectors. Surprisingly, on average, HEIs in areas with high growth in gross value added have experienced lower knowledge exchange income.

HEIs believe that between 28% and 41% of knowledge exchange income can be attributed to HEFCE third stream funding

X11.15 Evidence based on a survey of HEIs conducted by Quotec in 2006 suggested that between 28% and 41% of knowledge exchange income can be attributable to HEFCE third stream funding, either directly or indirectly. Our more limited sample based on interviews with senior management of HEIs during the case study research programme agreed with this, albeit at the upper end of the range.

The injection of £592 million by HEFCE through its third stream funding programmes over the period 2001-07 has generated between £2.9 billion and £4.2 billion in gross additional knowledge exchange income over the same period

X11.16 Gross knowledge exchange income was £10.3 billion over the period 2001-07 (in 2003 prices). Assuming the lower end of the additionality estimates of 28%, an injection of £592 million by HEFCE through its third stream funding programmes over the period 2001-07 has generated £2.9 billion in gross additional knowledge exchange income over this period, either directly or indirectly. This equates to a gross additional impact factor of 4.9. Assuming the upper end of the additionality estimates of 41%, the same injection suggests that £4.2 billion in gross additional knowledge exchange income over the period can be attributed, either directly or indirectly, to HEFCE third stream funding programmes. This equates to a gross additional impact factor of 7.1.

X11.17 However, this calculation may underestimate the true factor as it only includes those activities that generate income and are reported in the HEBCI surveys. A variety of non-quantifiable outputs could not be included, such as:

- social impacts that could not be monetised
- non-monetary benefits of otherwise income-generating activities, such as their educational and social value, and indirect effects of the engagements
- social benefits that are not captured by price paid by external organisations for the KE service
- lack of reliable data on outputs such as the value of spin-out companies
- indirect effects of engagements on external organisations.

The effect of these non-quantifiable outputs would be to increase the additionality of HEFCE third stream funding.

X11.18 In summary, each of the above approaches provides convincing evidence of a positive impact of HEFCE third stream funding on knowledge exchange income.

HEFCE third stream funding has resulted in a wide variety of outputs, both economic and social

X11.19 The complexity and diversity of the impacts of third stream funding preclude both a traditional cost-benefit analysis and a cost-effectiveness analysis. For this reason the approach in addressing the issue of value for money has been to establish a cost 'benefit' balance sheet which relates the third stream funding inputs to knowledge exchange outputs. The cost-benefit balance sheet does not include the indirect impacts that third stream funding may have enabled (see X11.7). A balance sheet for the overall sector is shown in Table X1, while separate balance sheets for each cluster are contained within Appendix C of the report.

Table X1 Cost 'benefit' balance sheet for the English HE sector

Inputs			Quantifiable outputs		
			Type	Period	Total output
HEFCE third stream funding (£m)	University Challenge Seed Fund	42	Collaborative research (£m)	2001-07	2,768
	Science Enterprise Challenge	40	Contract research (£m)	2001-07	3,200
	HE Reach Out to Business Comm	96	Consultancy (£m)	2001-07	1,080
	HEIF	300	Facilities and equipment (£m)	2001-07	354
	HE Active Community Fund	27	Courses (£m)	2001-07	1,688
	Knowledge Transfer Capability Fund	8	Regeneration/development (£m)	2001-07	960
	Centre for Knowledge Exchange	36	IP revenues (£m)	2001-07	228
	Other	43			
Total HEFCE third stream funding 2001-07 (£m)		592	Total income (£m)		10,279
Non-HEIF funding		n/k			
Allocation of expenditure to inputs (% HEIF 4 expenditure)			Non-income outputs		
Allocation of expenditure to inputs (% HEIF 4 expenditure)	Dedicated KE staff	52.3	Number of course days	2004-07	13,586,205
	Support for staff engagement	14.9	Number of patents granted	2001-07	3,885
	Seed/PoC funds	5.4	Number of non-software licences	2001-07	7,764
	Public relations/marketing	4.3	Number of software licences	2001-07	2,962
	Collaboration/partnerships/networks	2.7	Number of spin-offs with HEI ownership	2001-07	813
	CPD, enterprise education, student enterprise and employer engagement	2.6	Number of formal spin-offs	2001-07	111
	Training/staff development	2.5	Number of staff spin-offs	2002-07	278
	Engagement support services and other internal/external KE support	2.1	Number of graduate spin-offs	2001-07	4,327
	KE units, institutes and research centres	2	Total patent stock (active patents)	n/a	8,062
	Development funds	1.6			
	General KE support costs	1.6	Free public lectures (attendees, 000s)	2004-07	1,825
	KE initiatives and projects	1.2	Free performance arts (attendees, 000s)	2004-07	1,116
	Investment in spin-outs	1	Free exhibitions (attendees, 000s)	2004-07	12,487
	Incubation	0.5	Free museum education (attendees, 000s)	2004-07	844
	Community outreach	0.3	Free other events (attendees, 000s)	2004-07	7,086
	Other KE staff	0.3	Charge public lectures (attendees, 000s)	2004-07	271
	Consultancy	0.2	Charge performance arts (attendees, 000s)	2004-07	3,100
	Awards/events/culture change initiatives	0.1	Charge exhibitions (attendees, 000s)	2004-07	2,084
	Other expenditure	2.5	Charge museum education (attendees, 000s)	2004-07	254
	Unaccounted expenditure	1.6	Charge other events (attendees, 000s)	2004-07	4,128
Number of staff days for events 2001-07 (000s)		207	Total number of attendees at events (000s)	2004-07	33,196

		Gross ***additional*** income 2001-07 (£m)	Upper estimate	Lower estimate
Total HEFCE third stream funding 2001-07 (£m)	592	Collaborative research	1,373	919
		Contract research	1,231	821
		Consultancy	450	289
		Facilities and equipment	147	82
		Courses	496	302
		Regeneration/development	443	380
		IP	109	87
		All income streams	4,229	2,877
		Average additional impact	7.1	4.9

*Gross additionality excludes any displacement effects that may arise out of the knowledge exchange activity
Sources: HEBCI surveys, HEIF 4 strategies, HEFCE data, PACEC/CBR analysis

X12 Wider impacts of HEFCE third stream funding on the HEI

Third stream funding has strengthened the link between the triad of teaching, research and knowledge exchange activities undertaken by HEIs

X12.1 Third stream funding has strengthened the link between the triad of activities undertaken by HEIs: teaching, research and third stream. The flow of knowledge between these three pillars has increased as they increasingly influence each other. Knowledge exchange engagement has clear synergies with research activities undertaken by academics, with almost half of the academics surveyed believing that KE engagement has given them new insights into their work.

X12.2 Over half of the academics surveyed believed that knowledge exchange engagements have had some impact on their teaching activities:

- As a result of KE engagement, 38% of academics have changed the way in which they present the course material; this figure rises to 55% and 60% of academics in the low research and arts clusters respectively.
- A similar pattern was seen in the impact on course programme material.
- Industrial engagement for the development of course curricula is common in most engineering and applied science disciplines, although it is increasing in arts and humanities subjects.
- Enterprise education and entrepreneurship courses are also starting to appear in undergraduate and master's-level curricula.
- 16% of academics believed that KE engagement leads to an increase in the employability of their students; this figure rises to almost half of academics in the arts cluster.

X12.3 Knowledge exchange engagement is perceived to be complementary to the traditional activities of teaching and research, albeit with some academics believing that a degree of displacement has occurred because of the time constraints that most academics face.

Most HEIs collaborate to gain access to complementary capabilities

X12.4 HEIs collaborate for a variety of reasons:

- Approximately 70% of institutions do so to gain access to complementary capabilities.
- Over half of HEIs collaborate to enable them to gain access to additional resources such as funding. It is somewhat concerning that this is such an important reason for collaborating and it raises the question of whether HEIs would collaborate to anywhere near the same extent, other than for very specific instances, were such criteria not attached to funding streams.
- Collaborative ventures, both between departments within HEIs and between HEIs, are starting to help to share best practice among academics and institutions, although this could usefully become more widespread.
- Only a quarter of HEIs collaborate to gain economies of scale. One would have expected the smaller HEIs to collaborate to gain scale, in terms of facilities and other resources, and for reputation.

X12.5 Particular KE-related benefits from collaborative engagements are being realised that would otherwise likely not have arisen. For example, the cross-faculty, multidisciplinary institutes being set up are producing spin-off companies and intellectual property, and are conducting much more industrially relevant research.

Collaborative partnerships with large companies are beginning to go beyond the mere transactional towards a much more strategic partnership

X12.6 Collaborative partnerships between higher research intensive HEIs and large companies are starting to shift towards strategic partnerships. This reflects a realisation that a better understanding of the strategic direction of a large company's research will lead to more targeted research. It will also hopefully lead to more awareness of the issues surrounding the implementation of research into the company's products and processes, although much more progress needs to be made in this area.

HEFCE third stream funding is only one of a number of critical factors driving the changes to collaboration in the HE sector

X12.7 The challenges facing society and industry are inherently multidisciplinary in nature. Comprehensive solutions therefore require the expertise of more than one discipline. Demand-led multidisciplinary research centres are typically a direct response to this external driver of change. HEFCE third stream funding has facilitated this development by providing the resources for institutes to support engagements with external organisations. In addition, some successful knowledge exchange staff funded through HEIF have been instrumental in setting up large multi-partner research packages (multiple HEIs, Government, industry etc). Another key driver of change has been many funding bodies' requirement to collaborate.

HEFCE third stream funding has helped HEIs to attract other sources of funding

X12.8 HEIF funding has enabled HEIs to develop the capacity and capability to attract other sources of funding. The development of knowledge exchange offices has been one of the primary drivers in this respect. KEOs are increasingly writing the business proposals, handling contract negotiations and securing the (e.g. contract research) deals. In addition, HEFCE third stream funding is allowing HEIs to fund higher risk initiatives with potentially higher future returns. These high risks typically preclude many external sources from providing the initial rounds of funding until the benefits can be demonstrated. The demonstration effect enabled through HEIF has proven important for some HEIs to attract subsequent rounds of funding for such high-risk high-return projects.

HEFCE third stream funding has facilitated the sharing of best practice within HEIs and around the HE sector

X12.9 HEFCE third stream funding has, through a variety of mechanisms, stimulated the sharing of best practice both among academics within an HEI, and across HEIs. Critical mechanisms include the funding of knowledge exchange champions,

dissemination workshops and seminars, collaborative initiatives, and the formation of knowledge exchange associations. The HEIF-funded large-scale collaborative initiatives, such as WestFocus, have also resulted in the sharing of best practice between the partner institutions.

X13 Impacts on the external partners

Enterprises cooperate more with organisations outside the HE sector than with HEIs

X13.1 The UK Community Innovation Survey for 2004-06 reported that 10% of enterprises in the UK have cooperative arrangements for innovative activities with other enterprises or institutions. Of these cooperative arrangements, 29% are with HEIs. Interestingly, other types of partners are more common than HEIs, such as consultants, commercial labs and private research and development institutes. Enterprises are also more likely to cooperate with HEIs than to use them as a source of information. This reflects the importance of cooperation when using HEIs to improve innovative performance.

HEIs are particularly demanded by external organisations to obtain access to HEI facilities, enhance workforce and management skills, enhance technology and develop products

X13.2 The most common motivation for interacting with HEIs is to access their facilities. It is also clear from the survey evidence collected for this study, that external organisations particularly turn to HEIs to enhance their technology, increase their skills base and develop their products.

X13.3 External organisations turn to different types of HEIs for different forms of support. The six most research intensive HEIs are particularly demanded for enhancing technology, product development and increasing sales. The facilities of high research intensive HEIs are in the most demand relative to other HEIs. At medium research intensive HEIs there is greater demand than average for workforce training, management systems and graduate recruitment strategy support. There is a wider spread of demand for the low research intensive HEIs, which includes access to grants and their facilities, support for customer growth, and enhanced branding, marketing and recruitment. This is consistent with their focus on the needs of SMEs. Arts-focused HEIs are in particular demand for branding, marketing and customer service improvement.

HEIs are increasingly engaging with regional and sub-regional stakeholders

X13.4 RDAs and other regional/sub-regional stakeholders seek to engage with HEIs as they are now seen as key assets to the regional/local economy, particularly as a source of knowledge. These interactions have not only increased in number and value, but have also widened in scope and become more strategic. Furthermore, HEIs impact positively on the ability of these stakeholders to effectively deliver their economic development strategies.

Interactions with HEIs are considered highly successful by the organisations that work with them

X13.5 It is clear that organisations value working with HEIs; in the study's survey sample, over 60% considered the interactions as completely or highly successful. The success of these interactions impacts on overall organisational performance, with over half of external organisations in the survey sample reporting that they are critically or very important.

Demand from external organisations for HEI support is likely to increase

X13.6 Though potential demand from external organisations without links to HEIs is not known, almost half of the external organisations already working with HEIs plan to increase their engagement in the future. HEIs can also make further improvements in supporting external organisations. Of those external organisations which thought that the assistance offered could be improved, a key priority was for HEIs to improve their communication with them.

X14 Summary

- HEIs are in a period of transition in the development of an embracing culture and positive attitudes towards knowledge exchange engagement. It will take time for the full adjustment to pervade the HE sector.
- Initial concerns about whether the emphasis on the third mission would impact on the traditional teaching and research roles have proven to be unfounded. Many synergies between knowledge exchange, teaching and research have been realised.
- There have been modest shifts in culture and attitudes in the wider academic body of the HE sector.
- Knowledge exchange outputs have increased rapidly over the period 2001-07, with total knowledge exchange income rising by 12% per annum to £1.94 billion in 2007.
- The breadth of knowledge exchange engagement with external organisations across the HE sector does not appear to have created significant tensions among departments within HEIs.
- Between approximately £2.9 billion and £4.2 billion out of £10.3 billion generated through knowledge exchange engagements between 2001 and 2007 can be attributed to HEFCE third stream funding, either directly or indirectly. However, this almost certainly underestimates the true impact as many of the outputs cannot be monetised.
- There is greater recognition, by both academics and external organisations, of the value and benefits of working together on a highly diverse range of problems and initiatives.
- Different HEIs are finding their own unique position in the spectrum of knowledge exchange engagement, to the mutual benefit of each other. Similarly, from global corporations to micro-enterprises, a highly diverse set of firms and other types of external organisations are engaging with HEIs to solve their innovation challenges.

1 Introduction

1.1 Introduction

1.1.1 The overall aim of this study was: "to evaluate what has been achieved by HEFCE/OSI[3] third stream funding to achieve culture change and embed capacity towards optimising the direct and indirect economic impact of higher education (HE)". The term 'third stream' refers to interactions between higher education institutions (HEIs) and external organisations in the private, public and voluntary sectors, and wider society. It assumes that some knowledge or expertise flows between the HEI and users through these interactions.[4]

1.1.2 The study was not primarily concerned with evaluating the achievements of individual projects, but rather whether third stream funding is securing change in HEIs such that they are more responsive to the needs of business and the wider community and maximising the economic and social impacts of all their activities. The study was therefore concerned with establishing the extent to which third stream funding has:

- changed the culture and capacity within HEIs in line with aims
- secured benefits for the economy and society.

1.1.3 Within the broad aim of the study a number of distinct areas are identified on which conclusions are also drawn:

1. The direct deliverables from the Higher Education Reach Out to Business and the Community (HEROBC)/Higher Education Innovation Fund (HEIF) rounds, including impacts that endure beyond the period of funding. This will include the Centres for Knowledge Exchange (CKEs).
2. Impacts and outcomes achieved internally within the HEIs and externally for business and the community.
3. The organisations and individuals benefiting from the transfer of HE knowledge.
4. The contribution to third stream achievements by different HE subjects.
5. The value for money achieved, including the ability to leverage other funding.
6. The improvements secured by HEIs in the effectiveness and efficiency of their third stream activities. Examples of such improvements by HEIs include:
    - use of collaborative and /or competitive strategies and activities, including benchmarking performance against comparators and sharing good practice
    - mix of investments in staff and non-staff elements (including seed and proof of concept (PoC) funds
    - professionalism in individual and organisational performance
    - data through which to evaluate the direct and indirect impact of their activities on the economy and to inform their future activities.

[3] The functions of the Office of Science and Innovation (OSI) have now been integrated within the Department for Innovation, Universities and Skills (DIUS).

[4] The term 'third stream' is used to reflect the language used by the Higher Education Funding Council for England (HEFCE) in the original tender for the evaluation. HEFCE has used the term to reflect that the policy focus has been on a third stream of funding, which supports engagement with business and the wider community. Government has tended to use terms such as innovation, enterprise. The HE sector commonly uses knowledge exchange/transfer, enterprise, outreach etc.

7 The influence of different elements of HEROBC and HEIF, including any distinct influences of formula-based funding and project-based funding on HEIs' capacity and activities.

8 The contribution made by Science Enterprise Challenge (SEC), University Challenge, and HEFCE Strategic Development Fund projects to the third stream.

9 The contextual influences on the achievements of third stream funding, in particular:

- the maturity of the impacts and outcomes, as reflected in impacts and outcomes derived from third stream funding in different years
- the impact and outcomes derived for other public policy interventions.

10 The vision, planning and strategy for HEIs' future development and the embeddedness and sustainability of third stream activities and culture if government support were to be withdrawn.

1.2 History of third stream funding[5]

1.2.1 HEFCE's 'third stream' of funding for the higher education sector began in 1999 (working with government support from the then Department for Education and Skills (DfES) and Department of Trade and Industry (DTI)), with the introduction of funds specifically to support HEIs to increase their capability to respond to the needs of business and the wider community, where this would lead to wealth creation. This funding was distinct from the two established HE funding streams for teaching and research. In the beginning (from 1999 to 2004), third stream funding was made through the Higher Education Reach Out to Business and the Community initiative[6] sponsored by the DfES and DTI. HEROBC has been succeeded by successive rounds of the Higher Education Innovation Fund from 2002 to the present. HEIF is a joint funding initiative between HEFCE and the OSI, now in DIUS, funded substantially from the Science Budget.[7] It incorporates support for activities previously funded by HEFCE under HEROBC and by DTI under the University Challenge[8] and Science Enterprise Challenge[9] programmes. The latest round of HEIF funding, HEIF 4, was announced in December 2007 and "is designed to support and develop a broad range of knowledge exchange (KE) activities which will result in economic and social benefit to the UK". It is making available £396 million over the period 2008/09 to 2010/11.

1.2.2 The broad aim of all HEFCE/OSI third stream funding to date has been to enhance the direct and indirect economic benefits of HE, through embedding a culture and capacity within institutions that support the transfer and exchange of knowledge between HE, business and the wider community.

[5] This section is drawn from the documentation included in the invitation to tender.
[6] See also http://www.hefce.ac.uk/econsoc/buscom/pubs/report.htm
[7] HEIF was initially sponsored by the Office of Science and Technology, which then became the Office of Science and Innovation. The DfES and DTI were then changed into the Department for Children, Schools and Families, the Department for Innovation, Universities and Skills and the Department for Business, Enterprise and Regulatory Reform (BERR). The functions of the OSI now reside within DIUS.
[8] www.dti.gov.uk/science/knowledge-transfer/schemes/University-Challenge-SEED-Fund/page12117.html
[9] www.dti.gov.uk/science/knowledge-transfer/schemes/Science_Enterprise_Challenge/page12138.html

1.2.3 The HEROBC programme built upon some established third stream activity, but which was more narrowly conceived prior to 1999 as technology transfer. Some institutions and disciplines were more involved than others at this stage. The design of the HEROBC programme was informed by a report on the state of the emerging third stream from the PREST (Policy Research in Engineering, Science and Technology) team at Manchester University (commissioned by HEFCE and published in 1998[10]), a report for the DTI by Tartan Technology and the results of a University of Birmingham evaluation of Continuing Vocational Education (CVE).

1.2.4 While HEROBC and HEIF have been the primary vehicles of third stream support, the Council has also provided funding for similar aims through the Knowledge Transfer Capability Fund (KTCF),[11] Business Fellowships[12] and through bottom-up Strategic Development Fund projects.[13]

1.2.5 Initially the funding was awarded to time-limited projects, with the scale and collaborative nature of the projects (between multiple HEIs) varying across the different funding rounds. HEIF 3 included a formula-based allocation of funding to all HEIs plus an element of additional funding awarded through a competition to a small number of large-scale collaborative projects. Rounds of HEROBC and HEIF funding have had set time periods, but individual projects within each round have had some flexibility to start late or extend. Hence projects from different funding rounds may overlap. The Government's Science and Innovation Investment Framework in July 2004 announced commitment to a long-term stream of funding for the third stream.[14] The Sainsbury Review (2007) and the *Innovation Nation* White Paper (DIUS 2008) more recently reaffirmed the Government's commitment to the third stream.

1.2.6 There have been a number of other sources of government support for knowledge transfer from the HE sector, such as Science Enterprise Challenge and the University Challenge Seed Fund (UCF), which were funded directly by OSI until 2002 when they were incorporated into HEIF. Furthermore, incentives for HE to produce research and teaching which are themselves more relevant to the wider economy and society may also indirectly prompt third stream activities and approaches.

1.2.7 The Technology Strategy Board[15] and further initiatives such as Knowledge Transfer Partnerships (KTPs)[16] have aimed to stimulate knowledge transfer between business and HE, through funding support targeted at the business or 'demand' side. There has also been relevant investment in regional economic development from the Regional Development Agencies (RDAs).

1.2.8 The HEFCE/OSI support for the third stream has been in the context of greater government attention to the issues of competitiveness, productivity, innovation and enterprise and the contribution of the HE knowledge base to improvement in all

[10] Howells et al (1998) www.hefce.ac.uk/pubs/hefce/1998/98_70.htm
[11] http://www.hefce.ac.uk/econsoc/buscom/initia/#ktcf
[12] http://www.hefce.ac.uk/econsoc/buscom/initia/#bf
[13] www.hefce.ac.uk/finance/fundinghe/sdf/
[14] http://www.hm-treasury.gov.uk/ent_sciinnov_index.htm
[15] www.innovateuk.org/
[16] www.ktponline.org.uk/

these. The Government's policy interest was set out in the Science and Innovation Investment Framework, in response to the *Lambert Review of Business-University Collaboration*.[17] The latest HEFCE Strategic Plan[18] has anticipated that as the economy and society become more dependent on higher levels of knowledge and skills, this will in turn put higher and new demands on the HE knowledge base. This includes the needs of new sectors (such as service and creative industries) and new types of users (e.g. more small and medium-sized enterprises (SMEs)). It also includes the need for HE knowledge to be applied within local, regional, national and international dimensions.

1.3 Higher education institutions, knowledge exchange and innovation systems

1.3.1 In view of the breadth of activities to be covered in the study and the particular focus on the knowledge transfer and innovation impact of third stream funding, it is helpful to set out an overview of the role of HEIs in the innovation system. It is then possible to locate the ways in which third stream funding may impact upon that role.

1.3.2 Evolutionary and systems approaches to innovation policy have been increasingly emphasised in UK government thinking. This is most apparent in the *Innovation Nation* White Paper (DIUS 2008) and in the Sainsbury Report *The Race to the Top* (Sainsbury 2007). The Sainsbury Report explicitly adopted a systems approach and identified a national innovation eco-system as central to the elements determining the country's innovation rate. The eco-system was defined to include industrial research, publicly funded basic research, user-driven research, knowledge transfer, institutions governing intellectual property (IP) and standards, supply of venture capital, education and training of scientists and engineers, innovation policies of government departments, science and innovation policies of RDAs, and international scientific and technological collaboration. It devoted a chapter to each of these elements.

1.3.3 In this study we also adopt an innovation system framework. This framework can then be used to trace and identify the potential impacts and benefits from public intervention in the particular part of the system concerned with innovation and the knowledge base. While the innovation system approach focuses primarily on the economic agent, it does not ignore the powerful impact that HEIs can have on innovation within the community. The role of HEIs in the community has always been recognised by HEFCE in the provision of its funding for the third stream, despite the provision of funds by the Government in the context of its policies for science and innovation.

1.3.4 Evolutionary and systems approaches to innovation policy encourage a holistic view of policy development and do not just focus on price mechanism effects (Lundvall 2007). Innovation systems emerge from innovation ecologies, where innovation ecologies are seen to consist of economic agents interacting with each other and

[17] HM Treasury (2003) www.hm-treasury.gov.uk/lambert_review_business_university_collab.htm
[18] HEFCE (2006b) www.hefce.ac.uk/pubs/hefce/2006/06_13/

their institutional, technological and industrial environment (Metcalfe 2007). A variety of terminologies are designed to capture the elements of these ecologies and the systems to which they may lead (see for example Lundvall and Borrás 2005).

1.3.5 The core elements of an innovation system consist of *agents,* which are the typical market-based actors of a conventional economic approach. This includes the typical for-profit business activity of commercial firms, but also includes businesses and other organisations which operate in a not-for-profit environment, including for example cooperatives, mutual companies and public sector agencies, such as HEIs and public research laboratories. Agents also include both the public and private sectors as consumers of intermediate and final outputs.

1.3.6 Agents operate in *institutional environments*. These institutional environments condition the nature of market and non-market transactions between agents. Markets themselves are seen as socially constituted institutions, and the way they work is conditioned by the social and institutional environment. This includes the nature of contract law, intellectual property arrangements and the broader system of norms and rules which cover interactions and behaviour between agents. The institutional environment also includes a very wide range of non-market exchanges. This not only includes charitable activity, but also, for instance in relation to the HEI domain, a wide range of academic publication and conference activity which is not sold at a market price.

1.3.7 The final element of innovation systems resides in the *structure of formal and informal networks,* which links agents and through which inter-organisational or inter-agent market and non-market transactions are mediated. In a well-functioning economy innovation systems are transient in the sense that they form and reform as innovation problems and ecology conditions change. Seen from this point of view an innovation policy that encourages adaptability in innovation systems is particularly important.

1.4 The functions and processes of innovation systems

1.4.1 In locating the role of HEIs and support for knowledge exchange it is useful to identify particular functions or processes that an innovation system performs (see for example Bergek et al 2008). These functions include the determination of the scale and direction of the search for new opportunities and new knowledge in relation to innovation; the process of knowledge development itself; and the way in which markets are formed. System functions also include the methods and scale with which resources are mobilised overall and in the particular directions identified, and the forms of business experimentation which occur in pursuing opportunities.

1.4.2 The co-evolution of the identification of market opportunities and the sets of market and non-market developments which lead to their exploitation (or lack of it) goes hand in hand with what are traditionally regarded as external economies associated with market development, including for example the development of particular sets of skills

through the labour market and the development of specialised suppliers as economic activity in a particular area develops.

1.4.3 There is also an important set of feedback mechanisms in which particular kinds of new activity or new directions of activity are legitimised in terms of the underlying norms or practices governing behaviour. These functions and processes co-evolve and the state has an important role to play in the system as a whole.

1.4.4 Seen in this light, government intervention may affect the scale and stability of the innovation system in terms of the overall set of macro-economic conditions which it attempts to produce and the associated set of monetary and fiscal policy practices which it follows. Competition policy and the regulatory and legal framework – for example in relation to intellectual property rights (IPR) and standards and metrology – also have an important role to play in the function of an innovation system.

1.4.5 Direct public provision, through health, defence and education expenditures and public sector research institutions, also has an important direct bearing on the innovation system. Public procurement in relation to research and development (R&D) may be particularly relevant in the case of the role that HEIs play in this system. Finally, the state has a direct role to play through the funding of the knowledge base. It can also attempt to influence the wider set of norms and rules of the basis on which interactions between HEIs as one component of the system and other agents may develop.

1.4.6 Looked at from a systems perspective, arguments in support of innovation policy based on 'market failures' appear as one element of a systems-based policy. Market failures are usually identified in relation to the inability of those who spend on an activity to fully capture the social benefits. The failure of an inventor or those conducting research and development to be able to fully capture all of the benefits will, it is argued, lead to an under-optimal supply of those activities in the economic system. These so-called 'spill-over' effects from R&D and innovation are identified as a market failure justifying public intervention. This leads to arguments promoting patent systems in order to allow the extraction of value from new inventions and policies to subsidise or otherwise provide support for private sector R&D expenditure.

1.4.7 There is, however, a more fundamental issue which arises in relation to basic research. It is difficult to forecast or even to judge in retrospect what the commercial value of particular kinds of research activities has been. This is a reflection of the fact that it may take a very long time for a particular piece of research activity to be translated into an exploitable innovated activity. It is also because basic research activity tends to be at the frontiers of knowledge and therefore inherently risky in itself. The realisation by any individual institution or agent of the economic gains for basic science can easily be impeded if intellectual property rights are difficult to establish and defend. More fundamentally, there may be cultural inhibitions arising from organisational norms and practices which may prevent those conducting basic science from pursuing either individual or communal property rights. The result is that there may be substantial gaps between the private and social value attributed to and

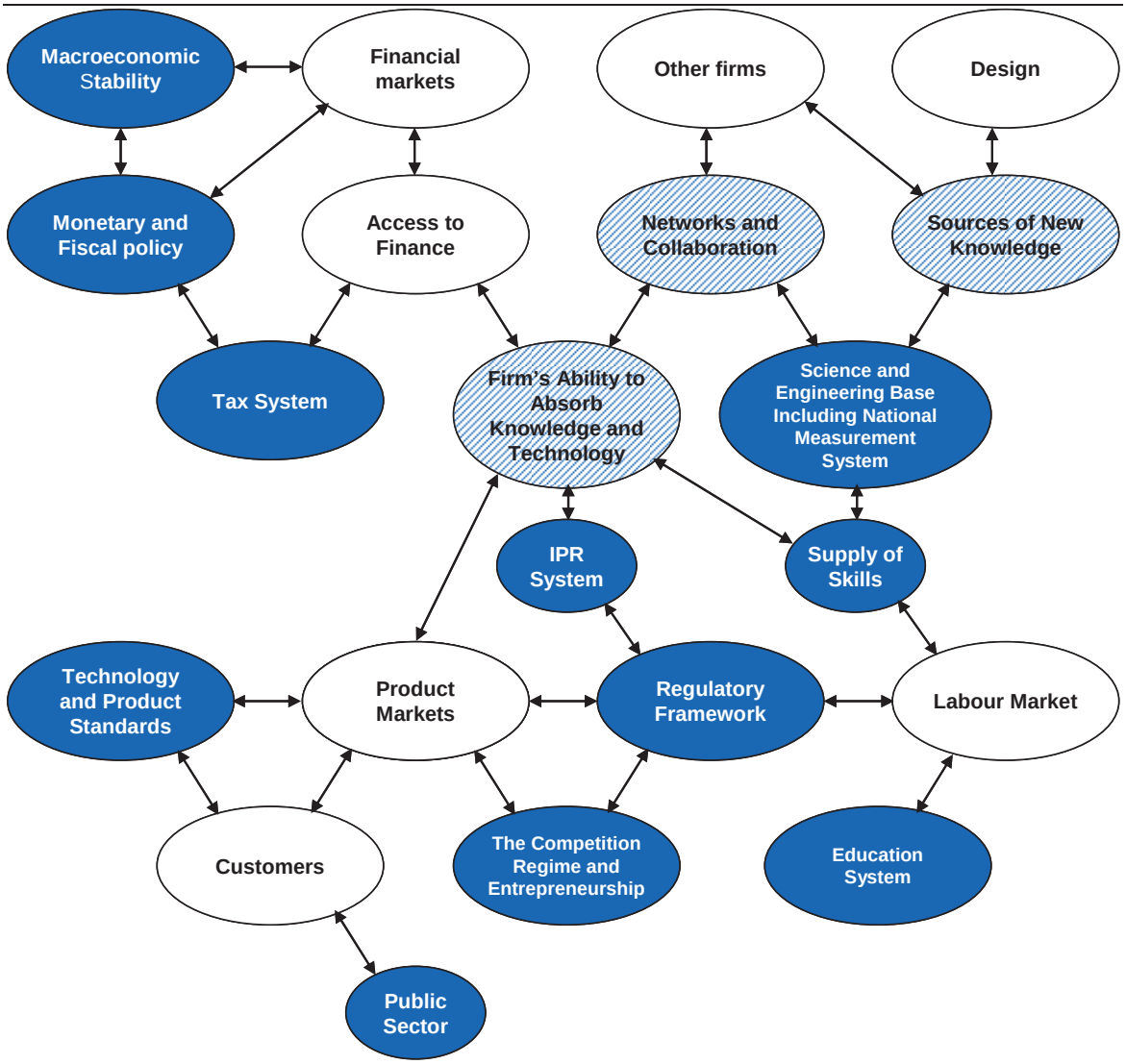
appropriated from basic research that go beyond market failure *per se* to include the institutional norms and values in the innovation system. In the light of these arguments it has been persuasively argued (Dasgupta and David 1994) that there will be a systemic failure which will cause major underinvestment in science and that in relation to interactions between the knowledge base and commercialised innovation activity occurring in the private sector there may be "no economic forces that operate automatically to maintain dynamic efficiency in the interaction of these two (organisational) spheres. Ill-considered institutional experiments, which destroy their distinctive features if undertaken on a sufficient scale, may turn out to be very costly in terms of long-term economic performance" (Dasgupta and David 1994 p. 487).

1.4.8 The development of policies to address these systemic problems has been an important part of the evolution of the innovation and knowledge exchange policy in the UK. The development outlined at the beginning of this chapter represents a particular set of attempts to develop and foster modes of interaction between, and attitudes towards, the exploitation of research, knowledge and other HEI expertise. These attempts have been designed to make the interface between external organisations and HEIs more porous, with a view to increasing the economic impact of underlying HEI activities.

1.5 Third stream funding in the national innovation system

1.5.1 In terms of the stylised national innovation system proposed by the then DTI in 2003 (Figure 1.1), third stream funding may be conceived as operating at the interfaces between the sphere representing the science and engineering base and the more lightly shaded spheres representing sources of new knowledge, networks and collaboration and firms' ability to absorb knowledge and technology.

Figure 1.1 A stylised national innovation system: the UK (DTI 2003)



Source: DTI (2003) *Competing in the Global Economy – The Innovation Challenge*, DTI Economics Paper No. 7, HMSO, November

1.5.2 Third stream funding may then be conceived of as an attempt to address institutional failure. This is the inability or relative lack of ability of a system to adapt in terms of changing patterns of behaviour and the rules or norms affecting inter-agent transactions which arise from broad underlying technological and other changes in the innovation ecology (Smith 2000, Lundvall and Borrás 2005, Edquist 2005). This 'failure' relates to both the demand and supply side of knowledge exchange and the norms and patterns of behaviour of each. It is now widely argued that HEIs play a more active role in commercialising scientific advances because of underlying changes in the nature of the innovation process itself. The need to develop a range of policies which can prevent this role from being inhibited then leads to broader discussions of potential or actual conflicts between 'science-based' norms of behaviour based on openness and speed of disclosure and 'business'-based norms based on secrecy and the protection of access to ideas in order to ensure commercial gains and appropriability. It also raises important issues in relation to the basis on

which research funding is allocated across fields and the tension between user-driven and basic research.

1.5.3 Seen from these perspectives the institution of third stream funding can then be conceived as a set of policies designed to develop linkages and promote networking and other activities to allow the co-evolution of activities and processes in HEIs and external organisations. The impact of these therefore depends on the extent to which the particular policy instruments used affect the pattern and direction of interaction. It also depends on the underlying cultural norms which govern the incentive for individuals to engage in knowledge exchange and related activities on both sides of the supply and demand side of the economy to integrate the HE system into the innovation process.

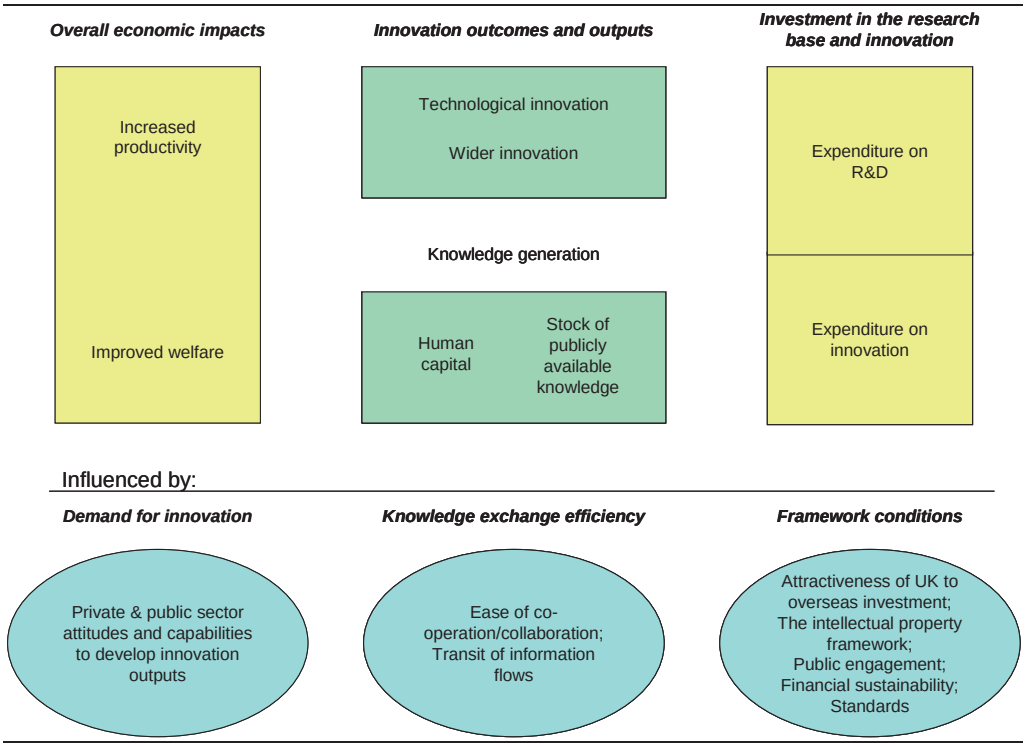
1.6 Innovation system and impact analyses

1.6.1 The economic impacts of investment in research and innovation in a systemic framework are set out in *Science and Innovation Investment Framework 2004-14: Economic Impacts of Investment in Research and Innovation* (BERR 2007).

1.6.2 In this report a distinction is made between different categories of inputs, outcomes and impacts. These include overall economic impacts, innovation outcomes and outputs, knowledge generation, investment into the research base and innovation. In relation to the research base and innovation, a process is envisaged in which *framework conditions* influence expenditure on R&D and expenditure on innovation. These framework conditions include the attraction of the UK to overseas investment, the intellectual property framework, financial sustainability in the knowledge base, and regulatory standards.

1.6.3 Innovation outcomes and outputs are measured in terms of technological market innovation and wider innovation, plus knowledge generation in the form of human capital and in the stock of publicly available knowledge. These in turn are seen to be influenced by knowledge exchange efficiency. This is defined as the ease of cooperation or collaboration and the ease of information flows from the knowledge base to the user community. Finally, overall impacts in terms of increased productivity and improved welfare are influenced by the demand for innovation captured by both private and public sector attitudes and by user capacity to develop innovation outputs. This reporting framework is shown in Figure 1.2.

Figure 1.2 UK economic impact reporting framework



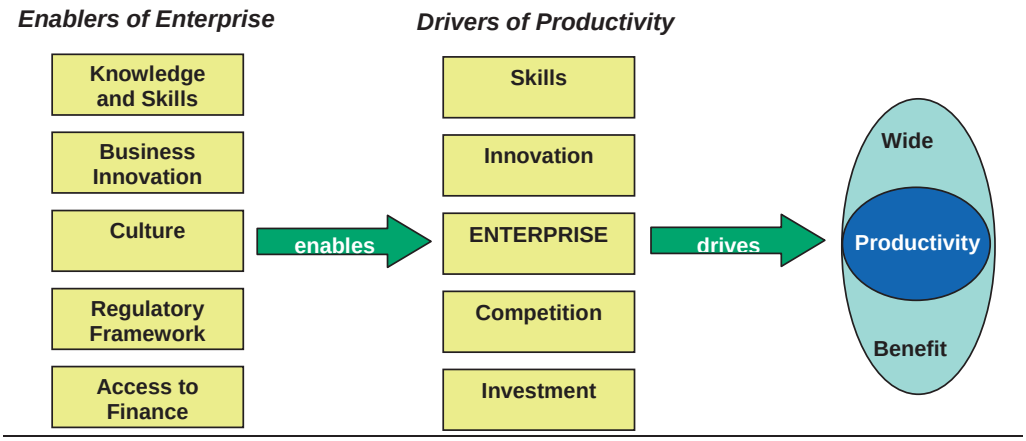
Source: BERR (2007) *Science and Innovation Investment Framework 2004-14: Economic Impacts of Investment in Research and Innovation*, July, p. 13

1.6.4 Seen in these terms, third stream funding is designed to operate in the area of knowledge exchange efficiency. It also has important links with the extent to which the knowledge base is an attractive location for funding in support of third stream activities, and enhances both the stock of human capital and the stock of publicly available knowledge and its links into the broader commercialisation and exploitation process.

1.7 Innovation and the promotion of enterprise: recent policy developments

1.7.1 The focus of third stream funding has been on innovation and the exploitation of activities from the knowledge base. It has, however, also been closely related to the promotion of enterprise more generally. This has two aspects: on the one hand the role of the knowledge base as a source of new businesses through the spin-out of new activities, and on the other hand the role of HEIs in supporting the development of businesses, and in particular SMEs, in the private sector. In this area too the issue of culture is emphasised in the schema which is used to link enterprise and productivity. This is captured in Figure 1.3 (HM Treasury and BERR 2008).

Figure 1.3 Enterprise enablers and productivity



Source: Adapted from *Enterprise: Unlocking the UK's Talent*, HM Treasury and BERR, March 2008, p.17

1.7.2 From this perspective, the role that HEIs may play in the enhancement and provision of knowledge, expertise, skills and business innovation is seen as one of a set of enablers which lead to the promotion of enterprise. Policies to change culture in the HE sector are linked to the broader aspect of cultural change to promote enterprise. Enterprise is then seen to lead to productivity improvement through the role it plays in the application of skills, innovative activity and physical capital investment. As with innovation there are well-known market failure arguments for policies to support enterprise. These relate in particular to the problem of underfunding of training, because the full value of the cost of training may not be captured by the training provider, and a set of well-known failures in capital markets arising from asymmetry of information between borrowers and lenders. In relation to third stream funding, the most important area from a systems perspective is an institutional failure related to the mechanisms and incentives for the promotion of collaborative activity between smaller businesses and the knowledge base and the general difficulties of promoting commercialisation through spin-offs and start-ups from the HE sector.

1.7.3 This systems failure in relation to smaller businesses received particular attention in the *Lambert Review of Business-University Collaboration,* in December 2003 (HM Treasury). The Review identified two broad trends that were shaping the way companies undertook their research. The first of these was the tendency for R&D to be outsourced to other institutions or public sector research laboratories. The second was that business R&D was increasingly global, with multinationals locating their research centres across the world in relation to their most important markets, in particular those where the research base was deemed to be outstanding. It noted that in principle UK HEIs were in a good position to capitalise on these trends, and concluded that the main challenge for the UK was not about increasing the supply of exploitable ideas from HEIs into business and society. Instead it argued that the key question was how to raise the overall level of demand by business for research and knowledge from all sources. Some of the key conclusions of the Lambert Review were:

- No changes were recommended to the R&D tax credit and related fiscal incentives, rather, it emphasised the importance of knowledge exchange and within that the central importance of human interactions.

- The lack of clarity over the ownership and exploitation of intellectual property resulting from collaborative research would be reduced by developing model contracts. These would also help to make negotiations shorter and less costly. They would also lead to there being as much flexibility as possible in the distribution of IP rights between HEIs and external organisations.
- A potential second barrier to commercialising IP from HEIs could lie in the variable quality of technology transfer offices. It argued that very few HEIs have a strong enough research base to sustain their own in-house offices of this kind, even though most HEIs were attempting to do so. The Review recommended that HEIs should develop shared services on a regional basis in relation to technology transfer.
- There was too much emphasis on developing HEI spin-outs. It argued that the pursuit of spin-outs *per se* may lead to the possibility of many unsustainable new ventures and a consequent drag on the licensing of technology to potential external users.
- Companies are broadly satisfied with the quality of the graduates they recruit, although there are some mismatches between their needs and the courses offered by some universities.
- The Review recommended the creation of a significant stream of business-relevant funding.

1.7.4 In the Sainsbury Review *The Race to the Top* (Sainsbury 2007) it was argued that there had been considerable progress since the Lambert Review. This included:

- the development of a dedicated third stream of funding in England (HEIF) which met the recommendation for a more predictable and enhanced funding stream under this heading
- the development of model contracts and guidance material to cover intellectual property issues in a number of different research scenarios
- the development of close links between the Association of University Technology Managers (AUTM) and UK technology transfer organisations
- the increased involvement of RDAs and devolved administrations in facilitating business-HEI links.

1.7.5 In relation to knowledge transfer the Sainsbury Review recommended:

- that there should be more support through HEIF to business-facing HEIs in order to incentivise them to perform more knowledge transfer with small and medium-sized enterprises
- that the knowledge transfer activities with research councils should be increased
- that the number of Knowledge Transfer Partnerships should be raised, and
- that further education colleges should undertake more knowledge transfer.

1.7.6 The Review also proposed *inter alia* that HEIF funding should be allocated entirely on the basis of a formula, with the formula constructed so that the money then currently allocated on the basis of a competition would go largely to business-facing HEIs.

1.7.7 The Review also made a number of recommendations in relation to the knowledge transfer activity of the research councils. It also recommended that DIUS should develop a strategy to promote and support knowledge transfer within the context of the wider reform of further education.

1.7.8 The Review made a number of recommendations in relation to the supply of venture capital and to the education of scientists and engineers and to the role that could be played by government departments and the RDAs – the latter in particular through their science and innovations strategies.

1.7.9 The *Innovation Nation* White Paper (DIUS 2008) reiterated the rationale for the Government's research base as set out in the 10-year Science and Innovation Investment Framework covering the period 2004-14. In relation to the specific issue of third stream funding, the *Innovation Nation* White Paper noted that HEIF was "now a permanent part of university-funding landscape", and that funding would "increase to £150 million per year by 2010/11. Funding will be allocated entirely through a formula and the benefits distributed more widely in line with Lord Sainsbury's recommendations".

1.7.10 In addition, the *Innovation Nation* White Paper noted that:

- the QR (quality related) block grant has been amended by HEFCE to introduce a dedicated element of £60 million to be allocated on the basis of how well institutions attract business research funding
- the Research Assessment Exercise (RAE) 2008 was to consider business aspects, including incentives for applied practice-based and interdisciplinary research, and to take into account user views.

1.7.11 In relation to other recommendations in the Sainsbury Review, the *Innovation Nation* White Paper noted that each research council had agreed a knowledge transfer target to be published in their delivery plans, and their next round of the public sector research establishment fund would require co-funding from other organisations.

1.7.12 The *Innovation Nation* White Paper also set out a proposal to encourage a development of the Innovation Voucher Scheme. This is designed to enable small and medium-sized enterprises to develop an initial engagement with a research base institution of higher or further education. The Innovation Voucher Scheme is intended to enable smaller, less well-established businesses to make initial contacts with potential knowledge providers. It is envisaged that vouchers could be important in overcoming cultural or behavioural barriers to engagement with the knowledge base as well as having the impact of reducing the costs of innovation for SMEs. The notion that such vouchers could incentivise first-time engagement with the knowledge base and provide a more market-based mechanism for allocating some knowledge transfer resources to HEIs is clearly a complementary activity in relation to the HEIF framework.

1.8 Community and voluntary activity

1.8.1 The role of HEIs in community development is increasingly recognised as important. This has been driven by an acknowledgement of the role that HEIs can play in the development of civil society and also by a response to the pressures on communities arising from a knowledge-based global economy. HEIs are now acting as important stakeholders in their communities, as educators, providers of cultural and sporting

facilities and sources of intellectual expertise.[19] The Dearing Review (1997) provided a more extensive account of the civic role of the HE sector related to lifelong learning, community and cultural roles. Ernest Boyer articulated the need for HEIs to develop a 'scholarship of engagement' that "connects the rich resources of the [HEI] to our most pressing social, civic, and ethical problems, to our children, to our schools, to our teachers and to our cities. Campuses would be viewed by both students and professors not as isolated islands, but as staging grounds for action" (Boyer 1996). Boyer suggested that teaching, application and integration (of existing knowledge) could be as important to the advancement of knowledge as the scholarship of discovery. HEIs are also increasingly being required to do more than just prepare students for employment. They play an important role in preparing them to become fully functional members of the community.

1.8.2 In addition to the emphases on innovation and enterprise, HEFCE's third stream mission has from the beginning been defined to include civic, cultural and community interaction. This has usually been subsumed in the term wider social impact in the enterprise and innovation impact analyses discussed above. This aspect of third stream activities was reflected in the title of HEROBC and in the introduction of the Higher Education Active Community Fund (HEACF) in 2002, which was focused on the specific volunteering aspect of community engagement. This agenda has now been taken forward in teaching enhancement funding, HEIF and the new Beacons for Public Engagement scheme.[20]

1.9 Report structure

1.9.1 In this report we have sought to analyse each of the key components of HEIF funding in relation to the reporting and conceptual frameworks set out in our innovation systems discussions and captured in Figure 1.2 and Figure 1.3.

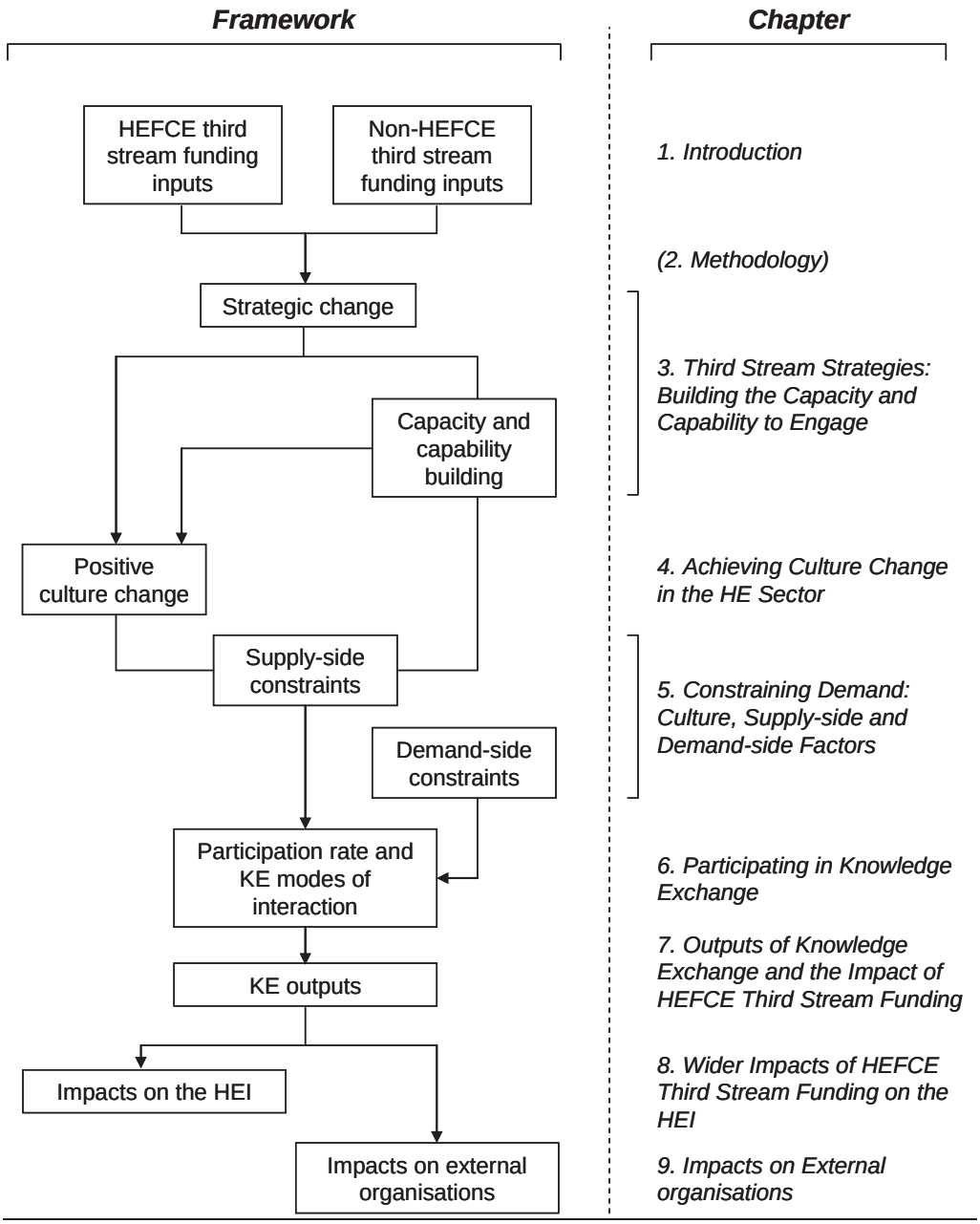
1.9.2 In the remainder of this introductory chapter we list key third stream activities and provide a broad overview of the main trends in HEFCE third stream inputs.

1.9.3 In Chapter 2 we present the methodology for addressing the aims and objectives of this study. Chapter 3 deals with third stream strategies designed to build capacity and capability to engage. Chapter 4 focuses on the essential institutional system features related to norms and cultural changes and which impinge directly on knowledge exchange efficiency. Chapter 5 looks at demand-side issues and their interaction with supply-side constraints, and thus addresses both information issues affecting the ease of knowledge exchange and private attitudes and capacities. Chapter 6 looks at actual participation in knowledge exchange activities, using the broad range of activities shown in Table 1.1. Chapters 7-9 focus on the analysis of outputs and impacts in terms of both HEIs and external partners. The key elements of this structure are set out in Figure 1.4.

[19] From Wilson, T. and Green, A. (2008) *From Onlookers to Leaders? Rethinking the Potential of Universities in Local Economic Development*, a think-piece from the University of Hertfordshire

[20] Beacons for Public Engagement are university-based collaborative centres to help support, recognise, reward and build capacity for public engagement work across the UK.

Figure 1.4 Report roadmap



Source: PACEC/CBR analysis

1.10 Range of third stream activities

1.10.1 On the basis of our review of the range of policy and systemic nature of HEI-external organisation knowledge exchange activities, and on the basis of an examination of successive bidding rounds of HEIF and the range of activities included in bids, it is possible to draw up a list of activities which can be encompassed under the third stream heading. These are shown in Table 1.1.

Table 1.1 Range of third stream activities

Targeted post-course placement of undergraduate and postgraduate students with external organisations
In-course student projects or placements or Knowledge Transfer Partnership with external organisations
Joint curriculum development with external organisations
Personal secondment (short or long term) to external organisations
Hosting (short or long-term) visits by individuals from external organisations
Membership of advisory boards to external organisations
Providing continuing professional development (CPD) (including training company employees through course enrolment or temporary personnel exchange)
A joint research agreement (original research work undertaken by both partners)
A contract research agreement (original research work done by the HEI alone)
A consultancy agreement (no original research undertaken)
Taking out a patent
Licensing research
Forming a spin-out
Forming a consultancy
Participation in consortia involving external organisations
Creation of physical facilities with external organisation funding (e.g. new laboratory or campus building)
Prototyping and testing for external organisations
Joint publications with individuals from external organisations
Attending conferences which have HEI and external organisations' participation
Organising conferences which have HEI and external organisations' participation
Participation in standard-setting forums
Participation in networks involving external organisations
Giving lectures or talks for (non-HEI) external organisations
Providing informal advice on a non-commercial basis
Giving public lectures for the community
Provision of community-based performance arts
Provision of community-based sports
Provision of public exhibitions
Involvement with schools projects

Source: PACEC/CBR analysis

1.10.2 These categories are designed to capture the full range of activities, including the human interaction aspect of knowledge exchange which was emphasised in the Lambert Review and has been noted in a number of studies of HEI-business interactions (e.g. Cosh et al 2006).

1.10.3 Table 1.1 may be divided into a number of broad categories. The first seven activities focus on the placement of undergraduate and postgraduate students and academic staff. Each of these may be seen as directly related to the development of informal interactions which can promote the opportunity to recognise and develop other opportunities for collaboration. This is in addition to the direct impact they have.

1.10.4 In relation to Knowledge Transfer Partnerships, the activities are linked specifically to the objectives of the government scheme of this name, which is now administered as part of the overall activities of the Technology Strategy Board. The Knowledge Transfer Partnership Scheme promotes interaction through the placement of students in businesses to help resolve the work on specific commonly agreed problems.

1.10.5 The next group of ten activities are more research-focused and relate to jointly undertaken research activities, contract research activities and consultancy activity as well as the participation in consortia by academics and involving external organisations. An activity in this group represents a combination of physical investment as well as research in which external organisations fund within the HEI a new laboratory or campus building. Finally, there is the provision of prototyping and testing facilities for external organisations by an HEI.

1.10.6 The next group of activities may be broadly summarised under the heading of dissemination and networking activities. The first two of these relate to joint publications between HEIs and business organisations and attendance at conferences where both sets of organisations are represented, as well as the organisation of such conferences. Given the importance of standard setting in relation to innovation and competitiveness participation, standard-setting forums are also listed here alongside the more general participation in networks involving external organisations. The giving of lectures and talks to external organisations is also included here as well as the provision of informal advice on a non-commercial basis.

1.10.7 Finally, there is a group of activities which may be broadly defined as community-based activities. These involve the giving of public lectures to the wider community, community-based performance arts, community-based sports, public exhibitions and involvement with schools and school projects.

1.10.8 The range of activities poses important challenges for the quantification of the range, extent and change over time in the extent to which they are occurring in the UK and may be linked to HEIF-related funding. In the analysis in the body of this study we therefore draw upon specially commissioned survey-based evidence in which we attempt to capture from academics and external organisations views of the extent of such activities, their link with HEIF-related funding and the extent to which there is a joint recognition by HEIs and industries of their relative importance.

1.10.9 The remainder of this chapter draws upon a more direct investigation of HEIF-related activity based upon published sources and upon an examination of the bids submitted for HEIF funding over the life of the programmes from 2002-11. We also provide an analysis in terms of the input of funding over this period by scheme, to allow us to capture the evolution of third stream funding in the light of the changes in the elements of overall funding described in our historical account earlier in this chapter.

1.10.10 We provide an analysis both in aggregate terms and also in terms of funding by type of higher education institution. This analysis uses six HEI groups derived in the course of the study on the basis of a cluster analysis. This grouped HEIs according to their similarity in terms of a number of factors, including research intensity and involvement with SMEs and the regional economy. The broad categories we derived are shown here as the top six research HEIs, which we selected as a group purely on the basis of their research leadership;[21] high research intensity; medium research

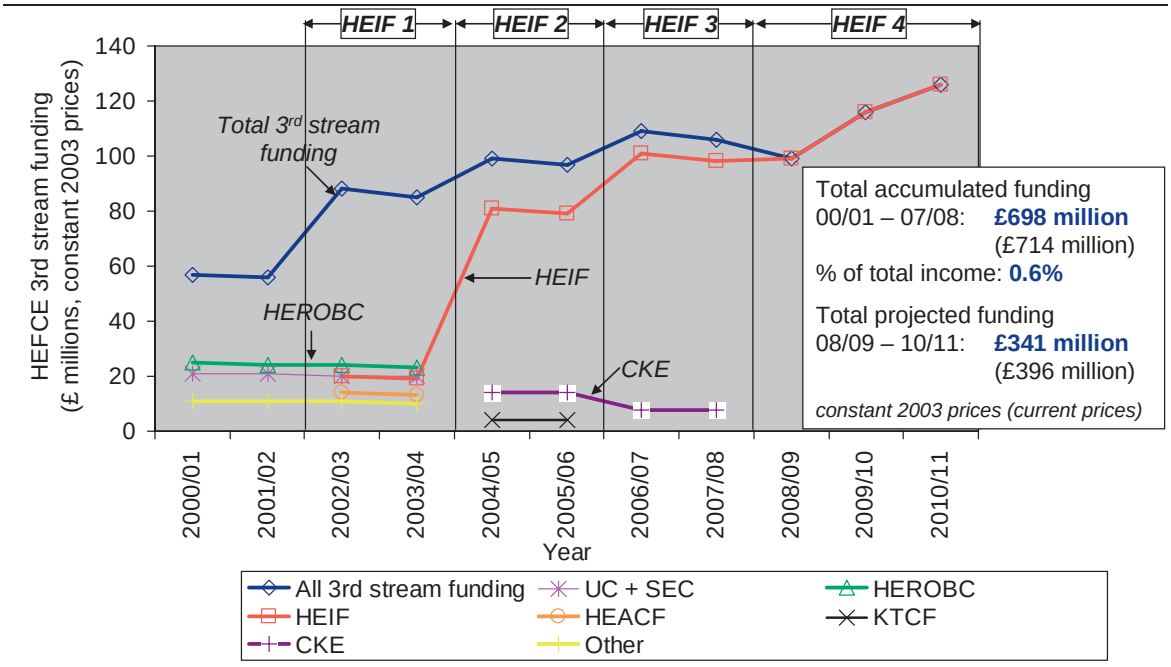
[21] Overall research leadership of the HEIs was determined based on total research income, number of academics, average 2001 RAE score and research intensity.

intensity; low research intensity; and an arts group. We also show all HEIs together as a comparator where appropriate.

1.11 Funding inputs: in aggregate and by cluster

1.11.1 Figure 1.5 shows the evolution of HEFCE third stream funding in constant 2003 prices from 2000/01 to 2010/11. In interpreting this figure it is important to note that the data did not allow a precise annual allocation of HEROBC and other components prior to 2003/04. One should note that the term 'third stream funding' is used here to describe the public funding provided to HEIs to support knowledge exchange engagements, while the term 'knowledge exchange income' is used to imply income from external organisations brought into the HEI as a result of knowledge exchange activities.

Figure 1.5 Evolution of HEFCE third stream funding 2000/01 to 2010/11 (£ millions, constant 2003 prices)

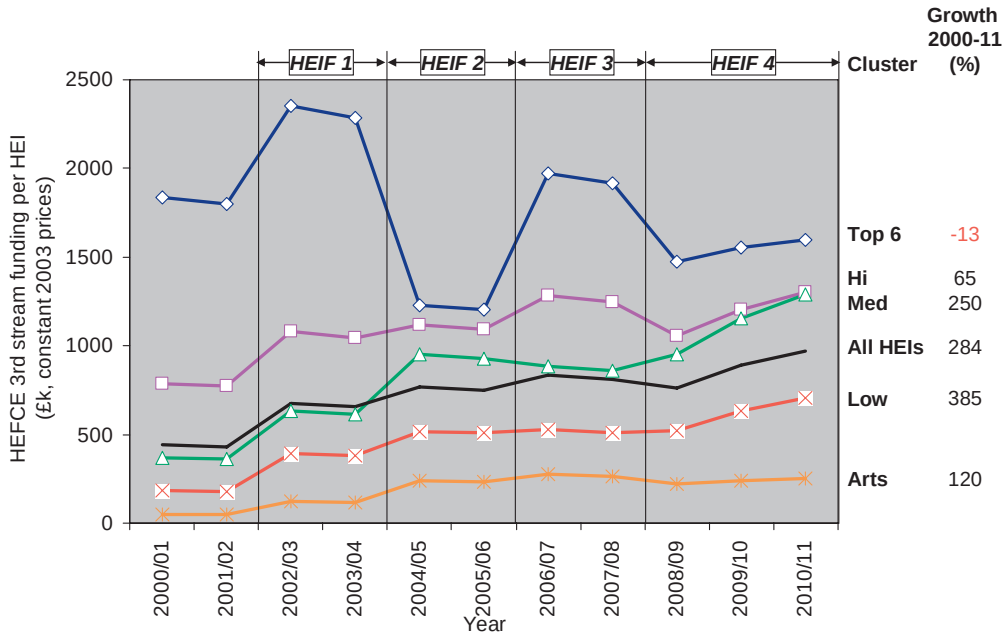


Source: HEFCE

1.11.2 The figure shows a general tendency for third stream funding as a whole to rise in aggregate in real terms. Over the period as a whole, total accumulated funding is estimated to have been £698 million, representing 0.6% of total HEI funding over this period. The total projected funding from 2008/09 to 2010/11 is £341 million in constant 2003 prices. The sharp jump from 2001/02 to 2002/03 arises because of the introduction in the latter year of the new HEACF and HEIF 1 streams.

1.11.3 Turning now to Figure 1.6, it is possible to show the allocation of third stream funding by type of higher education institution over the same period covered by Figure 1.5.

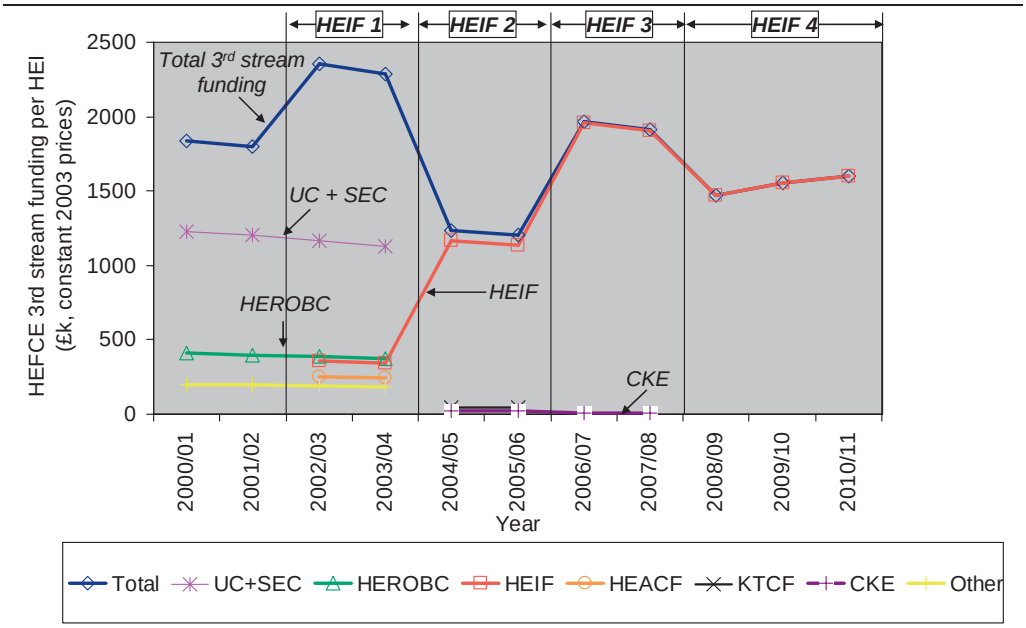
Figure 1.6 Evolution of third stream funding per HEI by cluster, 2000/01 to 2010/11 (£k, constant 2003 prices)



Source: HEFCE

1.11.4 The most striking feature of Figure 1.6 is the instability in the third stream funding flow to the top six institutions and the fact that it fell in real terms over the period 2000-2011. There were particularly dramatic shifts between 2003/04 and 2004/05 when funding fell rapidly, followed by a recovery between 2005/06 and 2006/07. The fall in 2007/08 and 2008/09 is shared also by the high research cluster of HEIs. For all the other groupings outside the top six, however, there has been a significant growth in real third stream funding over the period, with the medium and low research intensive clusters of HEIs achieving the most significant proportion of growth rates. Overall, therefore, it is clear that the scheme has evolved over time. There has also been a shift in the relative extent to which the top six research HEIs and the higher research intensive HEIs have been attracting HEIF funding compared to others. This followed from the move away from selective competition-based allocation prior to 2003 to a wider system-based scheme. Figure 1.7 allows us to look more closely at the evolution of third stream funding in the top six cluster.

Figure 1.7 Breakdown of third stream funding per HEI in the top 6 cluster, 2000/01 to 2010/11 (£k, constant 2003 prices)



Source: HEFCE

1.11.5 The amalgamation of many schemes into the overall third stream funding pattern from HEIF 2 onwards means that the evolution of total third stream funding and HEIF funding moved closely together from 2004/05 onwards. The cessation of the University Challenge and SEC funding streams and the HEROBC and other funding streams was, as we have seen, associated with a substantial fall in the income received by the leading research HEIs in the aftermath of the 2003/04 funding round. To the extent that the objective of HEIF 2 was to bring about this switch away from the higher research intensive institutions to the others, then this seems to have been achieved.

1.11.6 We can now consider in broad terms the allocation of funding to particular activities. Here it is useful to compare HEIF 1 and HEIF 4. Table 1.2 shows the allocation of HEIF 1 funding to activities in 2002/03 to 2003/04. The data here is in £ millions and current prices. The categories in the table are based on the headings specified in the respective bidding rounds. In HEIF 1 there was a large unspecified 'other' category of expenditure, which we have attempted to allocate across the other headings where possible. A large unallocated, however, still remains.

Table 1.2 Allocation of HEIF 1 funding to activities 2002/03 to 2003/04 (£ millions, current prices)

Activity overview	Total £m	%
Dedicated KE staff	11.9	31.1
KE units, institutes and research centres	6.8	17.7
KE initiatives and projects	3.2	8.5
Incubation	2.2	5.7
Engagement support services and other internal/external KE support	1.7	4.5
CPD, enterprise education, student enterprise and employer engagement	1.1	2.8
Seed/PoC funds	0.7	1.8
Collaboration/partnerships/networks	0.6	1.6
Support for staff engagement	0.6	1.5
Investment in spin-outs	0.5	1.3
Public relations (PR)/marketing	0.4	1.1
Training/staff development	0.3	0.9
Development funds	0.1	0.2
Other	1.6	4.2
Unallocated	6.5	17.0
Total	38.2	100.0

Source: HEIF 1 bids

1.11.7 It is clear that the most important allocation of funds went to activities concerned with dedicated knowledge transfer staff; the promotion of knowledge transfer units, institutes and research centres; and initiatives and projects connected with knowledge transfer generally. The funding of dedicated knowledge transfer staff accounted for almost a third of the total expenditure. This is consistent with capacity building in terms of human capital in this phase. Relatively small elements of funding were associated with investments in spin-outs and in seed and proof of concept funding. Roughly the same amount was spent on these two activities as was spent on collaboration, partnerships, networks and support for staff engagement. Enterprise education, student enterprise and employer engagement accounted for around 2.8% of the total, incubation around 5%, and engagement and support services alongside other internal/external knowledge transfer support accounted for 4.5%.

1.11.8 Table 1.3 provides a similar analysis for HEIF 4 funding covering the period 2008/09 to 2010/11. Once again, the figures are in current prices in £ millions. The most significant difference between the first and fourth HEIF rounds is the substantial increase in the proportion of funding going to support dedicated knowledge transfer staff, which was 52.3% in HEIF 4 compared with 31.1% in HEIF 1. Support for staff engagement has risen from 1.5% to 14.9%. Seed and proof of concept funding has also risen, from 1.8% to 5.4%, and marketing from 1.1% to 4.3%. There have also been small rises in the shares going to collaborative partnerships and networks; enterprise education, student enterprise and employer engagement; and training and staff development. Investment in spin-outs has remained virtually the same (1.3% compared with 1.0%). Funding for knowledge transfer units, institutes and research centres has fallen from 17.7% to 2% and incubation services from 5.7% to 0.5%.

Table 1.3 Total planned allocation of HEIF 4 funding to activities 2008/09 to 2010/11 (£ millions, current prices)

Activity overview	All HEIs	Share of total (%)
Dedicated KE staff	207.4	52.3
Support for staff engagement	59.3	14.9
Seed/PoC funds	21.6	5.4
PR/marketing	17.2	4.3
Collaboration/partnerships/networks	10.9	2.7
CPD, enterprise education, student enterprise and employer engagement	10.5	2.6
Training/staff development	10.0	2.5
Engagement support services and other internal/external KE support	8.1	2.1
KE units, institutes and research centres	7.9	2.0
Development funds	6.5	1.6
General KE support costs	6.4	1.6
KE initiatives and projects	4.9	1.2
Investment in spin-outs	4.1	1.0
Incubation	2.0	0.5
Community outreach	1.2	0.3
Other KE staff	1.2	0.3
Consultancy	0.7	0.2
Awards/events/culture change initiatives	0.6	0.1
Other expenditure	9.9	2.5
Unaccounted expenditure	6.3	1.6
Total	396.7	100.0

Source: HEIF 4 institutional strategies

1.11.9 In interpreting these changes it is important to bear two things in mind. Firstly, that at least in current price terms some of the substantial percentage shifts did not mean a fall in the amount invested. This was true, for instance, in relation to incubation services, where around £2 million was invested in current prices in both years. Secondly, there is inevitably some degree of uncertainty in attributing funding to activities on the basis of HEIF 1 bids and HEIF 4 institutional strategies. The fact that it is easier to more fully account for HEIF 4 funding activities means that some of the unaccounted expenditures in HEIF 1 may have been spread unevenly across activities which are more fully reported in HEIF 4. Nonetheless, the domination of funding towards the development of human capital through dedicated knowledge transfer staff and support for staff engagement is a significant feature of the comparison of HEIF 4 with HEIF 1. Equally, the increase of seed and proof of concept funding support expenditure from £0.7 million to £21.6 million when comparing these two periods is also highly significant, as is the rise in PR and marketing costs and the increase in spending on collaboration, partnerships and networks. The planned allocation of HEIF 4 funding to activities over the 2008/09 to 2010/11 period can also be analysed by clusters of HEIs. Table 1.4 sets out the values in current prices, while Table 1.5 sets out the planned allocation in percentage terms.

Table 1.4 Planned allocation of HEIF 4 funding to activities 2008/09 to 2010/11 (£k per HEI, current prices)

Activity overview	All HEIs	Cluster				
		Top 6	High	Medium	Low	Arts
Dedicated KE staff	1,608	3,609	2,309	1,836	1,029	538
Support for staff engagement	459	210	474	679	522	61
Seed/PoC funds	167	561	244	196	77	41
PR/marketing	134	346	174	147	111	24
Collaboration/partnerships/networks	84	61	101	121	84	7
CPD, enterprise education, student enterprise and employer engagement	81	8	115	53	63	6
Training/staff development	77	112	110	95	58	22
Engagement support services and other internal/external KE support	63	26	128	76	30	1
KE units, institutes and research centres	61	0	45	158	33	0
Development funds	50	54	50	65	66	0
General KE support costs	50	60	28	143	9	4
KE initiatives and projects	38	0	53	60	18	26
Investment in spin-outs	32	0	21	69	22	18
Incubation	16	0	17	19	22	0
Community outreach	10	0	8	26	1	3
Other KE staff	9	10	9	21	3	0
Consultancy	5	0	4	16	0	0
Awards/events/culture change initiatives	5	0	11	2	0	7
Other expenditure	77	138	128	92	33	28
Unaccounted expenditure	49	178	116	75	2	66
Total	3,075	5,373	4,146	3,951	2,183	853
Number of HEIs	129	6	34	33	35	18

Source: HEIF 4 institutional strategies

Table 1.5 Planned allocation of HEIF 4 funding to activities 2008/09 to 2010/11 (% of total)

Activity overview	All HEIs	Cluster				
		Top 6	High	Medium	Low	Arts
Dedicated KE staff	52.3	67.2	55.7	46.5	47.1	63.1
Support for staff engagement	14.9	3.9	11.4	17.2	23.9	7.1
Seed/PoC funds	5.4	10.4	5.9	5.0	3.5	4.8
PR/marketing	4.3	6.4	4.2	3.7	5.1	2.8
Collaboration/partnerships/networks	2.7	1.1	2.4	3.1	3.8	0.8
CPD, enterprise education, student enterprise and employer engagement	2.6	0.1	2.8	1.4	2.9	0.8
Training/staff development	2.5	2.1	2.6	2.4	2.7	2.6
Engagement support services and other internal/external KE support	2.1	0.5	3.1	1.9	1.4	0.1
KE units, institutes and research centres	2.0	0	1.1	4.0	1.5	0
Development funds	1.6	1.0	1.2	1.7	3.0	0
General KE support costs	1.6	1.1	0.7	3.6	0.4	0.5
KE initiatives and projects	1.2	0	1.3	1.5	0.8	3.1
Investment in spin-outs	1.0	0	0.5	1.8	1.0	2.1
Incubation	0.5	0	0.4	0.5	1.0	0
Community outreach	0.3	0	0.2	0.7	0	0.4
Other KE staff	0.3	0.2	0.2	0.5	0.1	0
Consultancy	0.2	0	0.1	0.4	0	0
Awards/events/culture change initiatives	0.1	0	0.3	0.1	0	0.9
Other expenditure	2.5	2.6	3.1	2.3	1.5	3.3
Unaccounted expenditure	1.6	3.3	2.8	1.9	0.1	7.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number of HEIs	129	6	34	33	35	18

Source: HEIF 4 institutional strategies

1.11.10 If we concentrate on Table 1.5, a number of differences across clusters may be noted. The first is that the top six research intensive HEIs and the arts group spend the most proportionately on dedicated knowledge transfer staff, while the medium research intensity HEIs spend the least proportionately. Support for staff engagement, by contrast, is lowest in the top six and the arts group and highest (at 23.9%) in the low research intensive grouping. As might be expected, the most research intensive HEIs allocate a proportionately higher share of their allocation to seed and proof of concept funds, which at 10.4% is almost double the average for all HEIs taken together, which was 5.4% over the planning period. The top six research institutions and the arts group also spend relatively little in terms of collaboration, partnerships and networks when calculated in proportional terms, while again the low research intensive group spend the most proportionately (3.8%). The top six research HEIs also spend relatively little on continuous professional development, enterprise education, student enterprise and employer engagement when seen in proportional terms. Thus they allocate 0.1% of funding for this activity compared with 2.6% for all HEIs. Once again, this feature is shared with the arts group of HEIs. There are few other differences of a systematic or significant kind across the research groupings.

2 Methodology

2.1 Introduction

2.1.1 The research programme was designed to achieve the aims and objectives set out in Chapter 1, and was organised within a traditional evaluation output measurement framework comprising the following key sections:

- third stream and other relevant inputs
- activities of HEIs supported by these inputs
- outputs from the different activities being undertaken to secure the aims and objectives of third stream funding
- impacts and outcomes arising from these activities.

2.1.2 Although the broad framework was necessary for organising the empirical research programme, the empirical analysis of the relationship between inputs and ultimate impacts and outcomes was complex and challenging. For example, there is considerable heterogeneity of projects, schemes and initiatives, which precludes any simple causal link between inputs, outputs and impacts and the different sources of third stream funding. Disentangling specific third stream impacts is also complicated by the existence of other public sector initiatives that also work to secure similar objectives to those of third stream funding. The scale and nature of outputs, impacts and outcomes differ with respect to the lifetime of such counterpart projects, giving rise to a complex spectrum of impacts and outcomes. There are in addition complex lags between inputs, outputs, impacts and outcomes. Although some outputs, impacts and outcomes are quantifiable, others can only be assessed qualitatively and this is particularly the case when assessing attitudinal and cultural shifts arising from third stream funded activities.

2.1.3 While the broad evaluation framework was helpful in organising the research programme, the approach has been carefully customised to deal with the issues raised by the third stream programme, and great care must be taken in drawing conclusions from the evidence. Figure 2.1 shows the broad framework deployed for this research programme. It demonstrates the wide range of initiatives and projects and provides examples of the variables to be included either quantitatively or qualitatively.

Figure 2.1 Evaluation framework for knowledge exchange activities in HEIs

INPUTS – HEFCE/DIUS third stream	OTHER INPUTS
HEROBC, HEIF, HEACF, KTCF, SEC, UCF, Business Fellows …	Internal resources, private sector funding, other UK government funding, EU funding, philanthropic funding

ACTIVITY MEASURES AND EXPENDITURES		
ECONOMIC		CULTURAL AND COMMUNITY
CAPACITY BUILDING	KNOWLEDGE EXCHANGE	
• Staff recruitment • Staff/student training • New courses • Physical infrastructure • Dedicated commercialisation units • IPR reporting requirement • Disclosure monitoring • Marketing/awareness • Strategic plan	• Contract research • Consultancy • Patenting • Spin-outs/new starts • Licensing • Placements • Finance • Advice • Entrepreneurial training • Assistance with IP • Distance learning	Requirement to support IP for: • literary/artistic • education/multimedia • free events • chargeable events Engagement in community regeneration: • voluntary work • free events • chargeable events • extra-mural courses Engagement with public sector: • health • education • social/ community activity

OUTPUT (Volume, Value)		
ECONOMIC		CULTURAL AND COMMUNITY

• Contract research
• Consultancy contracts
• Staff placements
• Students supported/trained
• CPD
• Training participation
• Seed corn funding
• Companies advised
	• HEI spin-outs
	• Patents
	• Licences
	• Workshops
	• Bespoke course take-up
	• Invention disclosures
	• IP revenues
	• Incubator occupancy
	• Science park occupancy
	• Networking events
		• Revenues from IP
		  • literary/artistic
		  • education/ multimedia
		• Events (free) participation
		• Events (charged) participation
		• Work with not-for-profit organisations
		• Engagements with community regeneration schemes

INITIAL IMPACTS AND LONGER TERM OUTCOMES	
INTERNAL CULTURAL CHANGE IN HEIs	EXTERNAL ECONOMIC, CULTURAL AND COMMUNITY BENEFITS
• Attitude and culture change in academic staff • Academic staff participation in commercialisation and knowledge exchange • Business representation in HEIs • Student participation in new curricula/courses • Recognition of 3rd stream in salary, recruitment and promotion processes	• HEI recognition by business as input into innovation activities • Employment/turnover/spin-outs/licensing income • Enhanced quality of life in local and wider community • Increased engagement of HEIs in economic and social activity at a local, regional and national level

Source: PACEC/CBR

2.1.4 The issues raised above also complicate the assessment of value for money from third stream funding. Our approach was to develop cost-benefit balance sheets (CBBS). These balance sheets aim to reveal the range and scale of net benefits derived per £ million of third stream funding. Inputs and benefits are monetised where possible, while those that cannot be determined quantitatively are included qualitatively in the CBBS. The cost-benefit balance sheets have been produced for

different groupings of HEIs. The varying portfolios mean that these are not to be construed as efficiency comparisons across portfolios but in terms of differences in bundles of outcomes per unit of spend.

2.2 Programme of empirical research

2.2.1 The programme of empirical research was designed within the traditional evaluation framework outlined above to address the aims and objectives of the study, and consisted of three elements:

- data collection and assembly
- data analysis and development
- outcomes and conclusions.

Data collection and assembly

2.2.2 The data collection and assembly element of the research programme consisted of two main research modules:

Module 1 – top-down 'macro' analysis of existing survey-based data

Module 2 – case study research of individual HEIs.

2.2.3 Completion of these two modules required a combination of research methods, including a detailed descriptive analysis of existing survey data from the HEI business interaction survey and third stream monitoring reports, statistical analyses, case study research, telephone and online survey research and face-to-face interviews.

2.2.4 The research programme was structured to establish in the first instance the 'macro' changes that have occurred for the sector as a whole using the existing survey databases, and then to deploy case study and new survey research. This new research sought to explore in more detail the findings at the 'macro' level and the impacts on business and the community.

2.2.5 The case study research module conducted an in-depth examination of a cross-section of HEIs. The programme investigated major **internal** changes in the HEIs as a result of third stream funding, including the extent of cultural and attitudinal shifts on the part of academic staff. It also provided evidence on **external changes** relating to economic and community impacts.

2.2.6 The case studies consisted of four inter-related sets of research activities:

- background desk research on each of the case study HEIs
- an interview programme with senior HEI academic staff and staff responsible for knowledge exchange activities
- an online survey of academic staff
- a telephone survey of external organisations engaged with the HEIs.

2.2.7 As part of the research programme, a number of indicators of change in culture, attitudes and capabilities of HEIs in their engagement in knowledge exchange were

developed. These both complemented and validated the subjective views of stakeholders derived from the interview and survey programme.

Data sources

2.2.8 A variety of data sources were used to construct a consistent database that covered all HEIs in England over a time period, where possible from 2000/01 to 2006/07. For purposes of simplicity throughout the report, the academic year 2000/01 is referred to as year 2001, 2002/03 as 2003 etc. The data sources included:

- Higher Education Business and Community Interaction (HEBCI) surveys
- Higher Education Statistics Agency (HESA) data on staff and student numbers, teaching and research income
- Higher Education Reach Out to Business and the Community bids, awards and monitoring statements
- Higher Education Innovation Fund rounds 1, 2 and 3 competitive bids, institutional strategies and monitoring statements
- Funding data from HEFCE on the variety of funding streams
- RAE data
- Other external data for local, regional and national contextual variables from the Office for National Statistics and other government sources.

Selection of case study HEIs: a cluster analysis

2.2.9 The case studies were selected in order to facilitate the aggregation of results and provide a representative view of the HE sector as a whole. The methodology for selecting the 30 HEIs for the in-depth analysis was based on a statistical cluster analysis. This was designed to establish groups of similar HEIs based on a range of characteristics, which then provided the basis for the random selection of case studies within each of these groups.

2.2.10 Examination of the data revealed some key variables to be missing for a small group of HEIs. In a number of cases it was possible to impute the missing values and retain the HEIs. Otherwise the HEI was dropped. In all, nine HEIs were dropped from the statistical analysis because of missing values. One HEI, the University of London, was dropped from the analysis because its component HEIs all appear separately.

2.2.11 A principal components analysis was used to reduce the range of variables which characterise HEIs to a set that are very good at describing the characteristics of the HEIs. Eight components factors were found to provide a very good description of the HEIs:

- IP reporting
- business oriented
- spin-off licences
- patents
- regional focus
- regional teaching

- financial support for spin-offs
- SME assistance and enquiries.

2.2.12 Two groups of HEIs were excluded from the cluster analysis, but were used in the selection of the case studies. The first group consisted of the main research HEIs (of which there are six). This group was identified based on the following:

- the six largest research spenders in terms of total research income from all sources, which also had
- the largest total number of academic research staff who
- scored an average on the 2001 RAE of over 5, and which
- were in the top third of HEIs in terms of research intensity.

2.2.13 Research intensity was calculated from the HESA data as the research income UK public total plus the research income from OSI total, divided by the number of full-time equivalent (FTE) staff in academic departments. The six HEIs selected on the above criteria were:

- University of Cambridge
- Imperial College, London
- King's College London
- University College London
- University of Manchester
- University of Oxford.

2.2.14 The second group consisted of HEIs with a strong focus on the creative arts and design. Using a combination of data inspection and the results of the initial experimentation with cluster analysis, 19 HEIs were identified as falling into this group for purposes of case study selection (including those with some missing values). The institutions in this sub-group of creative arts and design HEIs are shown in Table 2.1.

Table 2.1 Creative arts and design HEIs

University College Birmingham	Conservatoire for Dance and Drama	University of the Arts London	Royal Academy of Music
Arts Institute at Bournemouth	Dartington College of Arts	Central School of Speech and Drama, London	Royal College of Art
University College for the Creative Arts at Canterbury	Guildhall School of Music and Drama	Norwich School of Art and Design	Royal College of Music
Courtauld Institute of Art	Leeds College of Music	Ravensbourne College	Royal Northern College of Music
	Liverpool Institute for Performing Arts	Rose Bruford College	Trinity Laban Conservatoire

Source: CBR/PACEC analysis

2.2.15 The remaining HEIs were partitioned into high, medium and low research intensity groups and were subjected to the cluster analysis. This classification was used because the HEFCE Business and Community Interaction Survey and other analyses

suggested that some distinctive patterns of interaction were associated with research intensity.

2.2.16 The cluster analysis was undertaken on the HEIs remaining after the two groups detailed above were excluded. They were divided into three groups according to their research intensity (the HEIs in each cluster are listed in Appendix E), leading to five overarching clusters based on research intensity. Within these three research intensity groups, we then chose to cluster on factors related to regional and SME involvement. This led to the formation of nine groups of HEIs in England: seven clusters and the two excluded groups of HEIs. These groups formed the basis for the case study selection along the following criteria:

- Each of the top six HEIs is included in the sample.
- The sample in each cluster must be at least 1 (which sets the sample for high intensity 1, medium intensity 1 and low intensity 1).
- The sample for the remaining five clusters (high intensity 2, medium intensity 2, low intensity 2, low intensity 3 and arts) was allocated pro-rata to the size of their populations.

2.2.17 The case study HEIs selected are shown in Appendix D. Apart from the case study selection, much of the analysis was conducted based on the five cluster groups.

Case study interviews with key stakeholders within HEIs

2.2.18 The internal HEI interview programme was designed to obtain both qualitative and quantitative information on each case study HEI. The first interview was typically held with someone with a good overview of the knowledge exchange activities and processes within the HEI, usually the head of the knowledge exchange office (or equivalent). A number of heads of faculties/departments were then interviewed. Finally, the pro vice-chancellor with the remit for knowledge exchange or the vice-chancellor (VC) was interviewed to understand the strategic direction of the HEI with regards to knowledge exchange, and to validate key findings that arose from the previous interviews.

2.2.19 The questionnaires were semi-structured in nature and covered a range of topics, including the following:

- strategic overview of third stream engagement in the HEI
- drivers of strategic change
- key modes of interaction with external organisations, how these have changed and the importance of HEFCE third stream funding for supporting these activities
- evidence on the counterfactual of what would have happened had third stream funding not existed
- perceptions of the culture and attitudinal shifts
- extent and drivers of cultural and attitudinal shifts
- estimates of the attribution (directly or indirectly) of knowledge exchange income to HEFCE third stream funding
- changes to knowledge exchange offices

- third stream funding process and internal funding allocation processes
- institutional and organisational support for third stream activities and the importance of HEFCE third stream funding for supporting development of these structures
- impacts of third stream funding on the wider HEI
- impacts of third stream funding on interactions with external organisations
- key constraints to third stream engagement.

Survey of academics

2.2.20 The third component of the case study programme consisted of a survey of academics. Academics were asked to fill in an online survey form. The aim of the survey was to establish the extent and nature of engagement in knowledge exchange activities, motivations for engaging, and the extent to which the culture and attitudes of academics had shifted towards third stream activities. A similar exercise was carried out by PACEC and was undertaken by Professor Botham for Scottish Enterprise in 1996, and included HEIs in England. This allowed for the creation of a 'baseline' of pre-HEFCE third stream funding programmes, against which the survey results of this study were compared. Some of the questions as used in the 1996 survey were used in the current survey as well as new questions added.

2.2.21 The questionnaire covered the following topics:

- background of the academic, including position within HEI, area and stage of research, any previous employment with external organisations, and current engagement with external organisations
- modes of interaction with external organisations
- objectives and benefits of interactions with external organisations
- institutional factors (including culture and attitudinal factors) affecting interactions with external organisations
- impacts of interaction on traditional HEI roles
- obstacles to interactions with external organisations
- personal background.

2.2.22 Of the 30 case studies, 26 participated in the academic survey, yielding a total of 1,157 respondents. Eight HEIs yielded fewer than 20 respondents. The average number of respondents per HEI was 45, while the median was 39.

2.2.23 The results of the survey were weighted to account for differences between the achieved sample and the characteristics of the total population. The weights account for differences between the achieved sample by academic discipline and the size of the HEI clusters.

Survey of external organisations

2.2.24 The fourth component of the case study research programme was a telephone survey of external organisations that have engaged with the HEIs. The aim was to establish the broad perceptions of the benefits of engaging with HEIs. It also sought

to test the perceptions of businesses and community organisations on cultural and attitudinal changes occurring internally in the HEIs. It is important to point out that we were not aiming to undertake a full-scale evaluation exercise but rather to gain the broad perceptions of participants and beneficiaries of the benefits of the third stream engagement with HEIs.

2.2.25 The HEIs were asked to provide the contact details of a random selection of external organisations that engage with them. They were asked to ensure that the selection represented the full spectrum of activities undertaken and types of organisations with which they engage (i.e. to provide a random stratified sample of organisations).

2.2.26 The questionnaire covered the following topics:

- background information on the organisation
- objectives and benefits of the interaction
- modes of interaction
- impact of the interaction
- obstacles of the interaction
- general perceptions on the relationship between HEIs and external organisations.

2.2.27 Of the 30 case studies, responses were obtained from 373 external organisations across 25 different HEIs. Seven HEIs yielded fewer than 10 responses, and both the average and median number of responses per HEI was 15.

2.2.28 In addition to the survey of external organisations, contact was made with RDAs and other local and sub-regional economic development stakeholders such as economic partnerships. This yielded 11 responses. The aim was to gain their views on the following topics:

- nature of interaction with the HEI
- constraints to the interaction with the HEI and obstacles to setting the interaction up
- role of HEIs in regional economic development
- HEIs' capacity to engage with third stream partners
- perceptions of culture and attitudes
- impacts of HEI interactions on the organisation
- impacts on economic development.

Data analysis and development

2.2.29 The analysis addressing the key objectives of the study consisted of five main modules:

1 An analysis of the third stream funding programme mapping onto the evaluation framework of Figure 2.1.

2 An analysis designed to establish internal changes in the HEI, particularly the extent to which attitudes and culture have changed and the degree to which the perception of change is consistent with that of external organisations.

3 An analysis designed to assess the external impacts and outcomes of the third stream funding programme.

4 An analysis of the value for money from the third stream funding programme within the evaluation and cost-benefit balance sheet frameworks described earlier.

5 An analysis of the impact of the SEC and UCF programmes.[22]

[22] This module formed a separate report, provided separately from this document.

3 Third Stream Strategies: Building the Capacity and Capability to Engage

3.1 Introduction

3.1.1 Successful mutually beneficial engagement with external organisations has required strategic and organisational shifts on the part of both HEIs and their partners. As the importance of knowledge exchange activities has increased, HEIs have had to recast their strategic aims and adapt their organisational and institutional structures to acquire new capabilities and capacity to complement those required to fulfil their traditional research and teaching functions. Success in building the capacity and capabilities for increasing knowledge exchange and strengthening interactions with external organisations depends critically on the HEI's strategic and organisational response. A single best practice response is highly unlikely and the nature, scale and scope of responses will vary across different HEIs. Past experience of knowledge exchange, the range and scale of internal capabilities and the external context are all potentially important influences on HEIs in adapting to their changing role in the economy. At the same time it is increasingly the case that research and other programmes such as CPD, whether located in HEIs, business or the public sector, are being designed collaboratively, combining knowledge inputs for problem solving and new knowledge creation in mutually beneficial ways. As companies pursue strategies of open innovation, HEIs are becoming increasingly recognised as valuable partners, and for many HEIs this provides new funding opportunities beyond the traditional support for research and teaching provided by Government.

3.1.2 A key question is whether support from HEIF and the increasing emphasis given by Government in recent years to the opportunities for mutually beneficial interaction between HEIs, business and other external organisations have influenced the strategic stance of HEIs. It is also important to understand whether HEIs differ in their response and if so why. Strategic shifts by HEIs are reflected in changes in mission statements, long-term aims by senior management and the changing scope and balance of priorities and activities. They are also reflected in organisational changes usefully summarised in the acronym PARC: people, architecture, routines and culture (Roberts 2004). 'People' includes the development of new capabilities and skills on the part of those working for the HEI; the 'architecture' includes the knowledge exchange infrastructure, the organisational structure for knowledge exchange, the governance structure and formal and informal networks linking people in the HEI. The 'routines' include managerial process and decision making, incentive structures and processes by which the work of knowledge exchange is undertaken; 'culture' includes the shared values of those in the HEI, their 'mental models', how they see themselves in the organisation and the norms of behaviour that prevail in interpersonal relations both within and outside the HEI.

3.1.3 An important element of an HEI's knowledge exchange strategy is the identification of external organisations which potentially provide mutually beneficial opportunities for knowledge exchange and engagement. These will include public and voluntary sector

organisations as well as small and large organisations in different sectors and different locations. The 'competitive advantage' of an HEI in addressing the potential for knowledge exchange with these organisations will depend to a significant extent on its capabilities and capacity for fruitful interaction.

3.1.4 The first part of this chapter assesses the emergence of third stream activities as an important component of the overall HEI strategic mission. It assesses the strategic aims of knowledge exchange strategies and factors which help to shape these strategies, their sectoral and geographical focus and the type of external organisation with which the HEIs interact. The second part of the chapter then explores how the development of KE strategies is addressing the underinvestment in capacity and capability to engage in KE and how organisational structures are evolving and, importantly, how HEFCE third stream funding is facilitating these developments.

3.2 The third stream mission and knowledge exchange strategies

The balance between teaching, research and knowledge exchange

3.2.1 There is now strong support for the third stream mission by senior management across all HEIs. However, the emphasis between teaching, research and knowledge exchange in the mission of an HEI inevitably differs according to the type of HEI and the competitive advantages that it has developed within the HE sector and the wider economy. Some HEIs are centres of research excellence while others primarily provide teaching. Others were founded with a specific mission to conduct research with particular regard to its application to external organisations and to transfer this knowledge into relevant solutions. These differences are reflected in a diversity of mission statements and strategic aims across the HE sector, and mean that the extent of engagement with third stream activities prior to the introduction of HEFCE's third stream funding programme differed greatly across HEIs.

3.2.2 Notwithstanding this diversity, the mission statements and visions of most HEIs, across all types, from the top research HEIs to regional HEIs, old HEIs and new, now include explicit references to the third stream as an important role for the HEI. The strategic plans for almost all HEIs studied for this report now give a high profile to their third stream activities. In many HEIs these activities are as visible and command as much attention as the traditional activities associated with education and research. HEIs that did not make *explicit* references to the third stream nevertheless claimed that the interpretation of the existing mission and strategy had changed to provide a greater emphasis on the role of the third stream.[23]

The integration of research, teaching and knowledge exchange

3.2.3 Evidence on the emerging importance of the third stream mission in the overall strategic stance of HEIs is provided by an analysis of current HEIF 4 knowledge

[23] PACEC (2008) *Analysis of HEIF 4 Institutional Strategies: Overview Report*, a report to HEFCE

exchange strategies.[24] This shows that most HEIs have attempted to integrate their knowledge exchange strategies with their overall missions of teaching and research. Moreover, both the analysis of HEIF 4 strategies and the case studies revealed a widespread recognition of the synergies between knowledge exchange activities and activities related to teaching and research. The case studies pointed to clear opportunities for the creation of virtuous feedback linkages between teaching, research and knowledge exchange activities, with each strand supporting and reinforcing the other. For example, a top research HEI described how high quality research leads to attracting the best academics, which results in greater and better quality engagement in knowledge transfer, which brings in more income allowing them to maintain, expand and improve their research capabilities.

3.2.4 The extent to which this integration is implemented and exploited will depend on the commitment of both senior managers in HEIs and academics. Almost all of the senior management interviewed believed that knowledge exchange activities complement the mainstream missions of teaching and research, with little variation across different types of HEIs. For example, many HEIs are now using real-world case studies in their teaching, many are engaging with external organisations for curriculum development, and spin-off activity and business engagement can provide future placements for students. All of this makes courses much more relevant for employers and better equips students for the problems they will face in employment.

3.2.5 Furthermore, some of the senior staff interviewed as part of the case study research programme believed that there are some complementarities with teaching, with minimal displacement, while others perceived some displacement due to time constraints. With respect to research, many heads of faculties interviewed believed that, while knowledge exchange is complementary to their research activity, it nevertheless has some displacing effects. This was particularly the case in the top six and high research cluster HEIs, with displacement arising primarily because of time constraints. This becomes a particular issue when academics are under pressure to fulfil their RAE publication requirements. During such periods, engagement with the third stream would seem to prove burdensome.

The changing emphasis of the teaching, research and knowledge exchange missions

3.2.6 While knowledge exchange features prominently in the mission statements and strategic objectives of most HEIs, the balance between research, teaching and knowledge exchange has shifted only modestly in favour of the latter since 2001. Overall, knowledge exchange has become more important, but typically not at the expense of the core activities of research and/or teaching, depending on the HEI.

3.2.7 The importance of knowledge exchange as a strategic objective of the top six research-focused HEIs has grown in relation to the traditional streams of research and teaching since 2001. However, while pursuing such objectives was seen as

[24] PACEC (2008) *Analysis of HEIF 4 Institutional Strategies: Overview Report*, a report to HEFCE

important and in many cases encouraged, there was a consensus that it could not come at the expense of the quality of the research being undertaken.

3.2.8 This view was also echoed by the high and medium research cluster HEIs studied, where research and teaching were seen as the primary objectives for the HEIs, with knowledge exchange a secondary objective. They viewed knowledge exchange as playing an important role, but one that acts to support their research and teaching roles rather than as a dedicated mission in its own right. The justification for this view was that research and teaching are the primary competitive advantages for their HEIs that govern their reputation and how they rank either nationally or globally (depending on their institution's focus). This, in turn, influences the amount of revenue they can attract. Improving the research quality and teaching capabilities was therefore of paramount importance. The increased quantity and quality of knowledge exchange engagement was seen as being derived from improvements in the HEI's research and/or teaching base. Low research cluster HEIs typically saw teaching as their core activity, with emphasis on knowledge exchange objectives increasing since 2001 and seen as an important part of their strategic mission.

3.2.9 There are, of course, exceptions to this view. HEIs that were born out of industry or that were set up with a raison d'être to focus on industrially relevant research/teaching tended to see knowledge exchange on a par with teaching and/or research. This was typical of the arts HEIs and some dedicated science and technology HEIs.

Strategic plan development for knowledge exchange

3.2.10 In judging the extent to which the third stream mission has extended its reach to all parts of the HEI sector, an important question is whether the development of strategic plans specific to knowledge exchange activities has become more prevalent and more inclusive across HEIs. The evidence in Table 3.1 shows that this is the case and that there was a distinct increase in the number of HEIs with strategic plans for KE between 2001 and 2007, with more being devised through an inclusive process. The number of HEIs that had a fully developed strategic plan embracing all departments and units in the HEI increased from 6% to 27%. Only two HEIs had no strategic plan for third stream activity by 2007, and the number of HEIs falling between a partially developed and fully developed strategic plan had increased from 42% to 53%. An analysis of the underlying data showed that the development of strategic plans had improved in over 60% of HEIs over the period, while only 7% had worsened. There was very little variation in the average position of HEIs between the clusters, although the low research cluster and arts HEIs appear not to have progressed as far as the other, higher research intensive HEIs.

Table 3.1 Strategic plan for knowledge exchange (% of HEIs)

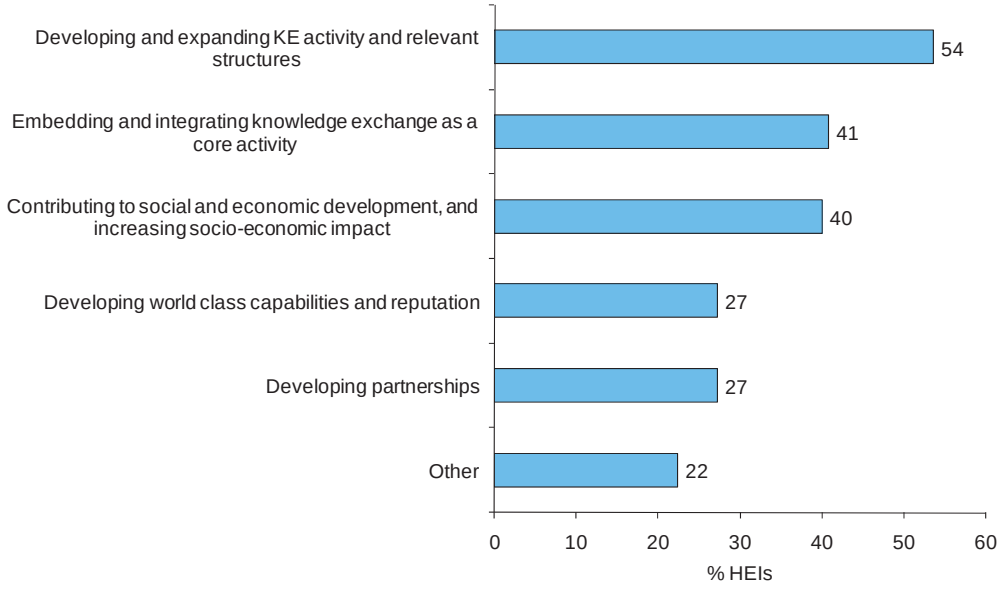
	2001	2007
1. No strategic plan in place. Ad hoc approach to business support.	4	2
2. Between 1 and 3.	10	3
3. Strategic plan developed and only partially implemented, or restricted to certain departments or central functions only.	38	15
4. Between 3 and 5.	42	53
5. Strategic plan developed as a result of an inclusive process across the whole HEI. Accepted across almost all units and recommendations implemented. Use of plan to set targets and monitor achievement.	6	27
Number of HEIs	121	130

Source: HEBCI surveys, PACEC/CBR analysis

Long-term goals of HEI knowledge exchange strategies

3.2.11 An analysis of the HEIF 4 institutional strategies also provided a rich source of information regarding the long-term knowledge exchange goals of HEIs. Broadly, the long-term goals articulated in these strategies can be categorised into five key areas: developing and expanding KE activity and relevant structures; contributing to social and economic development and increasing socio-economic impact; developing world class capabilities and reputation; developing partnerships; and embedding and integrating knowledge exchange as a core activity.

Figure 3.1 Long-term goals of all HEIs (% of HEIs)



Source: HEIF 4 institutional strategies, PACEC analysis

3.2.12 Figure 3.1 shows that the most frequent long-term goal for HEIs' knowledge exchange strategies is to develop and expand their knowledge exchange activities and to build the necessary infrastructure for this to be possible. This includes, for example, developing a single-point access for businesses, developing methods for diversifying revenue streams, developing a responsive portfolio to changing market

conditions, and generally developing and expanding capabilities and capacities to engage. Further evidence supporting this positive stance towards the third stream mission derives from the academic survey undertaken as part of this study, which revealed that 53% of academics believed that HEIF funding is having an impact on the development and expansion of KE activity at the departmental level; 20% believed this impact to be large.

3.2.13 An important conclusion from the case study programme is that income generation is becoming increasingly important, partly because of the way that HEIF funding is now being allocated (via a formula which is partly income driven), but also as a consequence of wider financial and other pressures. There is increasing acceptance on all parts that knowledge exchange activities, particularly those that are nearer to market, should be charged to the beneficiary as direct economic activity. HEFCE's financial memorandum[25] (p. 16-17) now states that:

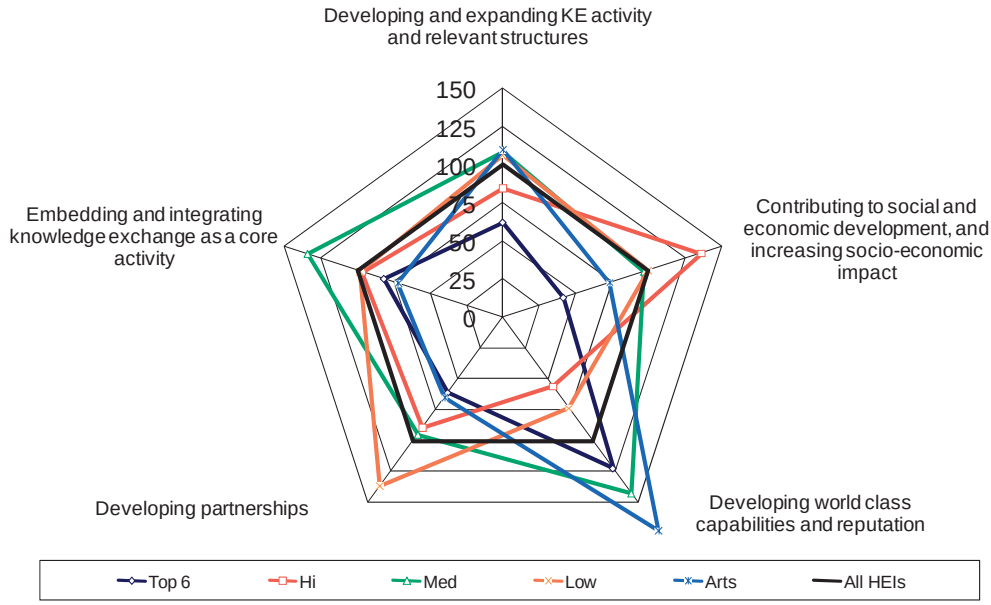
> *Institutions should seek to recover the full economic costs* [including direct and indirect costs, space/estate charges, depreciation and adequate recurring investment in infrastructure] *of all their activities, whether pricing is determined by reference to those full economic costs or by reference to prevailing market conditions. While there may be cases for individual projects or activities to be priced at below their full economic costs, this should be done as a conscious decision, within the context of strategic objectives. Institutions are expected, taking one year with another, to recover, in aggregate, the full economic costs of all their activities across the full range of their activities.*

3.2.14 For some HEIs the role of HEIF (and other funding) is to pump-prime third stream activities which are likely to become self-sustainable. Such activities must therefore generate some form of income to at least cover their costs. Over half of the case study HEIs studied sought to maximise the income potential of their knowledge exchange offering, with societal impact a sometimes important, albeit secondary objective.

3.2.15 The relative importance of economic versus societal goals differs substantially across HEIs. The management team within HEIs, when setting the strategic direction of KE in the institution, may seek to maximise the economic benefits of their activities, social benefits or, as in most cases, some mixture of the two. Approximately one-third of HEIs studied seek to achieve a balance between economic and societal returns, with a small number focusing primarily on the social aspects of their activities. Despite the lesser focus on societal impacts by many HEIs, they claim that many of their activities deliver societal benefits indirectly. For example, the discovery of a new drug that treats a disease may well deliver substantial economic benefits to both the HEI and the company that takes the drug to market, but the reduction of prevalence of the disease will deliver substantial benefit to society. This type of example is by no means limited to life sciences faculties and the pharmaceutical industry.

[25] HEFCE (2006a) *Model financial memorandum between HEFCE and institutions*, HEFCE 2006/24

Figure 3.2 Long-term goals of HEIs by cluster relative to all HEIs (=100)



Note: In radar diagram: number of HEIs in each cluster with the particular long-term goal, normalised to All HEIs = 100
Source: HEIF 4 institutional strategies, PACEC analysis

3.2.16 There are significant differences in the long-term goals of HEIs in different clusters (see Figure 3.2). While HEIs in all clusters have committed to developing and expanding their KE activities and developing relevant structures, commitments differ across clusters with respect to the aim of contributing to socio-economic development. HEIs in the top six cluster focus much less on this long-term goal compared with HEIs in the high research cluster. In the medium research cluster HEIs are more likely than others to focus on embedding and integrating knowledge exchange as a core activity in their HEI. Arts HEIs, along with those in the top six and medium research clusters, are more likely to focus on developing world class capabilities and reputation. Unsurprisingly, those in the top six research cluster are less likely than average to include developing partnerships as a long-term goal. This is consistent with results from the case study programme suggesting that these HEIs are more likely to focus on internal collaboration rather than collaboration with other HEIs.

3.2.17 The economic development focus of HEIs can be further broken down through an analysis of the HEBCI returns. It is clear from Table 3.2 that the focus differs substantially between clusters. Research intensive HEIs contribute to economic development much more through research collaboration with industry, technology transfer and meeting the national skills needs. HEIs with a lower research intensity typically focus more heavily on access to education, supporting SMEs and meeting regional skills needs.

Table 3.2 Economic development strategic focus in 2007 (% of HEIs)

Economic development focus	Total	Cluster				
		Top 6	High	Med	Low	Arts
Access to education	55	33	47	58	**74**	37
Research collaboration with industry	39	**100**	**76**	42	**6**	**16**
Supporting SMEs	38	**0**	**18**	48	51	47
Meeting regional skills needs	35	0	**12**	45	**60**	21
Technology transfer	30	**83**	**53**	30	**11**	11
Meeting national skills needs	28	**67**	35	**6**	**11**	**63**
Graduate retention in local region	20	0	**6**	**33**	20	32
Developing local partnerships	17	0	**6**	15	**37**	5
Attracting non-local students to the region	14	0	21	6	6	**32**
Support for community development	14	0	**3**	9	20	**32**
Attracting inward investment to region	5	17	**15**	0	0	0
Management development	4	0	6	6	3	0
Spin-off activity	2	0	3	0	0	5
Number of HEIs	130	6	34	33	35	19

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEBCI 2006/07

Drivers of strategic change

3.2.18 The emergence of knowledge exchange as a core strategic objective for HEIs alongside teaching and research has been driven by a number of factors. Firstly, government policy in this arena has raised awareness among both senior management and staff that the pursuit of knowledge exchange goals is a recognised and acceptable goal for HEIs. Over three-quarters of HEIs participating in the case study programme recognised the important role that government policy towards knowledge exchange has played in encouraging an increased strategic emphasis on third stream activities. Changes in staff attitudes were also seen as important in supporting the strategic shift.

3.2.19 The presence of a dedicated funding stream from HEFCE focused on knowledge exchange activity, combined with a positive and pro-active campaign at the government level, has been a second important factor that has facilitated the development of KE activity and KE strategies within many HEIs.[26] It has been of particular importance for HEIs with a relatively undeveloped KE presence. Within these HEIs it has raised the profile of knowledge exchange as an important element of their overall mission, and it has helped to create the necessary environment around which a sound KE strategy can be developed. For other HEIs seeking to expand their KE activities but constrained by resources, HEFCE funding has provided support backed up by the necessary non-appropriable funds. The overall outcome has been an enhanced credibility for KE engagement and a clear demonstration by Government to academics of the importance of the third stream mission.

[26] PACEC (2008) *Analysis of HEIF 4 Institutional Strategies: Overview Report*, a report to HEFCE

3.2.20 The leadership provided by a dynamic and supportive vice-chancellor is a third important driver of the third stream mission and emerged as important with no apparent differences between the clusters. Critical in this respect is the capacity of the VC to galvanise senior management around the knowledge exchange agenda and introduce the infrastructure and organisational structures required to ramp up knowledge exchange activities. In some cases the arrival of a new, dynamic vice-chancellor provided a fresh vision that incorporated the need for greater knowledge exchange, particularly with industry.

3.2.21 Growing financial constraints facing HEIs are also an important driver of the shift in the balance between the three streams. HEIs, especially those with a large science and engineering research base, are increasingly viewing income from knowledge exchange as a means of greater financial security and as a means of decreasing their reliance on public funding. HEFCE funding for knowledge exchange has been very important for allowing HEIs to develop the necessary capacity and capability which, in turn, has allowed many to attract other sources of funding.

3.2.22 This sub-section has discussed a variety of drivers of the shifting strategic balance in HEIs. However, one must recognise the important and complex inter-linkages between these different drivers. It is unlikely that any one alone will have been the sole cause of any shifts. A complex system of dynamic feedbacks between factors likely exists that reinforce each other as an HEI shifts its strategic focus.

Strategic development and potential impact of knowledge exchange at the departmental and academic discipline level

3.2.23 The increased profile of the third stream mission and the development of improved knowledge exchange strategies inevitably filter down to and impact on individual departments and subject areas. The survey of academics indicated that 45% of academics perceived an impact on the development of KE strategies within their departments as a consequence of HEIF funding. In addition, 49% of academics believed that HEIF funding has led to their department developing a strategy for increasing non-traditional sources of funding such as commercial income from courses, licence deals etc.

3.2.24 Funding from HEFCE to support knowledge exchange was also clearly apparent at the departmental level in most of the case study HEIs, and was perceived to have helped departments to develop the capabilities and confidence to enhance their KE activities as well as supporting greater integration of teaching, research and knowledge exchange. Perhaps not surprisingly these impacts vary by HEI cluster. Over three-quarters of HEIs in the higher research clusters (top six, high and medium) believed that the funding has assisted their departments to a small extent, compared with over a half of HEIs in the low research and arts clusters perceiving a large impact. However, these impacts cannot be attributed solely to HEIF funding and must be understood in the context of a more general shift in government policy towards support for knowledge exchange and a developing role for HEIs in the knowledge economy.

3.2.25 The extent to which the overall knowledge exchange objectives are embraced and implemented varies by discipline. Engineering and science-based subjects have historically been engaged with industry as a result of the applied nature of their research and teaching. These departments have tended to emphasise teaching, research and knowledge exchange similarly, with little change over time. One exception is in the top six research HEIs, where priorities of engineering and science subjects have tended to be focused on research and teaching with knowledge exchange increasing only slightly in importance. The non-science/engineering subjects for most HEIs have typically focused more heavily on teaching and research with the emphasis on knowledge exchange increasing in importance, although to a level lower than in science/engineering faculties.

3.2.26 Although there would appear to be clear discipline-related differences, the scale and commitment to KE in a faculty would seem to depend very much on the extent to which senior faculty management supports and concurs with the knowledge exchange mission of the HEI. In this respect the attitudes and enthusiasm for KE activities on the part of all faculty members are important, as is the extent to which faculty research and teaching activities overlap and complement those in industry and other external organisations.

3.2.27 The extent of support for KE at the departmental level is, not surprisingly, influenced by the department's potential for income generation. This potential is typically much higher in technological or science-based faculties compared with arts and humanities faculties. It also differs between the different types of technology/science subjects, and crucially in the time horizon for the payoff. Licensing income from a new drug patent may dwarf that from licensing an incremental innovation in a motor sport technology, but the payoff period will likely be much further into the future for the new drug. The non-financial impacts of knowledge exchange activities are likely to be much greater in arts and humanities disciplines compared with medical, engineering, science and technology. For example, many arts and humanities departments provide free and chargeable events, such as exhibitions, public lecture series or concerts, which disseminate knowledge to the wider public.

3.2.28 Arts HEIs are taking advantage of the rapid increase in scale and profile of the creative industries in the UK, particularly in London. This is generating consultancy and contract research opportunities in addition to the more traditional opportunities in courses and CPD etc. A number of the larger arts HEIs are also finding new opportunities in the intersection between technology and the creative arts through collaborations with other HEIs.

Academic discipline and sectoral specialisation

3.2.29 Another key factor shaping the knowledge exchange strategy is the academic discipline specialisation of the HEI. Excluding the arts HEIs (which by definition would be specialised), the top six research HEIs and those in the low research intensity

cluster are the most specialised by academic discipline.[27,28] Whereas the top six research HEIs specialise in medicine, HEIs in the low research cluster tend to specialise in the humanities and this is reflected in their respective Herfindahl indices of concentration.

Table 3.3 Share of academic staff FTE by discipline (%) and the degree of specialisation (Herfindahl index)

Discipline	All HEIs	Cluster				
		Top 6	High	Medium	Low	Arts
Medicine	28	44	28	22	20	2
Engineering	15	22	21	8	7	0
Science	11	11	13	13	7	1
Technology	6	4	6	9	6	0
Humanities	30	11	23	36	48	93
Languages	7	7	8	8	6	3
Other	3	1	2	3	4	1
Total (%)	100	100	100	100	100	100
Total number of academic FTEs	104,950	20,111	38,690	27,489	16,282	2,236
Herfindahl index of concentration	0.21	0.27	0.20	0.22	0.29	0.86
Herfindahl index of concentration (excluding medicine)	0.25	0.25	0.23	0.29	0.40	0.89

Note: A Herfindahl index of 1 = completely specialised; an index of 1/n = completely unspecialised where n is the number of academic disciplines
Discipline definitions provided in Appendix F
Source: HEBCI survey, PACEC/CBR analysis

3.2.30 The sectoral focus is an important element in HEIs' KE strategies. It reflects their academic discipline specialisation (Table 3.3), their internal capacity and capabilities, as well as the economic and social context within which they engage with partners in knowledge exchange. Table 3.4 shows that the cultural and creative sectors are most frequently targeted (identified by 81% of HEIs). This sector is quite diverse and ranges from arts and heritage to games design and industrial design. However, there are substantial differences across clusters, although the top six research cluster (not shown in this table) typically targets all sectors. Not surprisingly all HEIs in the arts cluster target this sector by comparison with 29% in the high research cluster. The arts cluster HEIs, however, do stand out as being more specialised in their choice of target sectors compared with HEIs in other clusters. The high-technology sectors also feature prominently in the KE strategies. Energy, environmental technologies, advanced engineering, information and communications technology (ICT), bio-technology and pharmaceuticals, and medical/science and technology equipment are identified by between one-fifth and just over one-third of all HEIs. These sectors are identified by the majority of HEIs in the top six research cluster and by a relatively high proportion of HEIs in the medium research cluster. Financial and business services are targeted by just under one-third of HEIs and are most frequently identified by the medium research cluster. The public and third sectors are identified by about one-third of HEIs. A number of sectors appear relatively infrequently as

[27] Academic discipline definitions are provided in Appendix F.
[28] Note that even removing Imperial College London, which specialises in medicine, science and technology, the HEIs in the Top 6 cluster remain only slightly less specialised than those in the Low Research cluster.

target sectors for knowledge exchange. Only a very small minority of HEIs explicitly seek to engage for community development and regeneration, although evidence from the case studies suggested that this was often perceived as an indirect outcome from other KE sector interactions.

Table 3.4 Main sectors targeted by HEIs in their knowledge exchange strategies (%)

Partner	Total	Cluster			
		High	Medium	Low	Arts
Creative & cultural sectors (including design)	81	29	90	75	**100**
Energy and environment/environmental technologies	38	**67**	35	42	**0**
Public and third sectors	36	38	35	50	24
Health and healthcare	34	38	**65**	29	18
Advanced engineering (including aerospace and automotive), other engineering and manufacturing	33	33	**75**	17	**0**
Financial/business services and management	31	29	**60**	29	12
Other science and technology	30	33	**55**	**13**	**0**
ICT	23	29	**50**	13	6
Biotechnology/biomedical science and pharmaceuticals	22	**43**	**40**	**4**	**0**
Hospitality, leisure and tourism	18	10	15	**42**	6
Agriculture, food and drink	16	10	20	**29**	**0**
Medical science/technology/equipment	13	**43**	5	4	0
Marketing, advertising, media and broadcasting	12	0	15	13	24
Education	11	5	20	13	12
Development and sustainability	9	14	20	4	0
Construction and building services	8	0	**20**	13	0
Transport & logistics/e-commerce	7	5	15	8	0
Retail	6	5	10	8	0
Social and rural enterprise	4	10	0	8	0
Sports and sport science	4	0	5	**13**	0
Defence and security	3	5	**10**	0	0
Community development and regeneration	2	5	5	0	0
Law	2	0	**10**	0	0
Other	31	**52**	15	25	24
Number of HEIs	90	21	20	24	17
Top 6 research HEIs	Two-thirds of HEIs in top 6 research cluster target all sectors with their KE activities. The remaining two HEIs target the following sectors: advanced engineering, biotechnology/biomedical science and pharmaceuticals, creative and cultural sectors (including design), energy and environment/environmental technologies, financial/business services, medical science/technology/equipment, and other science and technology				

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEIF 4 strategies, PACEC/CBR analysis

Partner/customer types in knowledge exchange strategies

3.2.31 The strategic focus by HEIs in terms of their interaction with different partners/customers will be influenced by their perceptions of the ultimate benefits to be delivered from such interaction. Overall, knowledge exchange interactions with the commercial and public sectors are ranked most highly in terms of the benefits they ultimately deliver (Table 3.5). However, there are significant variations across the

different clusters. There is a clear hierarchy in the ranking of benefits delivered by engagement with commercial private businesses. HEIs in the top six research cluster rank them most highly and the arts cluster least. Those in the low research intensity cluster are more likely to focus on public sector organisations, while arts HEIs are likely to focus on the charitable and voluntary sector. The strategic focus on particular customer types has not changed substantially since 2003.

Table 3.5 Average rank of partners/customers according to the benefits ultimately delivered in achieving third stream strategic aims and priorities in 2007

	All HEIs	Cluster				
		Top 6	High	Medium	Low	Arts
Commercial private business	1.6	1.0	1.4	1.5	1.9	2.0
Public sector (commercial and non-commercial)	1.7	2.0	1.7	1.6	1.6	2.0
Non-commercial organisations, social, community and cultural organisations	2.6	3.0	2.9	2.8	2.4	1.8
Number of HEIs	130	6	34	33	35	19

Source: HEBCI surveys, PACEC/CBR analysis
Ranking: 1=high benefits delivered and 4=low benefits delivered

3.2.32 In terms of target partners/customers the strategic stance can be further disaggregated into SMEs, large corporations and non-commercial customers. The 'SME' category includes not only small and medium-sized enterprises, but also sole traders and micro-businesses. Given the importance often attached to SMEs in terms of their potential for innovation and job creation, the extent to which they are targeted by HEIs in the KE strategies is clearly important. Table 3.6 shows that SMEs are the most frequent type of external organisation explicitly targeted in HEI strategies and are a strong focus for KE engagements by HEIs in the medium/low research and arts clusters. Large corporations are of obvious significance for the top six and high and medium research clusters, but much less so for the low research and arts clusters.

Table 3.6 Partners/customers targeted by knowledge exchange strategies, 2008 (% of HEIs)

Partner	Total	Cluster				
		Top 6	High	Medium	Low	Arts
SMEs	83	67	78	91	85	83
Public organisations	72	83	81	66	74	67
Large corporations	50	83	**69**	**66**	**32**	**17**
Other voluntary sector	30	**67**	25	19	38	33
Other private sector	25	33	25	22	26	22
Charities	18	17	19	9	24	22
Freelance workers	13	17	3	3	9	50
Number of HEIs	125	6	32	32	34	18

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEIF 4 strategies, PACEC/CBR analysis

Spatial focus of HEI knowledge transfer strategies

3.2.33 The diversity of HEIs' knowledge exchange strategies is also demonstrated through the spatial focus of their activities. The top research HEIs, and indeed those that are

global leaders in their particular disciplines (which includes many HEIs in the high research cluster) are all seeking to be globally competitive and hence cannot restrict themselves to regional or even national markets in their sectors. They therefore engage with external organisations regardless of geographical location. These HEIs typically engage at all spatial levels, determined primarily by the sector and the type of engagement. For example, education and public sector engagement will likely be both local and national (although top-tier HEIs are increasingly being able to consult internationally in this area). Knowledge exchange in the biomedical sector is typically international given that the main clusters in this sector lie outside the UK. Spin-out activity is inevitably focused locally as many HEI start-ups typically locate either within the HEI incubators or science parks, or close to the HEI, particularly in cases where the academic involved with the spin-out maintains their academic commitments. Such activity is therefore typically local regardless of the sector. Technology licensing, however, is not geographically constrained and therefore has more of a global focus.

3.2.34 As the intensity of research decreases, HEIs tend to provide an increasingly local and regional role (Table 3.7), providing, for example, regional skills training, services for SMEs and widening access to education (as suggested in Table 3.2).

Table 3.7 Geographical focus of HEIs' knowledge exchange strategies (% of HEIs)

	All HEIs	Cluster				
		Top 6	High	Medium	Low	Arts
Local/regional	41	17	**18**	45	**66**	42
National/global	59	83	**82**	55	**34**	58
Number of HEIs	130	6	34	33	35	19

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEIF 4 institutional strategies, PACEC/CBR analysis

3.3 Organisational structure and infrastructural change at HEIs

3.3.1 Although evidence from the research programme has identified important strategic shifts by HEIs in response to the challenges raised by the third stream imperative, HEIs cannot be changed as surely and as swiftly as strategy. Many HEIs are long established, with deeply embedded capabilities and values that constrain easy adaptation to a changing environment and new strategic priorities. It takes time to create institutional structures, change the set of people and capabilities, develop new physical infrastructures, build new networks and redefine the organisational structures which will support the realisation of major strategic changes. Notwithstanding these problems, these organisational and infrastructure changes are crucial to developing the necessary capability and capacity to successfully meet the aims and objectives of the third stream mission. Such investments also help to increase the efficiency and productivity of the knowledge exchange process and reduce the overall opportunity costs of academics engaging in knowledge exchange. For example, recruitment of high-calibre staff in a knowledge exchange office which handles the administrative burdens of knowledge exchange allows academics to focus on those knowledge exchange activities where they add most value. This not

only facilitates a more efficient division of labour in knowledge exchange, but also enhances the efficient use of an academic's time with regard to research and teaching. The next section analyses the organisational and infrastructure developments in support of knowledge exchange that have taken place in the past decade.

Funding allocation mechanisms

3.3.2 An important organisational structure for the operation of knowledge exchange activities within HEIs is the internal funding allocation mechanism that distributes HEFCE third stream funding to the variety of projects and initiatives. The mechanism can have important effects on academics, such as increasing the awareness of knowledge exchange within the HEI.

3.3.3 There is a plethora of internal funding allocation mechanisms within the HE sector, each being specific to the situation of the HEI. However, two broad internal funding allocation mechanisms have emerged: allocation by central committee (management board, central enterprise committee or equivalent) and allocation by internal competition.

3.3.4 The first mechanism, allocation by central committee, is the most common method for allocating the HEFCE third stream funding within the case study HEIs. The funding typically enters the HEI centrally through the vice-chancellor's office, finance office or business development office. A committee then decides on how the money should be allocated to different initiatives or projects. The allocation is driven by the strategic objectives of the HEI and in most cases involves some consultation with the faculties. The committee typically has representation from the faculties, the management board and, in some cases, external advisors. However, in some cases the funds are allocated centrally by the vice-chancellor's office to strategic priorities with very little consultation.

3.3.5 The second mechanism involves an internal competition or an application for funding process. In these HEIs, while the funds enter the HEI centrally, applications or bids for funding are requested by a central committee or steering group. In a number of HEIs the bids are similar to business plans, which must demonstrate, among other things, self-sustainability within a specified timeframe. The composition of the steering group differs quite substantially. Where top research intensive HEIs use this mechanism, the committee usually comprises senior management (e.g. registrars, pro vice-chancellors) with no faculty representation. In other HEIs the steering groups consist of representations from the management boards and enterprise units as well as faculties. In this mechanism it is typical for some of the funds to be ring-fenced for strategic initiatives such as knowledge exchange offices or proof of concept funds.

3.3.6 The second mechanism can sometimes include an internal marketing campaign alongside the call for bids. When combined with the improvements in support provided to academics for creating these bids, this mechanism can have important impacts on the awareness of knowledge exchange as a legitimate activity backed by

resources, which – as shall be seen later – is an important driver of raising participation.

Knowledge exchange offices in the 21st century

3.3.7 Over the period 2000-08 a significant amount of HEFCE third stream funding has been used to part-fund the development of knowledge exchange offices (KEOs) within HEIs. Such offices, which carry a multitude of different names such as business development offices, enterprise offices and corporate partnership offices, have emerged in almost all of the HEIs studied, many supported directly by HEFCE third stream funding. The case studies identified KEOs which have seen major changes since 2001 in terms of scale, scope, strategic focus and profile, and which are increasingly becoming dominant and credible structures within the fabric of HEIs. Almost half of KEOs had expanded in scale, with some growing from units of 1-2 people during the early days of HEIF to sizeable units of 10-15 today. In addition, the range of services they provide has increased in scope and depth in many cases.

3.3.8 All KEOs in the case study HEIs were internal departments within the HEI, led by a director who typically reports directly to the pro vice-chancellor responsible for knowledge exchange activities. Increasingly, they are becoming heavily involved with the HEI's senior management to formulate the strategic direction for knowledge exchange within the institution. These offices are then typically divided into various teams responsible for the different functions of office.

3.3.9 The organisation of the KE staff varies among institutions, with two primary models emerging: a predominantly centralised operation and a devolved operation. The centralised model sees the majority of KE staff residing within the KEO and delivering their services from the central unit. Approximately 30% of the HEIs studied use this model, with the majority of these being top six and high research cluster HEIs. It is common for the KE staff in central units to be organised in sectorally defined, demand-driven teams rather than by discipline. This highlights one perceived advantage of operating a centralised model. Given that the challenges facing external organisations are inherently multidisciplinary, it is much easier to identify and develop projects and packages of research that meet their needs if KE staff have knowledge of, and can easily access, capabilities across different disciplines relevant to the sector. Embedding KE staff within schools runs the risk that they become too narrow in their focus. However, a disadvantage of a centralised operation is that it is much harder to generate credibility and 'buy-in' among academic staff.

3.3.10 The devolved model typically involves the creation of a small central unit which then manages KE staff who are embedded within the different schools or research institutes. Approximately 70% of the HEIs studied follow this model. KE staff have been important in not only providing the business support services, but also in generating enthusiasm about engaging with the third stream. Arguably, the proximity to the academics facilitates developing credibility, but distance between KE staff likely makes it more difficult to identify cross-faculty or cross-sectoral opportunities.

Capabilities of knowledge exchange offices

3.3.11 These offices perform a variety of different functions within HEIs, focusing on the different segments of knowledge exchange engagement process from opportunity identification to project completion. Given the diversity of the sector and the varied strategic stances of HEIs, the particular functions of each KEO will differ in both focus and emphasis. Nevertheless, the broad functions are largely similar. KE staff within KEOs engage closely with academics to provide services such as advice on intellectual property, producing business plans for funding, contract research, etc. They also handle the business negotiations, which can become extremely complex where multiple partners and/or large amounts of investment and funding are involved. They provide the project management and client management systems necessary for professional engagement with external organisations.

3.3.12 Successful KEOs also engage very closely with both academics and external organisations to understand the capabilities that exist within the HEI and the innovation needs of industry and the public and charitable sectors. This allows them to map the capabilities of the HEI to the needs of users and to provide targeted services. Developing such an interface that is credible to both the academic and the external users requires particular skills: the ability to converse successfully with the academics in very narrow fields can be very different from that required to interact with the senior management of large external organisations about their future needs. There is some evidence to suggest that KEOs are starting to successfully deploy their staff to achieve this.

3.3.13 HEIs are increasingly trying to build on the transactional relationships that typically exist between an HEI and external organisations to create long-lasting strategic partnerships. This is particularly the case for top six and high research cluster HEIs. For example, HEIs are attempting to develop relationships with the senior level decision-makers in companies (e.g. at the board level or the heads of R&D departments). This improves HEIs' understanding of the key challenges facing businesses which, in turn, allows them to better target their engagement. At one HEI, the relationship with some companies had moved to the point where the HEI could suggest potential packages of work rather than being reactive and waiting for the company to seek the HEI's engagement. At other HEIs, the nature of strategic engagement was more about encouraging those who engage with businesses for a specific purpose (e.g. consultancy) to be aware of any other services the HEI could provide in the future. High-calibre KE staff who can understand not only the requirements of the strategic partner but also how the academic capabilities within the HEI can help the organisation are therefore the lynchpin of developing successful relationships. A number of KEOs have now introduced client account management systems or equivalent to help this process.

3.3.14 Related to this is the development of a 'central gateway' for external organisations to access HEIs' KE-related services. However, it is not yet clear as to the success of these central gateways as they rely upon KE staff having in-depth knowledge of many different areas of research and their applicability to industrial problems. If an external

organisation has already identified the academic, it would be inefficient to force the engagement through a KEO. However, in cases where the external organisation has not been able to identify a particular contact within the HEI, a central gateway should help to minimise the search costs.

3.3.15 The responsibility for the provision of consultancy support (e.g. providing project management assistance for academics engaging in consultancy) or a dedicated portal providing information to external organisations wishing to engage with HEIs can sometimes fall under the responsibility of the KEO if other dedicated structures do not exist within an HEI. Similarly, a number of KEOs provide a sales/marketing function for the HEI. Through networking with external organisations, they raise awareness of the range and nature of the benefits from engaging with the HEI.

3.3.16 Knowledge exchange staff can also perform a very important coordination role to ensure that the KE engagement process, from opportunity identification to project completion of the contract, occurs in an efficient and professional manner. This professionalisation of the engagement is becoming an important factor for the development of long-term strategic partnerships, which many offices strive to develop.

Developing successful KE staff

3.3.17 The success of KE staff depends crucially on the ability to become credible both among the academics with whom they work and with the external organisations with which they engage. A primary cause of failure of such roles is where they have been unable to generate 'buy-in' from academics. Being able to 'speak the language' of both academics and those in industry and the public and charitable sectors is crucial. The capabilities and qualifications of those working in such units therefore become paramount. Evidence from the case studies suggests that the most successful KE staff tend to have both a research background (either within academia or research roles within institutes or companies) and industrial experience.

3.3.18 Another very important attribute of successful KE staff is to be demand-focused. They must be able to understand the innovation needs of external organisations and respond with an appropriate set of capabilities within the HEI, which are increasingly likely to be multidisciplinary in nature and involve more than one department.

Profile and credibility of knowledge exchange offices

3.3.19 KEOs, particularly in the top six and high research clusters, have been able to raise their profiles within their institutions. Historically such offices were typically considered to be of much lower status than academic faculties. Anecdotal evidence from this research programme suggests that KEOs are most successful when they are not seen as an 'add-on' to the HEI, but embedded within it. In many cases this has been achieved by giving the enterprise and knowledge exchange functions a similar profile at the senior levels of management to the academic and teaching roles, for example by appointing a pro vice-chancellor for enterprise and knowledge exchange (or

equivalent) to which the KEO reports both visibly and directly. A high profile at the core of an HEI helps to build the required credibility for its success and raise the awareness of knowledge exchange among academics. It also sends a strong signal that the HEI is serious about its knowledge exchange agenda.

The role of knowledge exchange offices in initiating knowledge exchange engagements

3.3.20 The extent to which KEOs seek out knowledge exchange opportunities for academics to pursue varies substantially within the HE sector. At one end of the spectrum is the view that the identification of opportunities should remain the responsibility of academics and that the role of KEOs should be as a facilitator once the opportunity has been identified. Most adopt this largely reactive strategy towards generating KE opportunities.

3.3.21 The alternate view is a much more pro-active strategy in which staff within KEOs actively seek out KE opportunities. Underlying this approach is that while academics are good at identifying particular opportunities (primarily within their field), by forming close strategic relationships with large companies KE staff are ideally placed to identify demand-led, multidisciplinary packages of research and expertise. This is particularly the case where KE staff have gained the necessary buy-in from both academics and external organisations, and have also been successful at nurturing a strategic relationship with large corporations. The combined effect can potentially be an ability to successfully match the capabilities of the HEI to the innovation needs of businesses and to secure the necessary funding. This was the case for one high research cluster HEI, whose relationships with a number of large corporations have now developed to the point where they can suggest potential applications of new/emerging technologies that will ultimately benefit their products. A KEO at a top six research HEI has been relatively successful at spotting opportunities in external organisations that academics were unaware of, and securing funding for relevant research packages. This was the result of a particular member of staff's ability to sit comfortably in both academia and industry, and be able to relate to and understand both parties.

3.3.22 However, this capability still remains elusive for most KEOs. When one analyses the evidence on how interactions between academics and external organisations are initiated, knowledge exchange offices are the least frequent mechanism, with only 13% of academics choosing this route (Table 3.8 and Table 3.9). Those in science departments and those who undertake user-basic research are more likely than the average to use KEOs to initiate engagements. However, according to academics, the majority of knowledge exchange activities are still initiated through direct contact between the academic and the external organisation. This is particularly the case in medical departments and for those engaging in applied research.

Table 3.8 Mechanisms for initiating engagement: academics' perspective by department (% of academic respondents)

	Total	Department						
		Medical	Science	Tech-nical	Engin-eering	Lang-uage	Human-ities	Other
The external organisation, directly with the academic	59	66	61	48	53	38	62	51
By mutual actions following up contact at a formal conference or meeting	42	45	39	36	42	59	39	38
By mutual actions following informal contacts (including students or former students)	38	38	34	37	36	50	38	41
Your own actions in approaching external organisations directly	38	35	36	27	36	49	41	39
The HEI knowledge exchange office or other HEI agency	13	13	14	22	**24**	0	11	12
Other	5	5	5	**15**	6	3	**3**	9
Number of respondents	913	240	138	60	107	56	287	25

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008

Table 3.9 Mechanisms for initiating engagement: academics' perspective by stage of research (% of academic respondents)

	Total	Stage of research		
		Basic	User basic	Applied
The external organisation, directly with the academic	59	**51**	56	**67**
By mutual actions following up contact at a formal conference or meeting	42	37	45	45
By mutual actions following informal contacts (including students or former students)	38	35	34	38
Your own actions in approaching external organisations directly	38	**32**	39	41
The HEI knowledge exchange office or other HEI agency	13	13	**21**	**8**
Other	5	5	6	5
Number of respondents	913	221	223	395

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008

3.3.23 This view was echoed by external organisations. Only 8% of external organisations claimed that interactions were initiated by the knowledge exchange office (Table 3.10). However, this rose to approximately a fifth for organisations located abroad, suggesting that KEOs may play a more important role in identifying opportunities where geographical proximity to the academics is lacking. Another explanation could be that many overseas organisations may not see the English HE sector as a natural

partner for their knowledge exchange requirements. Therefore, in order to access these organisations, KEOs must actively identify and pursue such engagements.

3.3.24 Over two-fifths of external organisations sampled believed that the interactions were initiated by their own actions in approaching the HEI, although this was less the case for larger companies and those located locally and abroad. Informal contacts with academics proved the most important method of initiating engagements for large companies (over 200 employees).

Table 3.10 Mechanisms for initiating engagement: the perspective of external organisations (% of academic respondents)

	Total	Size (employees)				Location		
		<5	5-49	50-199	200+	Local (<30 miles)	Rest of UK	Abroad
Your own actions in approaching HEI directly	41	45	46	31	34	**34**	**64**	27
By mutual actions following informal contacts	23	18	**13**	29	**43**	**30**	**12**	18
By mutual actions following contact at conference or meeting	13	12	14	16	10	17	9	14
The HEI knowledge exchange office or other HEI agency	8	4	9	9	8	9	4	**18**
Action of HEI member of staff	7	**14**	6	9	**0**	**3**	3	**18**
Other	8	6	**12**	7	5	8	8	5
Number of respondents	283	49	126	45	61	115	74	22

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of external organisations 2008

3.3.25 The above suggests that currently the primary role for KEOs is the facilitation of the knowledge exchange process, providing many of the services outlined earlier, rather than in identifying opportunities for engagement. There are also other indirect mechanisms at work which may underestimate the impact of the KEO in initiating engagements. For example, a number of the KEOs studied hold marketing events or hold events which bring together academics and external organisations. This may lead to informal or formal introductions between the academics and external organisations that eventually lead to the initiation of a KE engagement.

The development of knowledge exchange offices and the impact of HEFCE funding

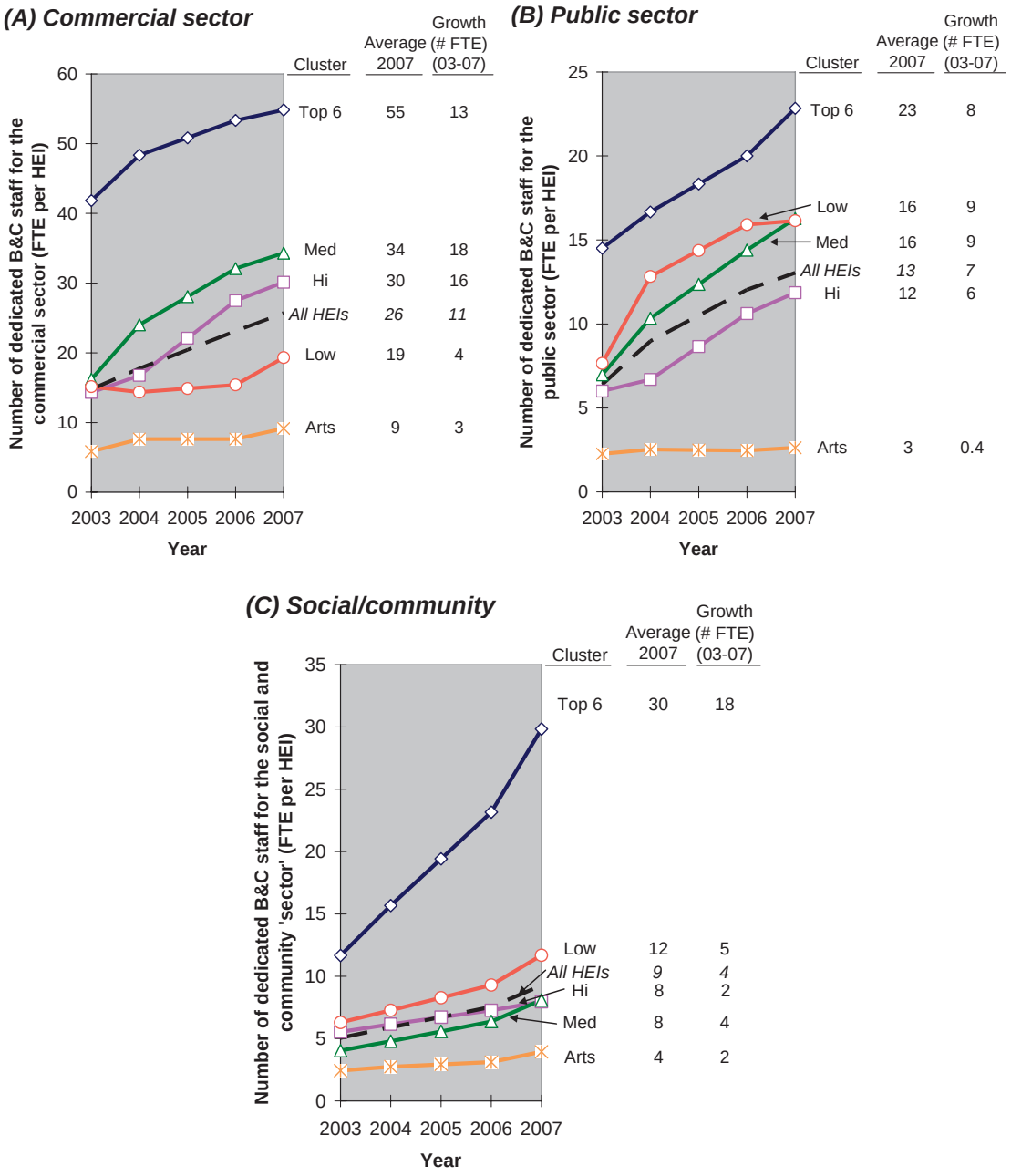
3.3.26 All of the KEOs in the case study HEIs were at least part funded through HEFCE third stream funding and complemented by a variety of other resources, including other public funding and, in some cases, internal resources. The availability of public funding, such as HEIF, for such offices has been crucial for their development. The movement to a formula-based system over a three-year period is very much welcomed by KEOs as it greatly facilitates hiring the high-calibre staff who are becoming an important part of the knowledge exchange process within HEIs.

3.3.27 KEOs in approximately 20% of the HEIs studied claimed that they are now more professional in their activities than in 2001. HEFCE third stream funding has allowed them to build up the necessary infrastructure and capacity and introduce the necessary structures, such as project management and account management systems. This has helped to increase the professionalism of their services, and has helped those KEOs to raise the quality of their interactions with external organisations and academics. In turn, this has helped to raise the profile of the office within the HEI.

3.3.28 The increased scale and scope of KEOs facilitates greater volumes and types of engagement with external organisations, while the growing professionalism and strategic focus and the introduction of better account management systems has helped to retain clients through repeat business.

3.3.29 Figure 3.3 shows that the overall number of knowledge exchange staff per HEI dedicated to the commercial, public and social sectors has risen over the period 2003-07 across all clusters.

Figure 3.3 Number of staff per HEI in dedicated business and community (B&C) roles



Source: HEBCI surveys, PACEC/CBR analysis

3.3.30 Top six research HEIs employ the largest number of dedicated knowledge exchange staff in all sectoral roles (commercial, public and social/community). Over the period there has been a similar level of expansion in such staff in the higher research intensive HEIs (top six, high and medium clusters) in both the commercial and public sector spheres. However, in social/community engagement, the top six research HEIs have expanded to a much greater degree than other types of HEIs. Arts HEIs, perhaps reflecting their typically much smaller size, have many fewer dedicated staff for interacting with business and the community.

Constraints to further growth

3.3.31 KEOs face a number of key constraints to their further development. A very large constraint is the ability to attract KE staff with suitable qualifications and capabilities. Such people are in short supply and are hard to attract given the salaries typically on offer. HEIs with successful KEO operations have typically had to increase the initial salaries and alter the job description in job advertisements before beginning to attract suitable candidates for the job. In some cases it has taken KEOs as long as eight months to find a good manager for a project, advertising many times for the post, increasing the salary each time and changing the requirements of the job.

3.3.32 Over three-quarters of the HEIs studied believed that KEOs could improve their capabilities to better support the development of KE within the HEI. A fifth of HEIs perceived a lack of capability in dealing with the legal side of the KE engagement process. Relatedly, a similar proportion believed that the offices needed to improve assistance with the intellectual property process. There was also tension between the KEO and particular faculties in approximately a quarter of HEIs studied. These tensions ranged from a lack of understanding of the faculty, to a humanities department that desired support from the KEO receiving very little contact with it and feeling 'neglected'. In addition, a department in a medium research intensive HEI 'head hunted' a key member of the KE staff from the central department.

3.3.33 Over one-third of HEIs studied believed that KEOs lack capacity, in both time and resources, to deal effectively with *all* KE requirements. One high research HEI believed that this led to bottlenecks in their engagement process. Others believed that more staff and resources would enable them to increase the capitalisation of opportunities that are currently being missed.

3.3.34 Another key constraint is financial, with approximately half of the case study HEIs citing this. This impacts on both staff recruitment and staff retention because of the low salaries (relative to industry) and the time-limited contracts as a result of much of the funding for KEOs coming from fixed-term funds, with little guaranteed for continuation. The movement of HEIF funding to a formula-based system has greatly eased the problem of time-limited contracts for KE staff, although it has not eliminated it. HEIs do not always guarantee the internal allocation of funds to KEOs, with these offices having to bid alongside other initiatives for funds at the outset of each round of funding.

3.3.35 Other key constraints include the adverse culture and attitudes of some academics towards knowledge exchange, the inability of KEOs to 'stand up against the research forces', and restrictions on KEO growth to avoid overlap with the other KE activities within the HEI, such as those of a commercialisation company.

Effectiveness of knowledge exchange offices

3.3.36 Despite the substantial investments in KEOs and the subsequent developments made in capability and capacity building, 45% of academics surveyed had had no contact with them over the past three years, despite most being aware of their

services (Table 3.11). However, this decreases to a much lower level for engineering departments (15%) and rises significantly for those in the humanities and other departments (53% and 66% respectively). Academics in engineering departments are most likely to frequently engage with KEOs, with 30% having engaged more than 12 times over the past three years. Those conducting user-basic research are also much more likely than average to engage with KEOs (Table 3.12), while those conducting basic research are much less likely. This suggests that there is much scope for raising awareness of the benefits that KEOs can bring to academics engaging in KE across different departments and stages of research (e.g. reducing the administrative burden of engagement, managing the contracts etc).

Table 3.11 Use of knowledge exchange offices by academics, by department (% of academic respondents)

	Total	Department						
		Medical	Science	Tech-nical	Engin-eering	Lang-uage	Human-ities	Other
No contact	45	43	43	38	**15**	62	**53**	**66**
Rarely (1-2 times)	22	26	23	18	**33**	14	19	**12**
Occasionally (3-11 times)	19	19	23	24	22	10	17	**9**
Frequently (12 or more times)	12	11	11	17	**30**	6	**9**	10
Not aware of these services	2	1	0	3	1	8	2	3
Number of respondents	967	259	148	59	108	67	299	25

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008

Table 3.12 Use of knowledge exchange offices by academics, by stage of research (% of academic respondents)

	Total	Stage of research		
		Basic	User basic	Applied
No contact	45	**57**	**32**	45
Rarely (1-2 times)	22	18	25	20
Occasionally (3-11 times)	19	15	**27**	19
Frequently (12 or more times)	12	8	15	13
Not aware of these services	2	2	0	3
Number of respondents	967	250	232	400

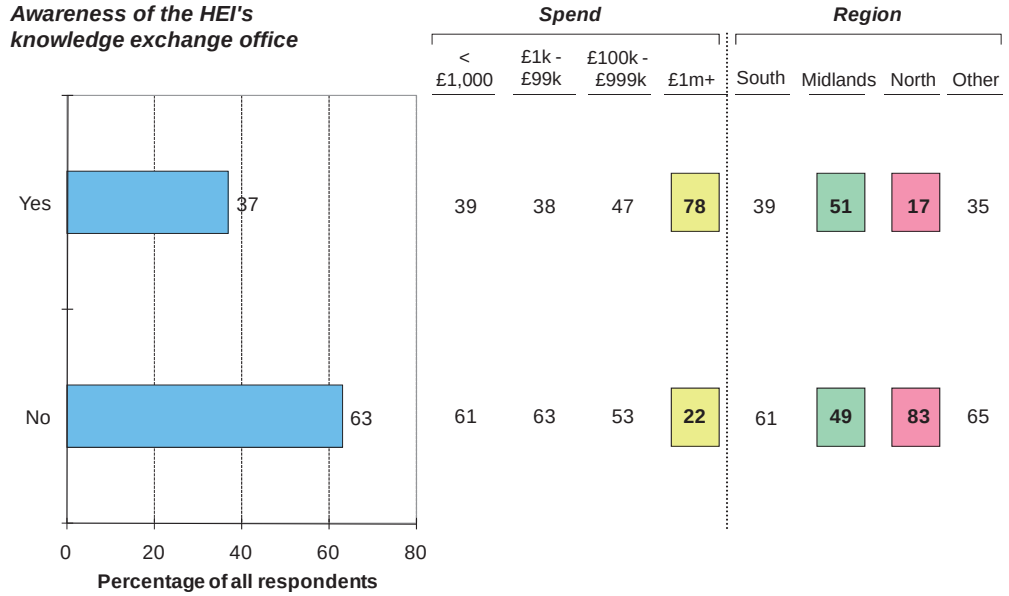
Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008

3.3.37 From the external organisations' perspective, only 37% of those surveyed were aware of HEIs' knowledge exchange offices, with those based in the UK more likely to be aware of their existence compared with just 23% of overseas organisations[29] (Figure 3.4). Companies which spend more on their interactions with HEIs are more likely to be aware of the KEO, as are those that are located in the Midlands. Those located in the North are least likely to be aware of their HEI's KEO. This result is even more significant when one considers that the sample is a random sample of

[29] Overseas figure not shown in Figure 3.4; source: PACEC/CBR survey of external organisations.

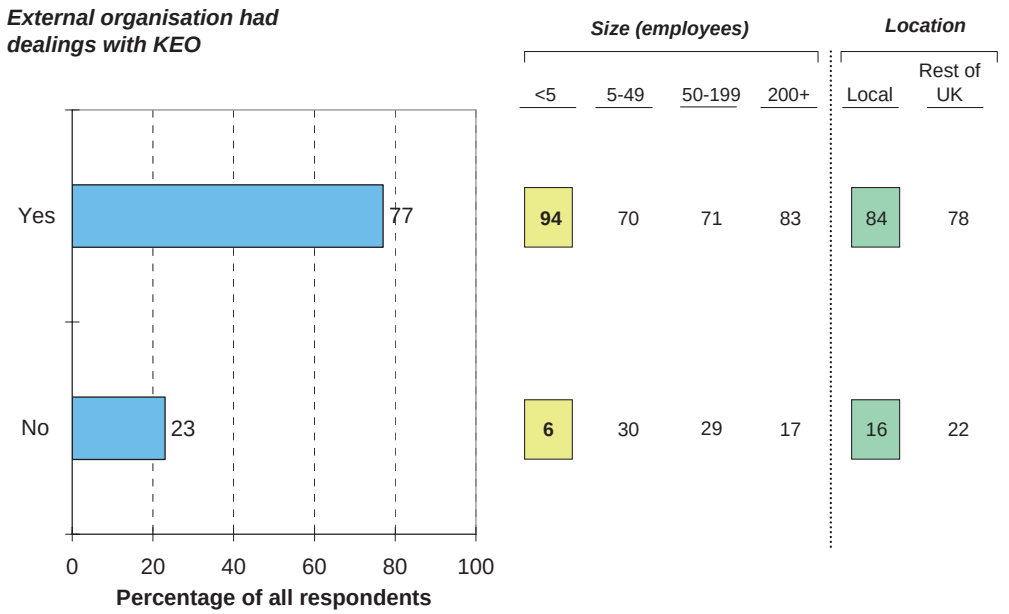
organisations *which already interact with HEIs*, not a random sample of all firms. This means that, of the organisations that interact with HEIs, many are not even aware of the purpose of or engage with the KEO.

Figure 3.4 Awareness of knowledge exchange offices by external organisations



Note 1: Spend – amount spent by the external organisation (excluding staff time) on the interactions with the HEI over the last three years.
Note 2: South – South West, South East and Greater London; Midlands – West Midlands, East Midlands and the Eastern Region; North – North West, North East, and Yorkshire and Humber; Other – overseas and unknown locations.
Source: PACEC/CBR survey of external organisations 2008

Figure 3.5 Engagement with knowledge exchange offices by those that are aware of its presence

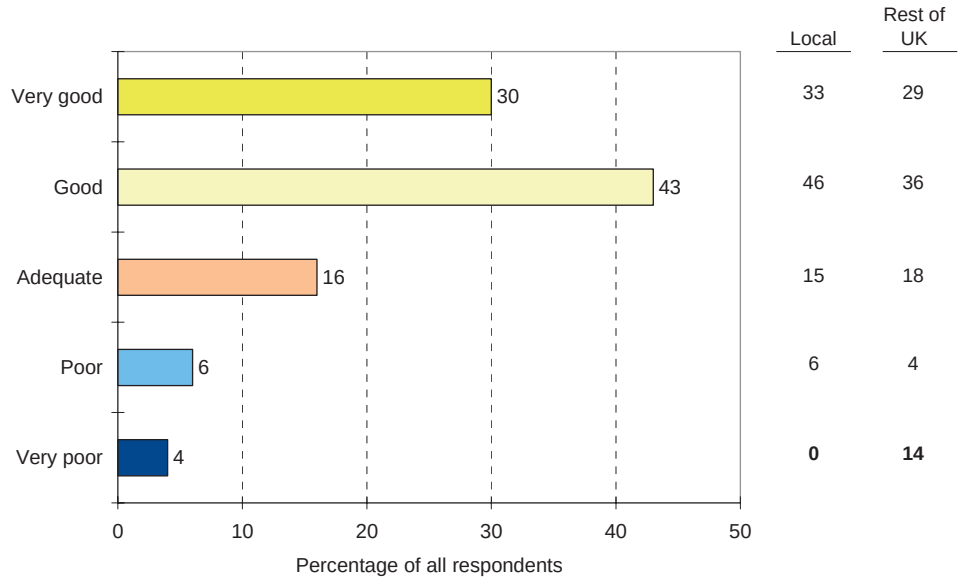


Source: PACEC/CBR survey of external organisations 2008

3.3.38 Of those that were aware of the office, over three-quarters had dealings with it (Figure 3.5). Almost all micro-companies surveyed that were aware of the KEO had dealings with it, with large organisations also more likely than average to have used its services. The location of the organisations relative to the HEI also seemed to influence whether they had dealings with the KEO.

3.3.39 Of those that have interacted with knowledge exchange offices, approximately three-quarters of external organisations rated the image of the KEO, in terms of the way businesses and other organisations can associate with it, as good or very good (Figure 3.6). This was slightly higher for local firms and lower for those in the rest of the UK. Only 10% of external organisations rated the KEO poorly or very poorly.

Figure 3.6 Rating of knowledge exchange offices by external organisations



Number of respondents: all external organisations (116); local (52); rest of UK (28)
Source: PACEC/CBR survey of external organisations 2008

3.3.40 This evidence, coupled with that from Table 3.11 that almost half of academics have had no contact with the KEO and from Table 3.10 which reveals that most of the engagements are initiated through direct contact between the academic and the external organisation, suggests that much of the knowledge exchange interaction occurs outside the sphere of influence of the KEO. This is despite the finding that external organisations that use their services find them useful. It is likely that KEOs are more effective for certain types of KE activities, such as large contract or collaborative research contracts, IP commercialisation, interacting with small firms etc, than other types. For example, for many of the smaller contracts, it is likely that the transaction costs of involving the KEO are too high for both the academic and the external organisation so that they attempt to bypass its services.

3.3.41 Given the satisfaction with the KEO by those that have had dealings with it, a key strategic challenge for HEIs and KEOs will be how to raise awareness, both internally and externally, of the value they can add to the KE process. However, this process

will need to be managed carefully to ensure that the available capacity can meet any increased demand.

Spin-out and intellectual property support infrastructure

3.3.42 KEOs are but one of the many different types of infrastructure that provide the capacity and capability to engage in knowledge exchange activities. The ability to commercialise knowledge and to engage in technology transfer are other important HEI capabilities. Two key methods have arisen in the sector: creating spin-out companies which will take the technology to market, or licensing the intellectual property. In some cases, HEIs may pursue a combination of the two – creating a spin-out company that manages the licensing of the IP to other companies. To facilitate the commercialisation process, many HEIs have set up dedicated internal units that may (or may not) form part of a wider KEO structure, or a limited company either wholly or partially owned by the institution. Table 3.13 shows that just over half of HEIs have an internal commercialisation department, which is particularly the case in the medium and low research clusters and in arts HEIs. Top six and high research HEIs are more likely to have both an internal department and an exploitation company. The share of HEIs without either an internal department or an exploitation company has fallen from 19% in 2001 to just 8% in 2007, representing an important build up of capacity and capability in the sector over the period.

Table 3.13 Commercialisation company (% of HEIs)

	2001	2007					
		Total	Top 6	High	Medium	Low	Arts
Yes, internal department and exploitation company	27	35	67	**50**	42	23	16
Yes, internal department only	37	51	**0**	38	58	**66**	53
Yes, exploitation company only	17	6	**33**	6	0	6	5
No commercialisation company	19	8	0	6	**0**	6	**26**
Total (%)	100	100	100	100	100	100	100
Number of HEIs	114	130	6	34	33	35	19

Percentages may not sum to 100 due to rounding
Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEBCI surveys, PACEC/CBR analysis

3.3.43 Related to this process of commercialisation is the ability of HEIs to access support for the spin-out process either internally or through a partner. This can be either through in-house capability or through a collaborative agreement with a partner. Table 3.14 shows the extent to which these capabilities exist within the HE sector. Overall, the total spin-off support capability in the HE sector increased during the period 2001-07, with only 8% of HEIs unable to offer any such capability, reduced from 20% in 2001. In all, 22% of HEIs are now able to offer all types of mechanisms, with most of these in the top six and high research clusters. There is a clear trend that as the research intensity of an HEI decreases down through the clusters, the variety of support mechanisms on offer either internally through the HEI or through a partner decreases. Worryingly, 32% of arts HEIs still have no access to any of the

mechanisms, although this will be partly because of lower demand for spin-out support services in these HEIs.

3.3.44 The most widespread mechanisms for spin-off support are the provision of business advice and entrepreneurship training, with 92% and 88% of HEIs respectively able to access such capability. Entrepreneurship training increasingly includes training for staff *and* students as well as investments in continuing professional development for both internal and external users. Almost all non-arts HEIs provide these capabilities either internally or through a partner. Three-quarters of HEIs provide access to seed corn investment, an increase from 55% in 2001. Access to incubators, either in-house or in the local area, is provided in approximately two-thirds of HEIs, increasing from less than 50% in 2001. Science park accommodation availability increased from 29% of HEIs in 2001 to 37% in 2007, but is largely concentrated in the top six, high and medium research clusters.

Table 3.14 Support for spin-out companies (% of HEIs)

Spin-off support		2001	2007					
			Total	Top 6	High	Medium	Low	Arts
Business advice		77	92	100	97	94	**100**	**63**
Entrepreneurship training		66	88	100	94	94	97	**53**
Seed corn investment		55	75	100	**97**	**88**	69	**26**
On-campus incubators		45	65	100	**82**	70	63	**26**
Other incubators in the locality		48	62	**100**	76	70	66	**16**
Venture capital		42	58	**100**	**88**	**73**	**40**	**11**
Science park accommodation		29	37	67	59	48	**23**	**0**
HEI has access, either in-house or from a partner, to:	All of above	11	22	67	44	18	11	**0**
	6 of above	16	22	33	26	**45**	**9**	**0**
	5 of above	16	20	0	21	21	29	11
	4 of above	13	14	0	6	6	**34**	11
	3 of above	12	5	0	0	0	11	**16**
	2 of above	8	6	0	0	3	6	**21**
	1 of above	3	2	0	0	0	0	**11**
	None of above	20	8	0	3	6	**0**	**32**
Total (%)		100	100	100	100	100	100	100
Number of HEIs		130	130	6	34	33	35	19

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEBCI surveys, PACEC/CBR analysis

3.3.45 The second key capability for commercialising research and knowledge generated within an HEI is to protect the intellectual property and license it out to users. Table 3.15 shows that the capability to license opportunities has increased slightly over the period 2003-07, with 21% taking no action in 2007, down from 26% in 2003. Two-thirds of HEIs have in-house capability to seek out licensing opportunities, with low research intensity and most arts HEIs more likely to lack these capabilities. However, approximately one-fifth of these HEIs have access to licensing capabilities externally.

Table 3.15 Capability to seek out licensing opportunities (% of HEIs)

	2003	2007					
		Total	Top 6	High	Medium	Low	Arts
In-house capability	64	66	83	**91**	**85**	**51**	**21**
External agency	10	13	17	**3**	12	20	21
No action taken	26	21	0	**6**	**3**	29	**58**
Number of HEIs	126	130	6	34	33	35	19

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEBCI surveys, PACEC/CBR analysis

3.3.46 There are likely to be large economies of scale both in the provision of spin-off support and in the provision of licensing capabilities. Many HEIs will not spin-out enough companies or generate enough IP licensing opportunities per annum to warrant full-time internal capability. There are likely many benefits to creating networks of institutions that, as a group, possess the full range of support capabilities that each member can draw upon, rather than each HEI attempting to develop its own internal capability or choosing not to engage in the process at all.

Knowledge exchange infrastructure for social and community interactions

3.3.47 A number of the HEIs studied have invested in infrastructure to facilitate links with society and the community, with some exploiting their knowledge exchange infrastructure which is partly funded through HEIF. Many of the HEIs studied have some form of local outreach activity. Many of these interactions involve engaging with deprived communities, widening participation, trying to engage children in science and engineering, and providing access to HEI infrastructure. Others have sponsored community concerts, dance and music events open to the public and public lecture series. Some of the HEIs have developed links with schools, while others are heavily involved with local and regional organisations such as Regional Development Agencies, community groups, charities and social enterprises. HEIs are also becoming more heavily involved in the formation of regional and sub-regional economic strategies and other such policies.

Impact of HEIF funding on strategic and infrastructural development

3.3.48 The importance of HEIF funding in building the capacity and capability to engage in knowledge exchange activities, and how it has helped these developments, depends crucially on how HEIs mobilise their other resources towards knowledge exchange. All of those interviewed believed that it was of some importance, with 30% believing the impact of HEIF funding to be slight while 70% thought it was of high importance.

Direct support for capacity and capability building

3.3.49 HEIF funding has been important for KE capacity and capability building for a number of different reasons. Firstly, HEIF funding has allowed HEIs to grow their capacity and capability over a much shorter period of time than would otherwise have been the case. It has provided the direct resource that has funded, and continues to fund, much of the infrastructure described above in many HEIs. In particular, it has part-

funded the creation and expansion of KEOs, with many KE staff currently being deployed in the sector at least part-funded through HEIF. Many smaller HEIs would not have been able to fund the development of their capacity and capability had HEIF funding not existed. Even many of the larger, well-established HEIs rely on HEIF to partly or wholly fund particular KE units, such as regional liaison offices and support for continuing professional development units.

3.3.50 Importantly, as HEIs gain more experience in the engagement process, HEIF funding has helped them to professionalise the process, for example through increased training and hiring high-calibre staff with more relevant industrial and academic experience. In addition, HEIF funding has enabled HEIs to invest in support infrastructure and mechanisms to be created that are necessary to improve the efficiency and productivity of the knowledge engagement process. For example, project management and client relationship systems, better supervision and support services help to ensure that engagements are delivered efficiently. This, in turn, helps to maintain and improve the reputation of the HEI as a reliable provider of knowledge exchange services. HEIs are also simplifying processes (for example, in relation to contract research or spin-outs) and streamlining the knowledge exchange process to help improve efficiency.

3.3.51 A number of the HEIs studied emphasised the sustainability criteria of their HEIF investments. Potential internal bids for funding were required to demonstrate that they would become financially self-sufficient by the end of a specified period. This ensured that, were the project delivering significant benefits to the HEI and beyond, a reduction in future HEIF funding would not jeopardise these benefits. For these initiatives, HEIF funding provided the initial 'start-up' investment. It has also allowed HEIs to fund riskier, more experimental initiatives that other sources of funding would not consider, particularly those where the benefits may not be certain or may accrue over a long timeframe. In these cases, HEIF funding has allowed HEIs to demonstrate the benefits to other funders who then enter further along the development process.

3.3.52 However, one must recognise that knowledge exchange support services and activities may not always generate income, but may generate substantial non-financial benefits both to the HEI and to the economy and society. For example, funding a post which creates local networks and liaises with the regional economic partnerships etc will likely generate no revenue for the HEI but is a worthwhile KE activity. Such networks may, among other things, facilitate innovation among SMEs and build the reputation for the HEI's other KE activities. HEIF funding has, in these cases, provided the necessary funding to allow these activities to develop.

3.3.53 HEIF funding has also impacted the breadth of coverage of knowledge exchange capacity and capabilities. It has allowed HEIs to target their KE support services internally to a greater number of departments and target a greater number of sectors than otherwise would have been the case. It has also facilitated the development of a wider portfolio of KE products and unlocked opportunities in areas that were hitherto unexploited. An increasing number of HEIs are conducting market research to better

understand their target markets and validate the nature of demand that their KE portfolio can satisfy, thus helping to ensure that their KE products and services are better targeted.[30] This has been greatly facilitated by the KE staff that HEIF funding has enabled HEIs to employ.

3.3.54 In a number of cases, while the amount of HEIF funding being allocated to infrastructural developments, such as a science park or a knowledge exchange office, was small, it provided the catalyst for the initiative to proceed. The initial competitive bidding rounds of HEIF funding also provided a good opportunity for HEIs to explore the variety of organisational and infrastructural needs that were required for knowledge exchange to develop within their institutions. The criteria and associated government campaign, regardless of the amount of funding available compared to other sources, helped to catalyse the thinking of the senior management of some HEIs towards developing and implementing knowledge exchange capabilities and capacity, and created an internal campaign around which interested parties could rally.

3.3.55 HEIF funding has also been instrumental in creating an integrated approach to knowledge exchange. This is an important development from the previously ad hoc knowledge exchange engagements by pockets of academics without much awareness of each other's activities. The infrastructure and organisational structures that HEIF funding enabled and facilitated meant that HEIs could begin to offer much more coordinated, flexible and integrated delivery mechanisms than the previously fragmented systems. This infrastructure, along with the development of networks of HEIs facilitated through the collaborative HEIF investments, has facilitated the sharing of best practice to a much greater degree than previously.

3.3.56 HEIs are also allocated HEIF funding for marketing and public relations activities. This, alongside the mere presence of a funding stream dedicated to knowledge exchange, has helped to raise the profile of the role that HEIs can play in regional, national and international innovation systems. It has helped some HEIs to create a clear identity for their KE portfolio and helped to raise the credibility of their activities.

Importance of ring-fenced funding

3.3.57 The fact that the funding is ring-fenced for KE is an important characteristic of the HEIF funding programme and prevents the funds from being appropriated for other uses within the HEI. Some claim that this characteristic has meant that, while HEIF allocations are only a small proportion of the total overall HEFCE allocation to HEIs, it has had a large impact on HEIs.

3.3.58 In summary, without this funding, many of the KE units and infrastructure would not have existed to the same scale, while some may never have existed at all. Where these units and infrastructure would have developed, it would have taken much longer to achieve and would likely have been a much more ad hoc rather than integrated service portfolio, covering a much narrower field of knowledge exchange.

[30] PACEC (2008) *Analysis of HEIF 4 Institutional Strategies: Overview Report*, a report to HEFCE

In addition, HEIs would likely have been forced to pursue primarily those activities that generated financial returns rather than the much broader scope of economically and socially beneficial activity undertaken at present.

3.3.59 However, there is still some distance to be travelled before all HEIs have developed the required infrastructure (either internally or within networks) to maximise their impacts on the economy and society.

4 Achieving Culture Change in the HE Sector

4.1 Introduction

4.1.1 The key challenge for the HE sector third mission is how to maximise knowledge exchange to the mutual benefit of the economy, the wider community and the HEI sector. Part of this challenge is to ensure that those who already engage maximise the quality and impact of their interactions and to encourage them to do more of it. A second critical challenge is to increase the number of academics who want to engage with external organisations – i.e. the participation rate in KE activities.

4.1.2 The decision to participate is driven by a number of factors, of which two are key. Firstly, the culture of an institution will have a very large impact on whether an academic decides to undertake knowledge exchange activities. Secondly, the presence and quality of 'enabling structures' that facilitate engagement will determine whether those who want to engage are actually able to do so. These structures can be both infrastructural in nature and organisational.

4.1.3 The previous chapter showed how HEFCE third stream funding has been an important catalyst and resource for the building of many of these enabling structures over the period 2001-08. This chapter now turns to one of the most important rationales for third stream funding policies: the cultural inhibitions and lock-in problems arising from the traditional HEI norms and practices that hamper the process of knowledge exchange. The chapter looks at the culture that exists within the HE sector towards KE and how it has changed over time. It begins by exploring the motivations behind academic engagement in knowledge exchange before looking at the underlying attitudes which help to shape these motivations. It finishes by presenting the key factors that are shaping and shifting culture within the HE sector and the extent to which HEFCE third stream funding has impacted on these changes, either directly or indirectly.

Culture change in large institutions

4.1.4 HEIs historically performed two main functions: teaching and research. The emergence of knowledge exchange as a core role of HEIs unsettled this traditional culture. To fulfil the emerging role demanded of HEIs, they have had to shift their culture to one that embraces not only teaching and research, but also their translation into impacts on the economy and society.

4.1.5 However, implementing strategic change in a large organisation such as an HEI can require more than simply announcing new strategic initiatives, modifying incentive structures, and committing resources to develop infrastructure and supporting organisational structures. The persistence of existing routines, norms and values can impede the new strategic direction from being achieved. This problem is particularly acute for organisations with very strong traditions and well-established norms and values (Bercovitz and Feldman 2008) such as HEIs. Understanding the culture of an

institution and consequently how to change it in a favourable manner therefore becomes of paramount importance to the successful achievement of the strategic aims and objectives.

4.1.6 A strong, positive knowledge exchange culture at the senior management level of HEIs is therefore a critical necessary but not sufficient condition for cultural change within the rest of the institution. The actions of senior management will, in turn, influence how those in charge of faculties organise their departments and the types of outputs they demand from their staff. In addition, all staff, from senior management to academic, will be impacted by external forces which shape their value judgements and, by implication, culture.

4.1.7 Edgar Schein, one of the most prominent theorists of organisational culture, provides a very general definition of culture:

> *The culture of a group can now be defined as a pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.* (Schein 2004 p. 17)

4.1.8 Culture therefore has two key dimensions: effective adaptation to the external environment, and internal integration that permits the functioning of the organisation and the external adaptation. More specifically, according to Schein culture can broadly be thought of as the norms, values, behaviour patterns, rituals and traditions, and can be categorised in various ways:[31]

- *Observed behavioural regularities when people interact* – the language they use, the customs and traditions that evolve, and the rituals they employ in a wide variety of situations.
- *Group norms* – the implicit standards and values that evolve in working groups.
- *Espoused values* – the articulated, publicly announced principles and values that the group claims to be trying to achieve, such as 'excellence in research' or 'achieving greatest economic and social impact'.
- *Formal philosophy* – the broad policies and ideological principles that guide a group's actions towards employees, clients and other stakeholders.
- *Rules of the game* – the implicit, unwritten rules for getting along in the organisation; 'the ropes' that a newcomer must learn in order to become an accepted member; 'the way we do things around here'.
- *Climate* – the feeling that is conveyed in a group by the physical layout and the way in which members of the organisation interact with each other, with clients or with other outsiders.
- *Embedded skills* – the special competencies displayed by group members in accomplishing certain tasks, the ability to make certain that things get passed on from generation to generation without necessarily being articulated in writing.

[31] Adapted from Schein (2004) *Organizational Culture and Leadership* (Third Edition), San Francisco: Jossey-Bass

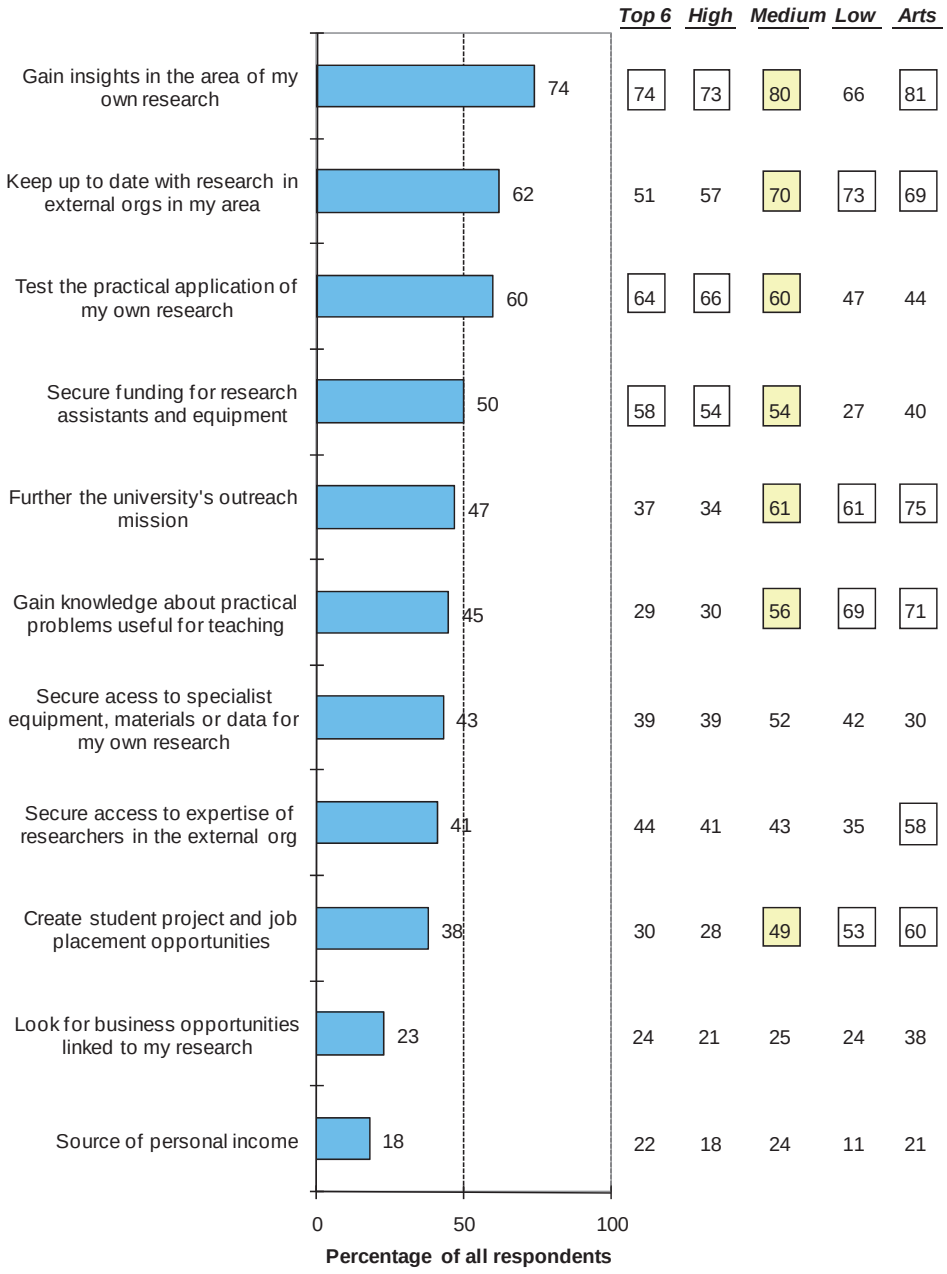
- *Habits of thinking, mental models and linguistic paradigms* – the shared cognitive frames that guide the perceptions, thought and language used by the members of a group and taught to new members in the early socialisation process.
- *Shared meanings* – the emergent understandings created by group members as they interact with each other.
- *'Root metaphors' or integrating symbols* – the ways in which groups evolve to characterise themselves, which may or may not be appreciated consciously but become embodied in buildings, office layout and other material artefacts of the group. This level of the culture reflects the emotional and aesthetic response of members as contrasted with the cognitive or evaluative response.
- *Formal rituals and celebrations* – the ways in which a group celebrates key events that reflect important values or important 'passages' by members, such as promotion, completion of important projects and milestones.

4.1.9 Schein (2000) also makes an important distinction between the *culture* of an institution, which is characterised by the above dimensions, and its *climate*. Policy makers and managers in organisations are increasingly talking about creating new or changing existing cultures and about the impacts of their culture on performance. However, the substance of much of these discussions is about changing the climate of the organisation. That is, the "embedded physical look of the [organisation], the emotionality exhibited by employees, the experiences of visitors or new employees upon entry, and myriad other artefacts that are seen, heard, and felt" (Schein 2000 p. xxiv). The climate is driven by underlying cultural assumptions; hence if an organisation wishes to create a climate that is more conducive to knowledge exchange, it must confront the deeper, underlying cultural assumptions that characterise the institution.

4.2 Motivations for engaging in knowledge exchange

4.2.1 The motivations for engaging in knowledge exchange provide insights into the reasons why academics are embracing such activities, and hence into the culture that is emerging within institutions. In addition, they provide evidence on whether knowledge exchange activities are being embraced as core activities *in their own right* or whether they are seen more as supporting the activities of teaching and research.

Figure 4.1 **Academics' motivations for engaging in knowledge exchange activities with external organisations (% respondents citing motivation as important or highly important)**



Source: PACEC/CBR survey of academics 2008

4.2.2 Overall, the motivation for academic engagement in KE activities was associated more with the perceived benefits to the academics' research programme than to their commitment to the third stream mission, although 47% of academics reported engagement in KE to further the HEI's outreach mission (Figure 4.1). However, when asked whether they were interested in the commercial application of their research,

only a minority of 20% said that they were not interested. These conclusions were not affected by age or seniority of academics.

4.2.3 The emphasis on research benefits from KE was also reflected in the disconnect in the motivations for engaging in knowledge exchange activities between the higher research HEIs (those in the top 6 and high research clusters) and lower research intensive and arts clusters (low and arts). Those in the medium research intensity cluster shared some features of both types (Figure 4.1).

4.2.4 The key motivations for engaging in knowledge exchange activities for the higher research intensity HEIs were to:

- gain insights in the area of my own research
- test the practical application of my own research
- secure funding for research assistants and equipment.

4.2.5 These motivations focus primarily on advancing academics' research and the application of this research to external organisations. Gaining insights into their research, which nearly three-quarters of academics believed to be the most important motivation for engaging, also increases in importance as the nature of the research becomes more applied. As indicated by many of the case study HEIs in these higher research clusters, engagement in knowledge exchange could not come at the expense of research quality. Owing to the time constraints on academics, the increased willingness to participate in knowledge exchange, and the pressures on the HEIs to maintain their research quality, it is therefore unsurprising that academics focus their motivations for knowledge exchange on advancing their research and its application to industry, the public and charitable sectors and society.

4.2.6 The most important motivation for academics in the lower research intensity and arts HEIs was similarly to gain insights into their research. However, the other important motivations differed considerably and were to:

- keep up to date with research in external organisations in my area
- further the HEI's outreach mission
- gain knowledge about practical problems useful for teaching
- create student project and job placement opportunities.

4.2.7 Academics in lower research intensive and arts HEIs appear to be motivated by furthering their HEI's outreach mission, supporting their teaching efforts and growing the opportunities for their students through placements. These motivations, again, reflect the overall strategic stance of their HEIs, which were shown in the previous chapter to be much more focused on promoting access to education and meeting regional skills needs, and much less on research (Table 3.2).

4.2.8 Lastly, arts HEIs viewed securing access to the expertise in external organisations as a highly important/important motivation for engaging in knowledge exchange. Once again, this is entirely consistent with the nature of their work. Arts-based disciplines are, by their nature, very applied and therefore require very close interactions with

professional practices. Without this interaction, students would not be taught the relevant skills required by employers in these sectors.

4.2.9 It is very interesting that only 18% of academics were motivated by increasing their personal income, with very little variation across all clusters (Figure 4.1). Related to this, only 23% were motivated by using knowledge exchange activities to look for business opportunities for their research (which, by implication, would lead to additional sources of income). This suggests that those who engage in knowledge exchange activities are not necessarily motivated by financial rewards that they generate, but rather by the benefits engagement delivers either to what they perceive as their core activities, or to the wider strategic mission of the HEI (e.g. the 47% of academics who are motivated by furthering their HEI's outreach mission). This has potentially important implications for the design of incentive structures where academics are engaged in research, teaching and knowledge exchange activities.

Embeddedness of a positive knowledge exchange culture

4.2.10 The case studies suggest that the culture in HEIs towards greater engagement in knowledge exchange is in a transient phase and that neither the process of cultural shift nor that of embeddedness of a knowledge exchange culture are complete. The majority of senior management interviewed believed that significant progress has been made in embedding a culture which both accepts and rewards KE activities, but it was also recognised that there is still some way to go before such a culture is completely embedded. Evidence gained from the case studies also suggests that the tide would be hard to turn back. Approximately three-quarters of those interviewed believed that knowledge exchange activities would continue in the absence of HEFCE funding, albeit most likely on a reduced scale. A top six research HEI noted that many of those academics engaged with the third stream have become so used to the benefits they derive from it that it would be almost impossible to return to the pre-HEIF level of engagement.

4.2.11 There is also some evidence to suggest that there are diminishing marginal returns to culture change towards greater KE engagement. The case studies revealed that HEIs that have historically been close to external organisations (such as arts HEIs and dedicated science and technology institutions) have seen systematically less cultural shift than those without a long-term tradition of third stream engagement.

4.3 Revealed academic attitudes towards knowledge exchange

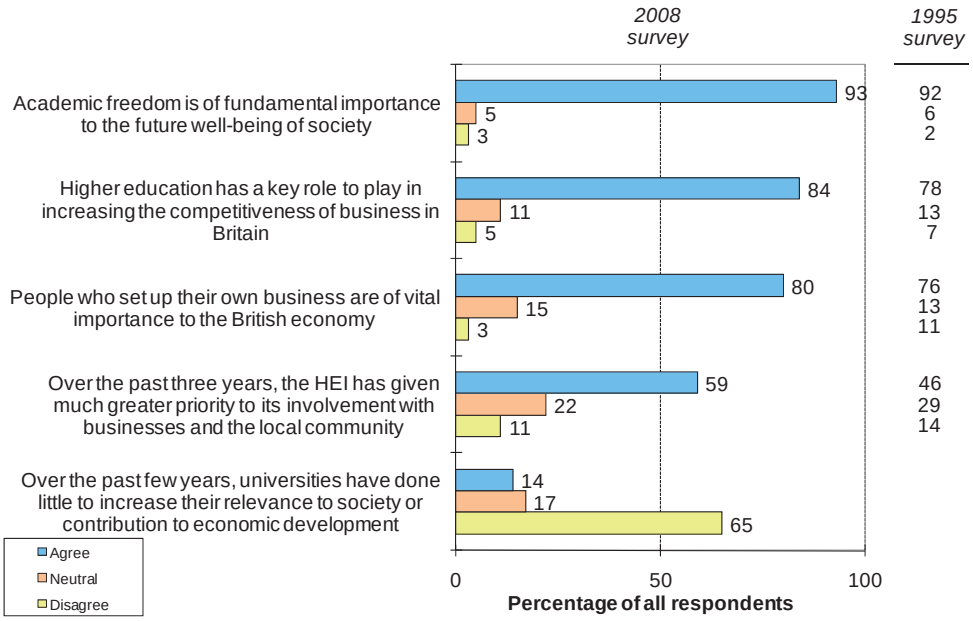
4.3.1 Motivations and attitudes towards engagement in knowledge exchange are likely to be heavily influenced by the value system within which academics work. Insights into their attitudes and values may be revealed by their responses to a number of key statements relating to knowledge exchange and the role of HEIs in the economy and more widely in society. An important objective of the survey of academics and external organisations was to assess the current attitudes and values of academics and how they vary across HEIs and types of academics. Academics' views and those

of external organisations were sought on 18 different statements. In order to establish the extent to which attitudes and values have changed in the period since strengthened third stream policy, comparisons are made with responses to the same questions in a survey of academics undertaken in 1995 (Scottish Enterprise 1996). This study thus provides powerful new evidence on the *change* in attitudes over the past 13 years, importantly covering the periods pre- and post-HEFCE third stream funding.

Academic attitudes on the role of HEIs in the innovation ecosystem

4.3.2 There was wide acceptance among academics that higher education has a key role to play in the competitiveness of businesses in Britain (Figure 4.2). The share of academics agreeing with this statement increased slightly from 78% to 84% between 1995 and 2008. In addition, almost all academics believed that academic freedom is of fundamental importance to the future well-being of society, with little change in this view over time.

Figure 4.2 Attitudes on the role of HEIs and the perceptions of change

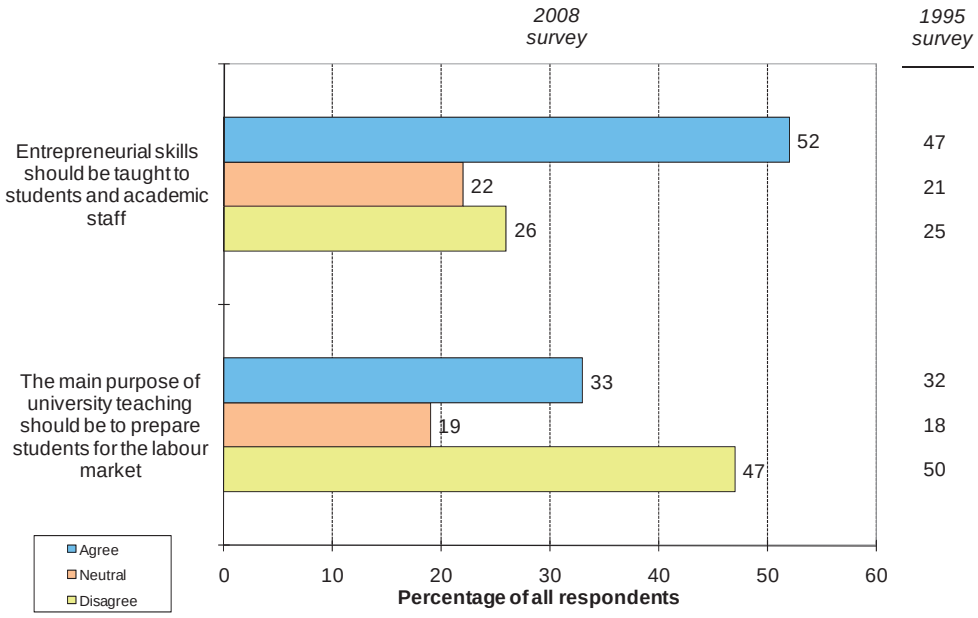


NB: Respondents were able to provide a response of 'Don't know' to the statement, hence the sum of 'agree', 'neutral' and 'disagree' may not equal 100
Source: PACEC/CBR survey of academics 2008

4.3.3 Most academics also agreed that entrepreneurship is of vital importance to the British economy, again increasing only slightly over the period. However, the share of academics disagreeing with this fell from 11% in 1995 to just 3% in 2008. Academics also now perceive that their HEIs are achieving their strategic aims of contributing to both the economy and society. They also believe that their institutions have given much greater priority to involvement with businesses and the local community over the past three years. Agreement with this view has increased substantially over the period, from 46% of academics in 1995 to 59% in 2008 and is most pronounced in low research intensity HEIs, where 74% of academics agreed with it. The perception

among academics, therefore, is that HEIs are implementing their strategic aims and objectives to increase their impact on the economy and society partly through greater engagement with external organisations.

Figure 4.3 Attitudes towards teaching



NB: Respondents were able to provide a response of 'Don't know' to the statement, hence the sum of 'agree', 'neutral' and 'disagree' may not equal 100
Source: PACEC/CBR survey of academics 2008

4.3.4 Only one-third of academics believed that the main purpose of academic teaching should be to prepare students for the labour market (Figure 4.3). Unsurprisingly, this increased to almost half of academics in the low research intensive HEIs, whose strategic missions are much more geared towards teaching than research. There has been little change in this view over the period 1995-2008. In addition, over half of academics in most clusters (except the high research cluster) believed that both staff *and* students should be taught entrepreneurial skills, thus helping to increase preparedness for the labour market, with this attitude increasing in prevalence over the period.

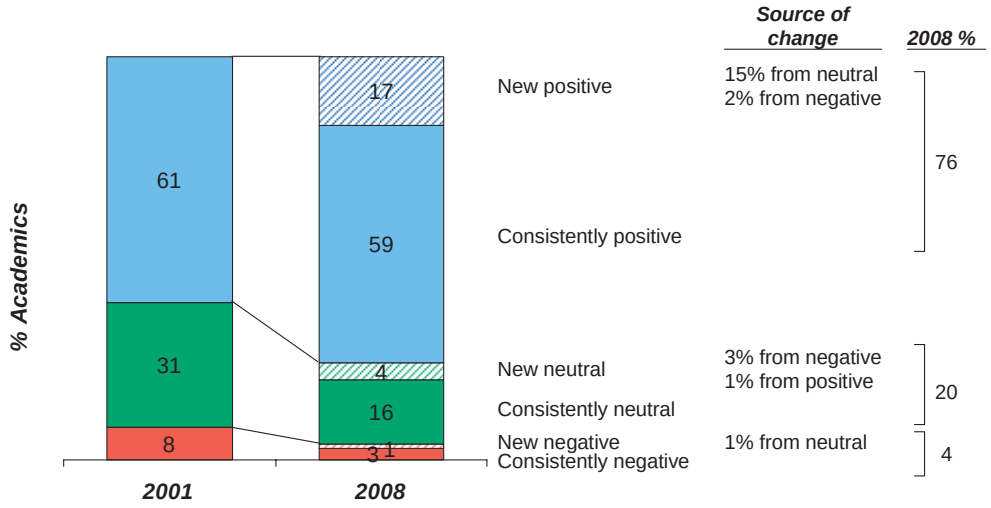
Perceptions of knowledge exchange as a legitimate activity

4.3.5 There have been significant changes in the perceptions of academic staff of how engagement in knowledge exchange is viewed by other academic staff within the HEI. Such changes reflect the extent to which there have been cultural and attitudinal shifts within the academic population that supports knowledge exchange as a 'legitimate' mission alongside teaching and research. Figure 4.4 shows that, overall, the culture towards knowledge exchange activities has become significantly more positive over the period 2001-08 (76% of academics now perceive a positive culture compared with 61% in 2001).

4.3.6 An analysis of the perception of changes in attitudes over the period showed that 15% of the 'switchers' came primarily from those who had a neutral position towards

KE activities in 2001, while 2% came from those who perceived such activities negatively. Only 2% of academics gained a more negative perception over the period.

Figure 4.4 Overall perception of cultural change among academics towards greater engagement in knowledge exchange

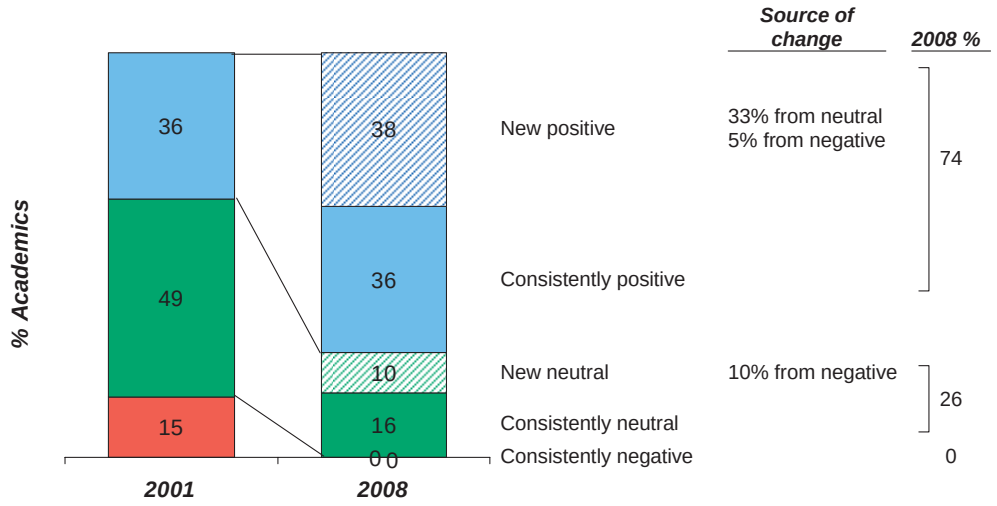


Number of respondents: 786
Effective sample size: 467
Source: PACEC/CBR survey of academics 2008

4.3.7 There are a number of differences in the extent of overall culture change among different types of HEIs and academics. Firstly, arts HEIs appear to have witnessed the largest change in culture since 2001[32] (Figure 4.5). The share of academics in these HEIs perceiving a positive KE culture increased from 36% in 2001 to 74% in 2008.[33] The majority of switchers once again came from those who tolerated such activity in 2001, with few making the switch from negative to positive. In addition, 10% of academics who perceived a negative KE culture in 2001 now perceived that such activities are tolerated.

[32] Although caution should be exercised with this result because of the relatively small sample size.
[33] One has to be cautious with this result because of the small sample size for academics from arts HEIs.

Figure 4.5 Overall perception of culture change among academics in arts HEIs towards greater engagement in knowledge exchange



Number of respondents: 17
Effective sample size: 19
Source: PACEC/CBR survey of academics 2008

Table 4.1 Differences in perceived legitimacy across disciplines and those with management responsibilities

		Percentage of all respondents				
Departments	Total	Consistently positive	Consistently neutral	Consistently negative	Positive shift	Negative shift
Science	61	**66**	59	43	55	56
Humanities* and arts	39	**34**	41	57	45	44
Number of respondents	1,157	464	122	21	160	19
Effective sample size	637	263	73	12	105	18

		Percentage of all respondents				
Management responsibilities	Total	Consistently positive	Consistently neutral	Consistently negative	Positive shift	Negative shift
Yes	53	**60**	56	43	**68**	46
No	47	**40**	44	57	**32**	54
Number of respondents	1,088	440	119	21	143	18
Effective sample size	610	255	70	12	110	17

* Humanities includes social sciences/economics, business/financial studies, creative arts, education and other humanities subjects
Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008, PACEC/CBR analysis

4.3.8 Differences in the acceptance of knowledge exchange as a legitimate activity are also seen across departments, with those in science-based disciplines almost twice as likely to have had consistently positive attitudes as those in humanities (including social sciences and economics), languages and the arts. Similarly, those with management responsibilities were much more likely to have been consistently positive over the period (Table 4.1).

Profiling the academic 'switchers'

4.3.9 A profile of the switchers shows that the majority who perceived a more positive attitude towards knowledge exchange over the period had been at their institution for more than six years, and were more likely to be professors. In addition, the switchers in both the positive and negative directions typically came from the science disciplines.

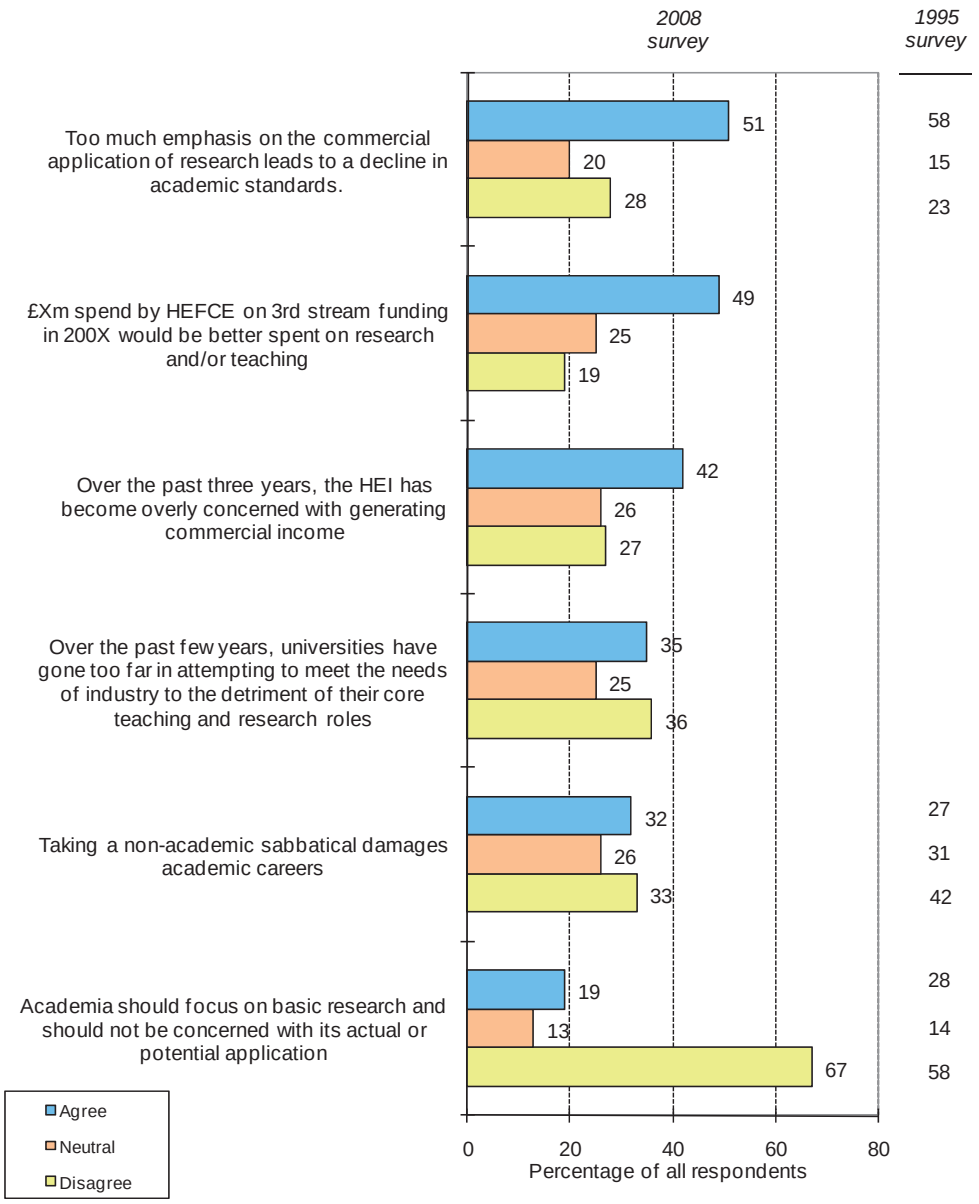
4.3.10 Academics who have previously had experiences with knowledge exchange, those who are currently working closely with external organisations and those who have been pro-active about getting involved with knowledge exchange (e.g. through helping in preparing bids for knowledge exchange funding) were more likely than average to have become more positive about KE engagement. Worryingly, it is also the academics in these groups who were likely to perceive a more negative knowledge exchange culture than in 2001 (although the 'negative switchers' are a small and decreasing share of all academics).

4.3.11 The positive switchers are more likely than the average academic to engage with external organisations using the following modes of interaction:

- providing CPD
- contract research (original research done by the HEI alone)
- consultancy (no original research undertaken)
- joint curriculum development
- preparing joint publications with individuals from external organisations
- membership of advisory boards to external organisations
- giving public lectures for the community.

4.3.12 Evidence on the legitimacy of knowledge exchange activities is also provided by the impact on the careers of academics by pursuing these activities. The case studies suggested that there were many fewer, if any, negative repercussions for the careers of academics who included KE activities within their wider portfolio.

Figure 4.6 The role of knowledge exchange alongside teaching and research



NB: Respondents were able to provide a response of 'Don't know' to the statement, hence the sum of 'agree', 'neutral' and 'disagree' may not equal 100
Source: PACEC/CBR survey of academics 2008

4.3.13 Academics increasingly disagree with the statement that academia should focus on basic research and should not be concerned with its actual or potential application, with 67% disagreeing with this statement today compared with 58% in 1995 (Figure 4.6). This rises to 81% of academics in low research intensity HEIs, which is unsurprising given their more applied research and teaching focus. This evidence suggests an increased acceptance of knowledge exchange as a legitimate activity for HEIs and/or individual academics. In addition, 51% of academics thought that too much emphasis on the commercial application of research leads to a decline in

academic standards, although the number sharing this view has decreased from 58% in 1995. This view was highly correlated with the research intensity of the cluster, with almost two-thirds of academics in the top six research cluster agreeing with it compared with just 44% in low research HEIs and 22% in arts HEIs.

4.3.14 However, there was much less consensus on whether HEIs have gone too far over the past few years in attempting to meet the needs of external organisations to the detriment of their teaching and research roles. Approximately one-third of academics agreed with this and a similar number disagreed. More academics in the higher research clusters agreed with this view while a greater share of academics in the medium and low research and arts clusters disagreed with it. Importantly, half of academics believed that the money spent by HEFCE on third stream funding would be better spent on research and/or teaching. Once again, academics in the higher research clusters were more likely to agree with this (53% of academics in the top six research cluster, 50% in high and 54% in medium research HEIs) compared with just over a third of academics in the low research and arts clusters.

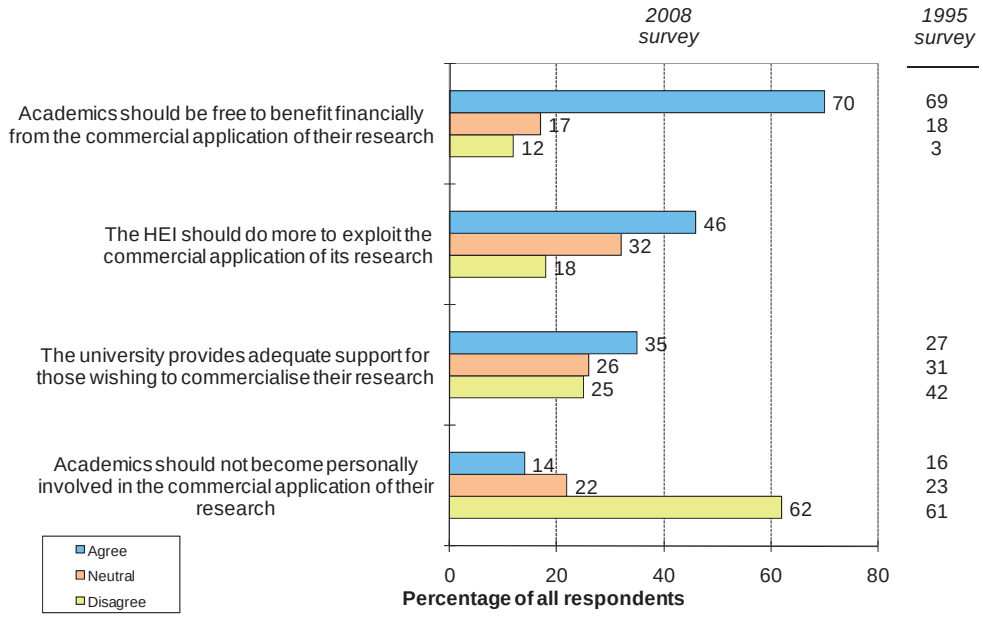
4.3.15 It is therefore becoming clear that while a culture towards embracing knowledge exchange is developing, it *cannot* come at the expense of academic freedom, and that there may be important negative effects on the quality and capacity of an HEI's teaching and research activities if it focuses too much on the commercialisation of its research. Given that much of the national and global reputation of institutions rests on the quality and quantity of their teaching and research, the fine balance between these emerging priorities for HEIs becomes paramount. The evidence suggests that academics in the higher research clusters believe that the balance has shifted too far towards industrial engagement and would prefer that HEFCE reallocate the funding towards research and teaching activities. Those in the lower research and arts clusters perceive that there is greater room for increased engagement. In addition, 44% of academics in the top six research cluster believe that their HEIs have become too concerned with generating commercial income, compared with 38% in the low research cluster and just 30% in the arts cluster.

4.3.16 However, while a more positive culture seems to be developing in most clusters, there is still resistance to taking non-academic sabbaticals, with approximately one-third of academics believing that it would damage their academic careers. Worryingly, this has increased over the period 1995-2008, up from 27% initially. Similarly, the share of academics believing that it does not harm their careers has decreased from 42% in 1995 to 33% currently. Non-academic sabbaticals are viewed as least damaging in the low research and arts clusters (where knowledge of professional practice is an important part of course content). Therefore, while knowledge exchange is being encouraged and becoming more commonplace, there is still very limited movement between external organisations and academia in most HEI clusters. This inevitably limits the flow of both *knowledge* and *understanding* of each other's requirements – an important criterion for aligning HEI research objectives with long-term needs of external organisations. Increasing the understanding of the limitations of both the research being carried out within the HE sector and the

application of the research to industrial needs is extremely important for increasing the overall demand for HEI-derived knowledge.

Attitudes towards the commercialisation of research

Figure 4.7 Attitudes towards commercialisation of research



NB: Respondents were able to provide a response of 'Don't know' to the statement, hence the sum of 'agree', 'neutral' and 'disagree' may not equal 100
Source: PACEC/CBR survey of academics 2008

4.3.17 Figure 4.7 shows that nearly half of academics believed that their HEI should do more to exploit the commercial application of its research. Superficially, this appears to contradict the evidence presented in Figure 4.6 that shows 42% believing that their HEI has become overly concerned with generating commercial income over the past few years. In addition, a sizeable number of academics agreed with *both* of these statements. A plausible reconciliation is that academics want to see increased commercial exploitation of their research, and be involved in the process (see Figure 4.7), but that the objective function of this process should *not* be governed by the amount of income that it can generate but rather the benefits that it can deliver to industry, the public and charitable sectors and society.

4.3.18 Where research can be commercialised, almost two-thirds of academics disagreed that they should not become personally involved with its commercialisation. In addition, seven out of every 10 academics believed that they should be free to benefit financially from the commercialisation of their research. These views have changed little since 1995 and show little variation across clusters. They suggest that academics want to learn more about, and become more greatly involved in, the knowledge exchange process. It also provides strong evidence on the importance of financial incentives for increasing engagement. However, the share of academics disagreeing that they should be free to benefit financially from research commercialisation increased substantially from just 3% in 1995 to 12% in 2008.

4.3.19 In terms of HEIs' capability to engage with external organisations, approximately one-third of academics believed that there is adequate support for the commercialisation process, while a quarter disagreed with this view. Over half of academics in the top six research cluster believed that their HEI provides adequate support, compared with a third of academics in the high and medium research HEIs and just 20% in the low research cluster. One explanation for the difference is that HEIs in the top six research cluster have largely had a much longer history of KE engagement. The low perception of support among the remaining clusters is concerning given the amount of investment that their HEIs have made into infrastructure and knowledge exchange processes. However, it is possible that these investments require fairly sizeable time lags between setup and impacting on academics. Firstly, the setup process from investment allocation to completion of infrastructure may take over a year. Secondly, once up and running, the KE unit may require a 'learning' period during which it improves its efficiency and processes, continually learning the best way with which to work with academics. Lastly, the newly created infrastructure will require internal marketing to academics to advertise its services and create 'buy-in'. Failing this, academics will continue to bypass the infrastructure and either not engage in the commercialisation of their research or attempt to run the process themselves, both of which would lead to the perception of inadequate support.

4.4 Internal factors influencing cultural change

4.4.1 It was argued earlier that the motivation for engaging in knowledge exchange is influenced by the value system of academics. The previous section also showed that this has shifted somewhat between the period prior to HEFCE investments in knowledge exchange, and post-investments. The chapter now turns to the drivers of these changes in attitudes towards knowledge exchange and its position alongside teaching and research.

Embracing knowledge exchange by the leadership of HEIs

4.4.2 The strategic mission for knowledge exchange has a powerful influence over the culture of an overall institution. It can impact the overall organisational structures put in place to achieve the objectives, the allocation of resources made by the heads of faculties and the development of particular types of infrastructure. The actions taken by the leadership to implement the strategy, such as the statements they make and the structures they choose to invest in, provide visible evidence to academics of their value judgements and the norms they expect to exist within the institution. The nature of the strategy and the actions of the leadership in subsequently implementing it will ultimately determine what types of academics can succeed within the institution, and what types of academics are recruited. This will have a very strong impact on the culture that exists within the institution and on the norms and value systems that prevail.

4.4.3 The knowledge exchange mission appears to be embedded at the senior management level within the HE sector. It is vigorously supported at the pro vice-

chancellor/vice-chancellor level of the HEI, with many of those interviewed strongly in favour of greater participation and developing a greater role for the HEI in delivering economic and societal benefits.

4.4.4 HEIs in the medium and low research clusters now typically see very little opposition to knowledge exchange, with the senior management fully approving of this mission. At one medium research cluster HEI, a dedicated team was set up to conduct a broad-based consultation across the HEI, looking at its knowledge exchange engagements, to inform the latest strategy. Unsurprisingly, some of the higher research intensive HEIs still experience some opposition towards the knowledge exchange agenda. Despite this, many HEIs have introduced board-level posts with the remit for enterprise and commercialisation.

4.4.5 However, achieving the necessary shifts in the strategic objectives towards the knowledge exchange mission met with initial opposition at the senior management level in approximately half of the case study HEIs. Those in the high research and low research clusters were most likely to have initially opposed change. Arts HEIs have always been closely engaged with external organisations because of the nature of their work, and saw limited or no opposition to any changes in the balance between teaching, research and knowledge exchange. Former polytechnics also experienced much less opposition to the strengthening of the knowledge exchange mission than other HEIs. However, some HEIs given university status in 1992 also focused heavily on developing and improving their research base with aims of becoming research-focused HEIs. In these cases, research was and is still seen as the primary objective for the HEI, with knowledge exchange activity remaining of secondary importance.

Changing promotion and assessment criteria

4.4.6 An important mechanism that some HEIs have used to validate knowledge exchange as a worthwhile activity for academics is to incorporate it as part of an academic's workplan and the overall planning cycle. In addition, a number of HEIs have taken a step further and recognised knowledge exchange as a career goal for some academics. To this end, they have introduced new pathways to professorship through enterprise and engagement in knowledge exchange. In such cases, assessments are typically flexible, based on the three streams of activity with care taken not to constrain any of them for any individual academic. There is also care not to enforce these changes on all academics, rather recognising that the institution must cater for academics with differing objectives relating to research, teaching and engagement in knowledge exchange. Many HEIs recognise that some academics should focus on research and/or teaching and have less engagement with external organisations, while others can, and should, focus more heavily on KE engagement and relatively less on research or teaching. Given this overall attitude, the goal has now become to increase academics' willingness to participate.

4.4.7 The criteria by which academics are promoted and assessed provide a good indicator of the culture that the HEI *would like* to develop in relation to different types of activities. These criteria provide a powerful indication and incentive to academics of

the values that senior management places on each activity within the portfolio. Traditionally, academic promotion has been through the strength of academic research and teaching, with little room for knowledge exchange activities. However, it is clear that knowledge exchange is emerging as an important component of promotion and assessments across the HE sector (Table 4.2).

Table 4.2 Changes in perceived importance of different promotions criteria 2001-08 (mean score of the perceived weight placed on each criterion by HEI for promotion: 0: low to 5: high)

		Total	Cluster				
			Top 6	High	Medium	Low	Arts
Research/publications	**2008**	**4.1**	**4.8**	**4.7**	**3.9**	**2.7**	**3.7**
	Change	0.2	0.2	0.1	0.3	0.5	1.5
Generating commercial income for the HEI	**2008**	**3.3**	**3.2**	**3.2**	**3.6**	**3.2**	**3.3**
	Change	0.8	0.7	0.6	0.9	1	1.2
Faculty/departmental administration	**2008**	**2.6**	**2.2**	**2.3**	**2.8**	**3.1**	**3.2**
	Change	0.2	0.3	0.2	0.3	-0.1	0.3
Teaching ability/workload	**2008**	**2.3**	**2.2**	**2.3**	**2.3**	**2.6**	**2.9**
	Change	0.1	0.2	0.3	0.1	-0.2	-0.5
Work with business/ industry	**2008**	**2.3**	**2.4**	**2**	**2.4**	**2.6**	**3.3**
	Change	0.6	0.6	0.5	0.6	0.7	1.1
Work with the local community	**2008**	**1.6**	**1.1**	**1.2**	**1.7**	**2.5**	**2.2**
	Change	0.4	0.2	0.2	0.4	0.9	0.7
Number of respondents		751	145	281	186	122	17

Note: Change refers to the change in mean ranking between 2001 and 2008
Source: PACEC/CBR survey of academics 2008, PACEC/CBR analysis

4.4.8 Overall, academics perceived research and publications to be the most important promotion criterion, followed by generating commercial income for the HEI, faculty administrative duties, teaching ability and workload, and finally working with business and the local community. However, while the importance of the more traditional promotion criteria of research and teaching has remained approximately constant over the period 2001-08, criteria relating to engaging with external organisations have increased substantially since 2001.

4.4.9 There are a number of important differences between different types of HEIs. Firstly, HEIs in the top six and high research clusters viewed research and publications to be of paramount importance compared with the medium and low research intensity and arts HEIs, which have a more balanced set of promotions criteria. This is unsurprising as the reputations of many of the top research HEIs are predicated on their research quality, and while they view knowledge exchange as an important mission it cannot come at the expense of research quality. Their promotions criteria therefore reflect these values. Most HEIs studied in the top six research cluster believed that while knowledge exchange should be encouraged, promotion and assessment should be based primarily on research. That said, many of these institutions have introduced some changes either implicitly in the way in which assessments are carried out, or explicitly with particular sections relating to knowledge exchange included in the appraisal. Interestingly, arts HEIs have seen a large increase in the importance of

research and publications in promotions criteria, and a significant decrease in importance of teaching ability and workload over the period.

4.4.10 Lastly, there is some evidence that HEIs are beginning to alter their recruitment criteria, either informally or formally, and increasingly recruiting candidates with stronger industrial credentials. However, there still appears to be limited movement between external organisations and academia and vice versa, particularly in the higher research intensive HEIs.

4.4.11 In summary, there are a number of different views emerging in the HE sector regarding the extent to which academics should be made to engage with external organisations:

- All academics should be looking to engage, with participation forming part of their contract and promotions criteria.
- Academics should have an overall balance between the three streams and are assessed on a balance. They must excel in particular streams but not all.
- Academics should be incentivised to engage, but it should not be compulsory. Those who are keen to engage should do so; those who are primarily driven by research should not be forced to undertake third stream activities.

Incentives for knowledge exchange engagement

4.4.12 The incentives that are provided to staff to carry out their duties are important instruments for influencing academic attitudes and culture. Table 4.3 shows the overall level of incentives offered to academics within HEIs to engage with businesses, comparing them to the barriers to engagement. An analysis of the HEBCI data shows that there has been clear progress in developing incentive schemes over the period 2001-07, with 74% of all HEIs moving in a positive direction towards improved incentive schemes, while only 9% shifted in a negative direction. In all, 15% of HEIs now provide strong positive signals to all staff to engage, with incentive procedures well established, clearly understood and applied, compared with only 4% in 2001. HEIs in the top six and high research clusters are most likely to have such comprehensive policies already in place, with very few low research and arts HEIs in this position. However, it appears that progress is being made with these HEIs. A further 16% of all HEIs have some incentive policies in place, but are still confronted by incentive barriers to engagement. In addition, these HEIs still take a narrow view on research and teaching promotion criteria despite official guidance to treat knowledge exchange on an equal level.

Table 4.3 Level of overall incentives offered by HEIs (percentage of HEIs)

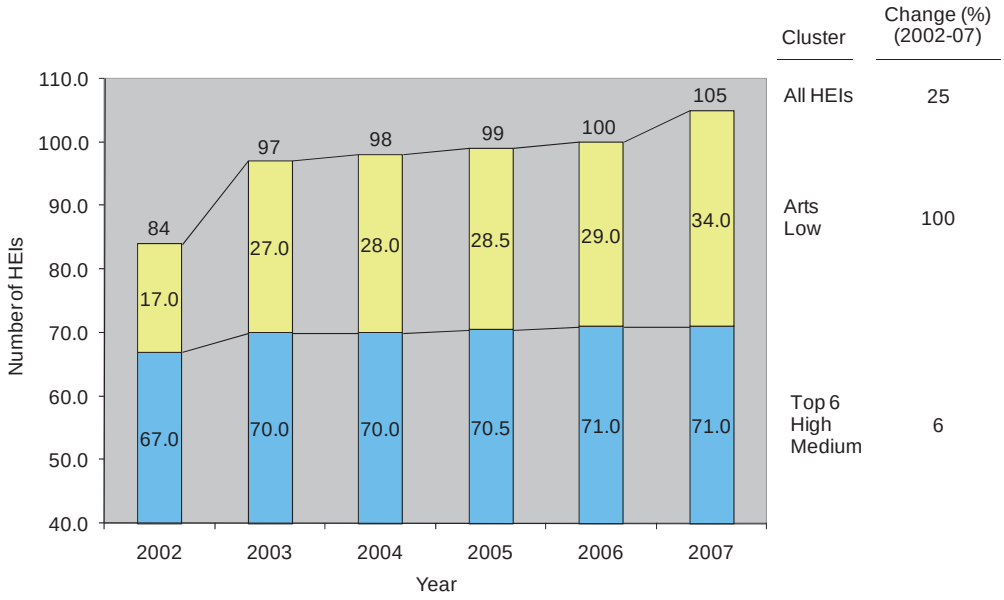
	2001	2007					
	All HEIs	All HEIs	Top 6	High	Medium	Low	Arts
1. Barriers outweigh any incentives offered. General corporate culture is focused on internal activities and narrow interpretation of teaching and research. Collaboration with business seen by staff as detrimental to career progression.	1	0	0	0	0	0	0
2. Between 1 and 3	14	8	0	3	3	14	16
3. Some incentives in place, but with some barriers remaining. Typically, policy may be generally supportive but there is a lack of understanding across the institution. Promotions committees still take a narrow focus on research even though guidance suggests industrial collaboration is valued equally.	56	16	17	15	21	20	5
4. Between 3 and 5	25	61	50	53	61	63	74
5. Strong positive signals given to all staff to encourage appropriate levels of industrial collaboration. Incentive procedures well established and clearly understood and applied.	4	15	33	**29**	15	**3**	5
Total (%)	100	100	100	100	100	100	100
Total number of HEIs	121	130	6	34	33	35	19

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEBCI surveys, PACEC analysis

IP incentives

4.4.13 Many HEIs offer financial incentives to staff for the intellectual property they generate. Figure 4.8 shows that the number of HEIs rewarding their staff has increased year on year since 2002. Most of the HEIs in the higher research clusters had such incentives in place, with the increase coming primarily from the low research intensive and arts HEIs.

Figure 4.8 Number of HEIs rewarding staff for generating intellectual property

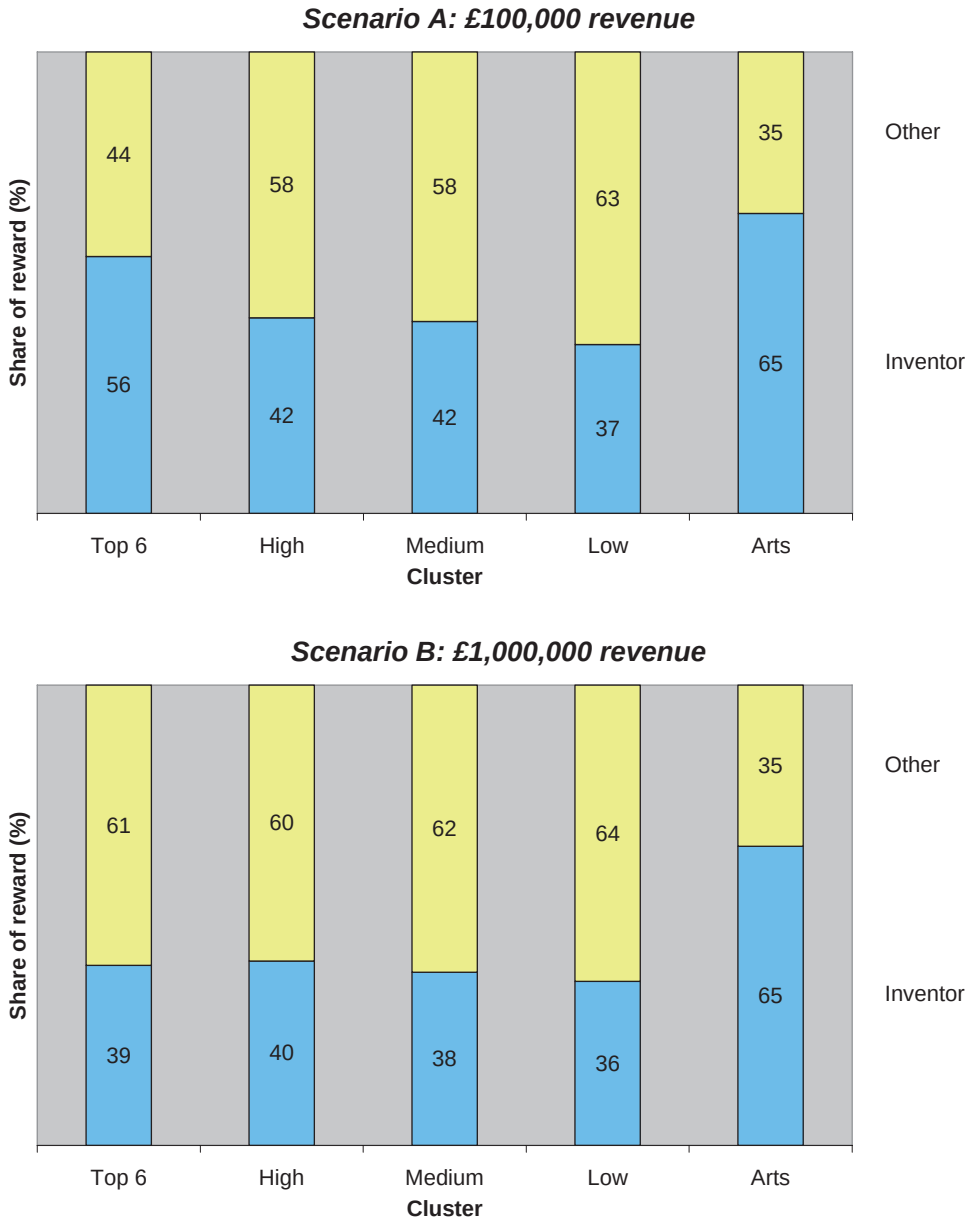


Total number of HEIs included in analysis: 130
Source: HEBCI surveys, PACEC/CBR analysis

4.4.14 The above shows that HEIs are increasingly rewarding their staff for generating IP. However, a variety of reward schemes exist in the HE sector, each with a differing structure, providing differing levels of reward to the inventor, department and HEI depending on the amount of income generated by the IP. In order to demonstrate the variability, two different scenarios have been created: in scenario A, the inventor generates IP which results in £100,000 of revenue; and in scenario B, this IP results in £1,000,000. These are presented in Figure 4.9.

4.4.15 The inventors in arts HEIs receive the largest share of the resulting rewards under both scenarios (65%). Inventors in low research intensive HEIs receive around 36% in both scenarios. However, the amount of rewards accruing to the inventors in top six research HEIs drops dramatically from 56% in the relatively low income-generating case (scenario A) to under 40% in the high income case (scenario B). Inventors in high and medium research institutions receive a similar but systematically decreasing amount as the royalties from their IP increase.

Figure 4.9 Reward structure in each cluster: two scenarios



Source: HEBCI surveys, PACEC/CBR analysis

Other important incentive mechanisms

4.4.16 Given the increasing commitments facing academics as a result of their research and teaching activities, managing their fixed 'time budget' becomes critical to ensuring that an HEI can maximise its impact through KE. To help ease the time burden, HEIs are increasingly introducing policies alongside other measures which reduce the administrative burden of engagement. These allow academics to 'buy out' their other commitments for a period of time to focus on knowledge exchange activities.[34] Examples of such funds include the ability to bid for 'time and expenses' to develop their KE capabilities, for example in consultancy, contract research and community

[34] PACEC (2008) *Analysis of HEIF 4 Institutional Strategies: Overview Report*, a report to HEFCE

outreach. A significant amount of HEIF 4 funding (15% of the £400 million allocated over three years) will be allocated to 'support for staff engagement', which includes the buying out of academic time. These funds would facilitate, for example, HEIs employing a part-time lecturer to cover for the academic while they engage in KE activity.

4.4.17 Another important incentive mechanism to encourage staff participation in KE activities is the celebration of success stories. These not only give staff the deserved recognition of their contribution to the overall impact of the HEI on the economy and society, but also serve to raise awareness of KE activities. They also highlight modes of best practice for engagement in particular areas.

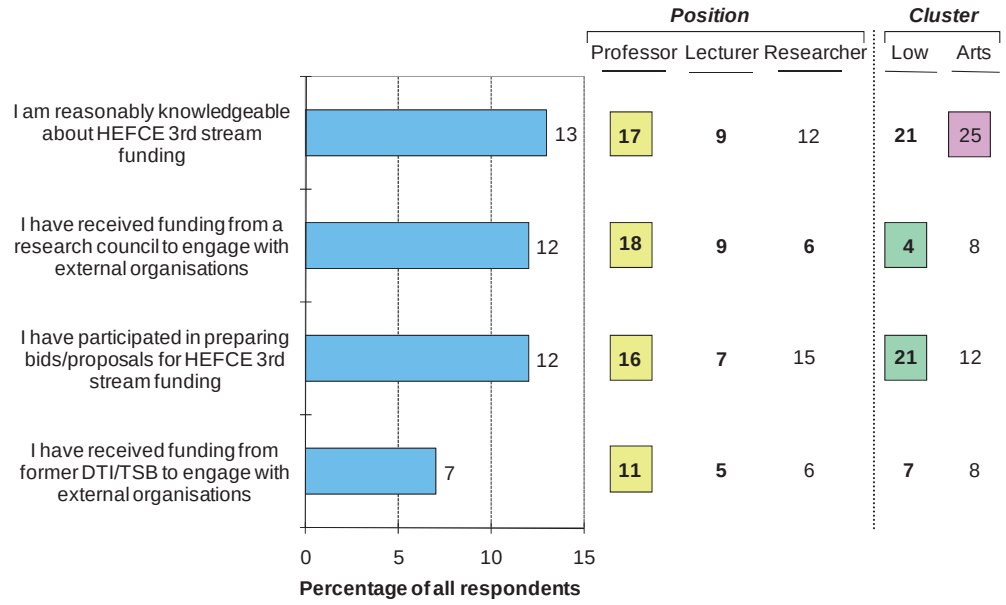
4.4.18 HEIs celebrate success in a number of different ways. Of the HEIs studied, many celebrated success through newsletters and bulletins, awards and speeches made, for example, by high-profile members of the HEI such as the vice-chancellor. Websites, events and seminars were also common methods of celebrating success. One HEI went much further, using local radio broadcasts to promote and celebrate major successes by academics in knowledge exchange. Other case study HEIs took advantage of launch events (such as the opening of buildings), postgraduate open days and research forums to showcase particular successes through displays. However, the ability to celebrate success can sometimes be limited because of confidentiality agreements and limited budgets.

Awareness of the value of knowledge exchange

4.4.19 Academics appear to be increasingly aware of the value and benefits that engagement with external organisations can bring to their careers. There is also a growing recognition of the need to protect and commercialise their intellectual property, and a better understanding of the issues surrounding commercialisation. At the same time, there is also a growing feeling that academic research should be made more accessible to the wider public. These attitudinal shifts have combined to help to foster a more open-minded approach to participating in knowledge exchange.

4.4.20 While awareness of the value and benefits of knowledge exchange engagement is increasing, very few academics appeared to be aware of government efforts in this area. Figure 4.10 shows that only 13% of academics were aware of HEFCE funding for knowledge exchange, rising to a quarter of academics for arts HEIs. Very few academics have been involved with the preparation of bids for HEFCE knowledge exchange funding. This suggests that either the bids are put together primarily at the senior management level without much consultation with academics, or that academics are unwilling to get involved in the bidding process. In addition, very few academics had received funding from research councils or other government bodies (such as the former Department for Trade and Industry or Technology Strategy Board) to engage with external organisations. Once again, this reflects either a lack of such funding, or a lack of interest by academics to apply for it.

Figure 4.10 Indicators of awareness



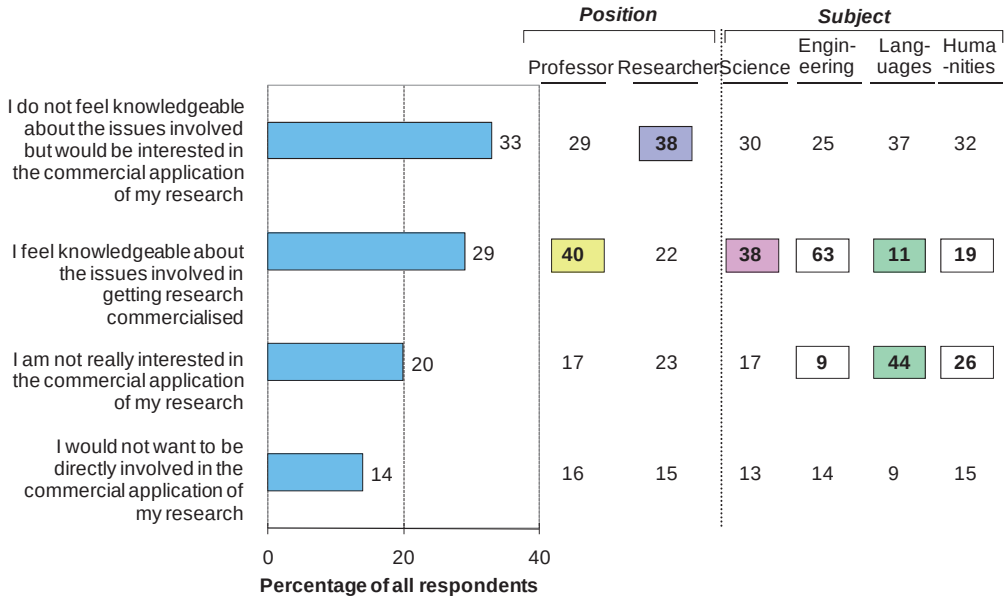
Respondents could select more than one option, so percentages may sum to more than 100
Number of respondents: total (1,128), professor (403), lecturer (487), researcher (181), low (172), arts (22)
Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008

Confidence of academics to engage

4.4.21 A lack of confidence and *perceived* lack of capability can be powerful barriers to engaging with external organisations. A key mechanism for confronting this is through the informal advice provided by those who have successfully engaged in the process to those who are less experienced or unsure.[35] HEIs are therefore investing in 'knowledge exchange champions', mentors and staff training programmes to help to overcome barriers and raise the confidence and capability of staff to engage with external organisations. Figure 4.11 shows that one-third of academics still did not feel knowledgeable about the issues involved with commercialising their research, but would be interested in its commercial application. This rises to 38% of researchers. One-fifth of respondents were not interested in the commercialisation of their research, decreasing to just 9% of engineering academics but increasing to 26% and 44% of humanities and languages respectively; 14% of academics were not interested in getting directly involved with its commercialisation.

[35] This result emerged from the case study interview programme with senior management.

Figure 4.11 Academic attitudes and confidence to engage in the commercialisation process



Respondents could select more than one option, so percentages may sum to more than 100
Number of respondents: total (1,082), professor (397), researcher (162), science (167), engineering (121), languages (73), humanities (323)
Medical, technical and other subjects are excluded as they show little significant difference to the average position
Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008

4.4.22 The evidence from the case studies suggests that as participation in knowledge exchange activities grows and training and mentoring become more widespread, there is a greater preparedness and confidence to engage. It is believed that there are significant positive network effects relating to academic engagement in knowledge exchange. The more academics that successfully engage in knowledge exchange, the easier the HEI as a whole will find it to increase engagement. For example, as the number of academics successfully engaging increases, there are more people to act as 'champions' and mentors to their peers, extolling the values and benefits of engagement.

4.4.23 The building of confidence is also helped by the celebrations of successes through various methods. Approximately 90% of the HEIs studied celebrated successes in some way, although only 30% believed that this was important for driving culture change.

Reducing the opportunity cost of knowledge exchange engagement

4.4.24 The opportunity cost of knowledge exchange engagement also appears to be decreasing. The investment in infrastructure, which has been greatly enabled through HEIF funding, has helped to provide the support infrastructure necessary to remove some of the burden of engagement from the academic. As described earlier, for example KEOs will now help in the writing of business plans, handle contract negotiations and advise on intellectual property and licensing. In some cases, HEIs

have established dedicated units which will handle the project management of the engagement to ensure that problems are minimised and progress remains on track. In addition, training for staff and mentoring through the use of knowledge exchange champions have given academics more confidence and capability for engaging. The overall professionalisation of the engagement process also helps to increase the efficiency and productivity of the engagement process. All of these factors help to relieve the time constraint facing academics, which enables them to not only continue to fulfil their teaching and research duties at current levels, but also to engage productively in knowledge exchange activities.

4.5 The impact of HEFCE third stream funding on cultural change

4.5.1 HEFCE third stream funding has played an important role in bringing about the culture shifts within HEIs through funding the enabling structures, creating campaigns which demonstrate to academics the values placed on knowledge exchange (backed by resources to engage), and through influencing the strategic direction of HEIs.

Impacting culture through funding the enabling structures

4.5.2 Many of the mechanisms through which the funding has impacted culture are indirect, working through the various drivers of culture change outlined above. It has helped to catalyse and fund the development of the enabling structures that have allowed the KE awareness-raising campaigns to take place. It has helped to fund the infrastructure that reduces the opportunity costs for engagement such as the knowledge exchange offices and other dedicated staff that facilitate the engagement. The funding has allowed HEIs to fund academics to act as knowledge exchange champions, which helps to raise the confidence to engage. It has provided the resources for funds to allow academics to buy out their existing duties to focus on developing their KE capabilities.

4.5.3 The emphasis of the funding on collaboration has also impacted the extent to which academics are willing to collaborate. While many other factors are impacting the need to become more multidisciplinary in nature, HEIF funding has facilitated many cross-cutting knowledge exchange initiatives, for example by funding the necessary infrastructure or covering the setup costs of the initiative. It has also brought together institutions that may otherwise have never collaborated. It is the successful realisation of these initiatives that helps to cement the change in culture towards a more cross-disciplined, collaborative mode of operation rather than an individualistic approach. However, a significant barrier to increasing collaborations between HEIs is the competitive view of other HEIs shared by institutions in similar fields or locations. This suggests that further culture change is required in this area to facilitate greater collaboration which may provide substantial benefits to each institution, the economy and society.

Impacting culture through developing the credibility of knowledge exchange

4.5.4 A more direct impact of HEIF funding on culture is through the actual campaign that it creates within an institution. The sustained, visible government campaign surrounding HEIF funding over many years has helped to demonstrate the value of knowledge exchange as a core activity to academics. The credibility afforded by such campaigns and financial resources has facilitated the acceptance of knowledge exchange as a legitimate activity alongside teaching and research rather than being seen as 'extra-curricular' in nature.

Impacting culture through strategic development

4.5.5 It was argued earlier that the strategic objectives and their public declaration (e.g. through the strategy document, speeches, informal discussions etc) impact on the culture within the HEI. The emphasis of the Government on knowledge exchange as a core function of HEIs, articulated and financially backed through the HEIF programme, has influenced the strategic direction of many HEIs. In some HEIs it provided the necessary focus around which it was possible to develop a broad knowledge exchange strategy alongside the teaching and research missions. The necessity of HEIs to justify how they would spend the HEIF funding helped HEIs to focus their strategic thinking on how to develop their knowledge exchange strategies, including exerting pressure on HEIs to integrate their teaching, research and knowledge exchange mission more closely. For example, the HEIF 4 institutional strategy that HEIs were required to submit for the funding to be released required them to explicitly demonstrate the integration of the three streams.

4.5.6 In addition, changes to many of the mechanisms required to achieve the strategic objectives, such as changing promotion criteria and incentive structures, have been prompted by HEIF funding and the government campaign surrounding it. These mechanisms work primarily through impacting the culture of academics.

Impacting culture through awareness

4.5.7 The creation of internal funds using HEIF funding to which academics can apply also creates internal visibility. This raises awareness of knowledge exchange as an important activity backed by the HEI. Internal marketing of these funds, alongside the support structures put in place, can also encourage academics to engage for the first time. A successful first engagement helps to develop a more positive culture.

Impacting culture through departmental structures

4.5.8 The presence of funding for knowledge exchange activities, combined with the impacts that it has had on strategy, credibility and the building of HEI-wide structures, has helped to impact the development of departments and through this the culture of academics. Where the funding has been internally devolved to departments, this has allowed them to build the necessary structures to engage with external organisations and fund departmentally-based knowledge exchange staff to facilitate and encourage engagement of academics. This facilitating environment, combined with the broader

impacts that HEIF funding has had on the overall HEI strategy (e.g. changes to promotion criteria and incentives for engagement) is helping to change how academics value knowledge exchange, moving it from a previously ad hoc, peripheral activity into the mainstream of the portfolio of activities.

5 Constraining Demand: Culture, Supply-side and Demand-side Factors

5.1 Introduction

5.1.1 The previous chapters have highlighted the importance of HEIF funding in catalysing and providing part of the necessary resources for the development of the structures that facilitate and enable interactions with external organisations. The funding has also impacted on the strategic direction and development of HEIs, which feeds down to changes in the operation of departments. The combined effect of the above, along with other pressures, has been a modest shift in culture towards embracing knowledge exchange as a mainstream activity alongside teaching and research. However, the previous chapter highlighted differences between clusters, with the shift being most pronounced in the low research intensity and arts clusters and less pronounced in the higher research clusters (particularly in the top six research cluster).

5.1.2 These positive developments in the sector, partly enabled through HEIF funding, will help to raise the participation rate and the quality of knowledge exchange engagement. However, the extent to which this rate can increase will depend on whether there is demand for such engagement and the supply-side and demand-side barriers that prevent the interactions from taking place.

5.1.3 External organisations will only demand the services of HEIs if they consider them to be competitive sources of knowledge compared with other potential sources. Demand will only materialise if the HEI offers relevant services of the desired quality *and* if the external organisation recognises the value that the HEI can offer.

5.1.4 This chapter first analyses the culture within external organisations as an important driver of the demand for knowledge exchange. It then turns to the supply-side and demand-side factors constraining the interactions, firstly from the perception of academics and then from the perception of external organisations. This discussion will complete the key drivers of participation which will form the focus of the next chapter.

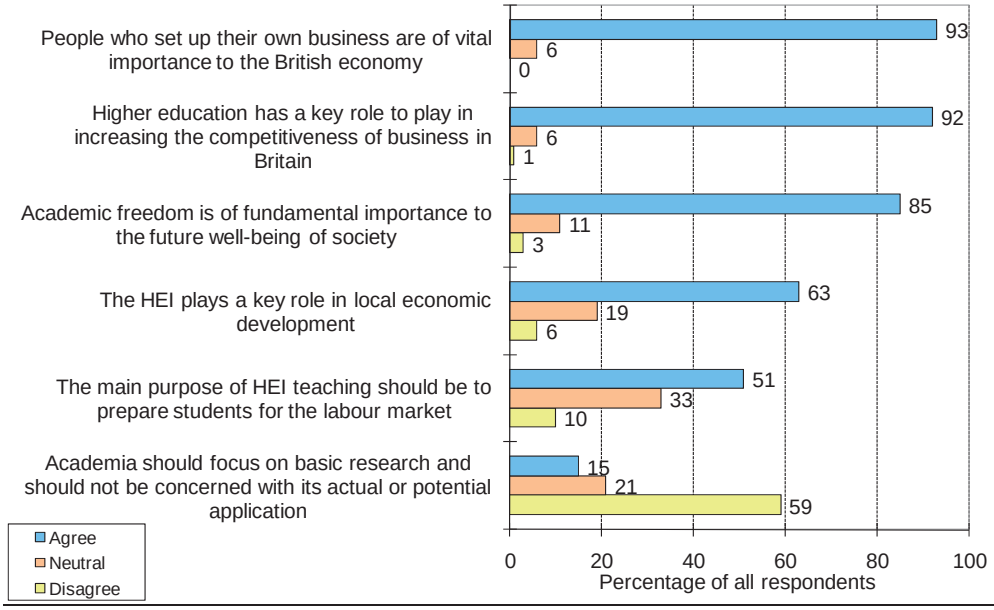
5.1.5 A very important caveat must be made and borne in mind while reading and interpreting the results of the survey of external organisations, in relation both to their attitudes and to the perceived supply-side and demand-side constraints. The survey of external organisations conducted for this research programme was intended to cover a random sample of those that have interactions with HEIs rather than a random sample of all external organisations. Therefore the results are characteristic of organisations that engage with HEIs, not of organisations more generally.

5.2 The influence of culture on the demand for knowledge exchange

5.2.1 The culture and attitudes towards HEIs as potential partners can be revealed by exploring external organisations' views on the role of HEIs in the economy and society, their perceptions of how this has changed in relation to knowledge exchange, the importance of HEIs in their strategic location decisions, the relevance of HEI-derived knowledge to their organisation and their overall culture towards interacting with HEIs. Demand will also crucially be impacted by the ability of external organisations to host the knowledge being derived within HEIs. This section will consider each of these in turn and compare, where possible, these views to those of academics. This comparison will provide powerful insights into the alignment of culture and attitudes which is believed to be important in maximising the flow of benefits between HEIs and the economy and society.

The role of HEIs in the economy and society

Figure 5.1 Attitudes of external organisations to the role of HEIs in the economy and society



Source: PACEC/CBR survey of external organisations 2008, PACEC/CBR analysis

5.2.2 External organisations that engage with HEIs almost universally believe that higher education has a key role to play in increasing the competitiveness of business in Britain (Figure 5.1). Almost half of these organisations believe that the main role for HEI teaching should be to prepare students for the labour market, with only 10% disagreeing with this view. Those in the North were much more likely than the national average to agree with this view, and those in the Midlands were more likely than average to strongly agree with it[36]. This provides some insights into the relative value placed by external organisations on the teaching, research and knowledge diffusion roles of HEIs.

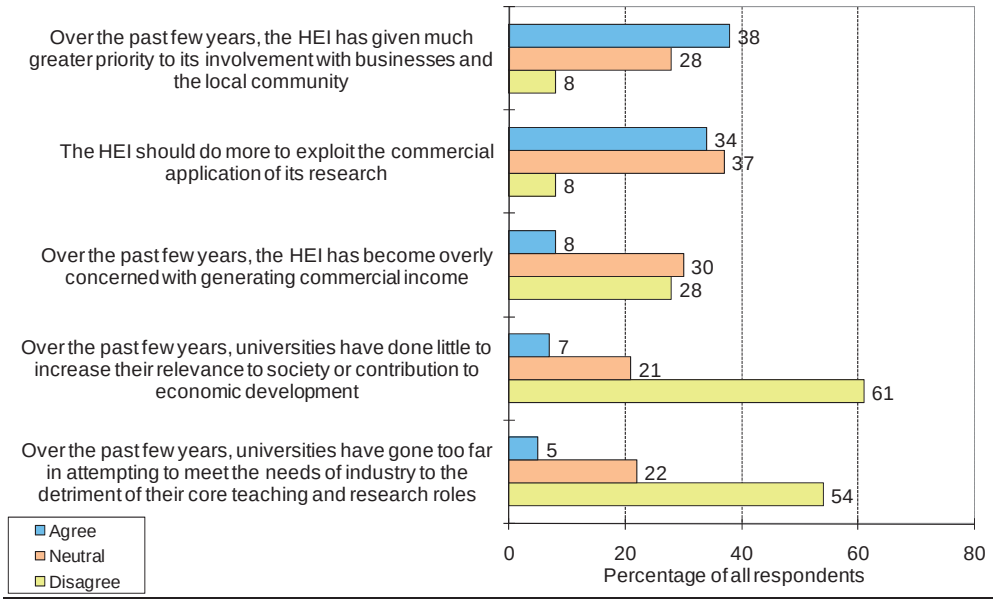
[36] PACEC/CBR Survey of External Organisations 2008: 69% of organisations in the North agree with this view compared with that national average of 51%; 21% of organisations in the Midlands strongly agree with this view compared with the national average of 13%.

5.2.3 Despite this emphasis on the teaching role of HEIs, most external organisations interacting with HEIs believed that academic freedom is of fundamental importance to the future well-being of society. In addition, almost six in 10 disagreed that HEIs should focus on basic research and should not be concerned with its application to industry, increasing to 72% for micro-organisations (fewer than five employees) and 73% for those located in the Midlands. Also, 63% of all external organisations believed that HEIs have a key role to play in local economic development, which increased to three-quarters of micro-organisations and 73% of those located in the North of England.

5.2.4 In terms of entrepreneurship, 93% of organisations interacting with HEIs believed that people who set up their own businesses are of vital importance to the British economy.

Perceptions of change to the role of knowledge exchange

Figure 5.2 Perceptions of change to the role of knowledge exchange in HEIs



Source: PACEC/CBR survey of external organisations 2008, PACEC/CBR analysis

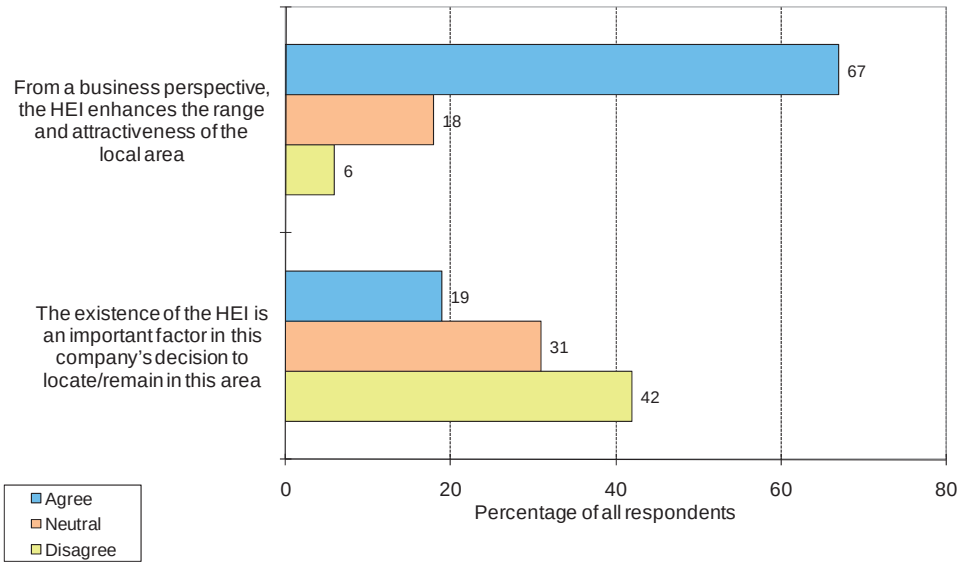
5.2.5 Figure 5.2 shows that most external organisations interacting with HEIs believed that HEIs are doing more to contribute to the economy, society and the needs of industry. In addition, 61% disagreed with the statement that, over the past few years, HEIs have done too little to increase their relevance to society or their contribution to economic development. Disagreement with this statement was particularly strongly felt in the Midlands (70% of organisations) and the North (76%), where it is becoming apparent that external organisations perceive a very strong role for HEIs in the economy and society. Similarly, 54% of external organisations did not believe that HEIs have gone too far in attempting to meet the needs of industry to the detriment of their core teaching and research roles. Once again, more organisations in the Midlands disagreed with this view (63%).

5.2.6 Despite the view that HEIs are increasing their contribution to industry, the economy and society, only 38% of all external organisations interacting with HEIs believed that they have given a much greater priority to their involvement with businesses and the local economy. This increased to 46% for micro-organisations. Once again, the greatest perceived change was in the Midlands and the North, with 55% and 61% respectively believing that their HEIs now give a much greater priority to interacting with businesses and the local economy.

5.2.7 However, when asked whether they believed that HEIs should do more to exploit the commercial application of their research, only 34% agreed, suggesting that most external organisations interacting with HEIs perceive that the current levels of commercialisation of research are appropriate. There was regional variation in this view, with almost half of organisations located in the Midlands being much more likely than the national average to agree that HEIs should do more to exploit their research base. There was also a lack of any strong view on whether HEIs have become overly concerned with generating commercial income, with little variation between size of organisation or region.

The importance of HEIs in the location decision of external organisations

Figure 5.3 Importance of HEIs in the location decision of external organisations



Source: PACEC/CBR survey of external organisations 2008, PACEC/CBR analysis

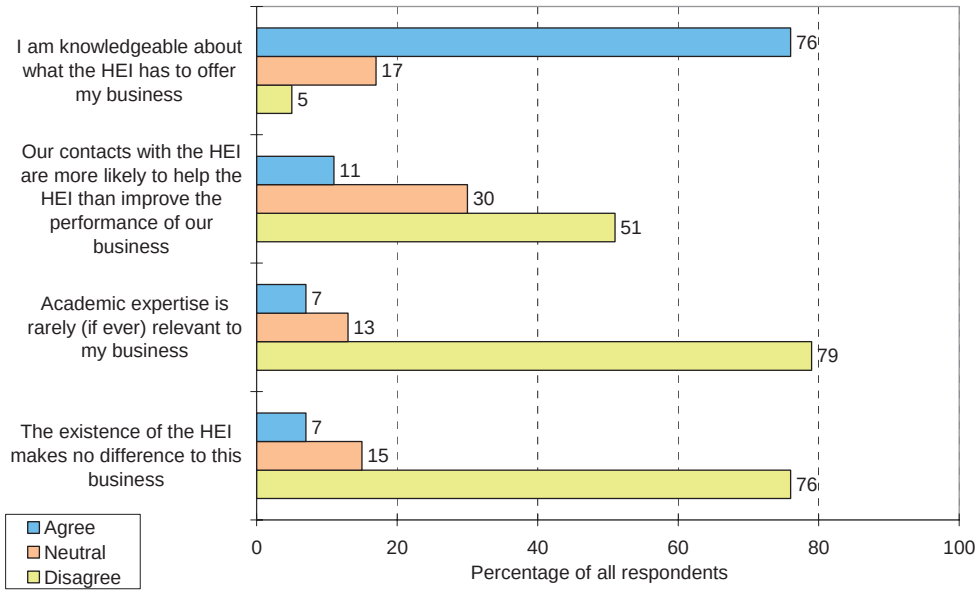
5.2.8 Figure 5.3 shows the importance of HEIs in influencing the location decision of external organisations. It is clear that while the existence of an HEI does not appear to be an important factor for many external organisations locating and remaining in a particular area (with only 19% agreeing with this view), most believed that HEIs enhance the range and attractiveness of the local area. The importance of HEIs for the attractiveness of the local area was particularly strong in the North of England,

with 44% of external organisations strongly agreeing with this view compared with the national average of 26%.

5.2.9 However, when the importance of the HEI in the location decision is analysed by sub-groups of external organisations, a very different result emerges. The geographical proximity of HEIs plays a more important role as the size of organisation decreases. Thus 40% of micro-organisations (fewer than five employees) thought HEIs were important in their location decisions compared with approximately one-fifth of SMEs (5-200 employees), and just 5% of large organisations (more than 200 employees). In addition, those in the North of England were much more likely to believe this was the case compared with the national average (34% of external organisations in the North compared with 19% overall).

The relevance of HEI-derived knowledge to external organisations

Figure 5.4 The relevance of HEI-derived knowledge to external organisations



Source: PACEC/CBR survey of external organisations 2008, PACEC/CBR analysis

5.2.10 Demand for knowledge exchange from HEIs will depend critically on whether those in external organisations perceive that the knowledge being created within HEIs is relevant to their products or services. Almost 80% of external organisations that interact with HEIs disagreed that academic expertise is rarely (if ever) relevant to their organisations (Figure 5.4). Similarly, over three-quarters disagreed that HEIs make no difference to their business, suggesting that the HEI plays some role in the development of their competitive advantage. This was most pronounced for micro and large organisations, with 85% and 83% disagreeing with this view respectively. The survey showed that, for micro-organisations interacting with HEIs, obtaining access to HEI facilities, enhancing their branding and enhancing their workforce skills and training were of high importance. For large organisations, branding was of much lesser importance as an objective for the interactions, focusing more on engaging

with HEIs to enhance workforce skills and training, obtaining access to HEI facilities and enhancing management skills and knowledge.

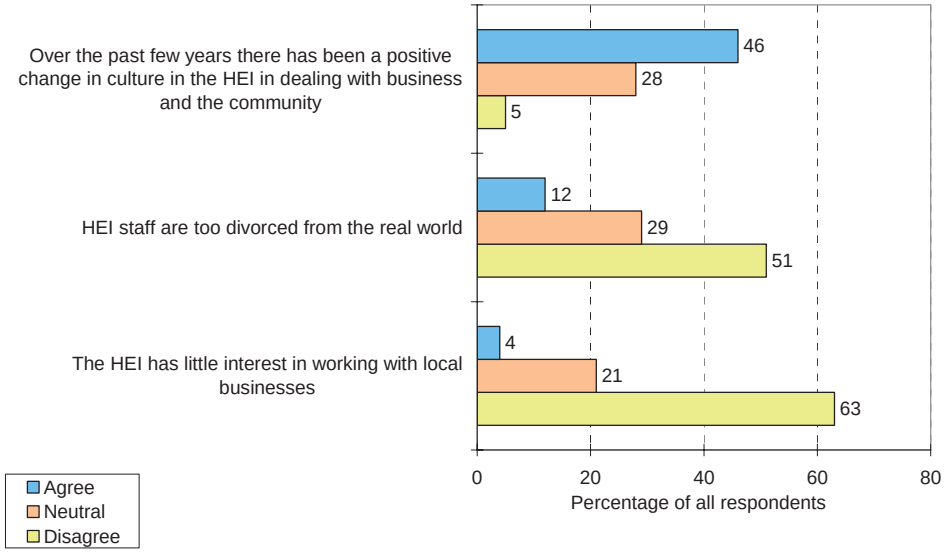
5.2.11 Most of those who interact with an HEI are also knowledgeable about what it has to offer their organisation. This was particularly the case in the North of England, where 88% of external organisations agreed with the statement compared with the national average of 76%. This suggests that once an organisation has secured the first interaction with an HEI, there seems to be an awareness of what it can potentially deliver to the organisation.

Perceived absorptive capacity

5.2.12 In addition to the perceived relevance of HEI-derived knowledge to external organisations, the absorptive capacity is also critical to determining demand for HEI knowledge exchange services. There is a disconnect in the perceived absorptive capacity – the ability of external organisations to host HEI-derived knowledge – between academics and the organisations themselves. The PACEC/CBR survey of academics showed that one-third of academics believed that British business does not have the capability to use HEI-derived research effectively. Unsurprisingly, this view was not shared by the external organisations. Almost half of external organisations disagreed with the statement "British business does not have the capability to use research effectively", compared with only 13% of organisations agreeing with it. This difference in views could result in academics not offering or developing certain types of knowledge exchange or research products to external organisations despite their perceived ability to host them, thus reducing the potential benefits that diffuse from the HEI to the economy and society.

Indicators of overall culture in external organisations towards knowledge exchange

Figure 5.5 Indicators of overall culture in external organisations towards knowledge exchange



Source: PACEC/CBR survey of external organisations 2008, PACEC/CBR analysis

5.2.13 The positive culture shifts within HEIs towards interacting with businesses and the community were recognised by 46% of external organisations which have interacted with HEIs (Figure 5.5), with only 5% disagreeing with this statement. The greatest perception of a positive change was in the North of England, with 61% of organisations observing positive developments, and by those that engage with HEIs in the high research cluster (with 68% of external organisations seeing a positive change). This result is somewhat at odds with the conclusions of the previous chapter, which suggested that the greatest culture shifts, as perceived by the HEIs themselves, were in the low research and arts clusters.

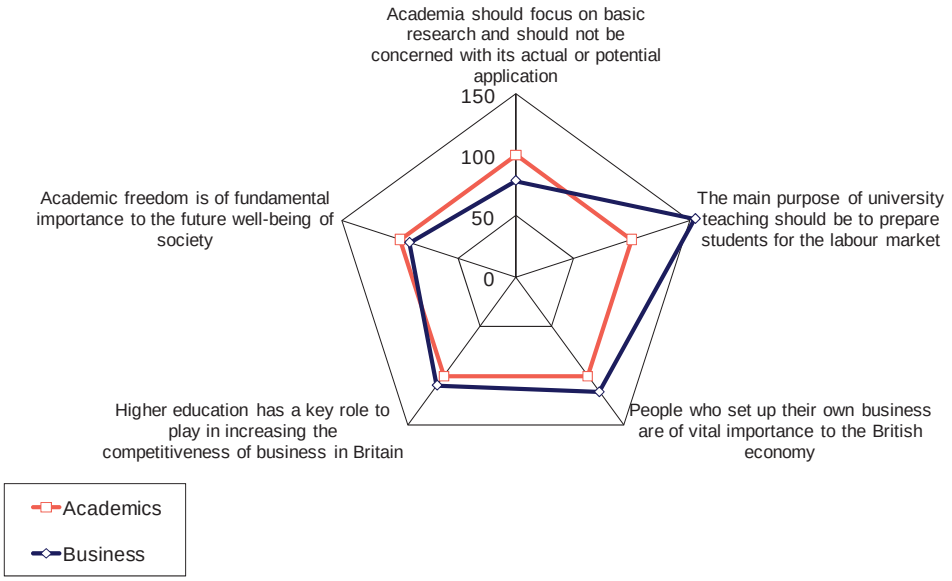
5.2.14 Another indicator of culture is whether external organisations engaging with HEIs view the HEI staff as too divorced from the real world. Only 12% of organisations believed this to be true, with little variation across HEI clusters, size of organisation and region.

5.2.15 The final indicator of a positive culture within external organisations to engaging with HEIs is whether they perceive that HEIs have little interest in working with local businesses. Previous chapters have shown that HEIs have invested substantial resources in improving the structures with which they can engage and on changing the culture to further embrace knowledge exchange with businesses and the community. Encouragingly, 63% of external organisations that interact with HEIs disagreed that HEIs have little interest in engaging with them, with this feeling most widespread among those organisations located in close proximity to the HEI with which they engage (82% of organisations) and those located in the Midlands (75%) and the North (71%).

Cultural differences between academics and external organisations

5.2.16 The alignment of attitudes between the providers and consumers of knowledge on the importance of HEIs in the economy and society, and of knowledge exchange in relation to teaching and research, will help to maximise the benefits that can be diffused across the boundaries. The surveys conducted for this research programme allow for such comparisons to be made.

Figure 5.6 Comparison of the attitudes of academics and external organisations that have interacted with HEIs on the importance of HEIs in the economy and society



Note: Share of academics agreeing with particular statement has been normalised to 100
Source: PACEC/CBR surveys of academics and external organisations 2008, PACEC/CBR analysis

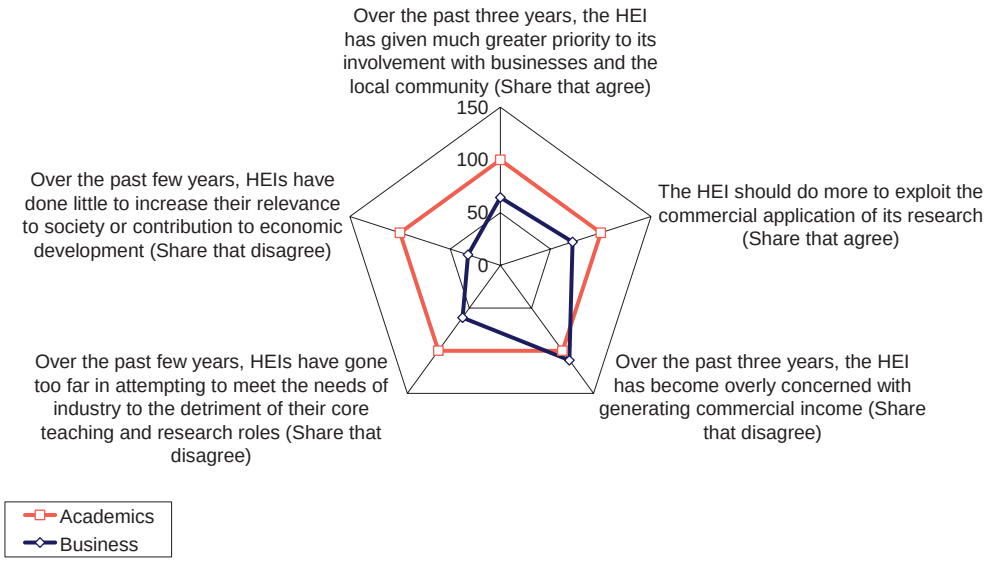
5.2.17 Figure 5.6 shows that attitudes towards the role of HEIs in the economy and society are very similar between academics and external organisations. There are similar beliefs that HEIs play a key role in the competitiveness of British businesses, that academic freedom is of fundamental importance to society and that entrepreneurship is vital to the British economy. However, unsurprisingly, external organisations that interact with HEIs were less likely to believe that academia should focus on basic research and not be concerned with its actual or potential application. Given that one of the key motivations for the external organisations interacting with HEIs is to enhance technological capability and capacity,[37] they will inevitably be more concerned than academics that HEIs explore the industrial application of their research.

5.2.18 The starkest difference in attitudes comes in the perceived importance of teaching as the key role of HEIs. The external organisations that engage with HEIs are much more likely to believe that the main purpose of HEI teaching is to prepare students for the labour market. Once again, this is unsurprising given that the survey also showed that other key motivations for organisations engaging with HEIs are to enhance

[37] PACEC/CBR survey of external organisations 2008

workforce skills and training, management skills and knowledge, and for graduate recruitment.

Figure 5.7 Comparison of academic and external organisation attitudes on how HEIs have changed over the past few years in relation to knowledge exchange



Note: Share of academics agreeing/disagreeing (see chart) with particular statement has been normalised to 100
Source: PACEC/CBR surveys of academics and external organisations 2008, PACEC/CBR analysis

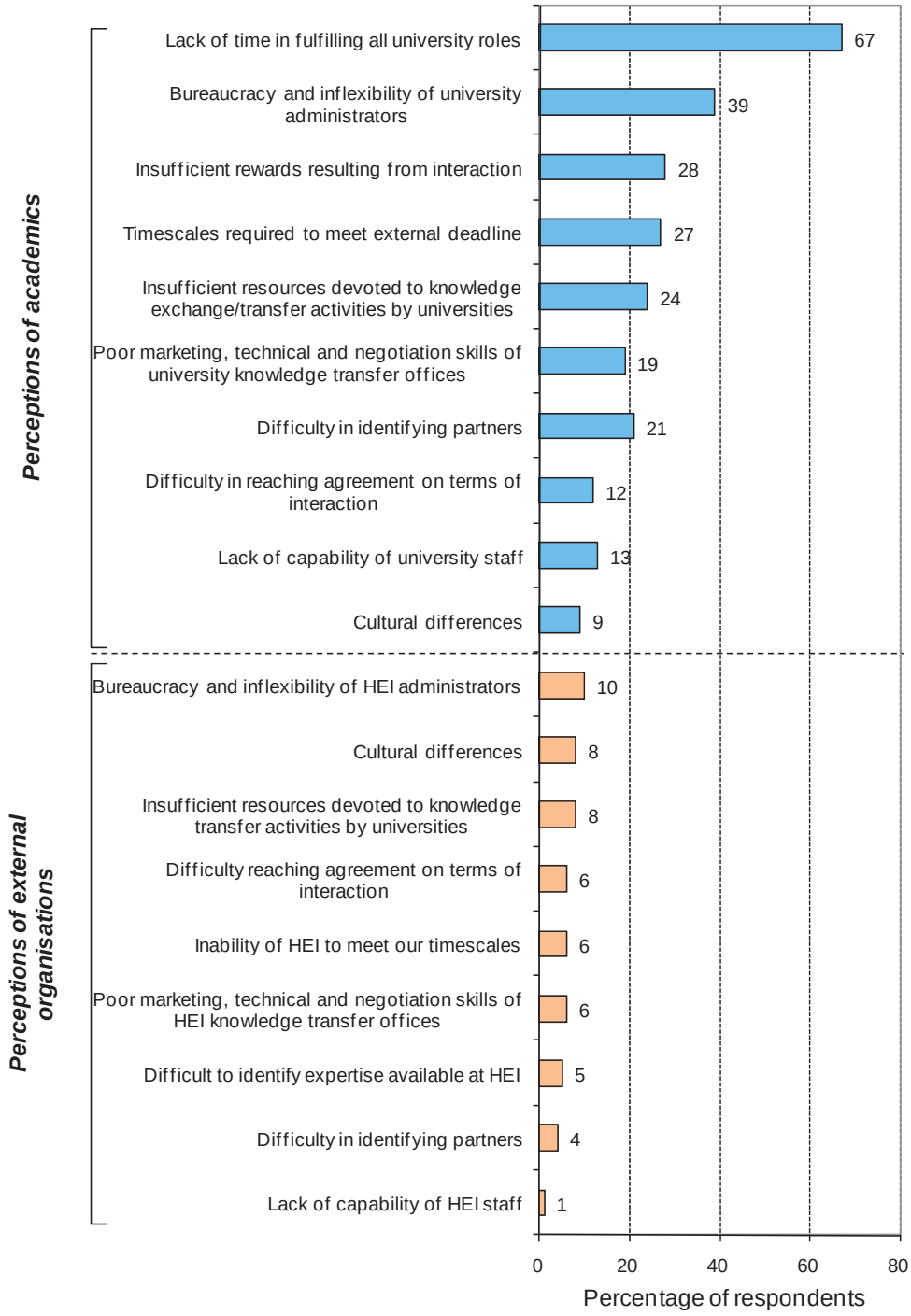
5.2.19 Despite the similarities in attitudes on the importance of HEIs in the economy and society, there were large differences in the perceptions of the extent of change in the HE sector (Figure 5.7). Academics were more likely to think that the HEI has given a much greater priority to interacting with businesses and the community over the past few years. They were also more likely than external organisations to perceive that HEIs have gone too far in meeting the needs of industry to the detriment of their core teaching and research duties. In addition, academics were much more likely than external organisations to disagree that HEIs have done little to increase their relevance to the economy or society.

5.2.20 Attitudes towards whether HEIs have become overly concerned with generating income were very similar. Interestingly, more academics than external organisations believed that their HEI should do more to exploit the commercial application of research. Combining this result with the finding that many external organisations that interact with HEIs appear to believe that the current levels of the commercial exploitation of research are appropriate suggests that either academics believe that their research has greater commercial application than is really the case, or that the absorptive capacity of companies is limiting the expansion of the exploitation of HEI-derived knowledge. The difference in opinion regarding the absorptive capacity of external organisations (see paragraph 5.2.12) suggests that academics believe the latter conclusion while external organisations believe the former.

5.3 Supply-side barriers

5.3.1 The remainder of this chapter now turns to the supply-side and demand-side constraints facing the interactions between academics and external organisations.

Figure 5.8 Supply-side factors constraining knowledge exchange engagement with external organisations: perceptions of academics and perceptions of external organisations (%)



Respondents could select more than one option, so percentages may sum to more than 100
Sources: Perceptions of academics – PACEC/CBR survey of academics 2008; number of respondents, 917. Perceptions of external organisations – PACEC/CBR survey of external organisations; number of respondents, 315
PACEC/CBR analysis

Perceptions of academics of the supply-side barriers

5.3.2 The constraints perceived by academics fall into both supply-side and demand-side barriers. Two-thirds of academics believed that the lack of time to fulfil their HEI commitments was a key supply-side barrier to increasing engagement (Figure 5.8). The case studies revealed that academics perceive that a heavy teaching and research workload dominates their time budget. In addition, inflexible timetables mean that engagements can become logistically difficult, especially during student terms. In addition, academics' research commitments are becoming increasingly global, with conferences and research collaboration around the world. Organising all of these commitments along with those emerging through knowledge exchange activities is becoming very difficult. Academics also complained of the high and increasing burden of administrative duties required of them, which reduces the time available for productive activities. This is partly reflected by the 39% of academics who believed that the bureaucracy and inflexibility of HEI administrators was a barrier for increasing engagement. The investments in capacity and capability by some HEIs, partly through HEIF, will have helped to mitigate some of these administrative burdens for knowledge exchange activities, but time constraints nevertheless remain the most frequently cited supply-side barrier to furthering engagement.

5.3.3 The integration of the teaching, research and knowledge exchange missions of HEIs is also helping to relax the time constraints facing academics through the realisation of the synergies between the three streams of work. This has also helped to build the acceptance of knowledge exchange as a core activity (thus helping to relax the cultural constraints), and has helped to demonstrate the positive synergies that exist between teaching, research and knowledge exchange.

5.3.4 Some 28% of academics also believed that there are insufficient rewards resulting from the interactions. This implies that the overall benefits (widely defined) may not exceed the opportunity cost of engagement. As highlighted earlier, the motivation for engagement for many academics does not appear to be personal income. This suggests that incentive schemes that address how academics value the benefits will be as important as the financial incentives arising out of the engagement. In addition, actions to reduce the opportunity cost would also help to reduce the incentive-related barrier.

5.3.5 A lack of capability of staff was only rated as a barrier by 13% of academic respondents to the survey. However, the case study evidence suggested that this can be an important barrier leading to a 'catch-22' situation whereby academics with limited experience are unwilling to undertake knowledge exchange activities which would give them the necessary confidence and experience to engage further. However, neither the top six research cluster nor the arts cluster saw this as a barrier. The actions of many HEIs in recruiting KE champions and mentors, as well as the training and staff development being invested in using HEIF funding,[38] will help to reduce this barrier.

5.3.6 Encouragingly, cultural resistance towards engagement in knowledge exchange ranked least of the constraints perceived by academics to increasing engagement. However, the case study evidence arising from interviews with senior management suggested that culture towards knowledge exchange was a more significant barrier than the survey of academics suggests. A number of senior managers highlighted that they perceive that many academics still see knowledge exchange engagement as a lesser priority than research and teaching activities. Another problem that some senior academics raised during the case study interview programme was that industrial funding was still seen as less prestigious than that from research councils, even if the outputs are similar and include academic papers in research publications. Given their time constraints and the pressure on academics to publish, this discourages them from engaging further in knowledge exchange. HEIF funding, through the impacts that it is having on culture (as described at the end of the previous chapter) is helping to relax this constraint, which was once seen as a significant barrier to interacting with external organisations (see, for example, the findings of the Lambert Review[39]).

Perceptions of external organisations of the supply-side barriers

5.3.7 Recalling the important caveat mentioned at the beginning of this chapter, it is important to note that the constraints are those perceived by external organisations that have already overcome the major hurdle of initiating their first engagement with an HEI. The survey results do not reflect the perception of barriers by organisations with no current interactions with HEIs.

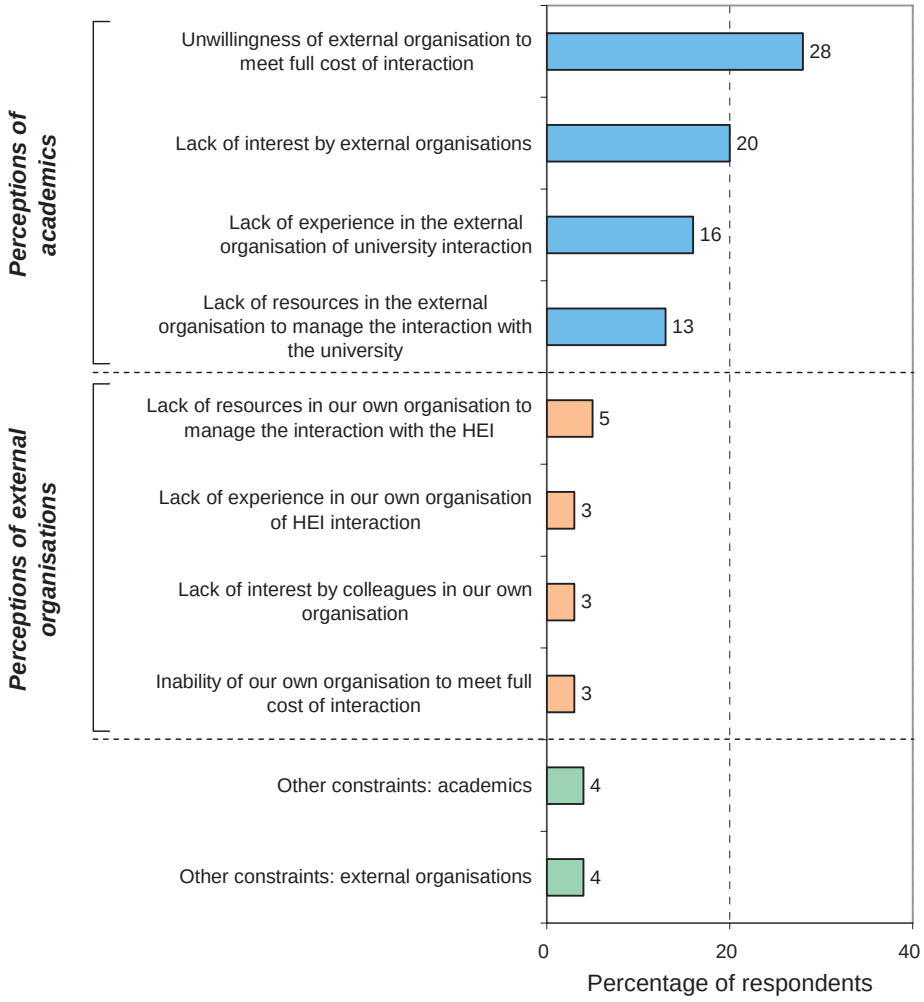
5.3.8 While 39% of academics believed that the bureaucracy and inflexibility of HEI administrators was a barrier to interactions, just 10% of those external organisations that have interacted with HEIs perceived this as a constraint, although this was the most frequently cited constraint (Figure 5.8). The second most common constraint, cited by 8% of external organisations, was cultural differences. The small number of external organisations citing this as a constraint may be because of the manner in which the sample was constructed, focusing on those that already engage with HEIs rather than a random sample of all external organisations. That said, one may argue that such organisations are better placed to comment on the true culture within an institution compared with the views of a random sample which would only be able to provide evidence on the perceived culture within HEIs.

5.3.9 Of the external organisations surveyed, 8% cited insufficient resources devoted to KE activities by HEIs. This could include time devoted by academics in the case of jointly supervised projects between academia and external organisations, or lack of resources devoted to facilities important for the interaction (such as laboratory space, machinery etc). Encouragingly, the lack of capability of HEI staff was the least frequent constraint, echoing the views of academics.

[38] PACEC (2008) *Analysis of HEIF 4 Institutional Strategies: Overview Report*, a report to HEFCE
[39] HM Treasury (2003) *Lambert Review of Business-University Collaboration*

5.4 Demand-side barriers

Figure 5.9 Demand-side factors constraining knowledge exchange engagement with external organisations: perceptions of academics and perceptions of external organisations



Respondents could select more than one option, so percentages may sum to more than 100
Sources: Perceptions of academics – PACEC/CBR survey of academics 2008; number of respondents, 917. Perceptions of external organisations – PACEC/CBR survey of external organisations; number of respondents, 315
PACEC/CBR analysis

5.4.1 While HEIF funding is primarily aimed at correcting the supply-side problems that exist within the HE sector, there are a number of demand-side issues that remain to be addressed (Figure 5.9). These demand-side barriers may be creating a potentially significant barrier to maximising the value that HEIs can bring to the economy and to innovation.

5.4.2 Firstly, 28% of academics believed that the inability of external organisations to meet the full costs of the interaction constrained interactions. One case study HEI noted how the movement to charging full economic costs of the engagement has made it too expensive for many companies. Some HEIs therefore have to charge less than full economic costs and accept losses on activities in order to be able to extend their overall KE engagement beyond their existing clients. This may reflect the

undervaluing of the contribution of research to the overall value chain by many external organisations or the tight financial constraints facing many external organisations.

5.4.3 The inability to pay the full costs of engagement is particularly acute for micro-companies, SMEs and community organisations, which are typically much more budget constrained than larger corporations and the public sector.[40] This demand-side barrier therefore represents a potentially large barrier to HEIs, whose natural market sectors for engagement are dominated by SMEs and community organisations (such as the creative sector). This constraint is also severely limiting the willingness of HEIs to engage with SMEs, favouring instead a focus on large companies. However, a case study HEI is finding alternative ways for SMEs to pay for their engagement, such as through contributing their knowledge and experience to the curriculum base offered by its faculties and departments.

5.4.4 The lack of resources within external organisations to manage the interaction with HEIs was also the most frequent demand-side barrier cited by external organisations, albeit in only 5% of cases. The low value likely reflects the nature of the sample, which focuses on those that have engaged or currently engage with HEIs.

5.4.5 Another constraint facing academics in increasing their interactions is the lack of interest by external organisations in accessing and exploiting the knowledge being generated within HEIs. One-fifth of academics believed this to be the case, with 16% believing that external organisations lack the experience to interact with HEIs. However, only a very small number of external organisations echoed this view.

[40] PACEC/CBR HEI case study research programme 2008

6 Participating in Knowledge Exchange

6.1 Introduction

6.1.1 The participation rate of academics in knowledge exchange will be driven by a number of different factors, including the influence of the HEI strategy, the internal culture, the available capacity and capability, and external pressures. The report thus far has highlighted how HEFCE funding has influenced many of these drivers, including strategic changes in favour of greater knowledge exchange engagement, greater integration of knowledge exchange with teaching and research, the development of structures to facilitate engagement and a more positive culture towards engagement.

6.1.2 The above factors will form part of a complex dynamic system in which strategy, culture, available capacity and capability and other factors drive participation. This in turn feeds back and influences the strategy, culture and the building of capacity and capability. In addition, the differing time lags of each of these participation factors make it extremely difficult to disentangle the relative impact of each of the drivers of the participation rate.

6.1.3 The report embraces the wide variety of potential mechanisms through which academics can interact and exchange knowledge with the economy and society. It covers those modes traditionally associated with knowledge exchange (termed ‘core’ modes) and those that are more loosely associated (termed ‘other’ modes) (Table 6.1). The survey also explored the frequency of interaction over the past three years, looking at infrequent engagement (1-2 times in the past three years), frequent (3-6 times) and very frequent (more than six times).

Table 6.1 Modes of interaction

Core modes of interaction	*Other modes of interaction*
A consultancy agreement (no original research undertaken)	Attending conferences which have HEI and external organisations' participation
A contract research agreement (original research work done by the HEI alone)	Giving lectures or talks for (non-HEI) external organisations
A joint research agreement (original research work undertaken by both partners)	Giving public lectures for the community
Creation of physical facilities with external organisation funding (e.g. new laboratory or campus building)	Hosting (short or long-term) visits by individuals from external organisations
Enterprise education	In-course student projects or placements or Knowledge Transfer Partnership with external organisations
Involvement with schools projects	Joint publications with individuals from external organisations
Joint curriculum development with external organisations	Membership of advisory boards to external organisations
Participation in consortia involving external organisations	Organising conferences which have HEI and external organisations' participation
Prototyping and testing for external organisations	Participation in networks involving external organisations
Providing continuing professional development (including training company employees through course enrolment or temporary personnel exchange)	Participation in standard-setting forums
	Personal secondment (short or long-term) to external organisations
	Providing informal advice on a non-commercial basis
	Provision of community-based performance arts
	Provision of community-based sports
	Provision of public exhibitions
	Targeted post-course placement with external organisations of your undergraduate and postgraduate students

Source: PACEC/CBR analysis

6.1.4 This chapter presents the participation rates in KE activities and how they have changed over the period. It will explore the diversity in the modes of interaction that academics use to engage with external organisations. Lastly, it will attempt to analyse some of the determinants of whether an academic chooses to participate or not, using an econometrics approach.

6.2 Participation rates in knowledge exchange

6.2.1 This first section presents the participation rates in knowledge exchange activities by academics based on the findings of the PACEC/CBR survey of academics (2008). It also presents the qualitative assessments of the senior management of the case study HEIs on how the rate has changed over the period 2001-08. It will compare the findings to the few other sources of information that are available: a survey by D'Este and Patel (2007) and the results of the HEBCI surveys.

6.2.2 There were a number of potentially inconsistent results within the sample. A sizeable number of academics (approximately 22%) claimed that they had never engaged with the private, public and charitable/voluntary sectors over the past three years, yet when asked about the mode and frequency of interactions with the private, public and

charitable/voluntary sectors claimed that they did engage. One reconciliation is that there are activities which are delivered to no particular sector, such as an extra-mural lecture to the community for no fee, or engagement with supra-national organisations. The nature and scale of this problem are shown in Table 6.2.

6.2.3 As is evident from the analysis of inconsistencies, most arose because of the infrequent engagement in many activities. Particular problems in the core modes occurred with joint research, involvement with schools' projects, participation in consortia involving external organisations and consultancy. There were only small levels of inconsistencies at the 'frequent' and 'very frequent' levels of engagements.

6.2.4 Inconsistencies were higher in the 'other' modes of interaction, with most modes having relatively high rates of inconsistencies at the 'infrequent' level of engagement. In addition, many modes also had relatively large inconsistencies at the 'frequent' level of interaction, namely in attending conferences with external organisation participation, joint publications, giving lectures or talks for non-HEI organisations, providing informal advice, participating in networks with external organisations, and giving lectures to the community. It is not inconceivable that the target of many of these activities could lie outside the private, public or charitable/voluntary sectors, or at the boundaries.

6.2.5 Therefore, the problem of inconsistencies is likely not as large as initially believed, with most problems occurring in the 'infrequent' level of engagement. In addition, the participation rate based on the modes of engagement is calculated from those frequently or very frequently engaging in any mode of interaction, thus also minimising the impact of inconsistencies at the 'infrequent' level. However, to confront this potential problem of inconsistencies, the report presents an upper and lower bound to the participation rate, with the former calculated with data including the inconsistencies, while the latter rate is based on the data with the inconsistent data forced to the correct value (i.e. no engagement). The average rate is also presented.

Table 6.2 Modes of interaction claimed to be undertaken by those claiming no interaction with the private, public and charitable/voluntary sectors

		(% of responses)		
		Infrequent	Frequent	Very Frequent
Core modes	A joint research agreement (original research work undertaken by both partners)	5.8	1.0	0.5
	Involvement with schools' projects	5.8	1.2	0.5
	Participation in consortia involving external organisations	4.8	0.6	0.0
	A consultancy agreement (no original research undertaken)	4.1	0.4	0.0
	Joint curriculum development with external organisations	3.7	0.8	0.0
	Providing continuing professional development (including training company employees through course enrolment or temporary personnel exchange)	2.5	1.0	0.8
	A contract research agreement (original research work done by the HEI alone)	2.5	0.7	0.2
	Prototyping and testing for external organisations	0.9	0.3	0.1
	Creation of physical facilities with external organisation funding (e.g. new laboratory or campus building)	0.8	0.0	0.1
	Involvement with enterprise education	0.8	0.2	0.2
Other modes	Providing informal advice on a non-commercial basis	8.3	2.6	1.0
	Giving lectures or talks for (non-HEI) external organisations	7.9	2.7	0.9
	Attending conferences which have HEI and external organisations' participation	7.5	7.3	2.0
	Participation in networks involving external organisations	7.2	2.6	0.3
	Organising conferences which have HEI and external organisations' participation	5.8	1.2	0.6
	Giving public lectures for the community	5.3	2.5	0.6
	Membership of advisory boards to external organisations	5.1	1.1	0.3
	Joint publications with individuals from external organisations	5.0	3.2	1.0
	Hosting (short or long-term) visits by individuals from external organisations	4.6	2.2	0.2
	Participation in standard-setting forums	4.0	0.7	0.1
	In-course student projects or placements or Knowledge Transfer Partnership with external organisations	3.3	0.9	0.9
	Targeted post-course placement with external organisations of your undergraduate and postgraduate students	2.6	1.9	0.3
	Provision of public exhibitions	1.9	0.8	0.4
	Personal secondment (short or long-term) to external organisations	1.7	0.6	0.0
	Provision of community-based performance arts	0.9	0.3	0.0
	Provision of community-based sports	0.4	0.1	0.0
	Number of respondents	1,060	1,060	1,060

Modes of interaction are highlighted if the response rate is above 2%
Source: PACEC/CBR survey of academics 2008, PACEC/CBR analysis

Level of academic participation in knowledge exchange

6.2.6 There are a number of different indicators of the participation rate of academics in knowledge exchange activities with external organisations, based on different questions posed to academics during the PACEC/CBR survey of academics 2008.

6.2.7 The first indicator is based on academics' response to direct questions on whether they work closely with business/industry or other external organisations as a result of their academic work. The direct indicator suggests that the average participation rate in knowledge exchange activities is 52% of academics (Table 6.3), with the rate slightly lower for HEIs in the top six and high research clusters (49% and 48% respectively) and higher for the low research intensive and arts HEIs (63% and 65% respectively). Those in arts HEIs are more likely to work with business and industry as a result of their academic work than other clusters. This is likely because of the highly vocational nature of their discipline and the high number of staff who straddle the professional/academic divide (case studies 2008).

Table 6.3 Direct survey-based indicators of the participation rate

		All HEIs	Cluster				
			Top 6	High	Medium	Low	Arts
Work closely with business/industry as a result of academic work	**Average**	**29**	**34**	**24**	**26**	**31**	**46**
	Upper bound	*29*	*34*	*24*	*27*	*31*	*48*
	Lower bound	*28*	*33*	*23*	*25*	*30*	*43*
Work closely with other external organisations as a result of academic work	**Average**	**42**	**37**	**41**	**43**	**54**	**51**
	Upper bound	*44*	*39*	*42*	*46*	*54*	*55*
	Lower bound	*41*	*36*	*39*	*40*	*53*	*47*
Work closely with business/industry or other external organisations as a result of academic work	**Average**	**52**	**49**	**48**	**53**	**63**	**65**
	Upper bound	*54*	*51*	*49*	*57*	*64*	*70*
	Lower bound	*50*	*47*	*46*	*49*	*61*	*60*

Source: PACEC/CBR survey of academics 2008, PACEC/CBR analysis

6.2.8 The next indicator explores the level of participation with external organisations based on academics' responses to the variety of possible modes of interaction. It considers only those claiming frequent or very frequent engagement (i.e. more than three interactions in the past three years) through particular modes.

Table 6.4 Participation rate in knowledge exchange

Cluster	Core modes			All modes		
	Average	*Upper bound*	*Lower bound*	**Average**	*Upper bound*	*Lower bound*
All HEIs	**52**	*56*	*48*	**75**	*84*	*66*
Top 6	**49**	*54*	*44*	**74**	*83*	*65*
High	**50**	*53*	*47*	**71**	*79*	*63*
Medium	**52**	*55*	*49*	**78**	*89*	*67*
Low	**61**	*66*	*56*	**82**	*92*	*73*
Arts	**47**	*56*	*38*	**71**	*82*	*60*

Note: Participation rate is based on the respondents answering 'frequent' or 'very frequent' to any mode of interaction
Number of respondents: upper bound (924); lower bound (724)
Source: PACEC/CBR survey of academics 2008

6.2.9 With the exception of the arts cluster, the participation rates based on the core modes of interaction (Table 6.4) agree very well with the participation rates deduced from the direct indicator (Table 6.3), with 52% of academics engaging in such modes. This rises to three-quarters of all academics if one considers the broader range of modes. In addition, the participation rates based on the core modes of interaction for the individual clusters (except the arts cluster) agree well with the direct indicators. The highest participation rate based on the modes of interaction is in the low research cluster (82% for all modes; 61% for core modes). One explanation for the difference between the direct participation rate and the rate based on all modes of interaction is that, because of the order of questions in the survey questionnaire (with the direct indicator questions coming before the modes of interaction question), academics may not have considered the full range of possible modes when answering the direct indicator question.

6.2.10 There will be considerable variation within each cluster because of the differing initial conditions facing each HEI in terms of KE engagement. For example some HEIs, such as Cranfield University, were founded on the premise of close engagement with industry and would therefore observe much higher participation rates compared with other HEIs in their cluster. Other HEIs, particularly those in the top six and high research clusters, still have pockets of staff who believe that research and teaching should be the main focus of the HEI,[41] although the senior management interviewed believed that this proportion is decreasing.

Variation of participation rates across different types of academics

6.2.11 The case study interviews also suggested differing participation rates between different types of academics, for example across different age groups, academic positions, stage of research and discipline. These differences were explored using the PACEC/CBR survey of academics (Table 6.5).

[41] Interviews with senior management during the HEFCE third stream evaluation case study research programme 2008.

Table 6.5 Participation rates across different types of academics

Academic position*	Core modes			All modes		
	Average	Upper bound	Lower bound	**Average**	Upper bound	Lower bound
Professor	**58**	61	55	**82**	89	74
Reader	**53**	56	49	**76**	86	67
Senior research fellow	**53**	56	50	**78**	86	69
Senior lecturer	**53**	58	47	**77**	87	67
Lecturer	**37**	40	34	**60**	71	49
Post-doc researcher	**34**	38	30	**67**	78	55
Other	**54**	58	50	**73**	82	65
Stage of research	Core modes			All modes		
	Average	Upper bound	Lower bound	**Average**	Upper bound	Lower bound
Basic research	**33**	39	27	**59**	73	44
User-inspired basic research	**53**	56	51	**80**	88	73
Applied research	**65**	68	61	**84**	90	78
Other	**45**	50	40	**68**	80	57
Age of academic	Core modes			All modes		
	Average	Upper bound	Lower bound	**Average**	Upper bound	Lower bound
Under 30	**34**	39	29	**55**	64	46
30-39	**44**	48	40	**73**	83	63
40-49	**54**	58	49	**72**	82	62
50 and over	**56**	61	52	**81**	90	72
Faculty	Core modes			All modes		
	Average	Upper bound	Lower bound	**Average**	Upper bound	Lower bound
Medical	**58**	61	54	**77**	83	70
Science	**47**	53	41	**72**	83	61
Engineering	**69**	71	68	**87**	91	82
Technical	**41**	44	38	**67**	76	57
Humanities	**52**	56	47	**77**	88	65
Language	**31**	33	30	**51**	58	45
Other	**43**	49	38	**72**	81	63

* Results for PhD students have been removed from this table because of very small sample size
Number of respondents: upper bound (924); lower bound (724)
Source: PACEC/CBR survey of academics 2008, PACEC/CBR analysis

6.2.12 The level of engagement increases as the stage of research moves from basic research towards applied research, with the participation rate for the core KE engagement interaction modes doubling from 33% of academics conducting basic research to 65% of academics conducting applied research. Participation rates were particularly high in engineering and medical disciplines, with 69% and 58% of academics respectively engaged in at least one of the core modes. Participation was lowest in languages subjects. The participation rate in humanities was surprisingly high. However, the humanities category includes, among others, social sciences, economics, business studies and creative arts, all of which are likely to naturally engage with external users as part of their academic work. Academics in these departments engaged through a variety of channels, including the provision of CPD (19%), consultancy (16%), societal engagement through involvement with school projects (15%) and contract research (14%).

6.2.13 The participation rate was also highly correlated with the age of the academic and with academic position. Academics under 30 years of age were almost half as likely to participate through the core KE modes of interaction compared with those over 50. Similarly, post-doctoral researchers and lecturers exhibited a systematically lower participation rate compared with those later in their careers, with professors having the highest participation rates (58% in core modes and 82% in all modes).

6.2.14 The differences across academic positions partly reflect the changing objectives facing academics during different points of their careers. Broadly speaking, young academics are required to validate their capabilities through their research publications and typically have much larger teaching commitments to those later in more senior positions. They are therefore much less likely to have the time to engage with external organisations. In addition, they typically lack the necessary credibility and experience to successfully engage. Those in the later stages of their careers, who have accomplished much in their academic lives, may be looking for alternative sources of validation and may see the challenges of external organisations as one mechanism for this. They are also much more likely to have the required academic reputation and experience to minimise the transaction costs associated with reputation.

Robustness of the level of academic participation rates in knowledge exchange

6.2.15 The only other known source of participation rates of academic engagement with external organisations, based on a survey of a random sample of organisations, comes from D'Este and Patel (2007), who looked at HEI-industry linkages in engineering and physical sciences disciplines. They limited their engagement channels to:

- meetings and conferences – attendance at industry-sponsored meetings, attendance at conferences with industry and HEI participation
- consultancy and contract research – consultancy work (commissioned by industry, not involving original research), contract research (commissioned by industry and undertaken only by HEI researchers)
- creation of physical facilities – setting up spin-off companies, creation of physical facilities (including campus laboratories, incubators and cooperative research centres)
- training – postgraduate training in company (e.g. joint supervision of PhDs), training company employees (through course enrolment or personnel exchanges)
- joint research – joint research agreements (involving research undertaken by both parties).

6.2.16 The definitions of the activities (apart from the creation of physical facilities) were very similar, thus allowing for comparison of the participation rates for meetings and conferences, consultancy and contract research, and joint research.

Table 6.6 Comparison of participation rates between D'Este and Patel (2007) and PACEC/CBR survey of academics (2008)

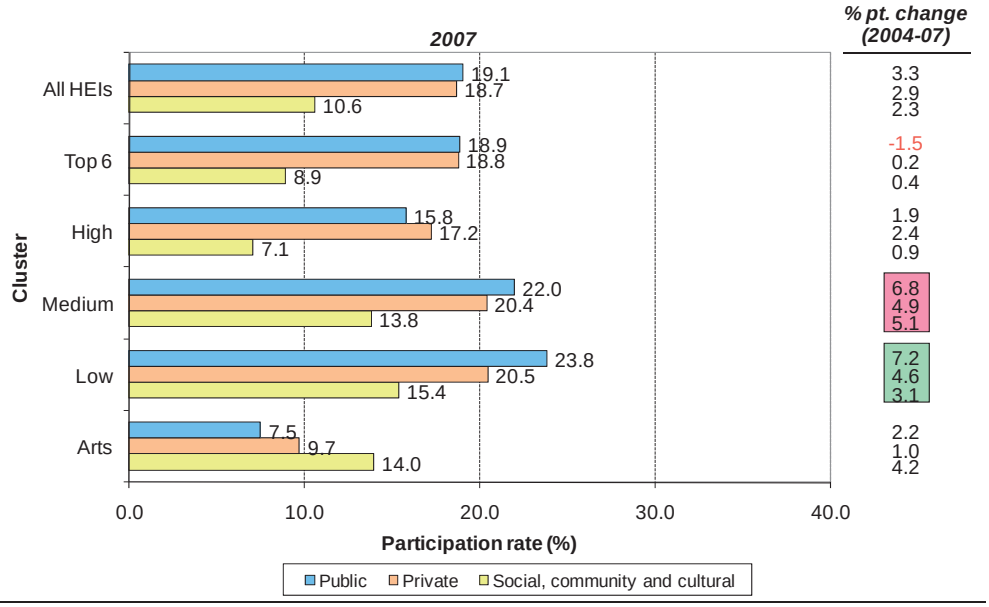
	D'Este and Patel survey 2002/03	PACEC/CBR survey of academics 2008		
		Average	Upper	Lower
Meetings and conferences	65.0	**60.0**	65.0	55.0
Consultancy and contract research	56.3	**45.5**	49.0	42.0
Joint research	44.6	**27.5**	28.0	27.0
Training*	42.5	**19.5**	21.0	18.0
Creation of physical facilities	20.8	**1.0**	1.0	1.0

* Training was termed continuing professional development (including training company employees through course enrolment or temporary personnel exchange) in the PACEC/CBR survey
Number of respondents: upper bound (924); lower bound (724)
Sources: D'Este and Patel (2007) "University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry?", *Research Policy*, Vol. 36, pp. 1295-1313, PACEC/CBR survey of academics 2008, PACEC/CBR analysis

6.2.17 There is very good agreement between the sources for the participation rate in meetings and conferences with external organisation participation, and relatively good agreement for consultancy and contract research engagements (Table 6.6). There is less good agreement for joint research and training. The large difference in rates for the creation of physical facilities is likely definitional, with the D'Este and Patel (2007) survey including the setting up of spin-offs while the PACEC/CBR survey did not. Nevertheless, the similar order of magnitude between surveys is very encouraging.

Changes in the knowledge exchange participation rate

Figure 6.1 Participation rates based on HEBCI data



Sources: HEBCI surveys, PACEC/CBR analysis

6.2.18 The magnitude of engagement estimated by both the PACEC/CBR survey of academics and by D'Este and Patel is much higher than that suggested by the Higher Education Business and Community Interaction survey (Figure 6.1). However, the HEBCI survey only provides information about participation of academics in any one

given sector (social, community and cultural sector, commercial sector and the public sector). It does not provide information on how many academics engage in more than one type of sector. Therefore it is not possible to estimate the *total* level of engagement across all sectors. In addition, it is unlikely that the estimates returned in the HEBCI survey are based on a random sample of academics within their institutions.

6.2.19 Despite these limitations, the *change* in the level provides useful information on how senior management within HEIs *perceive* culture change within their institutions. Overall, HEIs perceived an increase in participation across the different sectors, with public sector KE participation growing fastest, by 3.3 percentage points, followed by private sector participation and finally societal KE participation (Figure 6.1). However, there is considerable variation between clusters. Public sector engagement in the top six research cluster decreased over the period, while participation in the other sectors remained approximately constant. Private and public sector participation in the high cluster grew modestly over the period. The growth in the overall HE sector participation across all sectors was driven by the medium and low clusters.

6.2.20 It is therefore clear that, at first glance, the medium and low research clusters, and to some extent HEIs in the arts cluster, have seen the greatest changes to their 'enabling' culture. Previous chapters described how large increases in capacity and capability in many HEIs across all clusters will inevitably contribute to an increase in the participation rate. In addition, changes to academic culture and attitudes can have an impact on the participation rate.

6.2.21 Changes in the willingness of academics to participate in KE activities are also evident through the increased level of such activities (e.g. number of consultancy contracts, contract research contracts, KTPs, number of staff participating in other KE activities etc), with all HEIs citing this as a good proxy. However, one must also remember that a change in the number of engagements could reflect an increase in either the participation rate or the quantity of engagement by the same number of academics. The increased attendance at internal third stream-related workshops and seminars was also cited by the case study HEIs as important evidence on the change in the willingness to participate. A number of senior managers interviewed within these HEIs also claimed that they are observing academics being more pro-active about their knowledge exchange activities, for example seeking out advice and support from KEOs or applying for seed funding.

6.3 Scale of engagement in the modes of knowledge exchange interaction

6.3.1 The previous section presented the overall participation rates by academics in knowledge exchange. This section now turns to the scale of interactions in the diversity of methods outlined in Table 6.1. The level of engagement in the variety of modes of interaction reflects partly the specialisms of each particular HEI.

Table 6.7 Level of engagement in core knowledge exchange activities (% of respondents claiming frequent or very frequent interactions)

	Total	Cluster				
		Top 6	High	Medium	Low	Arts
Providing CPD	21	19	18	24	23	22
Contract research agreement (original research work done by the HEI alone)	18	17	**24**	15	**8**	6
Joint research agreement (original research undertaken by both partners)	17	15	**25**	**13**	**6**	4
Consultancy agreement (no original research undertaken)	17	21	15	19	13	17
Participation in consortia involving external organisations	17	16	18	16	15	12
Involvement with schools projects	12	11	11	12	14	12
Joint curriculum development	10	8	**4**	11	22	16
Prototyping and testing for external organisations	6	4	7	7	7	2
Enterprise education	4	1	4	**2**	**10**	**19**
Creation of physical facilities with external organisation funding	2	1	1	**5**	2	0
Number of respondents	1,116	214	415	288	176	24
Effective sample size	613	160	282	111	83	28

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008

6.3.2 The provision of CPD courses was the most frequently cited form of engagement with external organisations, with 21% of academics engaged in such activities. This was the case for HEIs in the medium and low research and arts clusters. The most frequent method of engagement in the top six cluster was consultancy, while academics in the high research cluster engaged most frequently through joint and contract research. While contract research was the second most frequent method of engagement overall, this was largely owing to the large level of engagement through this mode in the high research cluster. Consultancy was a top-three most frequent mode of interaction in the top six research, medium research and arts clusters, while low research intensity HEIs frequently engaged with external organisations for joint curriculum development. Contract research was more prevalent in the higher research clusters (those in the top six, high and medium research clusters) compared with lower research intensity and arts HEIs. The latter HEIs focus on enterprise education to a much larger degree than the higher research HEIs. Some 12% of academics surveyed had frequent or very frequent interactions with schools.

Table 6.8 Other forms of knowledge exchange activities (% of respondents claiming frequent or very frequent interactions)

	Total	Cluster				
		Top 6	High	Medium	Low	Arts
Attending conferences with external organisation participation	56	56	59	55	**49**	63
Providing informal advice on a non-commercial basis	35	**41**	**31**	33	40	29
Giving lectures/talks for (non-HEI) external organisations	34	**42**	32	35	29	31
Participation in networks involving external organisations	32	27	**27**	**38**	**42**	**52**
Joint publications with external organisations	26	31	**33**	23	**9**	20
Membership of advisory boards to external organisations	22	26	**18**	24	22	33
In-course student projects, placements or Knowledge Transfer Partnerships	20	16	10	32	**27**	**41**
Hosting visits by individuals from external organisations	19	21	**15**	18	23	25
Giving public lectures for the community	15	**24**	15	15	**10**	4
Organising conferences which have HEI and external organisation participation	15	19	16	15	**10**	16
Post-course placements with external organisations	14	13	**11**	16	**19**	20
Standard-setting forums	10	9	10	10	6	**23**
Provision of public exhibitions	5	**2**	4	4	**8**	35
Provision of community-based performance arts	4	4	**2**	4	**8**	**16**
Personal secondment to external organisations	3	3	2	4	2	4
Provision of community-based sports	1	0	1	**2**	2	0
Number of respondents	1,116	214	415	288	176	24
Effective sample size	613	160	282	111	83	28

Q: How frequently have you engaged in any of the following types of activities with public or private sector organisations external to the HE sector (including third sector organisations) within the last three years?
Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008

6.3.3 Many academics provide informal advice on a non-commercial basis to external organisations, which helps to diffuse knowledge from the HEI into the economy and society (Table 6.8). The scale of engagement with external organisations through informal means suggests that there is a potentially large amount of knowledge being exchanged that is not being captured by most statistics on HEI-external organisation links. In addition, without accounting for the imputed value of these informal links, any attempts to value the overall contribution of the HE sector to the economy and society, and to the UK innovation system, will likely underestimate its true impact. In addition, this provision of informal advice helps to build up the networks between academics and external organisations that may lead to other forms of knowledge exchange. Participation in networks was particularly common in medium and lower research and arts HEIs, as was engaging with external organisations through student projects.

6.3.4 Other frequent modes of interaction included giving lectures and talks for external organisations (34% of academics), submitting joint publications (26%), and becoming members of the advisory boards of external organisations (22%). Hosting visits for individuals from external organisations was particularly frequent for academics in arts HEIs (25%), which is unsurprising given the large number of academics in this cluster who have their own professional practices. In addition, given the nature of their disciplines, academics in arts HEIs were more likely than average to provide public exhibitions and community-based performance arts. Those in the top six research cluster were more likely than the average to provide public lectures for the community (24% compared with the average of 15%).

Table 6.9 Engagement through the commercialisation of research with ANY participation over the past three years (% of responses)

Commercialisation mechanism	Total	Cluster				
		Top 6	High	Medium	Low	Arts
Applied research through knowledge transfer	36	34	33	35	43	53
Formed/run a consultancy via your research	18	22	15	17	20	**40**
Taken out a patent	13	**24**	15	9	**2**	7
Licensed research outputs to a British-owned company	6	11	7	5	1	7
Licensed research outputs to a foreign-owned company	6	**17**	6	3	1	0
Licensed research outputs to a company in the region	5	**10**	3	7	1	7
Formed a spin-out company in the local area to exploit research	5	**10**	5	5	3	7
Formed a spin-out company in the rest of the region	1	2	**0**	5	0	0
Formed a spin-out company in the rest of the UK	1	0	2	0	1	0
Formed a spin-out company abroad to exploit research	1	0	**2**	0	0	0
Number of respondents	791	145	**321**	184	127	13
Effective sample size	440	113	**208**	75	59	14

Average of upper and lower bound participation rates
Share of infrequent, frequent and very frequent responses
Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008, PACEC/CBR analysis

6.3.5 Table 6.9 shows the levels of active engagement in the commercialisation of research. The previous tables on the broad range of engagement modes focused on frequent or very frequent participation (more than three times in the past three years). However, the action of commercialising research through licensing, forming a consultancy, taking out patents or forming a spin-out company is expected to be much more infrequent. For this reason, the above table focuses on any participation in such activities over the past three years.

6.3.6 Over one-third of academics surveyed claimed that they had applied their research through knowledge exchange or technology transfer at some point over the past three

years; 18% formed or ran a consultancy while 13% had taken out a patent on their research during this period. Academics in the top six research cluster were more likely than average to take out patents to exploit their research.

6.3.7 The exploitation of research through licensing was slightly more common than taking research to market through the formation of a spin-out company. Those in the top six research cluster were much more likely to license their research to foreign-owned companies. In addition, when academics chose to form a spin-out company to exploit research, it was most likely to be in close geographical proximity to the HEI, with this being much more frequent for those in the top six research cluster. This allows them to continue their duties as an academic, but also allows the newly formed company to benefit from the close interaction with the academic's HEI resources.

Future engagement in commercialisation activities

6.3.8 Table 6.10 presents the mechanisms that academics who are currently engaging in particular commercialisation mechanisms are planning to engage in or would like to undertake. On average, those who currently commercialise their research in the medium and low research clusters all planned to engage in increased levels of each mechanism, with highest planned activity in forming or running consultancies, applying research through knowledge exchange or transfer and forming local spin-outs. Those in high research HEIs would like to further engage or planned to increase participation in most licensing activities (to British and foreign-owned companies and to companies in the region).

6.3.9 The biggest increases in planned participation in the commercialisation of research for academics in the top six research cluster were through the formation of spin-outs, locally, in the UK but outside the region and, interestingly, abroad. The largest decrease in planned participation for top six research academics was in patents (-6 percentage point differential between the current level and planned level) and licensing research outputs to foreign-owned companies. These academics, unlike those in other clusters, did not plan to significantly increase engagement in licensing opportunities for their research.

Table 6.10 Commercialisation activities that academics were planning to do or would like to do (% of respondents; numbers in brackets are the differential with the current participation in each commercialisation mechanism*)

Commercialisation mechanism	All HEIs	Cluster				
		Top 6	High	Medium	Low	Arts
Applied research through knowledge exchange/transfer	37	36	31	38	49	50
	(1)	(1)	(-3)	(7)	(8)	(4)
Formed/run a consultancy via your research	24	22	22	22	32	57
	(6)	(-2)	(6)	(5)	(11)	(20)
Licensed research outputs to a British-owned company	14	14	17	16	6	7
	(7)	(2)	(9)	(12)	(4)	(0)
Taken out a patent	14	18	14	10	7	14
	(1)	(-6)	(-2)	(2)	(5)	(7)
Formed a spin-out company in the local area (within 30 miles) to exploit research	12	16	11	8	15	7
	(6)	(5)	(5)	(3)	(11)	(0)
Licensed research outputs to a foreign-owned company	12	13	15	10	6	0
	(5)	(-6)	(8)	(7)	(5)	(0)
Licensed research outputs to a company in the region	11	12	13	12	4	7
	(5)	(2)	(8)	(6)	(3)	(0)
Formed a spin-out company abroad to exploit research	5	7	4	8	1	7
	(4)	(7)	(2)	(8)	(1)	(7)
Formed a spin-out company in the region but outside the local area to exploit research	5	6	3	7	6	7
	(3)	(4)	(3)	(2)	(6)	(7)
Formed a spin-out company in the UK but outside the region to exploit research	4	7	1	5	4	0
	(3)	(7)	(-1)	(5)	(3)	(0)
None of the above	43	42	48	45	37	21

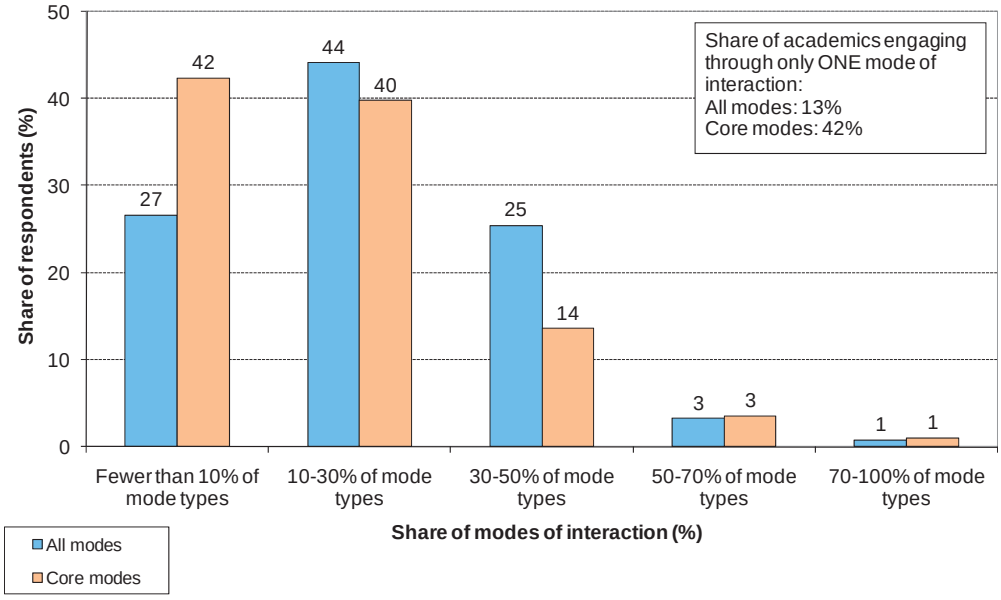
* Analysis restricted to those who answered both parts of the question, meaning that the planned participation is of those who currently undertake each mechanism
Source: PACEC/CBR survey of academics 2008, PACEC/CBR analysis

Breadth of modes of engagement

6.3.10 The diversity of potential modes of interaction with external organisations has been highlighted above. The breadth of engagement is shown in Figure 6.2 and looks at the share of academics who participate in different ranges of activities. Many academics interact with external organisations through multiple modes of interaction, with 44% engaging through 10% to 30% of all mode types (40% for core mode types).[42] A further 25% exploit between 30% and 50% of all mode types (14% of core mode types). Just 13% of academics interact with external organisations through only one mode, although this rises to 42% when using the narrower definition of core modes.

[42] All mode types: 26 potential modes of interaction. Core mode types: 10 potential modes of interaction.

Figure 6.2 Breadth of modes of engagement



Note 1: Average of upper and lower bounds
Note 2: All modes: 26 potential modes of interaction. Core modes: 10 potential modes of interaction
Number of respondents: upper bound (924); lower bound (724)
Source: PACEC/CBR survey of academics 2008, PACEC/CBR analysis

6.4 Factors driving the decision to participate in knowledge exchange: an econometric analysis

6.4.1 The factors driving the decision to participate in knowledge exchange can be explored using an econometric methodology. Table 6.11 reports the results of a multivariate analysis of the personal and institutional characteristics that affect the probability that an academic will interact with a private, public or charitable/voluntary sector organisation. In general, the results indicate that personal characteristics have a significant impact on the probability to participate while institutional characteristics have little effect. This holds for both institutional characteristics that were reported by the respondents of the academic survey, as well as the characteristics reported by the HEIs themselves through the HEBCI survey.

Table 6.11 Probit regressions* of the probability that an academic interacts with private, public and third sector organisations on individual and institutional characteristics

	Interaction with private firms	Interaction with public organisations	Interaction with charitable/voluntary sector organisations
Professor	0.351**	0.341**	0.432**
	-0.085	-0.076	-0.085
Reader, senior lecturer	0.190*	0.209**	0.240**
	-0.08	-0.073	-0.079
Lecturer	Omitted category**		
Research fellow	0.163	0.104	0.109
	-0.115	-0.104	-0.121

Other	0.326**	0.094	0.293**
	-0.093	-0.097	-0.105
Previously US-based	-0.063	-0.105	0.12
	-0.076	-0.077	-0.079
Medicine, dentistry	-0.061	0.319**	0.387**
	-0.114	-0.096	-0.119
Biology, chemistry	-0.108	0.179*	0.146
	-0.081	-0.084	-0.099
Physical sciences	Omitted category**		
Engineering	0.229*	0.198*	-0.12
	-0.11	-0.093	-0.092
Social sciences	-0.218**	0.309**	0.259**
	-0.07	-0.075	-0.09
Arts and humanities	-0.169*	0.197*	0.246**
	-0.075	-0.08	-0.086
Other	-0.215**	0.133	0.129
	-0.077	-0.094	-0.105
Management responsibility	0.175**	0.071	0.003
	-0.047	-0.047	-0.046
Basic research	-0.131*	-0.264**	-0.208**
	-0.06	-0.055	-0.047
User-inspired basic research	0.161**	-0.087	-0.051
	-0.059	-0.057	-0.05
Applied research	Omitted category**		
Been employed in small business	0.078	-0.025	-0.058
	-0.059	-0.057	-0.051
Started, owned small business	0.175**	0.094	0.023
	-0.063	-0.06	-0.059
Family owns small business	0.036	0.022	0.032
	-0.056	-0.056	-0.054
Been employed in large business	0.193**	-0.032	-0.001
	-0.054	-0.053	-0.05
Been employed in public sector	-0.046	0.185**	0.086
	-0.05	-0.049	-0.048
Been employed in charitable/voluntary sector	0.031	-0.008	0.454**
	-0.07	-0.068	-0.063
Female	-0.078	-0.114*	0.075
	-0.05	-0.05	-0.047
Age: under 30	-0.223	0.374**	-0.093
	-0.157	-0.1	-0.14
Age: 30-39	0.033	0.124	0.037
	-0.071	-0.068	-0.068
Age: 40-49	Omitted category**		
Age: over 50	-0.121*	0.077	-0.057
	-0.053	-0.053	-0.049
Strategy for interacting with business	-0.032	0.101	0.006
	-0.058	-0.058	-0.054
New knowledge transfer activities	0.041	0.025	0.025
	-0.057	-0.057	-0.051

Strategy for non-traditional funding	0.061	0.059	-0.008
	-0.053	-0.054	-0.05
New recruitment criteria	-0.013	-0.061	0.101*
	-0.053	-0.053	-0.051
In-house IP capability	0.146	0.027	0.022
	-0.122	-0.134	-0.12
External IP capability	0.307*	0.1	0.15
	-0.154	-0.163	-0.168
No IP capability	Omitted category**		
Enquiry point for SMEs	-0.155	-0.279**	-0.225
	-0.14	-0.106	-0.126
Assistance to SMEs	-0.093	0.081	-0.008
	-0.093	-0.09	-0.086
Central contracting system	-0.075	-0.075	-0.1
	-0.085	-0.082	-0.085
Exploitation company	0.129	-0.027	0.186
	-0.175	-0.168	-0.178
Commercialisation department	0.208	-0.102	0.217
	-0.172	-0.165	-0.158
Exploitation and commercialisation	0.175	0.034	0.013
	-0.145	-0.14	-0.13
No commercialisation facilities	Omitted category**		
Third stream funding (in logs)	0.043	0.075	-0.013
	-0.091	-0.079	-0.071
FTE academic staff, 2005 (in logs)	-0.015	-0.253	0.047
	-0.155	-0.13	-0.117
Research income, 2005 (in logs)	0.009	0.054*	-0.014
	-0.026	-0.025	-0.022
Observations	617	626	629

* Probit regressions explore the probability that a variable explains a binary dependent variable (in this case, whether the academic participates in knowledge exchange or not).
** Results of a regression may be erroneous if all dummy variables on a particular issue (e.g. basic research, user-inspired research and applied research) are included. For this reason, one dummy variable for each set must be omitted. This is technical issue known as perfect collinearity.
Standard errors in parentheses: * significant at 5%; ** significant at 1%. Coefficients report marginal effects. For dummy variables the coefficients report the effect of a discrete change of the dummy variable from 0 to 1.
Sources: Variables from 'Professor' until 'Age: over 50' are taken from the PACEC/CBR survey of academics 2008, covering the period 2005-08, while variables from 'In-house IP capability' until 'No commercialisation facilities' are taken from the HEBCI survey 2005

6.4.2 In terms of the individual characteristics that affect interaction, the results indicate that professors, readers and senior lecturers are more likely to participate than lecturers, but that senior research fellows are neither more nor less likely to participate than lecturers. The largest impact was due to the field of the researcher; academics in engineering are 23% more likely to interact with private firms than academics in the physical sciences, and between 40% and 45% more likely to interact with private firms than academics in the social sciences, and the arts and humanities. Academics in medicine, the social sciences, the arts and humanities and engineering are between 20% and 30% more likely to interact with public sector organisations than academics in the physical sciences, while academics in medicine, the social sciences and the arts and humanities are more likely to interact with the charitable/voluntary

sector. Academics working on basic research are less likely to interact with any type of external organisation while, surprisingly, academics working on user-inspired basic research are more likely to interact with private sector organisations than academics working on applied research.

6.4.3 Having management responsibility within the HEI, regardless of the position held, is associated with an 18% higher probability of interacting with the private sector, while being under 30 years of age increases the probability of interacting with the public sector. Female academics are less likely (11%) to interact with the public sector.

6.4.4 Previous business, public or charitable/voluntary sector experience has an important impact on the probability to interact. Academics who have started, own or have owned a small business are 18% more likely to interact with the private sector, while academics who have been employed by large firms (with over 250 employees) are 19% more likely to interact with the private sector. Academics who have been employed in the public sector are 19% more likely to interact with it, while academics who have been employed in the charitable/voluntary sector are 45% more likely to interact with it.

6.4.5 In terms of the institutional context, having an external IP capability raises the probability of interaction with the private sector by over 30%, while having a dedicated entry point for SME contacts is associated with a lower probability of interaction with the public and charitable/voluntary sectors, perhaps because the focus is on promoting exchange with the private sector.[43] The introduction of new recruitment criteria linked to knowledge exchange activities, as reported by the academics interviewed in the PACEC/CBR survey of academics 2008, has a positive effect on interactions with the charitable/voluntary sector, but no statistically significant effect on interactions with the private and public sectors.

6.4.6 Finally, the extent of the HEI's accumulated third stream funding has no statistically significant effect on the probability to interact with external organisations, but the degree of research intensity, as measured by the research income of the HEI while controlling for the size of the academic staff, has a positive effect on the probability to interact with the public sector, but no effect on other types of interaction.

[43] These variables were taken from the HEBCI survey, and refer to the year 2005.

7 Outputs of Knowledge Exchange and the Impact of HEFCE Third Stream Funding

7.1 Introduction

7.1.1 This chapter presents an analysis of the quantifiable outputs emerging from HEI knowledge exchange activities. *Inter alia* they include income generated, the number of contracts, patents and licences, and social and community events. These outputs (measures of different third stream income flows) provide a first measure of the benefits received by external organisations[44] in their knowledge exchange activities with HEIs. They do not, however, capture the full range of benefits that are secured by external organisations and academics as a result of their KE activities. Thus firms may become more productive as a result of engagement with HEIs and academics may improve the quality of their research and teaching. Some evidence on these wider impacts is provided in the chapter on impacts on external organisations (Chapter 9). Using historic data from the HEBCI database, the analysis here focuses on changes in the growth and composition of outputs to 2007 and changes in partner/customer types. Evidence from the case studies, the academic survey and a survey undertaken by Quotec in 2006[45] also enables an assessment of the extent to which changes in third stream outputs are attributable to HEFCE third stream funding. Lastly, a value for money assessment is made based on the outputs produced relative to the funding inputs received by HEIs.

7.2 The baseline and the evolution of knowledge exchange outputs

Table 7.1 Number of non-commercialisation-related engagements per HEI in 2004 and 2007

Cluster	Year	Contract research	Consultancy	Facilities and equipment	Course learner days
Top 6	2007	922	301	236	21,525
	2004	821	295	740	53,248
High	2007	343	741	161	15,706
	2004	317	181	165	9,665
Medium	2007	115	426	56	29,524
	2004	104	225	105	31,561
Low	2007	40	242	81	49,724
	2004	26	161	29	41,532
Arts	2007	4	42	52	6,027
	2004	3	16	17	42,58
All HEIs	2007	173	387	97	26,887
	2004	155	164	114	24,818

Source: HEBCI surveys, PACEC/CBR analysis

7.2.1 The first indicator of the scale of outputs and how they have evolved is the number of HEI engagements under different modes of interaction. Table 7.1 shows that the

[44] This assumes that the price paid for the service represents (as a first approximation) the value of the service to the external organisation

[45] Quotec Ltd (2007) *Higher Education Innovation Fund impact survey (Study C)*, a report to HEFCE

number of engagements through contract research, consultancy and courses all increased over the period 2004-07, although access to facilities and equipment declined.

7.2.2 The number of engagements in contract research and consultancy increased across all clusters. The number of course learner days decreased substantially in the top six research cluster, primarily because of massive reductions in days at Imperial College London and the University of Manchester. Engagement in providing access to facilities and equipment decreased for the higher research clusters, but increased rapidly for the low research and arts clusters. The reduction in engagement in facilities and equipment service provision in the top six research cluster was almost solely owing to reductions at University College London.[46] The arts cluster was the only one to experience growth in all of these modes of engagement between 2004 and 2007.

Table 7.2 Number of commercialisation-related engagements per HEI in 2004 and 2007

Cluster	Year	Patent stock	Licences	Share of non-UK licences in total (%)	Spin-offs (HEI ownership)	Spin-offs (formal, no HEI ownership)	Spin-offs (staff start-ups)	Spin-offs (graduate start-ups)
Top 6	2007	571	88.2	21.7	46.2	1.3	4.7	38.8
	2004	220	28.8	22.0	40.3	5.3	1.0	1.7
High	2007	94	25.7	27.0	11.2	1.7	1.6	4.4
	2004	81	11.0	18.7	9.3	1.0	2.6	1.7
Medium	2007	32	31.9	12.1	3.4	0.5	0.8	20.5
	2004	12	42.1	4.6	3.5	0.7	1.1	7.6
Low	2007	5	11.7	86.8	0.5	0.2	1.1	41.1
	2004	2	0.4	14.3	0.7	0.7	0.5	6.8
Arts	2007	10	1.6	0.0	0.2	0.1	0.6	43.2
	2004	1	0.5	50.0	0.1	0.0	0.2	4.7
All HEIs	2007	62	22.3	28.7	6.1	0.7	1.2	25.5
	2004	35	15.1	9.1	5.4	0.9	1.1	5.0

Source: HEBCI surveys, PACEC/CBR analysis

7.2.3 Table 7.2 shows the number of engagements for commercialisation-related engagements such as patenting, licensing and forming spin-off companies. The stock of patents increased from 35 patents per HEI in 2004 to 62 patents per HEI in 2007, with increases in all clusters. The patent stock is also clearly correlated with the research intensity of HEIs, with top six research HEIs holding the most active (those under licence to an external party) and live (those registered but yet to be licensed) patents and low research intensity HEIs holding the fewest. In addition, the number of licences per HEI (including both software and non-software licences) is also largely correlated with the research intensity of the clusters, with those in the top six research cluster holding the highest number and those in the low research intensity and arts clusters holding the fewest. Of these licences, approximately 29% are to non-UK organisations, with those in the low research cluster having the highest share of non-UK licenses (87%). The final KE mechanism for commercialising research is the

[46] One must be very wary when comparing the results of the top research HEIs with the other clusters because of the very small sample (six HEIs) compared with the other clusters (approximately 33 in each and 19 in the arts cluster).

formation of a spin-off company. There are a number of different types reported in the HEBCI data:[47]

- Spin-offs (HEI ownership) – companies set up to exploit IP that has originated from within the HEI.
- Spin-offs (formal, no HEI ownership) – companies set up to exploit IP that has originated from within the HEI but where the HEI has released ownership (usually through sale of share and/or IP).
- Spin-offs (staff start-ups) – companies set up by active (or recent) HEI staff but not based on IP from the institution.
- Spin-offs (graduate start-ups) – all new businesses started by recent graduates (within two years) regardless of where any IP resides.

7.2.4 The type of spin-off appears to depend on the cluster. The top six research HEIs have high numbers of spin-offs with HEI ownership and graduate start-ups, while the high research cluster is dominated by spin-offs with HEI ownership, with relatively few graduate spin-offs. The medium and low research and arts clusters are dominated by graduate start-ups, with relatively few other types of start-ups. When looking at the changes over the period 2004-07, the prevalence of graduate start-ups has permeated the HE sector across all clusters (excluding those in the high research cluster), increasing faster than any other type (from five per HEI to 25.5 per HEI over the period).

Evolution of knowledge exchange by income stream

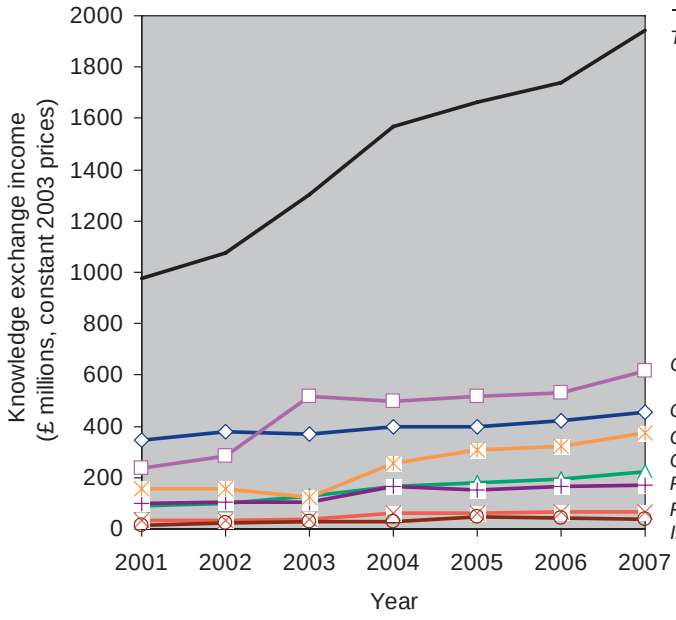
7.2.5 Engagements in knowledge exchange derive income for HEIs. Figure 7.1 shows that income from knowledge exchange activities[48] in 2007 was £1.94 billion, growing by approximately 12% per annum since 2001 (at constant 2003 prices). Contract research income was the greatest contributor to total income in the final year, generating 32% of total KE income. Collaborative research contributed 23% to overall KE income, courses generated 19%, while income from consultancy contracts made up 11% of the total.

7.2.6 The HEBCI survey considers income from regeneration and development projects to be a good proxy for direct economic and social impact of HEIs. Such funding allows HEIs to engage directly in economically and socially beneficial projects. Regeneration and development income contributed 9% to total KE income and grew by 9% per annum over the period 2001-07. An analysis of the source of this regeneration funding showed that 36% came from RDA programmes in 2007. A further 21% came from the European Regional Development Fund (ERDF), 19% from the European Social Fund (ESF) and 10% from UK Government regeneration funds. The share of regeneration funding coming from ERDF decreased by 10% per annum over the period 2004-07 while that coming from the UK Government increased by 22% per annum (Figure 7.5).

[47] Definitions were obtained from the HEBCI guidance notes.
[48] The income from knowledge exchange is based on the HEBCI data and comprises the available income streams from contract research, collaborative research, courses, consultancy, facilities and equipment, licensing and regeneration and development projects.

7.2.7 Revenues from intellectual property constitute a very small proportion of the total income derived from knowledge exchange. However, the current revenues generated by intellectual property may greatly underestimate the net present value of these agreements to HEIs because much of the value from the licence deals may take many years to be realised (e.g. in pharmaceuticals where drug development may take 10-20 years before reaching the market).

Figure 7.1 Scale and evolution of knowledge exchange income



Income stream	2007 income (£m)	2007 share of total (%)	CAGR 01-07 (%)
Total	1,942	100	12
Contract research	618	32	17
Collaborative research	454	23	5
Courses	374	19	16
Consultancy	222	11	16
Regeneration	170	9	9
Facilities and equipment	67	3	14
IP revenues	38	2	18

Source: HEBCI surveys, PACEC/CBR analysis

Average value of knowledge exchange contracts

7.2.8 The highest value knowledge exchange contracts on average are secured through contract research, generating £28,000 per contract, compared with just £4,000 per consultancy contract (Table 7.3). However, there is considerable variation according to the partner type. While contract research contracts are the highest value type of engagement with non-commercial organisations and SMEs, licensing generates the most per contract income when engaging with non-SMEs. Courses generated on average £106 per learner day, an increase of 35% over the period 2004-07.

Table 7.3 Scale and growth of the average value of knowledge exchange contracts

		Partner type			
		SME	Non-SME	Non-commercial	All
Contract research	Average 2007 value (£k per contract)	14	27	30	28
	Change 2004-07 (%)	-9	5	17	11
Licensing/IP income	Average 2007 value (£k per contract)	9	30	4	10
	Change 2004-07 (%)	9	-40	12	-11
Facilities/equip services	Average 2007 value (£k per contract)	6	7	4	5
	Change 2004-07 (%)	31	-16	62	33
Consultancy	Average 2007 value (£k per contract)	2	8	5	4
	Change 2004-07 (%)	-22	-31	-65	-44
Courses	Average 2007 value (£k per learner day)	n/a	n/a	n/a	0.1
	Change 2004-07 (%)	n/a	n/a	n/a	35

All financial values are in constant 2003 prices
Source: HEBCI surveys, PACEC/CBR analysis

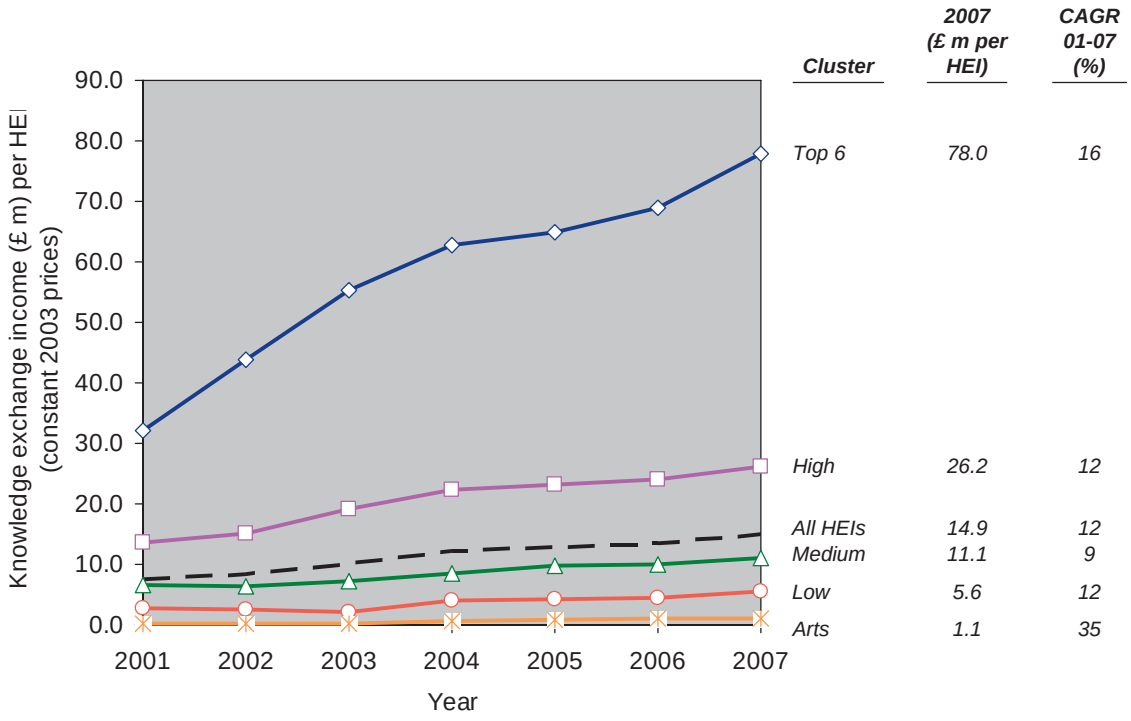
7.2.9 The average value of contracts grew for most types of engagements with non-commercial organisations, except for consultancy, while it declined for most types of engagements with non-SMEs, except for contract research. The latter may suggest that larger firms are increasingly valuing the contribution of HEI research for product development and enhancing their technological capabilities.

7.2.10 The average value of contract research engagements with SMEs declined over the period 2004-07, as did the average value of SME consultancy contracts, providing more evidence on the financial constraints facing SMEs in accessing HEI-derived research. The average value of facilities and equipment services contracts with SMEs grew rapidly over the period.

Evolution of knowledge exchange income by HEI cluster

7.2.11 HEIs in the top six research cluster experienced the largest absolute growth in knowledge exchange income per HEI over the period 2001-07 (Figure 7.2), with those in the top six and low research and arts clusters all experiencing above the average growth in the sector. Those in the high and medium research clusters grew more slowly than the sectoral average.

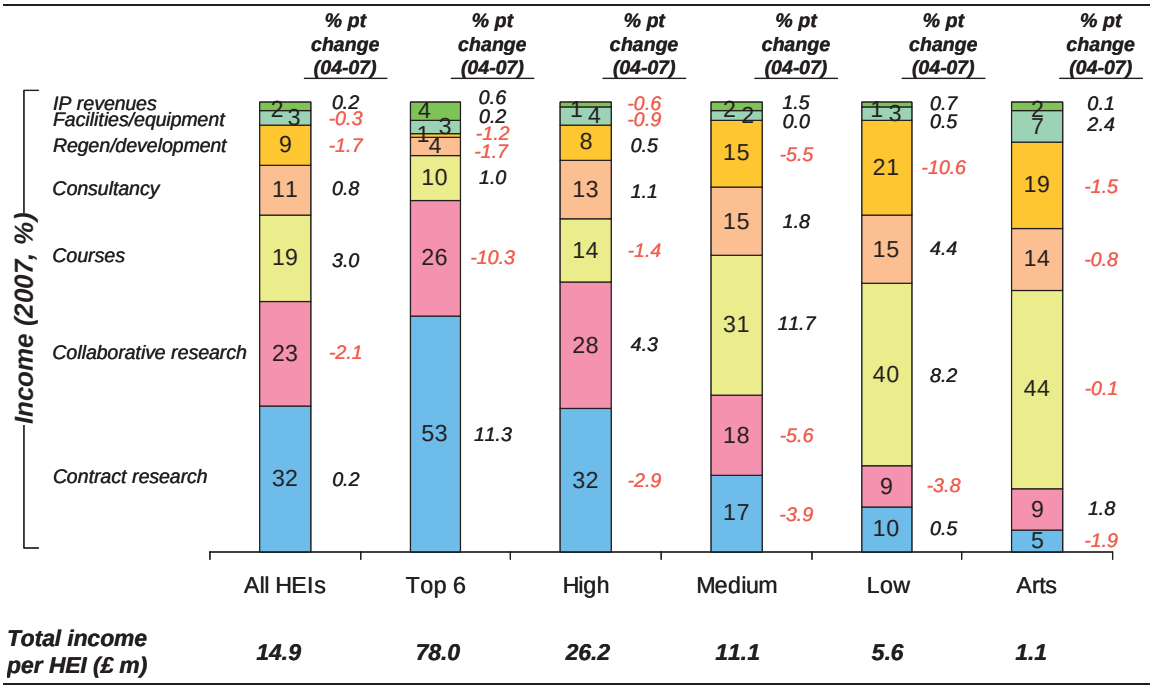
Figure 7.2 Evolution of knowledge exchange income by cluster



CAGR: compound annual growth rate
Source: HEBCI surveys, PACEC/CBR analysis

Composition of knowledge exchange income by cluster

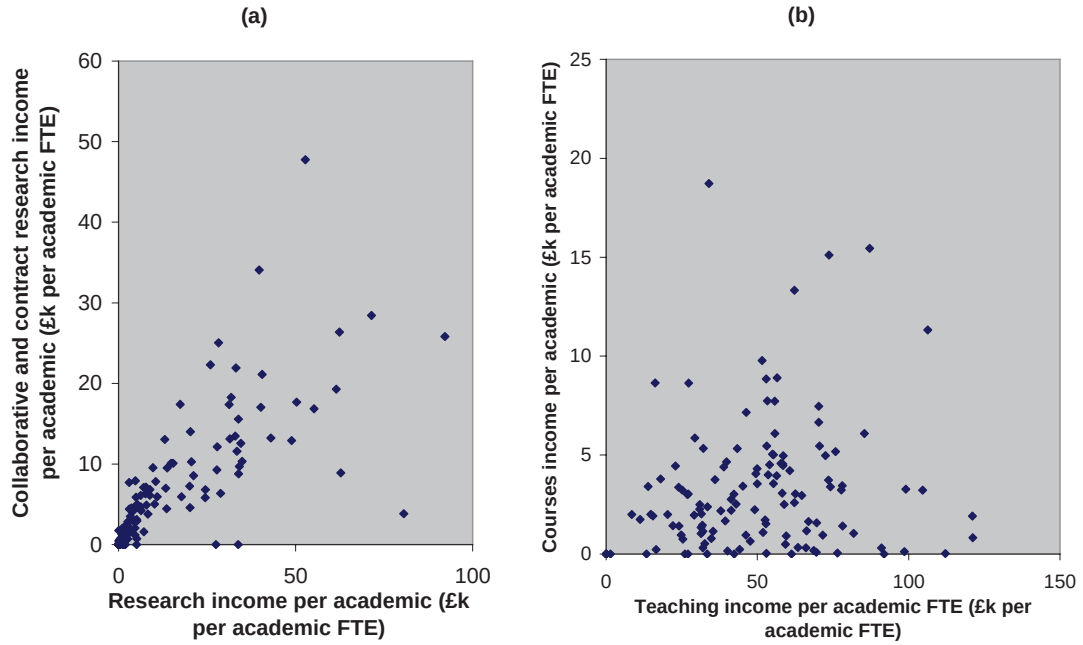
Figure 7.3 Composition of knowledge exchange income by cluster



Financial values are in constant 2003 prices
Sources: HEBCI surveys, PACEC/CBR survey of academics, PACEC/CBR analysis

7.2.12 The composition of knowledge exchange income also varies across clusters, emphasising the different specialisms of the HEIs and the modes of interaction they exploit to diffuse knowledge into the economy and society (Figure 7.3). Those in the higher research clusters (top six and high research clusters) generate much of their KE income through channels which involve conducting some original research (contract and collaborative research). This is shown clearly in Figure 7.4 (a) where a clear relationship exists between research income and contract and collaborative research income. Contract research income as a share of total KE income grew by approximately 11 percentage points for the top six research cluster while collaborative research income shrank by a similar amount over the period 2004-07. The high research cluster experienced the opposite trend.

Figure 7.4 (a) Relationship between research income and contract and collaborative research income in 2007 and (b) relationship between teaching income and courses income in 2007



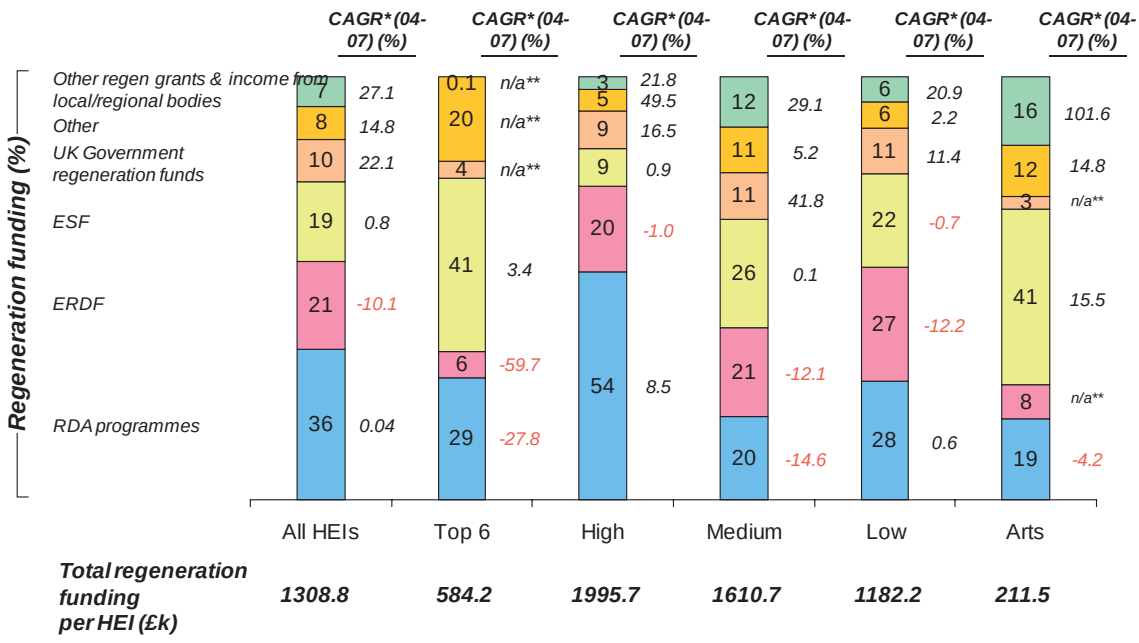
Financial values are in constant 2003 prices
Source: HEBCI survey, PACEC/CBR analysis

7.2.13 The medium and low research clusters generate much less of their KE income through collaborative and contract research, a share which declined over the period. HEIs in these clusters generate large proportions of their KE income through the provision of courses, a result of their much stronger teaching emphasis compared to research. However, the relationship between teaching income per academic FTE and course income per academic FTE does not appear to be very strong (Figure 7.4 (b)). The low research cluster has experienced moderate growth of course income as a share of total KE income over the period, as well as in consultancy income. Income from consultancy is relatively constant across clusters with the exception of the top six research cluster. Facilities and equipment services and IP revenues constitute a very small proportion of total KE income across all clusters.

7.2.14 There has been little change in the composition of KE income for the arts cluster over the period 2004-07, with collaborative research income and income from facilities and equipment services increasing the most. The case study arts HEIs were increasingly developing and making available their facilities and equipment for the micro and SME companies that comprise the bulk of the creative sectors. Many of these companies would not be able to afford such facilities and equipment, suggesting that there are large economies of scale that the HEI can provide.

7.2.15 There is also a correlation between the share of regeneration and development income in total KE income that an HEI secures and its cluster (Figure 7.3). Those in the medium and low research and arts clusters secure more regeneration and development income as a share of total KE income than those in the top six and high research clusters. However, the absolute amount of such funding grew only in the high research and arts clusters, with all other clusters registering contractions. As a share of total KE income, this type grew only very slightly in the high research cluster; all other clusters have seen declines. For example, the low research cluster has seen course income grow much more rapidly than regeneration and development funding, causing the share of the former to increase by 8.2 percentage points over the period 2004-07 and the latter to fall by 10.6 percentage points.

Figure 7.5 Sources of regeneration funding and compound annual growth rate over the period 2004-07



ESF: European Social Fund;
ERDF: European Regional Development Fund
Financial values are in constant 2003 prices
Source: HEBCI survey, PACEC/CBR analysis

7.2.16 An analysis of the sources of regeneration funding by cluster over the period 2004-07 showed that ESF funds were the largest source for the top six and medium research and arts clusters, while RDA programmes were the largest source for HEIs in the high and low research clusters (Figure 7.5). The top six research cluster has seen the

amount of ERDF funding received plummet by about 60% per annum and now contributes just 6% of total regeneration income. It has also seen large declines in RDA funding over the period. Arts HEIs secured less RDA funding as a share of total regeneration funding in 2007 compared with 2004, but have seen very large increases in the share derived from other regeneration grants and income from local and regional bodies (the very high CAGR is due to a low base year value).

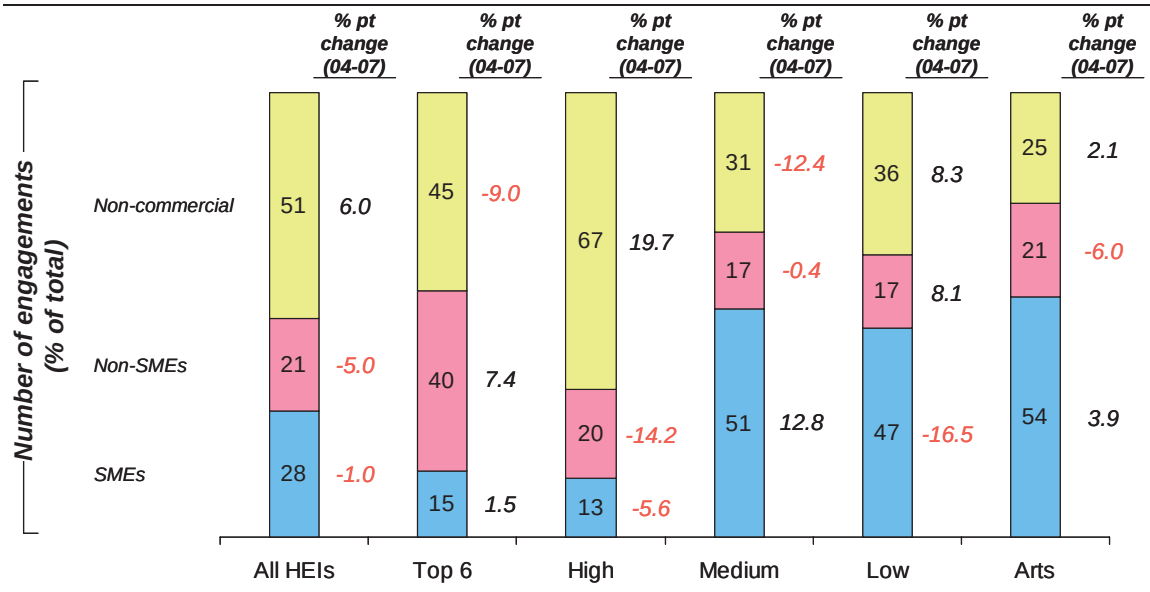
Composition and evolution of outputs by partner/customer type

Composition of the number of engagements by partner type

7.2.17 The composition of the total number of engagements by partner type also shows variation across clusters (Figure 7.6). Partners have been categorised into three different groups in the HEBCI database:[49]

- SME – small and medium-sized enterprises, sole traders and micro-businesses
- non-SME – other commercial business that are not classified under SMEs
- non-commercial – public sector, not-for-profit and charities.

Figure 7.6 Composition of the number of engagements by partner type



Source: HEBCI surveys, PACEC/CBR analysis

7.2.18 Engagements with non-commercial organisations constitute just over half of all interactions with external organisations in the HE sector, with the share growing by six percentage points over the period 2004-07 (Figure 7.6). SME engagement was the second largest share of total engagements (28% of total), while interactions with non-SMEs formed only 21% of the total number of engagements. However, the composition varied considerably over the different clusters of HEIs. Overall, those in the top six and high research clusters had a much smaller focus on SMEs, with only 15% and 13% of total engagements respectively coming from SMEs. In the top six

[49] Higher Education Business and Community Interaction survey guidance notes.

research cluster, 40% of all engagements were with non-SME organisations, compared with approximately 20% in other clusters. In addition, engagements with these organisations grew by 7.4 percentage points over the period. High research HEIs focused most heavily on non-commercial organisations, with the share of these types of engagements in total growing by almost 20 percentage points over the period 2004-07.

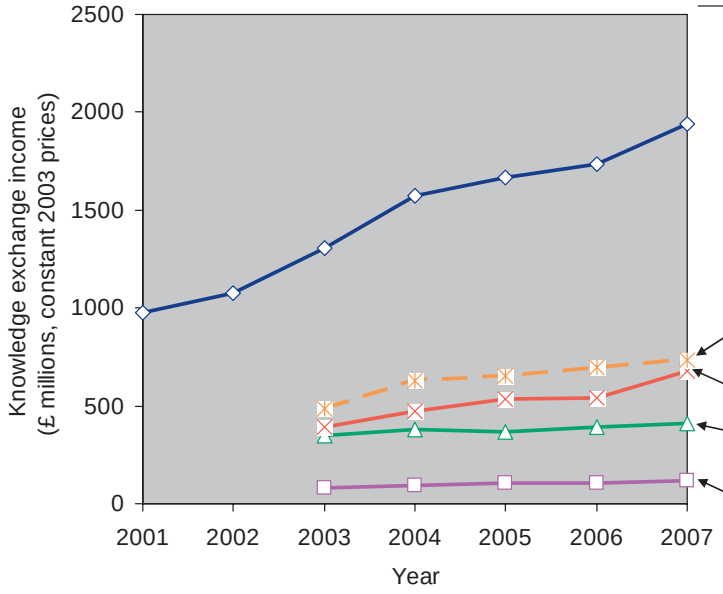
7.2.19 HEIs in the medium and low research and arts clusters engaged primarily with SMEs, with such engagements constituting approximately half of all engagements in each of these clusters. The share of engagements with SMEs grew by almost 13 percentage points in the medium research cluster. This emphasis on SMEs reflects the overall strategic focus on supporting SMEs (Figure 3.2).

Evolution of knowledge exchange income by partner type

7.2.20 Knowledge exchange income from all types of partners grew over the period 2003-07, with engagements with non-commercial organisations generating the largest share of income (35%) (excluding income with no partner type breakdown). Combining the evidence on income shares by partner type (Figure 7.7) with that in Figure 7.6 demonstrates that while SME engagement constituted 28% of all engagements, it only generated 6% of total KE income, compared with non-SME engagement, which generated 21% of all KE income from 21% of engagements. This highlights the difficult choices facing HEIs when deciding what types of organisations to target, particularly when faced with tightening financial budgets.

7.2.21 Income from non-commercial engagements grew fastest over the period, with non-SME income growing much slower than the other sources.

Figure 7.7 Evolution of knowledge exchange income by partner/customer type



Customer type	Income share 2007 (%)	Growth 03-07 (£%)
Total	100	45
(Income with no 'type' breakdown)	38	53
Non-commercial	35	72
Non-SME	21	18
SME	6	45

Financial values are in constant 2003 prices
Source: HEBCI surveys, PACEC/CBR analysis

Social outputs

7.2.22 The societal outputs of knowledge exchange engagements are much harder to quantify than the more commercial engagements undertaken by HEIs. The HEBCI survey collects data on different types of social, community and cultural activities such as public lectures, performance arts, exhibitions and museum education. These include both free and chargeable events held by the HEI. It collects the staff inputs for these events in terms of the number of days (assuming one day is eight hours) and the outputs of the activities in terms of the number of attendees. However, it does not collect information on the amount charged to attendees, thus preventing any accurate valuation of the total value of these events. Nevertheless, useful comparisons can be made across clusters regarding the 'productivity' (attendees/staff days) of holding these different types of events.

7.2.23 On average, more people attend free events than chargeable events held by HEIs (Table 7.4). The number of attendees across most types of events, both free and chargeable, grew over the period 2004-07. The only event type to decrease over the period was chargeable museum education events. The attendees at chargeable events increased at a faster rate than those at free events. Exhibitions were the most well-attended free event (excluding 'other' events), while performance arts drew the largest number of people for chargeable events.

Table 7.4 Number of attendees at free and chargeable events

Event type	Cost to attendee	Number of attendees (000s)				Growth 2004-07 (%)
		2004	2005	2006	2007	
Public lectures	Free	370	438	473	600	62
	Chargeable	34	66	73	109	223
Performance arts	Free	236	231	310	344	46
	Chargeable	512	747	774	1,080	111
Exhibitions	Free	2,471	2,763	3,216	4,062	64
	Chargeable	294	444	519	838	185
Museum education	Free	87	211	226	326	274
	Chargeable	38	88	101	28	-28
All events (excluding 'other')	Free	3,164	3,644	4,225	5,332	68
	Chargeable	879	1,345	1,467	2,054	134

Source: HEBCI surveys, PACEC/CBR analysis

7.2.24 However, the 'productivity' of holding the events – i.e. the number of attendees attracted per number of staff days contributed to setting up the event – decreased for most types of events, both free and chargeable, over the period 2004-07 (Table 7.5). Free and chargeable performance arts and free museum education events were the only types to grow over the period. However, this measure only considers the number of attendees per staff days committed to the event. It does not take into account the potential for increased quality resulting from a higher number of staff contributing to the event. In such a case the overall benefit to the individual attendee may increase even if the number of attendees decreases.

Table 7.5 Events analysis: number of attendees per staff input

Event type	Cost to attendee	Number of attendees per staff day of input				Growth 2004-07 (%)
		2004	2005	2006	2007	
Public lectures	Free	46	48	50	44	-4
	Chargeable	37	40	27	32	-13
Performance arts	Free	38	57	53	40	5
	Chargeable	76	88	83	98	28
Exhibitions	Free	214	162	185	175	-18
	Chargeable	873	273	324	209	-76
Museum education	Free	22	51	52	70	224
	Chargeable	173	69	74	38	-78
All events (excluding 'other'*)	Free	106	106	114	106	0.3
	Chargeable	108	103	98	108	-0.1

* Excludes Open University, which returned over 203,500,000 attendees at its events in 2007, growing from over 115,500,000 in 2004, and University College for the Creative Arts, which returned 1,200,000 attendees in 2004

Source: HEBCI surveys, PACEC/CBR analysis

7.2.25 Table 7.6 shows that HEIs in the top six research cluster attracted the most attendees to their events, both free and chargeable, with arts HEIs holding the second most well-attended free and chargeable events. These clusters also enjoyed a higher number of attendees for every staff day inputted in hosting free events than the sector average, although the arts cluster declined by 62% over the period 2004-07. However, for chargeable events, the number of attendees per staff input was highest in the high and low research clusters, and grew fastest in the low research cluster.

Table 7.6 Events analysis by cluster

Cluster	Variable	Cost to attendee	
		Free	Chargeable
All HEIs	Number of attendees per HEI 2007	41,013	15,801
	Productivity (# attendees per staff days inputted)	106	108
	Productivity change 2004-07 (%)	0.3	-0.1
Top 6	Number of attendees per HEI 2007	379,696	70,186
	Productivity (# attendees per staff days inputted)	130	109
	Productivity change 2004-07 (%)*	n/a	n/a
High	Number of attendees per HEI 2007	27,888	17,266
	Productivity (# attendees per staff days inputted)	92	281
	Productivity change 2004-07 (%)	15	1
Medium	Number of attendees per HEI 2007	17,329	3,459
	Productivity (# attendees per staff days inputted)	68	29
	Productivity change 2004-07 (%)	20	-10
Low	Number of attendees per HEI 2007	9,437	9,735
	Productivity (# attendees per staff days inputted)	75	162
	Productivity change 2004-07 (%)	79	251
Arts	Number of attendees per HEI 2007	63,302	31,078
	Productivity (# attendees per staff days inputted)	127	85
	Productivity change 2004-07 (%)	-62	13

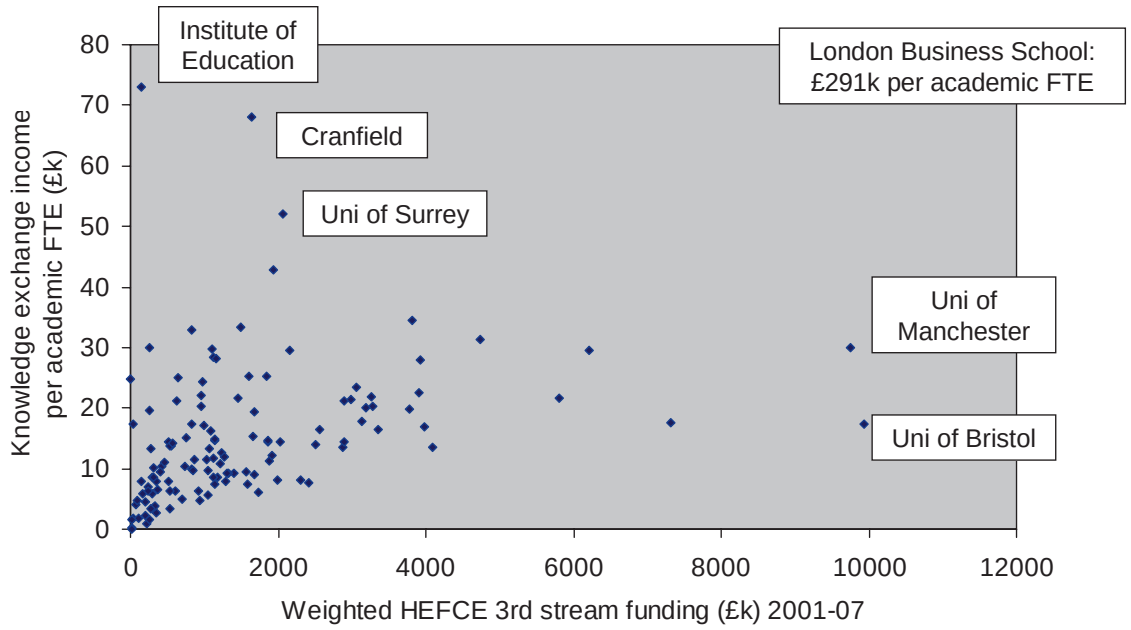
* Productivity change was not available for this period owing to lack of data for these HEIs in the initial period
Source: HEBCI survey, PACEC/CBR analysis

7.3 The impact of HEFCE third stream funding, additionality and the counterfactual

7.3.1 The above analysis shows a substantial increase in aggregate third stream income over the period 2001-07, with increases identified across a range of different types of third stream engagement and across different clusters of HEIs. An important question is to what extent can these changes be attributable to the introduction and subsequent increases in HEFCE third stream funding?

7.3.2 At a purely descriptive level there is a positive relationship between HEFCE third stream funding and knowledge exchange income per academic FTE (Figure 7.8). The cumulative third stream funding for each HEI for the period 2001-07 has been weighted to allow for the fact that the impacts of third stream income do not accrue in the same year as the investments, but with a lag. This positive relationship, combined with the evidence from the case study interviews, suggests that HEFCE third stream funding has had some impact on the ability of HEIs to secure increased knowledge exchange income. The change to formula funding will have an impact on establishing this positive relationship because under this regime the funding is allocated in part based on third stream income. However, because of the timescales analysed here (2001-07), the impact of funding allocated through the formula-based funding (HEIF 3 funding, 2006/07 to 2007/08) will have had a minimal impact on this relationship.

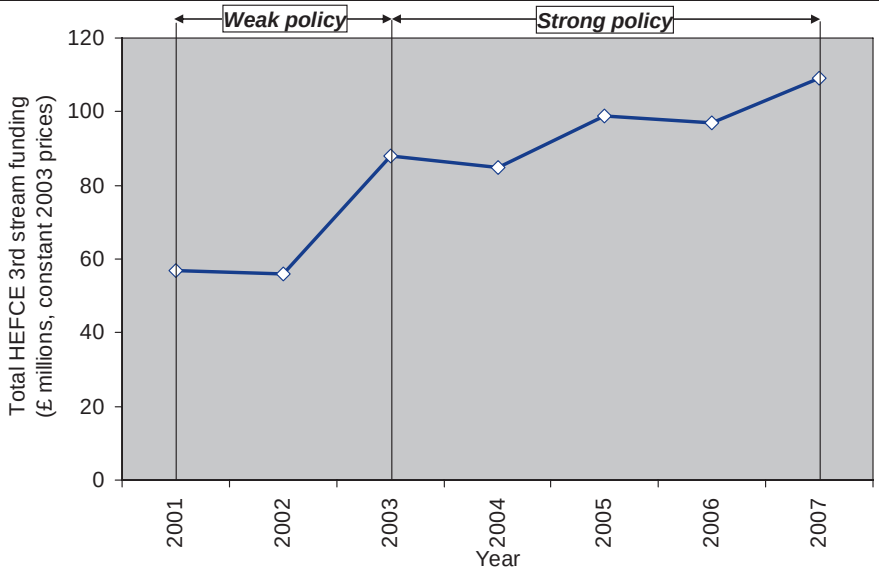
Figure 7.8 Relationship between HEFCE third stream funding and knowledge exchange income per academic FTE



Outliers with extreme values are highlighted in the chart
Financial values are in constant 2003 prices
Sources: HEBCI surveys, HEFCE data, PACEC/CBR analysis

7.3.3 Although indicative of a positive relationship between third stream funding support and knowledge exchange income, the analysis lacks the rigour provided by a methodology which compares third stream income of a group of HEIs in receipt of funding with that of a 'control group' not in receipt of funding, in periods with and without third stream funding support. However, this approach is not possible owing to the lack of a time series that covers both the periods with and without third stream funding. Nevertheless, the time series of data and the nature of the evolution of third stream funding does permit a comparison of performance during a 'weak' policy period during which funding for knowledge exchange was relatively low and fragmented and a 'strong' policy period in which funding had increased substantially for most HEIs (Figure 7.9) and was consolidated into a smaller number of funding programmes. In addition, because not all HEIs received HEFCE third stream funding in the initial period, a quasi-control group of HEIs exists, which allowed the study to test the extent to which receiving funding in the initial period is correlated with higher performance over time.

Figure 7.9 'Weak' versus 'strong' policy periods



Source: HEFCE data, PACEC/CBR analysis

7.3.4 The methodology for assessing the impact of third stream funding is therefore multi-pronged and consists of the following five stages of analysis:

- comparison of the growth in knowledge exchange income during the 'weak' policy period and the 'strong' policy period
- comparison of the growth in knowledge exchange income between those that initially received HEFCE third stream funding and those that did not
- comparison of the growth in knowledge exchange income between those that received large amounts of HEFCE third stream funding over the period 2001-07 and those that received little funding
- an estimation of the average impact of HEFCE third stream funding using subjective-based estimates of gross additionality[50]
- an estimation of the marginal impact of HEFCE third stream funding on knowledge exchange outputs using a multivariate econometric estimation technique.

Knowledge exchange performance during weak and strong policy environments

7.3.5 Total knowledge exchange income, excluding contract research income, grew more strongly in the strong policy period and by a greater amount (14% per annum, £539 million) than during the weak period (3% per annum, £48 million) (Table 7.7). However, there was considerable variation in the annual growth rate between income streams. Consultancy income and IP revenues grew much more slowly in the strong period compared with the weak, while collaborative research grow only slightly faster. Income from facilities and equipment services, courses and regeneration funding grew much faster in the strong period compared with the weak period. However, simply analysing the comparing growth rates provides a limited and potentially distorted view of change. For example, if the value in the base year of the first period

[50] Quotec Ltd (2007) *Higher Education Innovation Fund impact survey (Study C)*, a report to HEFCE

is very low compared with the final period, a very high growth rate may be obtained despite a larger absolute increase in the final period. It is therefore prudent to analyse the absolute change in income in addition to the growth rates. Table 7.7 shows that the absolute changes in income were larger in the strong policy period compared with the weak policy period for all income streams except contract research and intellectual property.

7.3.6 The key drivers of these different growth rates in each period are unclear. For example, demand for collaborative research in the UK is likely to have accelerated in the period 2003 to 2007 as economic growth increased following the slowdown in the earlier period, and outsourcing may also have increased during the upswing period. Similarly, increased demand for bespoke training courses will have been encouraged by the upswing as firms looked to raise the skills levels of their employees. HEIs would have been well placed to meet increases in demand with strengthened capacity and capabilities as a result of HEFCE third stream funding.[51]

Table 7.7 Compound annual growth rates of knowledge exchange income across different income streams during the weak and strong policy periods

Income stream	Change in income (£m)			CAGR (%)		
	Total period 2001-07	Weak period 2001-03	Strong period 2003-07	Total period 2001-07	Weak period 2001-03	Strong period 2003-07
Collaborative research	106	20	85	5	3	5
Contract research	*379*	*280*	*99*	*17*	*47*	*4*
Consultancy	133	41	92	16	21	14
Facilities and equipment services	36	6	30	14	9	16
Regeneration and development	68	1	67	9	1	13
Courses	219	-33	252	16	-11	33
IP revenues	24	13	12	18	38	10
All income streams (excluding contract research income*)	587	48	539	10	3	14
All income streams (including contract research income)	*966*	*327*	*638*	*12*	*16*	*10*

* Contract research income was excluded because of likely issues with the way in which HEIs reported this income stream in the 2001/02 and 2002/03 surveys
Source: HEBCI surveys, PACEC/CBR analysis

7.3.7 The potential impact of HEFCE third stream funding on KE outputs becomes clearer if one conducts the analysis by cluster (Table 7.8). All HEIs will be buffeted by many of the same external macro-economic pressures that will differentially impact the different streams of income, making the impacts of HEFCE third stream funding more pronounced (although it is still very difficult to disentangle the impacts of different factors owing to the different specialisations of each HEI in terms of academic discipline, sector, modes of interaction etc).

7.3.8 While KE income in the top six research cluster grew much more slowly – and less in absolute terms – in the period of strengthened third stream policy, the reverse is true for all other clusters. The reasons for the sharp decline in the growth of income for the

[51] Case study interviews with Science Enterprise Centres.

top six cluster in the period 2003-07 are unclear. The small sample size of this cluster compared with other clusters may be one reason for its very different performance. In such cases, the effect on any one HEI may have a considerable impact on the cluster average. In addition, issues with the data (e.g. confusion on whether or not an HEI is able to return particular incomes) are likely to have a much larger effect on the average.

Table 7.8 Compound annual growth rates of knowledge exchange income across clusters during the weak and strong policy periods

Cluster	Change in income per HEI (£k)			CAGR (%)		
	Total period 2001-07	Weak period 2001-03	Strong period 2003-07	Total period 2001-07	Weak period 2001-03	Strong period 2003-07
Top 6	16,105	11,884	4,221	10	26	3
High	6,957	-803	7,760	9	-4	15
Medium	4,128	439	3,688	10	4	14
Low	2,845	-336	3,181	15	-8	29
Arts	938	59	879	40	19	52
All HEIs	4,512	365	4,147	10	3	14

Contract research income was excluded in this analysis owing to likely issues with the way in which HEIs reported this income stream in the 2001/02 and 2002/03 surveys.
Source: HEBCI surveys, PACEC/CBR analysis

Knowledge exchange income performance and the initial receipt of HEFCE third stream funding

7.3.9 HEFCE third stream funding was not initially provided to all HEIs in the HE sector. This means that a quasi-control group exists with which to conduct comparisons of the importance of this initial condition. HEIs initially in receipt of HEFCE third stream funding experienced faster growth in their third stream income than those that did not receive such funding (Table 7.9). One reason for this could be that those HEIs in initial receipt of HEFCE third stream funding were able to develop their infrastructure and capabilities to a greater extent than those that only started to receive such funding in later funding rounds – i.e. they are further along the KE development path. There are also many lessons to be learnt along this development path. Those that received funding initially will have had more time to adapt their structures to reflect good/best practice. One important caveat to this argument is that there may have been a significant bias in the initial allocation of funding (then competitive bidding) to HEIs more able to write competitive business plans and towards those with an already well-developed capability in KE. However, the findings do suggest an impact of HEFCE funding: HEIs funded earlier with the potential to use such funding more effectively have secured a more rapid growth in their third stream income.

Table 7.9 Comparison of scale and growth of knowledge exchange income (£k) per HEI between those that did and did not initially receive HEFCE third stream funding

	Knowledge exchange income (£k) per HEI		Growth 2001-07 (%)
	2001	2007	
Received HEFCE third stream funding initially	9,084	18,873	108
Did not receive HEFCE third stream funding initially	5,622	10,210	82
All HEIs	7,513	14,941	99

Financial values are in constant 2003 prices
Sources: HEBCI surveys, HEFCE data, PACEC/CBR analysis

7.3.10 The Science Enterprise Challenge fund helped HEIs to set up Science Enterprise Centres whose main function was to deliver courses to students, staff and external organisations. Table 7.10 shows that course learner days increased in those HEIs that received SEC funding and decreased slightly in those that did not receive such funding. This provides some evidence that SEC funding has had an impact on the scale of course provision in many HEIs.

Table 7.10 Scale and growth of course learner days for HEIs in receipt of SEC funding

	Course learner days (days per HEI)		Growth 2004-07 (%)
	2004	2007	
HEI receiving SEC funding	26,006	33,722	30
HEI not receiving SEC funding	24,271	23,739	-2
All HEIs	24,818	26,887	8

Source: HEBCI surveys, PACEC/CBR analysis

Table 7.11 Scale and growth of course income for HEIs in receipt of SEC funding

	Courses income (£k per HEI)		Growth 2004-07 (%)
	2004	2007	
HEI receiving SEC funding	3,601	4,580	27
HEI not receiving SEC funding	1,214	2,087	72
All HEIs	1,967	2,874	46

Financial values are in constant 2003 prices
Source: HEBCI surveys, PACEC/CBR analysis

7.3.11 However, in terms of the income generated from courses, HEIs that did not receive SEC funding experienced relatively faster growth in course income over the period 2004-07 than those that did receive such funding (Table 7.11). The average income per course day is also higher for those receiving SEC funding (£136 per chargeable day in 2007) than those not receiving such funding (£88 per chargeable day in 2007). It is also important to note that many Science Enterprise Centres do not charge for their courses[52], which could explain the slower growth in course income over the period despite a much faster growth in course days (note, however, that course income grew by a slightly larger absolute amount). However, it is impossible to know from the available data, ratio of free course days to chargeable ones. It is therefore

[52] Case study interviews with Science Enterprise Centres.

not possible to say definitively whether the difference in growth in course income is due to a rise in the volume of course days or the price per day.

7.3.12 In terms of social and community engagements, the analysis revealed differences between HEIs that did and HEIs that did not receive HEFCE third stream funding initially (Table 7.12). Those in initial receipt of HEFCE third stream funding attracted more attendees per HEI than those that did not, across most free event types (except for performance arts) and for most chargeable event types (except museum education events). Excepting chargeable museum education events, they also had higher 'productivity' in 2007 both for free and for chargeable events. There is therefore some evidence to suggest that HEFCE third stream funding may have played a role in raising the number of attendees per unit staff day inputted to host the events. However, there was not the same near universal outperformance for the *change* in productivity over the period. Productivity for events held by those in receipt of initial HEFCE third stream funding grew more slowly, or declined faster than those held by HEIs not receiving such initial funding for half of the event types (excluding 'other'): free public lectures, free and chargeable performance arts, and chargeable museum education events. The lower productivity may, however, reflect the failure to quality adjust the outputs.

Table 7.12 Comparison of events between those HEIs that did and did not receive HEFCE third stream funding initially (attendees, 'productivity' and change in 'productivity')

Event type	Cost to attendee	No initial HEFCE third stream funding			Received initial HEFCE third stream funding		
		Number of attendees per HEI 2007	Attendees per staff day	Change in attendees per staff day 2004-07 (%)	Number of attendees per HEI 2007	Attendees per staff day	Change in attendees per staff day 2004-07 (%)
Public lectures	Free	3,274	28	-1	5,726	60	-12
	Chargeable	676	22	-27	972	45	-4
Performance arts	Free	2,766	31	23	2,546	56	-18
	Chargeable	7894	60	41	8,653	191	32
Exhibitions	Free	12,137	113	-57	47,128	198	-2
	Chargeable	1,805	154	-84	10,297	221	-70
Museum education	Free	636	55	7	4,061	73	313
	Chargeable	272	52	-44	161	27	-87
All events (excluding 'other')	Free	18,813	58	-21	59,461	137	8
	Chargeable	10,646	59	-25	20,084	169	6

Sources: HEBCI surveys, HEFCE data, PACEC/CBR analysis

Knowledge exchange performance and the level of HEFCE third stream funding

7.3.13 Evidence on the impact of third stream funding can also be gleaned from an analysis of the relative growth of KE outputs of HEIs that have received large amounts of funding and those that receive relatively small amounts. *A priori*, one would expect HEIs in receipt of relatively large amounts of funding to have extended their capabilities and capacity to a greater extent than HEIs receiving smaller amounts of funding. Greater funding will not only have facilitated greater interaction with external

organisations, it will also have enabled HEIs to go further in encouraging academics to engage (e.g. through making available the necessary funds to buy out academic time, or provide the necessary proof of concept funding) and adopt a more positive attitude towards the knowledge exchange mission. To conduct the analysis, the population of HEIs was divided into the top 30 and bottom 30 HEIs in terms of cumulative third stream funding over the period 2001-07 and the growth rates of each stream of income subsequently calculated.

7.3.14 Table 7.13 shows that, on average, those that received larger amounts of HEFCE third stream funding over the period 2002-07 experienced larger absolute increases in their KE income, across *all* income streams. The compound annual growth rate (presented in Table 7.13) provides a much more mixed picture, with income from consultancy, facilities and equipment services and regeneration and development growing faster for those that received greater amounts of HEFCE third stream funding. The other streams of income grew more slowly for these HEIs than for those that received relatively less. However, owing to the large differences in magnitude of the income received in each of the modes between those that received large amounts of funding and those that received low levels of funding, and owing to the significantly low base for those that received low levels of funding, the absolute change provides a more appropriate comparative indicator for the extent of change between the two groups. There is therefore a strong presumption that HEFCE third stream funding has had a positive impact on the overall growth of knowledge exchange income.

Table 7.13 Comparison of the change in knowledge exchange income between HEIs receiving different levels of cumulative third stream funding

Knowledge exchange income stream	Level of cumulative HEFCE 3rd stream funding 2002-07	Income (£k) per HEI		Change in income (£k) 2002-07	CAGR 2002-07 (%)
		2002	2007		
Collaborative research	Lowest 30	255	459	204	12
	Top 30	8,852	9,571	718	2
Contract research	Lowest 30	14	407	393	96
	Top 30	7,325	16,079	8,754	17
Consultancy	Lowest 30	150	174	24	3
	Top 30	2,062	4,346	2,284	16
Facilities and equipment services	Lowest 30	47	61	15	6
	Top 30	718	1,604	886	17
Courses	Lowest 30	69	611	542	55
	Top 30	2,455	4,744	2,289	14
IP revenues	Lowest 30	2	13	11	42
	Top 30	451	884	434	14
Regeneration and development	Lowest 30	124	113	-11	-2
	Top 30	1,093	1,805	713	11
All KE income	Lowest 30	537	1,725	1,188	26
	Top 30	21,863	37,227	15,364	11

Financial values are in constant 2003 prices
Source: HEBCI surveys, PACEC/CBR analysis

Average impact of HEFCE third stream funding: estimation of gross additionality

7.3.15 The gross additionality of HEIF funding was estimated quantitatively through a survey conducted by Quotec in 2006.[53] The survey attempted to assess the direct and indirect contribution of HEIF funding to KE income in 2003/04 for each of the key income streams and outputs. It was based on the results of a postal questionnaire sent to all HEIs in England, yielding 76 respondents. The Quotec findings are presented in Table 7.14 and Table 7.15.

7.3.16 The results suggest that between 28% and 41% of third stream income can be attributed to HEIF funding either directly or indirectly (Table 7.14).[54] The extent of additionality varied across clusters. Except for the upper estimate for the top six research cluster, the additionality factor increases as research intensity decreases. The top six cluster demonstrated the greatest variability between the upper and lower estimates, with between 25% and 44% of KE income attributable to HEIF funding, compared with 24% to 33% for the high research cluster and 44% to 61% for the low research cluster.

7.3.17 A rationale for the increasing attribution of KE income to HEIF funding as the research intensity of the clusters decreases is that HEIs in the higher research clusters have typically historically engaged closely with external organisations and had already built up a significant amount of enabling infrastructure prior to HEIF funding. In addition, those HEIs tend to be larger and more able to invest internal resources or attract other sources of funding to invest in their KE agenda. The introduction of HEIF funding facilitated further development of KE outputs, and particularly the integration and consolidation of activities, but not to the same extent as HEIs that lacked such infrastructure and maturity of engagement.

Table 7.14 Gross additionality estimates of HEIF funding and KE income attributable to HEIF funding in 2007

		All HEIs	Top 6	High	Medium	Low
Total KE income in 2007 (£m)		1,942	468	892	365	196
Additionality (%)	Upper estimate	41	44	33	48	61
	Lower estimate	28	25	24	37	44
KE income in 2007 attributable to HEIF funding (£m)	Upper estimate	799	207	299	177	119
	Lower estimate	544	117	211	135	86

All financial data is in constant 2003 prices
Note: It is assumed that the additionality does not change over time between the Quotec survey, which refers to the HEBCI data for 2003/04, and 2006/07. It is recognised that this will not be the case because of the changing nature of the investments made through the funding and the maturity of third stream engagement. However, owing to lack of data it was felt that this provided a rough *first* approximation
Source: Quotec survey of HEIs in England in 2006 as part of Quotec (2007) *Higher Education Innovation Fund Impact Survey (Study C)*, a report to HEFCE

7.3.18 On the basis of this evidence, between £544 million and £799 million of knowledge exchange income across the HE sector in 2006/07 can be attributed to HEFCE third

[53] Quotec (2007) *Higher Education Innovation Fund impact survey (Study C)*, a report to HEFCE
[54] Approximately one-fifth of respondents to this survey claimed that all of their KE income was either directly or indirectly attributable to HEIF funding. This contradicted evidence from case study interviews for similar HEIs. Therefore both lower and upper estimates of gross additionality were calculated. The lower estimate excludes the indirect estimate of gross additionality for HEIs that claimed that *all* of their KE income was attributable to HEIF. The upper estimate is based on all responses.

stream funding (Table 7.14). If one assumes a constant additionality factor over the period,[55] between £2.9 and £4.2 billion out of £10.3 billion generated through KE engagement over the period 2001-07 can be attributed to HEFCE third stream funding.

Table 7.15 Gross additionality estimates of HEIF funding on knowledge exchange income in 2003/04 by activity

		All HEIs	Top 6	High	Medium	Low
Collaborative research	Upper estimate	50	44	53	54	67
	Lower estimate	33	21	42	40	57
Consultancy	Upper estimate	42	60	30	52	71
	Lower estimate	27	34	15	45	45
Contract research	Upper estimate	38	53	28	42	49
	Lower estimate	26	37	18	30	30
Courses	Upper estimate	29	23	20	45	52
	Lower estimate	18	5	15	28	32
Facilities and equipment	Upper estimate	41	29	34	78	68
	Lower estimate	23	29	11	58	51
IP income	Upper estimate	48	39	52	78	44
	Lower estimate	38	20	49	77	44
Regeneration & development	Upper estimate	46	5	39	45	66
	Lower estimate	40	0	37	41	51

Source: Quotec survey of HEIs in England in 2006 as part of Quotec (2007) *Higher Education Innovation Fund impact survey (Study C)*, a report to HEFCE

7.3.19 Additionality was highest for collaborative research (33%-50%) and IP income (38%-48%) and lowest for courses (18%-29%) (Table 7.15). In the top six research cluster, HEIF funding has contributed most to consultancy income (34%-60% gross additionality), with very little impact on regeneration and development income. High research HEIs believed that HEIF funding contributes most to collaborative research and IP income and least to their courses income. Low research intensity HEIs perceived that gross additionality of HEIF funding is high for many of their knowledge exchange activities, with consultancy the highest and IP income the lowest.

7.3.20 The case study programme undertaken as part of this research programme also provided a rich primary source of information on the gross additionality of HEFCE third stream funding. Each interviewee was asked their views on what would have happened had the funding not existed, particularly in terms of the nature, scale and timescales of development of engagement with external organisations. In addition, many of the HEIF 4 institutional strategies submitted to HEFCE in April 2008 for the release of the fourth round of HEIF funding[56] included the perceptions of senior managers within HEIs of the importance of HEIF funding and what would have happened had it not existed.

[55] It is recognised that this will not be the case because of the changing nature of the investments made through the funding and the maturity of third stream engagement. However, owing to lack of data it was felt that this provided a rough *first* approximation.
[56] For an overview of the strategies see PACEC (2008) *Analysis of HEIF 4 Institutional Strategies: Overview Report*, a report to HEFCE.

7.3.21 Most case study HEIs believed that the nature of the knowledge exchange activities undertaken would have been different without HEFCE third stream funding. This view was echoed across most high and low research and arts HEIs. For example, without this funding, knowledge exchange activities and networks with external organisations would not have taken place, and many collaborative ventures such as i10, WestFocus, CommercialiSE, Centre for Creative Business (collaborative venture between London Business School and the University of the Arts London) would not have existed. The University of Sunderland claimed in its HEIF 4 strategy that:

> *Without the* [HEIF funded] *specialist knowledge required to access these programmes and initiatives the University recognises that many collaborations and business would not take place.*

7.3.22 In addition, knowledge exchange engagement would likely have been much more geared towards short-term income generation thus changing the composition of activities and potentially limiting the types of benefits that HEIs can deliver to the economy, and particularly to society. For example, one top six research HEI noted that certain types of its commercialisation activity would have been a much lower priority within the institution in the absence of HEIF funding. HEIF funding supported a lot of activity within the commercialisation office that does not yield immediate financial returns. These types of activities would likely have faded away in the absence of HEIF funding in favour of projects with higher *short-term* financial returns. The HEI's regional economic development engagement mission would never have existed in the absence of this funding. This view was echoed by the University of Cambridge in its HEIF 4 strategy:

> *Without HEIF funding it is difficult to see how these* [knowledge exchange] *activities would have been funded; these activities are not self financing with the exception in the long term (over 10 years) of technology transfer but even this is contingent on having one or more exceptional revenue generating cases in the portfolio. With this one future exception, the benefits, economic and social, do not bring economic benefit to the University on a time scale that would allow a business case to be made to fund them.*

7.3.23 In addition, one HEI claimed that many professional development opportunities would not have got off the ground nor would it have been possible to sustain the development of the infrastructure that has facilitated much of the engagement in the HE sector. The Institute of Cancer Research also noted in its HEIF 4 strategy that without HEIF funding its ability to carry out its KE activities to a high standard would have been limited and the success rate of engaging with external organisations much lower.

7.3.24 Most case study HEIs also claimed that the scale of their knowledge exchange operations and activities would have been lower in the absence of HEFCE third stream funding. For example, in some cases the knowledge exchange offices (or equivalent) would not have been as large as they are now nor would they have

achieved the same success as they have done. The University of Newcastle upon Tyne noted, in its HEIF 4 strategy, that:

> *In the absence of HEIF funding it would have been difficult to develop high quality professional support systems while at the same time improving the volume of activity.*

7.3.25 In other HEIs where the KE engagement capability was historically concentrated within a handful of people at the centre of the HEI, had HEIF funding not existed there would have been much less devolution of this capability to the faculty level, for example, through devolving their business development functions. They would also not have been able to recruit and establish KE champions to help encourage engagement.

7.3.26 It was perceived by many case study HEIs that third stream funding has speeded up the introduction and/or expansion of knowledge exchange activities; without the funding, it would have taken them much longer to achieve their current level of engagement. This was also the case in HEIs that were historically very close to external organisations. In these HEIs, rather than stimulating change, HEIF funding has enabled further changes by providing the necessary infrastructure. In the absence of this funding they would still have engaged with external organisations; however, it would not have been on the same scale. The infrastructure would have taken much longer to develop and it would not have been able to expand to cover as many industrial sectors and academic disciplines. This would have hindered the ability of the HEI to integrate its knowledge exchange engagement services from their previously ad hoc nature. One such HEI similarly believed that without HEIF funding it would have taken them longer to develop the necessary capability and infrastructure to achieve their goal of moving up the engagement value chain from mere transactional engagements to much more strategic partnerships. They noted how HEIF funding focused their strategic thinking about how best to achieve this while allowing for an element of ‘learning by doing’ with their infrastructural development that other funders would not have tolerated.

7.3.27 An HEI noted how, despite its being grounded within an industrial setting, HEIF funding has been crucial for developing the KE structures necessary for engaging and has allowed them to lever in other sources of funding as a result. In the absence of this funding, it would have been extremely difficult to have secured the necessary resources to develop their infrastructure to the same extent. They would also not have been able to develop the breadth of services on offer to external organisations. The same HEI also noted that it is unlikely that KE would have become firmly embedded in the mainstream of academic activities had HEFCE third stream funding not existed.

7.3.28 Some HEIs would not have seen the same level of integration of their KE services across their institution had HEIF funding not existed. For example, at both a medium and a low research cluster HEI, had the funding not existed their services would still be very much localised at the faculty level with little integration across the institution.

Funding for KE engagement would have had to be secured on an ad hoc basis at the faculty level, with little sharing of experience and best practice within the HEI. The development of their KEOs through successive rounds of HEIF (in one HEI this included a significant learning period between HEIF 1 and HEIF 3) has led to a much greater integration of their KE services and a much greater degree of professionalism in their interactions with external organisations. The University of Essex noted in its HEIF 4 strategy that:

> *Without the HEIF 4 funds it would not have been possible to pursue these important* [KE] *agenda in an effective and organised manner. The absence of a core team of skilled knowledge transfer staff to support academics and build links with business, the public and third sectors and relevant intermediaries would severely limit the impact of many of our knowledge transfer activities.*

7.3.29 The case study evidence suggests that the overall lack of development in knowledge exchange engagement would have been severely hampered in HEIs without a history of interacting with external organisations, particularly in low research cluster HEIs. HEFCE third stream funding has been crucial for providing the initial infrastructure and organisational structures, along with the stimulus for strategic change and sharing of best practice, which would not have occurred to the same extent, as rapidly or covering the same scope in the absence of the funding.

7.3.30 RDAs and other sub-regional stakeholders believed that, in the absence of HEIF and other dedicated government funding streams for knowledge exchange, there would be less incentive or capacity to engage with business and less development of knowledge exchange activities. There would also be a deterioration of the linkages between HEIs and the business community, reducing the capacity to develop and grow knowledge-based industries and having a detrimental effect on the regional economy.

Marginal impact of HEFCE third stream funding on knowledge exchange income

7.3.31 Multivariate econometric analysis provided another approach to assessing the additionality of knowledge exchange income as a consequence of third stream funding. In this approach the growth of knowledge exchange income was seen to be determined by a set of initial conditions and the third stream funding received. The initial conditions included the particular internal characteristics of the HEI (such as its size, departmental composition, research quality and staff-student ratio) that might be expected to influence the growth of knowledge exchange income. It also included variables characterising the external economic context – such as the growth of gross value added (GVA) in the local economy, the share of high-technology firms and accessibility to support infrastructure and institutions. The econometric methodology used a simple ordinary least squares (OLS) estimator with robust standard errors. Owing to the skewed distribution of many of the variables, many were entered into the regressions as their natural logarithm (Ln).

7.3.32 The dependent variable was the natural logarithm of knowledge exchange income in 2007. The full list of independent variables included the following:

- Natural logarithm of knowledge exchange income in 2003. This accounted for the different starting levels of knowledge exchange activity in different HEIs.
- Natural logarithm of the cumulative third stream funding received by HEIs, weighted to account for the fact that the funding will take a number of years to fully impact on the HEI.
- Share of academics in medical, science, engineering and technical (MSET) disciplines.
- Natural logarithm of the number of academic FTEs in 2003 to proxy for the size of an institution.
- Natural logarithm of research income in 2003.
- An aggregate of the RAE rating of medical, science, engineering and technology departments weighted by the number of full-time equivalent academics entered for the RAE. This provided a proxy for the overall research quality of the HEI.
- An aggregate of the RAE rating of humanities and languages (HL) departments weighted by the number of full-time equivalent academics entered for the RAE. This provided a proxy for the overall research quality of the HEI.
- Student to staff ratio in 2003.
- Natural logarithm of the number of dedicated business and community staff in 2003.
- A dummy variable to indicate whether an HEI was nationally or globally focused (=1) or locally or regionally focused (=0).
- A dummy variable to indicate whether an HEI had access to on-campus incubators in 2007.
- A dummy variable to indicate whether an HEI had access to science parks in 2007.
- A dummy variable to indicate whether an HEI had access to seed corn funding in 2007.
- A dummy variable to indicate whether an HEI had access to venture capital funding in 2007.
- The long-term growth in GVA of the local area between 1995 and 2006 to allow for the differential impact of HEIs located in fast growing regions compared to slow growth or declining local areas. This data was weighted to allow for spatial effects: HEIs will be influenced not only by the local authority district in which they are located, but also by neighbouring districts. A distance decay function was applied to the data to account for this.
- The share of employment in SMEs in the region. As with the long-term growth of GVA, a spatial weighting was applied to this variable.
- The share of employment in high-technology industries in the region. As with the long-term growth of GVA, a spatial weighting was applied to this variable.

The coefficients on the independent variables (e.g. β) entered as natural logarithms can be interpreted as elasticities (a unit percentage change in the variable yielding a β% change in the dependent variable knowledge exchange income), holding all other variables constant. The elasticity on HEFCE third stream funding thus provides an

estimate of the marginal impact of a given change in funding on knowledge exchange income.

Table 7.16 Results of a multivariate econometric analysis of the factors influencing knowledge exchange income

Dependent variable: Ln (knowledge exchange income in 2007)		
Variable	Coefficient	P-value
Ln (industrial income in 2003)	0.130	(0.187)
Ln (weighted total third stream funding 2001-07)	0.149**	(0.048)
Share of academic FTE in MSET	0.910***	(0.007)
Ln (academic FTE in 2003)	0.365***	(0.008)
Ln (research income in 2003)	0.247***	(0.009)
RAE*FTE in MSET	-0.00001	(0.735)
RAE*FTE in HL	0.0002*	(0.056)
Student to staff ratio in 2003	0.016	(0.189)
Ln (business and community staff in 2003)	-0.044	(0.492)
GVA growth in region 1995-2006	-0.048*	(0.076)
Share of employment in SMEs in the region	-0.208*	(0.052)
Share of employment in high-tech in the region	0.457*	(0.072)
National/globally focused HEI	-0.013	(0.904)
Access to on-campus incubators 2007	0.292**	(0.026)
Access to science parks 2007	0.031	(0.767)
Access to seed corn funding 2007	-0.070	(0.76)
Access to venture capital funding 2007	-0.253*	(0.054)
Constant	15.66**	(0.034)

* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Number of observations: 92

R^2: 0.8987

MSET: medical, science, engineering and technology; HL: humanities and languages

Financial values are in constant 2003 prices
Source: HEBCI surveys, PACEC/CBR analysis

7.3.33 The results of the regression analysis are presented in Table 7.16. The coefficient on cumulative weighted third stream funding was both significant at the 5% level of significance and positive in sign. The coefficient implies that, accounting for all other variables, a 10% increase in the cumulative weighted third stream funding yields a 1.5% increase in KE income – i.e. a £19.5 million (10%) increase in cumulative weighted third stream funding over the period 2001-07 would have generated a £28.9 million (1.5%) increase in knowledge exchange income in 2007 after accounting for the effects of other variables.

7.3.34 The size of the HEI also played an important role in explaining the current level of KE income. This supports the expectation that there are economies of scale in the provision of many KE services to academics such as provision of staff training and development workshops, central infrastructure such as knowledge exchange offices and IP capabilities and marketing campaigns. This result, coupled with the finding

that a higher share of academics in medical, science, engineering and technology departments was linked to higher KE income, suggests that there may also be network effects. That is, the more academics who engage, the easier it is to convince the additional academic to participate. This is because there is more collective experience of good practice in the process and more academics to act as informal mentors and champions for engaging.

7.3.35 Research income was an important factor explaining the current level of knowledge exchange income, with a 10% increase in research income associated with a 2.5% increase in KE income. It was argued earlier in this report that important synergies are likely to exist between research and knowledge exchange. For example, greater research income allows for more research to be carried out that may have applications for external organisations. This will increase the probability that any given external organisation will find relevant research for its operations and choose to engage with the HEI for its exploitation. The increased income to the HEI then allows the academic to engage in further research, thus further increasing the probability of generating commercially relevant research.

7.3.36 Access to on-campus incubators was both significant and positive although science parks and seed corn funding were both insignificant, even at the 10% level of significance suggesting they have little explanatory power over KE income. Worryingly, access to venture capital funding in 2007 was negatively correlated with KE income.

7.3.37 The research quality[57] of humanities and languages departments appeared to matter in explaining KE income while that of MSET departments did not. There may be a number of explanations for this result. For example, in situations where there have been historically low levels of participation in knowledge exchange with limited track record, an external organisation wishing to engage may well use research quality as an important signal of whether the academic can deliver the desired results. Given the historically lower levels of engagement in humanities and languages departments compared with MSET departments, it is unsurprising that research quality is much more important in the former than in the latter. An alternative explanation could lie in the inability of the RAE to capture the qualities of research that external organisations seek out. This effect could be disproportionately larger for MSET departments compared with humanities and languages departments.

7.3.38 A high share of employment in SMEs within the local area of the HEI was linked with lower KE income, potentially because of the financial difficulties faced by such companies in engaging with HEIs. Conversely, HEIs located in areas with high employment in high-technology sectors generated more KE income. Surprisingly, however, the growth of GVA in the region was significant at the 10% level of significance and negative. *A priori* one would have expected HEIs in fast growing areas to be associated with higher KE income. This appears not to be the case.

[57] Research quality was defined by the RAE score and adjusted for the number of full-time academic staff in the department.

7.4 Value for money of HEFCE third stream funding

7.4.1 The average impact of HEFCE third stream funding on knowledge exchange income provides an indication of the value for money achieved by the funding. It compares the magnitude of the cumulative outputs secured over the funding period to the cumulative inputs.

7.4.2 The injection of £592 million by HEFCE through its third stream funding programmes over the period 2001-07 has generated between £2.9 billion and £4.2 billion in gross additional KE income (not accounting for any displacement effects of knowledge exchange engagements). This suggests an average gross additional impact factor of between 4.9 and 7.1. However, one must bear in mind that the inputs do not include non-HEFCE funding for knowledge exchange.[58] Similarly, the output measure is based on income received by HEIs for their KE services. This provides a good proxy for the value that external organisations place on such services. However, it is unlikely to fully capture the intermediate and ultimate impacts on the organisations. For example, engagement with an HEI could improve the overall R&D process, facilitate innovation in products and processes, and facilitate entry into new geographies to increase future sales revenue. These would likely not be fully captured in the amount paid by external organisations to HEIs. In addition, particularly for firms that produce intermediate goods, the price paid for the services will not capture the benefits that firms' downstream customers experience as a result of the interaction with the HEI.

7.4.3 Nevertheless, an analysis of the variety of inputs and outputs that arise from the knowledge exchange process is informative of the ability of the sector to generate outputs from the inputs. These are presented in the form of a cost-benefit balance sheet which recognises that many outputs, and indeed inputs, cannot be quantified. Table 7.17 presents the quantifiable KE inputs and outputs for all HEIs in England where available. The gross additionality for each income stream was estimated using the data from a Quotec survey[59] (see Table 7.14 and Table 7.15).

7.4.4 Inputs include HEFCE third stream funding and other non-HEFCE funding such as internal resources and funding from philanthropic organisations, governments and private companies. HEFCE third stream funding has enabled many HEIs to invest in a range of human and physical infrastructure such as dedicated KE staff, seed and proof of concept funds, training and staff development, KE units, institutes and research centres. All of these investments are inputs into the process that translates the activities of academics into outputs that can be measured by the HEI, intermediate outcomes and, ultimately, impacts on gross value added and employment (final outcomes). As argued earlier, the income from knowledge exchange activities provides a first estimation of the value placed on HEI-derived knowledge by external organisations.

[58] Attempts to access this information were made during the case study interview programme, but many claimed it would have been too costly for the HEI to collect the total cost of engaging in knowledge exchange, including for example the opportunity cost of academic engagement. The collection of KE expenditure data may be an area worth considering for future HEBCI surveys if methods for collecting it are not found to be too burdensome on HEIs.
[59] Quotec (2007) *Higher Education Innovation Fund impact survey (Study C*), a report to HEFCE

Table 7.17 Cost 'benefit' balance sheet: all HEIs

Inputs			Quantifiable outputs		
			Type	Period	Total output
HEFCE third stream funding (£m)	UCF	42	Collaborative research (£m)	2001-07	2,768
	SEC	40	Contract research (£m)	2001-07	3,200
	HEROBC	96	Consultancy (£m)	2001-07	1,080
	HEIF	300	Facilities and equipment (£m)	2001-07	354
	HEACF	27	Courses (£m)	2001-07	1,688
	KTCF	8	Regeneration/development (£m)	2001-07	960
	CKE	36	IP revenues (£m)	2001-07	228
	Other	43			
Total HEFCE third stream funding 2001-07 (£m)		592	Total income (£m)		10,279
Non-HEIF funding		n/k			
Allocation of expenditure to inputs (% HEIF 4 expenditure)			Non-income outputs		
Allocation of expenditure to inputs (% HEIF 4 expenditure)	Dedicated KE staff	52.3	Number of course days	2004-07	13,586,205
	Support for staff engagement	14.9	Number of patents granted	2001-07	3,885
	Seed/PoC funds	5.4	Number of non-software licences	2001-07	7,764
	PR/marketing	4.3	Number of software licences	2001-07	2,962
	Collaboration/partnerships/networks	2.7	Number of spin-offs with HEI ownership	2001-07	813
	CPD, enterprise education, student enterprise and employer engagement	2.6	Number of formal spin-offs	2001-07	111
	Training/staff development	2.5	Number of staff spin-offs	2002-07	278
	Engagement support services and other internal/external KE support	2.1	Number of graduate spin-offs	2001-07	4,327
	KE units, institutes and research centres	2	Total patent stock (active patents)	n/a	8,062
	Development funds	1.6			
	General KE support costs	1.6	Free public lectures (attendees, 000s)	2004-07	1,825
	KE initiatives and projects	1.2	Free performance arts (attendees, 000s)	2004-07	1,116
	Investment in spin-outs	1	Free exhibitions (attendees, 000s)	2004-07	12,487
	Incubation	0.5	Free museum education (attendees, 000s)	2004-07	844
	Community outreach	0.3	Free other events (attendees, 000s)	2004-07	7,086
	Other KE staff	0.3	Charge public lectures (attendees, 000s)	2004-07	271
	Consultancy	0.2	Charge performance arts (attendees, 000s)	2004-07	3,100
	Awards/events/culture change initiatives	0.1	Charge exhibitions (attendees, 000s)	2004-07	2,084
	Other expenditure	2.5	Charge museum education (attendees, 000s)	2004-07	254
	Unaccounted expenditure	1.6	Charge other events (attendees, 000s)	2004-07	4,128
Number of staff days for events 2001-07 (000s)		207	Total number of attendees at events (000s)	2004-07	33,196

		Gross ***additional*** income 2001-07 (£m)	Upper estimate	Lower estimate
Total HEFCE third stream funding 2001-07 (£m)	592	Collaborative research	1,373	919
		Contract research	1,231	821
		Consultancy	450	289
		Facilities and equipment	147	82
		Courses	496	302
		Regeneration/development	443	380
		IP	109	87
		All income streams	4,229	2,877
		Average additional impact	7.1	4.9

*Gross additionality excludes any displacement effects that may arise out of the knowledge exchange activity
Financial values are in constant 2003 prices
Sources: HEBCI surveys, HEIF 4 strategies, HEFCE data, PACEC/CBR analysis

7.4.5 Table 7.17 shows that the HEFCE third stream funding and the inputs that it enabled generated between approximately £0.9 billion and £1.4 billion worth of gross additional collaborative research contracts, £0.8 billion to £1.2 billion of contract research, £300 million to £500 million of course revenues and £290 million to £450 million of consultancy over the period 2001-07. The case study interviews, particularly with arts cluster HEIs, suggested that the inputs will also have resulted in gross additional attendees at events, extending both the audience of these events and the quality of the content. This combination means that the overall value to these events will have increased as a result of the HEFCE third stream funding-enabled inputs.

7.4.6 The cost-benefit balance sheet does not include the indirect impacts that third stream funding may have enabled. For example, the discovery and licensing of a drug to a pharmaceutical company will generate both income for the HEI and societal benefits in the long run because of the lower prevalence of a particular disease. This example also highlights another limitation of this analysis. Many of the benefits of HEI interaction with external organisations, particularly through collaborative and contract research, may take many years to be realised by the external organisation. The value of these impacts could not be included in the cost-benefit balance sheet analysis.

Table 7.18 Average impact by cluster

		All HEIs	Clusters			
			Top 6	High	Medium	Low
Cumulative KE income 2001-07 (£m)		10,279	2,442	4,884	1,967	901
Cumulative HEFCE third stream funding 2001-07 (£m)		592	76	244	156	94
Additional cumulative KE income 2001-07 (£m)	Upper estimate	4,229	1,080	1,636	953	547
	Lower estimate	2,877	611	1,156	728	394
Average gross additionality factor: ratio of additional KE income to third stream funding	Upper estimate	7.1	14.2	6.7	6.1	5.8
	Lower estimate	4.9	8.0	4.7	4.7	4.2

Note that not enough useful data could be obtained for the arts cluster
All financial values are in constant 2003 prices
Sources: HEBCI surveys, PACEC/CBR case study interviews 2008, PACEC/CBR analysis

7.4.7 The average gross additional impact of income as a result of HEFCE third stream funding for each cluster is presented in Table 7.18 (the full cost benefit balance sheets for the individual clusters can be found in Appendix C). This shows that the gross additionality factor is approximately correlated with the research intensity of the clusters with those in the higher research clusters generating more gross additional income as a share of HEFCE third stream funding received than those in the lower research clusters. Therefore, despite the lower research intensive HEIs having a higher share of their total KE income directly or indirectly attributable to HEFCE third stream funding (Table 7.14), when the amount of KE income generated is taking into account in relation to the amount of funding received, the higher research intensive HEIs generate in a higher 'gross additionality factor' (i.e. generate more gross additional KE income per pound of third stream funding received). However, one must be very cautious when interpreting these results. It does not include the non-monetised benefits (which may be more important for lower research intensive and arts HEIs). In addition, as noted earlier, the average impact was calculated by

assuming that the income received by HEIs provides a first approximation to the value of this engagement perceived by external organisations. The case studies suggest that lower research and arts cluster HEIs are much more likely to engage in activities that have lower income generating potential but nevertheless have economic and social benefits such as providing training schemes for SMEs who find it difficult to pay high prices for such engagements. The underestimation of outputs will therefore likely be most pronounced in the low research and arts cluster.

7.5 Towards net additionality

7.5.1 The estimations of additionality thus far have focused on gross additionality without taking into account the displacement effects that HEI engagement in particular KE activities may have on private sector provision. This is extremely important for assessing the net additional impact of HEFCE's third stream policies.

7.5.2 Private sector displacement may occur if the KE product or services the HEI are providing can be substituted by a private sector product or service. The degree of substitutability is therefore a crucial determinant of displacement. If the degree of substitutability is high, then the KE activity of the university may be potentially displacing. If it is low, however, then the private sector would find be limited in its capacity to provide the KE services of the HEI. This is likely to occur when large amounts of tacit knowledge are involved in the KE activity and where the knowledge cannot be easily codified and is embodied within the human capital stock of the academic built up over many years.

Figure 7.10 Degree of substitutability of KE activities

Activity	Share of total KE income (%)	Degree of substitutability
Contract research – original research	32	Low
Collaborative research – original research	23	Low
Courses – original research	19	Low
Courses – training / other		High
Consultancy (no original research)	11	High
Regeneration / development	9	High
Facilities and equipment services	3	Mid
IP / Licensing / Patents	2	High
Spin-outs – non-codifiable knowledge	n/a	Low
Spin-outs – codifiable knowledge	n/a	High
Events	n/a	High

Source: PACEC/CBR

7.5.3 While it was not possible to quantitatively estimate the degree of substitutability and hence displacement effects of private sector activity as a result of KE engagement by HEIs, an initial qualitative assessment was made. This is presented in Figure 7.10.

7.5.4 The degree of substitutability of KE activities will vary according to the type of activity. Where original research is carried out (as in the case of contract and collaborative research), then the likelihood that a private sector agent could replicate the research is very low and hence the potentially displacing effects of the HEI in this activity are low. Likewise, where the HEI delivers instruction and training courses that are based on the latest academic research and knowledge, it is unlikely that a private sector agent could easily construct a competing course to a similar quality and deliver the research. However, where courses are based on standard texts and established research in such cases it is much more likely that a private sector agent could replicate the course and the displacement effects could be high. Similarly, the provision of consultancy activities where no original research is undertaken and tacit knowledge is not a large factor, it may be potentially displacing as private sector alternatives may be able to provide similar services.

7.5.5 The degree to which facilities and equipment services could be easily provided by private sector firms is unclear. In a number of cases identified through the case study programme, HEIs were able to provide highly specialised equipment and / or facilities that many firms would not have been able to afford (particularly SMEs). HEIs can provide the necessary economies of scale and expertise to make the investment viable. Particularly, if the equipment or the facilities were installed for academic purposes (research and / or teaching), are highly specialised, and are underutilised, then the displacement effects on the private sector may be lower. If, however, the facilities and equipment were installed solely for purpose of engaging with the private sector, then displacement would be likely as a private sector agent, with sufficient up-front investment, could provide a direct substitute.

7.5.6 Overall, it is encouraging that those activities that generate the largest amounts of KE income are likely to have a low degree of substitutability. It is therefore very likely that the HEFCE third stream funding programme has generated *net* additional outputs.

8 Wider Impacts of HEFCE Third Stream Funding on the HEI

8.1 Introduction

8.1.1 This chapter turns to the wider internal impacts of HEFCE third stream funding on the HEI. The funding will generate both positive and negative externalities on the other activities that are undertaken within institutions, such as research and teaching, the ability to lever other sources of funding and the ability to effectively share best practice. Limited collaborative activity between HEIs and economic and societal agents was seen as an important rationale for third stream policies, an issue that potentially constrains the innovation process and the benefits that can be derived from the HE sector. The chapter will therefore also explore the extent to which HEFCE third stream funding has helped to bridge the gap in the lack of collaborative activity.

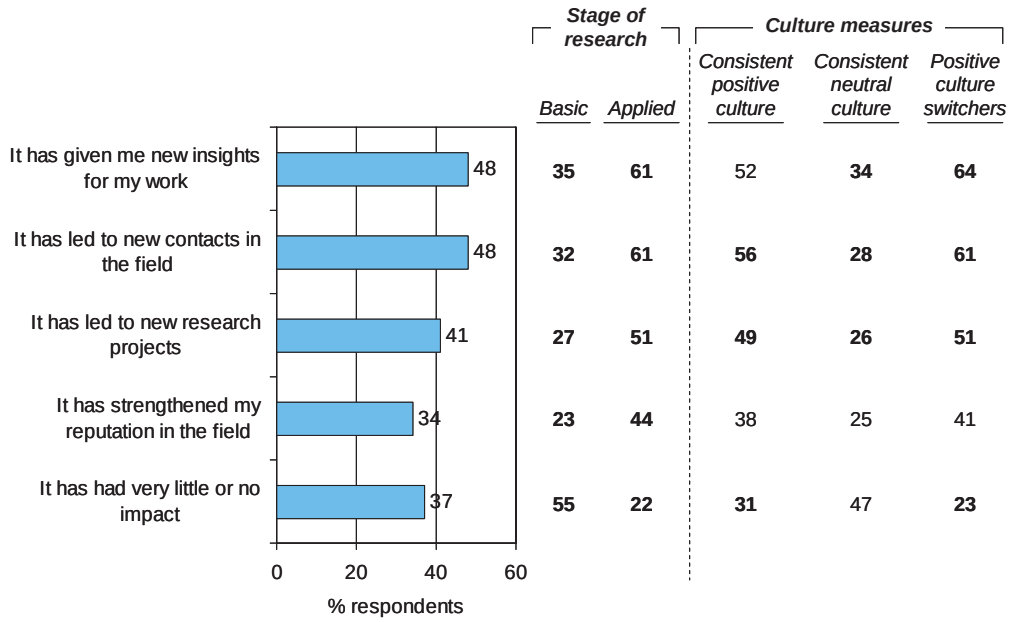
8.2 Impacts on research and teaching

8.2.1 Third stream funding has strengthened the link between the triad of activities undertaken by HEIs: teaching, research and third stream. The flow of knowledge between these three pillars has increased as they increasingly influence each other. This is partly being driven by the legitimisation of third stream activities among academics. The evidence from the case studies suggests that third stream engagement is increasingly seen as complementary to the traditional activities of teaching and research, albeit with some believing that there was a degree of displacement owing to the time constraints that most academics face.

Impact on research

8.2.2 Knowledge exchange engagement has clear synergies with research activities undertaken by academics (Figure 8.1). Almost half of the academics surveyed believed that KE engagement has given them new insights into their work. This increased to 61% for academics undertaking applied research but, unsurprisingly, fell to just 35% of those carrying out basic research. Applied researchers were much more likely to believe that KE engagement leads to new research projects and a strengthening of their reputation in the field. This correlation with the stage of research is unsurprising because of the nature of applied research focusing much more on the issues that are of *direct* relevance to an individual, company, group or societal need. Knowledge of the user's needs therefore becomes an important determinant of the success of the research. Knowledge exchange engagement is one method by which academics can gain these insights. Over half of basic researchers believed that there are no impacts of KE on their research compared with just 22% of applied researchers.

Figure 8.1 Impact of knowledge exchange activities on research



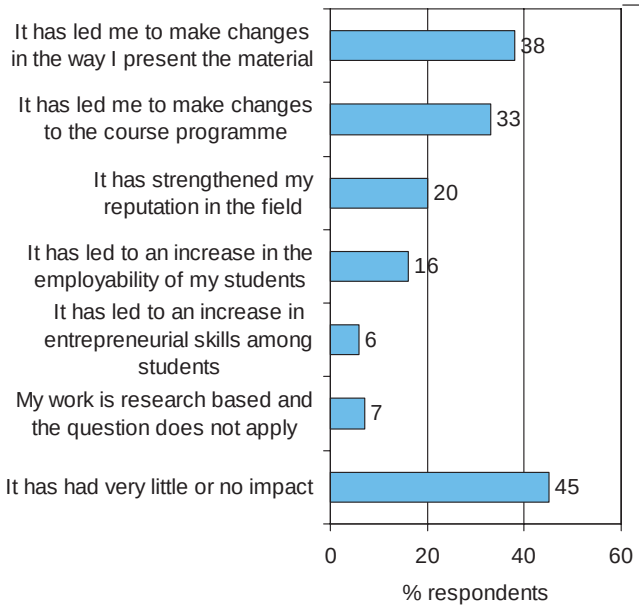
Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the number in the left-hand total column (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008, PACEC/CBR analysis

8.2.3 There were also important differences in the perceptions of impacts of KE on research between academics with different attitudes towards knowledge exchange. Those who were consistently positive towards knowledge exchange engagement over the period 2001-08 were more likely to perceive an impact of KE on research compared with those who were consistently neutral. In particular, those who were consistently positive were much more likely than the average academic to perceive that KE engagement generates new contacts in the field in which they conduct research. In addition, there was a much stronger perception of impacts for those whose attitudes towards KE shifted in a positive direction over the period 2001-08. Such academics were much more likely than the average to view knowledge exchange as giving them insights into their work, generating new contacts in the field and leading to new research projects. This suggests that there are significant benefits to research from the changes to culture witnessed in the HE sector, facilitated by HEFCE third stream funding.

8.2.4 There was very little deviation from the average position on the impacts of KE on research across the different clusters, disciplines, academic position and age of academic. The few exceptions were that professors were more likely, and lecturers less likely, than average to believe that KE engagement strengthens their reputations within their field of research (40% of professors and 29% of lecturers compared with 34% on average). Those in the top six research cluster on average believed that KE engagement leads to new research projects to a greater extent than the sectoral average (51% compared with 41% on average).

Impact on teaching

Figure 8.2 Impact of knowledge exchange activities on teaching



	Stage of research		Positive culture switchers	Cluster				
	Basic	Applied		Top	High	Med	Low	Arts
It has led me to make changes in the way I present the material	**28**	43	**50**	37	**30**	38	**55**	**60**
It has led me to make changes to the course programme	**23**	**38**	**43**	34	**22**	34	**50**	45
It has strengthened my reputation in the field	**13**	**27**	**29**	18	**15**	22	**30**	34
It has led to an increase in the employability of my students	**6**	**22**	20	13	**9**	16	31	**47**
It has led to an increase in entrepreneurial skills among students	3	7	**14**	10	**2**	4	**11**	**34**
My work is research based and the question does not apply	7	9	**13**	**15**	9	3	3	4
It has had very little or no impact	**60**	**37**	**26**	40	**54**	46	**29**	**17**

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the number in the left-hand total column (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of academics 2008, PACEC/CBR analysis

8.2.5 The case studies also suggest that there has been some impact on the nature of teaching that is undertaken within HEIs. This is supported by the survey of academics, which revealed that 55% of academics perceived some impact (Figure 8.2). However, this varied considerably between different types of academics. For example, 60% of basic researchers perceived very little or no impact on their teaching activities compared with just 37% of applied researchers. This is not surprising if one assumes that the course content of the basic researcher reflects this research and contains little applied content. Those academics who have developed more positive attitudes towards KE engagement were also much more likely than the average to perceive impacts on teaching, as were those in the low research and arts clusters, whose HEI missions are geared much more towards teaching than research.

8.2.6 Knowledge exchange engagement has led 38% of academics to change the way in which they present the course material, increasing to 50% for those who have developed a more positive attitude towards KE over the period 2001-08, and to 55% and 60% of academics in the low research and arts clusters respectively. A similar pattern was seen in the impact on course programme material. Those conducting applied research, positive culture switchers and those in the low research cluster were more likely than the average to have made changes to their courses as a result of KE engagement. For example, the case studies revealed that many HEIs are now engaging with external organisations to develop more relevant course material. In

addition, many academics are increasingly using case studies and 'live examples' to bring the real world into the classroom.

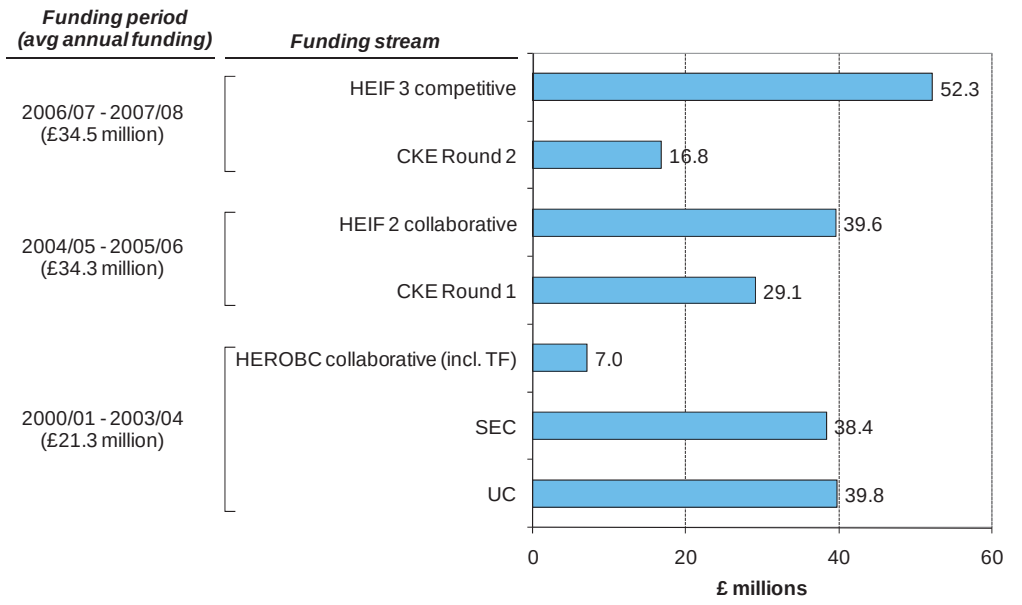
8.2.7 Industrial engagement for curriculum development is common in most engineering and applied science disciplines. A notable development, however, was the claim by an arts and humanities department in an HEI in the medium research cluster that HEIF funding had prompted a greater engagement with external organisations for the development of curricula for their courses. Enterprise education is also starting to appear in increasing numbers of courses with, for example, a top six research cluster HEI aiming to introduce an enterprise module in most of its master's-level courses. Another, low research cluster HEI is introducing more entrepreneurship into the curriculum and trying to get more students into the business incubators before graduation to gain real-life experience. Spin-outs from HEIs are also providing placement opportunities for students during their industrial projects or work placement years.

8.2.8 Almost half of academics in arts HEIs believed that KE engagement leads to an increase in the employability of their students, with 34% believing that their involvement with external organisations has led to an increase in entrepreneurial skills among students. Both of these impacts are highly pronounced in the arts cluster compared with other clusters. This is likely because of the highly applied and practical course content of subjects within these HEIs requiring that they maintain their relevance to industry. In addition, these HEIs have many staff who hold both a part-time academic position and a professional practice.

8.3 Impacts on collaboration

8.3.1 HEFCE, through a variety of funding streams, provided over £220 million in dedicated funding for collaborative initiatives over the period 2000/01 to 2007/08. These included the HEROBC collaborative funding, including the element of HEROBC Teaching Fellows (TF) scheme; HEIF 2 collaborative funding; the competitive element of HEIF 3, which allocated 25% of the total HEIF budget to fund 11 competitively won collaborative projects; funding for Centres for Knowledge Exchange; Science Enterprise Challenge funding; and University Challenge funding (see Figure 8.3). This figure shows that the undeflated dedicated annual funding available from HEFCE for collaborative initiatives rose from £21.3 million in 2000/01 to £34.5 million in 2007/08.

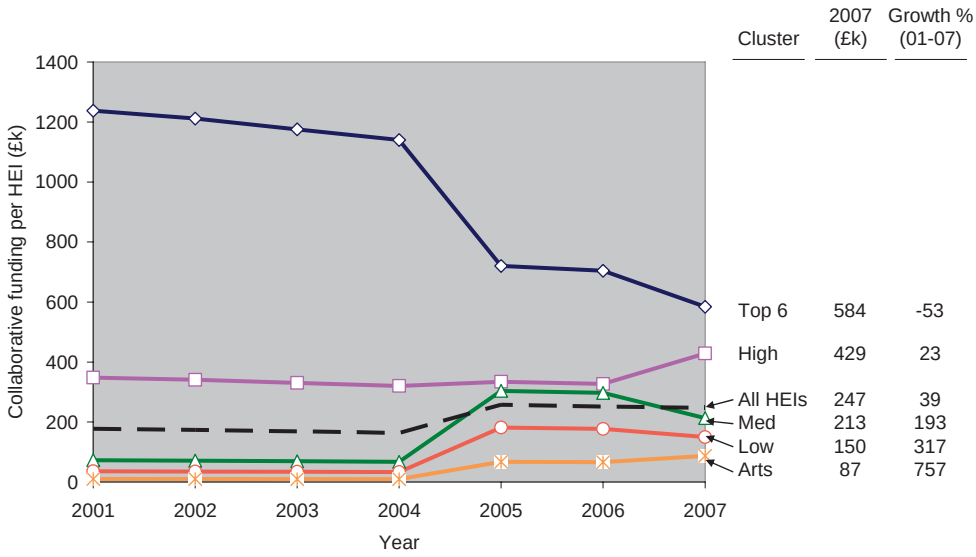
Figure 8.3 HEFCE funding dedicated to collaborative initiatives



Undeflated amounts
Source: HEFCE funding data, PACEC/CBR analysis

8.3.2 Figure 8.4 shows that the average annual funding for collaborative initiatives per HEI rose over the period 2001-07 by 39% to approximately £247,000. However, this varied considerably between clusters, with those in the top six research cluster receiving approximately £584,000 in 2007 compared with those in the low research cluster receiving just £150,000. However, those in the top six cluster saw their overall collaborative funding decrease over the period while the remaining clusters witnessed increases in funding, with the magnitude increasing as the research intensity decreases. This figure suggests that there was some convergence in the amount of collaborative funding received by HEIs over the period.

Figure 8.4 Dedicated HEFCE third stream funding for collaborative initiatives



Financial values are in constant 2003 prices
Collaborative funding includes: HEROBC collaborative funding, HEROBC Teaching Fellows collaborative funding, HEIF 2 collaborative funding, funding for Centres for Knowledge Exchange and the HEIF 3 competitive awards
Source: HEFCE funding data, PACEC/CBR analysis

Intra-HEI versus inter-HEI collaboration

8.3.3 The perception of the senior management interviewed during the case studies was that HEFCE third stream funding has facilitated a significant strengthening in intra-HEI collaboration and to a lesser extent inter-HEI collaboration. Most case study HEIs, across all cluster types, believed that knowledge exchange activities have led to an increased amount of collaborative work both within the HEI and externally. This does not mean that HEIs do not undertake collaborations with other HEIs. On the contrary, almost 90% of HEIs have some form of collaboration with another HEI (Table 8.1). The implication of the case study evidence is that there is a preference towards, and relative strengthening of, intra-HEI collaboration compared with inter-HEI collaboration.

8.3.4 This result was most pronounced in the top six research cluster, where there is a greater willingness to collaborate between disciplines within the same HEI rather than with other HEIs. One sign of the increased levels of intra-HEI collaboration is the proliferation of interdisciplinary research institutes or centres being set up. They are typically demand-led in their approach to research and bring together academics from a range of disciplines. In terms of collaborating with other HEIs, the perception was that high levels of competition between these HEIs was one reason for the limited inter-HEI collaboration.

8.3.5 Collaborations appear to work best between non-competing HEIs or disciplines. HEFCE third stream funding was claimed by some case study HEIs to be a key catalyst for bringing together HEIs from different fields to explore potentially riskier

initiatives at the intersection of disciplines. One example is the bringing together of completely new areas of research such as the intersection between the creative arts and technology, which could have significant economic as well as societal value. Examples of where HEIF funding has been of great importance at bringing together different HEIs include the University of the Arts/London Business School partnership, the Imperial College/Royal College of Art partnership, the CommercialiSE collaborative partnership led by Oxford Brookes, the London Genetic Initiative, WestFocus, Knowledge House and the Digital Knowledge Exchange.

Other types of collaborative partnerships

Table 8.1 Types of collaborative partners

(% HEIs)		All HEIs	Cluster				
			Top 6	High	Medium	Low	Arts
HEIs	Other HEIs	88	100	94	88	88	**72**
Industry	Large corporations	49	83	60	59	**29**	33
	SMEs	39	33	26	53	41	39
Public sector	RDAs	62	67	66	66	68	**39**
	Other public sector bodies	59	**100**	51	53	65	61
	Local government	43	33	40	50	41	44
	Central government	17	**67**	23	13	12	6
Other	International partners	38	67	**54**	28	24	44
Number of HEIs		117	6	31	28	32	18

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEIF 4 institutional strategies, PACEC/CBR analysis

8.3.6 HEIs focus their collaborative efforts on different types of organisations and geographies. RDAs are the most frequent partner in the public sector, with little variation between non-arts HEIs, while arts HEIs are more likely to partner with other public sector bodies. HEIs in all clusters except the top six research institutions are more likely to collaborate with local government than central government, while the opposite is true in the top six research cluster. Unsurprisingly, the higher research intensity HEIs are more likely to collaborate with large corporations, while low research intensity and arts HEIs, with their stated economic development aim of supporting SMEs (see Table 3.2), partner more frequently with SMEs.

8.3.7 The collaborative partnerships with large companies are beginning to go beyond the mere transactional towards a much more strategic partnership. Companies and HEIs are realising the additional value to be gained by creating such partnerships. For example, a better understanding of the particular strategic direction of the research of a large company will lead to more targeted research being undertaken, with lower 'integration' costs. In addition, a close strategic relationship will enable HEIs to start thinking about how research or ideas in other disciplines can be applied to future research goals of the large company. This can help to facilitate both product and process innovation.

Geographical focus of collaboration

8.3.8 There is a clear correlation between geographical focus and research intensity (Table 8.2). Higher research intensive HEIs seek out international and national collaborations, while lower research intensive HEIs are more likely to partner regionally and locally.

Table 8.2 Geographical focus of collaborations

(% HEIs)	All HEIs	Cluster				
		Top 6	High	Medium	Low	Arts
International	61	**100**	**80**	55	**41**	72
National	61	83	69	71	**41**	67
Regional	89	83	89	94	94	78
Local	61	33	66	58	71	50
Number of HEIs	117	6	31	27	32	18

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEIF 4 institutional strategies

Transaction costs to collaboration

8.3.9 While there appears to be an overall increase in the amount of collaboration in the HE sector in England, many barriers still exist. Collaboration, particularly external engagement between HEIs and other partners (whether other HEIs, firms, public sector, charities or other), involves a number of transaction costs which are non-trivial and, in many cases, high enough to prevent the collaboration from developing regardless of potential benefits. Major transaction costs include:

- Search and information costs – there are initial costs associated with the identification of suitable partners and obtaining accurate information about their true capabilities.
- Bargaining and coordination costs – costs are borne by each partner during the bargaining and negotiation process where the objectives of the initiative and the role of each partner are agreed. HEIs may find it difficult to coordinate these negotiations and agree a common agenda for the collaboration. Related to this is the coordination cost relating to the partner HEIs agreeing to the resources to be committed to the initiative.
- Enforcement costs – there may be substantial costs to ensure that each partner carries out their allocated part of the work to meet the agreed objectives.

8.3.10 One of the key difficulties highlighted by HEIs in securing collaborations is developing a set of common objectives that are of equal importance to each partner. The partnerships appear to be weaker in cases where the collaboration is of substantially greater importance to one institution than another, as it will affect the amount of resources (including time and effort) that are committed. A corollary of this is that when the dedicated funding for such initiatives (e.g. HEIF) runs out, it can become very difficult to convince each partner to finance its continuation, leading to the initiative's weakening and potentially its ultimate demise. Other barriers facing collaborations being set up include high levels of competition between HEIs, a lack of management capability and experience for such initiatives, and the logistics of

organising a potentially large number of organisations around the same goals. All of the above contribute to the high transaction costs faced by HEIs. These can frequently be large enough to prevent the collaboration from taking place.

8.3.11 However, HEFCE funding has been instrumental in helping HEIs to overcome these barriers, resulting in many collaborative initiatives being set up between HEIs. Many of the collaborations at the HEIs studied, such as WestFocus, CommercialiSE, the London Technology Network, the Imperial College/Royal College of Art collaboration and the Intelligent Media Initiative were seen as very successful. HEFCE funding has provided not only the necessary financial resources to enable HEIs to fund the setup and running costs of the initiatives (e.g. product/service development, infrastructure, funding necessary staff positions etc), but has also allowed HEIs to cover the transaction costs such as the costs of searching for partners, developing the service portfolio and the costs of contract negotiations. The availability of funding specifically for collaborative initiatives has also concentrated the strategic thinking of HEIs regarding how they interact with other HEIs. A number of HEIs claimed that they would not have been able to pursue these collaborations in the absence of HEFCE third stream funding.

8.3.12 If these barriers can be successfully overcome, it is likely that "collaboration opens the door for further collaboration."[60] The more collaborative work that is undertaken by HEIs, the more the overall cost of collaboration decreases, leading to an increased willingness of HEIs to collaborate.

Benefits of collaboration

8.3.13 HEIs collaborate for a variety of different reasons (Table 8.3). Approximately 70% of institutions do so to gain access to complementary capabilities, with this being a relatively more important reason for those in the high research intensity clusters than those in the low research and arts clusters. Over half of HEIs, including all HEIs in the top six research cluster, collaborate to enable them to gain access to additional resources such as funding. Many sources of funding, such as funding from Regional Development Agencies or the European Union, require that HEIs form collaborative consortia in order to access their funds. It is somewhat concerning that this is such an important reason for collaborating and it raises the question of whether HEIs would collaborate to anywhere near the same extent, other than in very specific instances, were such criteria not attached to the funding streams. A number of case study HEIs, particularly those in the higher research intensity clusters, revealed that they thought that high levels of competition between HEIs made it harder for HEIs to effectively collaborate. Accessing new geographies was specifically important for those HEIs in the high research cluster, while accessing new market sectors was a very common reason in top six research HEIs.

8.3.14 The case study HEIs claimed that they are realising particular knowledge exchange-related benefits from collaborative engagements that would otherwise likely not have arisen. For example, the cross-faculty, multidisciplinary institutes being set up,

[60] Interview with a case study HEI.

encouraging intra-HEI collaboration, have developed spin-outs, IP, and conducted industrially focused research. Such collaborations have also led to academics widening their fields of research and exploring exciting new areas that are typically demand-led. Internal collaboration promotes dialogue between faculties and between experts in different areas, some of which has been surprisingly fruitful. It also helps to promote best practice for engaging in KE through the informal sharing of engagement experiences between academics.

Table 8.3 Reasons for collaborating

(% HEIs)	All HEIs	Cluster				
		Top 6	High	Medium	Low	Arts
Provides complementary capabilities	70	83	76	67	63	65
Provides/enables access to additional resources/funding	57	**100**	58	52	60	53
Opens new geographies	40	33	**55**	26	43	35
Opens new market sectors	32	**83**	24	33	33	29
Provides economies of scale (e.g. sharing infrastructure, training)	23	17	30	22	17	24
Better coordination of activities	16	17	15	4	**30**	12
Provides market intelligence	16	**50**	9	19	10	18
Achieves value for money	9	0	9	15	10	6
Shares good/best practice	8	17	6	11	0	18
Develops graduate employability/graduate enterprise activity	4	0	0	7	7	6
Offer complete (one-stop shop) solutions	3	0	3	0	7	0
Achieves greater impact	3	0	0	4	7	0
Benefits and broadens research base	3	0	3	0	3	6
Other	11	0	12	15	13	6
Number of HEIs	116	6	33	27	30	17

Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: HEIF 4 institutional strategies, PACEC/CBR analysis

8.3.15 Just under one in 10 HEIs believed that collaboration helps to share best practice. There were a number of examples, such as the WestFocus consortium led by Kingston University, whose partners claimed that the initiative has greatly facilitated the sharing of best practice between the collaborators, both formally and informally.

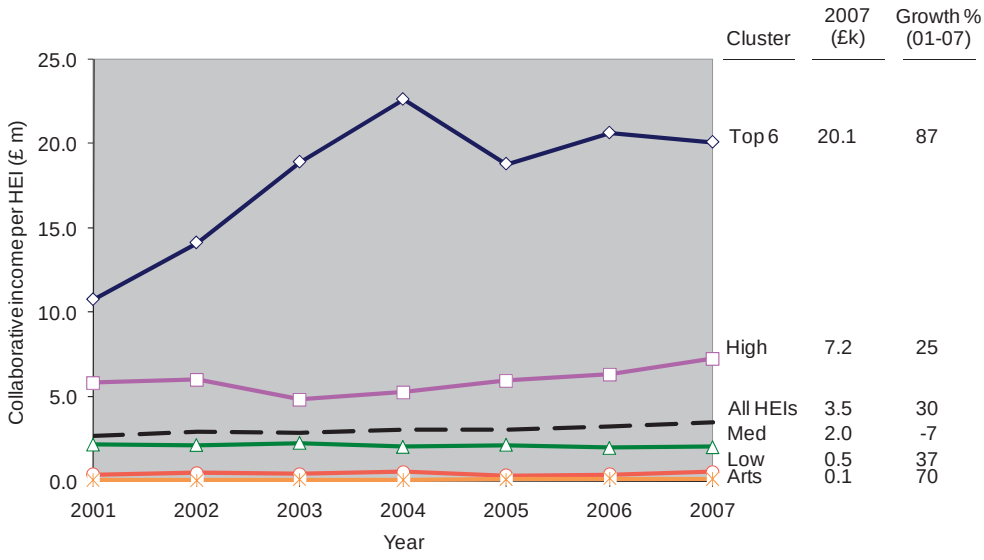
8.3.16 Surprisingly, only 23% of HEIs collaborated to gain economies of scale, with this reason relatively more important for those in the high research cluster and relatively unimportant for those in the low research intensity cluster. *A priori*, one would expect smaller HEIs to collaborate to gain scale, in terms of both facilities and resources, but also in terms of reputation among funders. In addition, other activities such as training staff, commercialisation support and legal advice for knowledge exchange would all benefit from economies of scale. WestFocus provides a good example of this occurring in practice, with the partner HEIs exploiting the economies of scale that result from the bringing together of seven HEIs to provide commercialisation support,

enterprise education, entrepreneurship, knowledge exchange and business development. However, there was little evidence of this practice being widespread.

Collaborative research income

8.3.17 When one turns to the amount of collaborative research income generated by HEIs over the period, the trends do not follow those observed in collaborative funding. Figure 8.5 shows that those in the top six research cluster have seen the greatest increases in their income, while those in the medium research cluster have seen their collaborative research income decrease over the period. However, there could be a number of different explanations. Firstly, the definition of collaborative research income in the HEBCI database requires the collaboration to include at least two partners in addition to the HEI, one of which must be a government or public body. In addition, collaboration between HEIs with no other type of partner is excluded.[61] Such definitions may favour collaborative activity in larger HEIs, which are more common in the higher research clusters. Secondly, the measure is of collaborative income for *research* rather than collaborative income generally. HEIs in the lower research clusters and the arts cluster may collaborate for reasons other than research, income for which would likely be inadmissible in the HEBCI returns. Given that the clusters are primarily categorised according to their research income, it is unsurprising that those in the higher research clusters generate more collaborative research income.

Figure 8.5 Collaborative research income



Financial values are in constant 2003 prices
Source: HEBCI survey, PACEC/CBR analysis

Drivers of change in collaboration and the impact of HEFCE third stream funding

8.3.18 One of the key drivers of the change in the nature and extent of collaboration is the recognition by HEIs and academics that most industrial problems today are inherently

[61] See HEFCE *Higher education – business and community interaction survey guidance*

multidisciplinary in nature. Comprehensive solutions therefore require the expertise from more than a single discipline. The setting up of demand-focused multidisciplinary institutes that focus on particular sectors or industrially/societally driven problems such as climate change is a direct response to this driver. HEFCE third stream funding has facilitated this development by providing resources for these institutes and support for their engagement with external organisations. It has also acted to stimulate cross-faculty working by making available the necessary resources to overcome the transaction costs.

8.3.19 The increase in collaborative activities undertaken by HEIs can partly be attributed to HEIF funding. This is particularly the case where HEFCE third stream funding has enabled business development managers who are both user-focused and academic-focused rather than merely academic discipline oriented to be successfully deployed within the institution. Where this is the case, these have been used to maximum effect in identifying demand opportunities within industry and the public and charitable sectors, and aligning them with the capabilities of the academics across disciplines. In some HEIs they have also been good at putting together research packages (multiple HEIs, industrial sponsors, government-industrial partnerships etc). However, the business development manager role has not been successful across all the HEIs interviewed. In some cases there was a failure to build the necessary credibility among both academics and external organisations, and a number of departments ceased the funding of the post once HEIF funding was withdrawn. However, they are currently using their HEFCE third stream funding allocation to support other approaches that foster internal collaboration, such as a multidisciplinary institute that assimilates the research of various faculties in the HEI and disseminates this research to the economy and society, primarily through consultancy activities.

8.3.20 Other drivers of increased collaborative activity include the formalisation of knowledge exchange activities as mainstream activities, demand for interdisciplinary solutions, substantial external funding opportunities which require the creation of collaborative groups, philanthropic donations for interdisciplinary, demand-led research, regional and central government funding for collaborative ventures and the efforts of KE champions and KEOs. Lastly, an important driver is a more positive attitude towards collaboration among academics and greater recognition of the benefits it can deliver.

8.4 Ability to attract other sources of funding

8.4.1 Almost all HEIs studied believed that HEFCE third stream funded initiatives and projects have led to an increased ability to attract funding from other sources. However, the extent to which this has changed varied both among institutions and within institutions. Most of the high and low research HEIs studied and the entire arts cluster claimed that this ability has increased to a large extent, while most of the medium research intensity cluster believed that ability has increased to a small extent. Within the top six cluster, the perception was mixed within each institution.

Some believed that third stream funded activities have led to a large increase in the leverage ratio, with others believing a much smaller impact.

8.4.2 HEIF funding has enabled HEIs to develop both the capacity and capability to attract other sources of funding. The development of knowledge exchange offices has been one of the primary drivers in this respect. They are increasingly writing the business proposals, handling contract negotiations and securing the deals (e.g. in contract research). The professionalism and capability of the staff within such offices, particularly in the top six and high research clusters, have helped HEIs to attract multimillion pound opportunities, both from large corporations and from the public sector (e.g. RDAs and central government) that would have been difficult to secure otherwise. A good example is the Integrated Vehicle Health Management centre of excellence secured by a HEIF-funded post at Cranfield that will cement their strategic relationship with Boeing as well as bringing them to their Technology Park. It is hoped that this in turn will attract SMEs to the site and the local region, thus generating further jobs in the area. Another good example is the OwnIt project at the University of the Arts, part funded by the London Development Agency (LDA), which offers free intellectual property advice to the creative sector. A HEIF-funded initiative, the Enterprise Centre for the Creative Arts at the University, was instrumental in conceiving of the idea and securing the funding from the LDA.

8.5 Impact of the movement towards formula funding

8.5.1 The movement towards formula funding for the third and subsequent rounds of HEIF has brought with it a number of advantages and disadvantages, and created a number of impacts on HEIs. Firstly, most HEIs prefer the stability and predictability of the current formula-based system over the former competitive bidding allocation system. This helps HEIs with long-term strategic planning by removing some of the financial uncertainty of implementing long-term objectives. Importantly, it also provides the stability of funding to provide longer term contracts for KE staff. The competitive bidding system meant that many KE staff were typically on relatively short-term fixed contracts with no guarantees of continuation after the end of the funding round. The movement towards a formula-based system largely removes this constraint and facilitates the recruitment of high-calibre candidates in KE positions.

8.5.2 The formula-driven allocation mechanism has also prompted many HEIs to develop better internal monitoring systems, partly in order to provide accurate metrics for the HEBCI survey, the main source of information for the allocation formula. Monitoring, and particularly evaluation, systems were found to be lacking in many HEIs.[62] However, the case studies suggested that in some HEIs where this was the case internal systems were being developed to better monitor their KE activities, consistent with the requirements of HEBCI.

8.5.3 However, this close alignment of HEI monitoring systems with the HEBCI data, with particular focus on the metrics that drive the formula, creates a substantial risk to

[62] PACEC (2008) *Analysis of HEIF 4 Institutional Strategies: Overview Report*, a report to HEFCE

knowledge exchange activity. HEIs may start to focus on particular types of activities in order to maximise the metrics to secure the maximum possible funding. This could easily distort the system, with HEIs focusing their KE activities on the limited number of metrics that the HEBCI survey collects. For example, an HEI that has a distinct advantage in the provision of courses to large multinational companies may be inclined to focus on SME provision in order to maximise the formula, despite its delivering most value to the economy through the former type of customer. In addition, owing to the large component of the formula that focuses on KE income, arts HEIs – which can deliver substantial non-monetary value to the economy and society, for example through the provision of free advice to micro-companies in the creative sector or through community-focused activities – may divert more effort to income-generating activities.

8.5.4 Other case study HEIs claimed that the formula favours those that have high levels of KE engagement and hinders those that are growing their capability rapidly from a low base. This is because the formula for the subsequent three years is based on the previous year's HEBCI data, with no growth forecasts included.

8.5.5 Lastly, a number of HEIs noted that, while the overall benefits of allocating the funding through a formula greatly outweigh those from a competitive bidding system, it may stifle the innovation that is being seen in the sector in relation to knowledge exchange engagement. Owing to the reliance on metrics to determine the allocation, HEIs will be less likely to fund riskier initiatives if they may harm their future allocation. The ability of funding to allow riskier projects to be funded was seen by a number of HEIs as an important benefit of HEIF funding over other sources of funding for KE.

8.5.6 The ability to stimulate innovative initiatives was seen as the key advantage of the competitive bidding system. There was a perception that the bidding process prompted HEIs to invest a lot more time and energy upfront in the design of projects, focusing their minds on innovative ideas that could secure the bid. The competitive bidding system was also viewed as better supporting large-scale collaborative initiatives. One HEI claimed that this ability to stimulate perhaps somewhat risky but highly innovative projects meant that "massive potential could be achieved in two years rather than ten". The movement towards a formula-based system is causing many HEIs to review whether the benefits of allocating their formula internally exceed those deriving from contributing to the collaboration. Given the necessary funding required to set up many KE initiatives prior to becoming self-sustaining, there was a concern that HEIs will choose to fund internal initiatives at the expense of those that deliver benefits to a wider group of HEIs. An interview with a major collaborative initiative set up through HEFCE funding highlighted the uncertainty of its future after the end of the HEIF 3 funding round because of the unwillingness of its partners to commit their formula-based funding. It remains to be seen whether HEIs will contribute similar levels of their allocation to future collaborative projects compared with the amounts invested through competitive bids.

8.5.7 The key disadvantage of the competitive bidding system was that it forced HEIs to expend large amounts of time and resources putting together bids, which could better be used elsewhere. In addition, some HEIs claimed that the bidding system was susceptible to 'politically driven outcomes' and that the transparency of the formula allocation mechanism is greatly preferred.

8.5.8 On balance, most HEIs perceived the benefits of the formula allocation mechanism greatly outweighing the costs and much preferred it over the competitive bidding system. Few wanted to return to the previous state.

8.6 Impacts on the sharing of best practice

8.6.1 HEIs seek out best practice from a number of different sources in order to improve their performance in knowledge exchange engagement. The primary source for good or best practice is from within the HEI itself. Many recognise that the KE experience and capability being created within their own institutions through individual academic-external organisation interactions may yield valuable lessons for other academics wishing to engage. Some HEIs have sought to disseminate successful engagements and good practice through a variety of means such as seminars and workshops and through KE events. HEFCE third stream funding has also funded KE champions and mentors whose aim is to encourage academics to engage in knowledge exchange. These KE champions are beginning to form informal, and sometimes formal, networks that provide a fertile ground for the sharing of best practice. In addition, the professionalisation of the 'knowledge exchange professional' within the HE sector is leading to networks of such individuals that, among other things, share best practice. The formation of bodies such as the Association for University Research and Industry Links (AURIL), University Companies Association (UNICO), Praxis and the Institute for Knowledge Transfer (IKT) all help to share knowledge around the HE sector.

8.6.2 Other HEIs provide another key source for sharing best practice. HEFCE third stream funding has brought together HEIs with different KE capabilities and experiences for collaborative initiatives. These can often result in the sharing of best practice between partners either formally or informally. In addition, this mechanism also works at the localised level within HEIs when academics of different disciplines are brought together to engage with external organisations. The partners of the WestFocus consortium best articulated this relationship between collaboration and the sharing of best practice in their HEIF 4 strategies:

> *The partnership brings particular value by virtue of the extensive sharing of best practice between institutions, the high regional profile and visibility it has achieved and the access to third stream and seed-corn funds it has facilitated.*
>
> Brunel University

Through the WestFocus collaboration and its Knowledge Exchange there is sharing of best practice in a number of areas including commercialisation and incubation.

University of Westminster

8.6.3 Some of the globally focused HEIs are looking internationally for best practice, with a focus on the KE experience of American HEIs while a few turn to the European experience. Once again, transatlantic and pan-European collaborations help to facilitate this process. Some HEIs also use external consultancies to provide advice on best practice.

9 Impacts on External Organisations

9.1 The role of HEIs in a network of interacting organisations

9.1.1 This study's survey and case study research found that HEIs interact with a wide range of external organisations in the private, public and charitable/voluntary sectors. However, it is important to recognise that HEIs are only one of many actors which offer support to organisations in all these sectors. This chapter provides evidence on the relative importance of HEIs compared to these other actors for undertaking innovative activity. There is a particular focus on innovation in the private sector, which reflects the interest in this area by previous research. Though caution should be taken in generalising these findings to outside the private sector, this existing work provides some context for the focused findings on HEIs' interactions with all external organisations in the sections to follow.

9.1.2 The focus of previous work on the contribution of HEIs to innovation in the private sector is not surprising, given their traditional role as sources of research and trained graduates. The HEI's role in supporting innovation is supported by the latest UK Community Innovation Survey[63] (CIS), for the period 2004-06. This reports that 10% of enterprises in the UK have cooperative arrangements on innovative activities with other enterprises or institutions, down from 13% for the period 2002-04. Of these arrangements, 29% are with HEIs, decreasing from 33% in 2002-04. However, HEIs are not the only actor within the UK innovation network. Table 9.1 shows that innovation partnerships take place with a range of actors, with other types of partners more common than HEIs, such as consultants, commercial labs and private R&D institutes.

Table 9.1 Innovation cooperation partners

Cooperation partners	% Enterprises with a cooperation agreement	
	2002-04	2004-06
Within your enterprise or enterprise group	50	54
Suppliers	76	67
Clients or customers	74	68
Competitors	44	37
Consultants, commercial labs, private R&D institutes	42	36
Universities or other HEIs	33	29
Government or public research institutes	31	23

Source: UK Innovation Survey 2005 (DTI), UK Innovation Survey 2007 (BERR)

9.1.3 Table 9.2 shows that engineering-based manufacturing and knowledge-intensive services enterprises are most likely to have cooperative agreements, around a third of which have cooperative agreements with HEIs. The primary sector is the most likely to use HEIs as the cooperative partner of choice, with 63% of cooperative agreements being with HEIs. Enterprises in the construction sector are least likely to choose HEIs as partners. There appears to be little difference between enterprises of

[63] The CIS is a survey conducted every four years by EU member states that allows the monitoring of Europe's progress in the area of innovation.

different sizes in terms of their willingness to engage with HEIs as cooperative partners.

Table 9.2 Innovation cooperation agreements and partnership with HEIs disaggregated by sector and size of company (%)

		2002-04		2004-06	
		% any cooperation	*…of which % cooperating with HEIs*	% any cooperation	*…of which % cooperating with HEIs*
Sector	All sectors	13	*33*	10	*29*
	Primary sector	10	*55*	10	*63*
	Engineering-based manufacturing	16	*40*	18	*32*
	Other manufacturing	13	*36*	14	*26*
	Construction	10	*34*	4	*14*
	Retail and distribution	13	*24*	8	*21*
	Knowledge-intensive services	20	*41*	16	*36*
	Other services	9	*26*	7	*30*
Size	All 10+	13	*33*	10	*29*
	10-49	12	*32*	9	*28*
	50-249	16	*36*	13	*31*
	10-249	13	*33*	10	*29*
	250+	22	*43*	19	*36*

Source: UK Innovation Survey 2005 (DTI), UK Innovation Survey 2007 (BERR)

9.1.4 National SME surveys by the Centre for Business Research (CBR) at the University of Cambridge also provide information on formal or informal collaborative partnership arrangements.[64] In the 2004 survey, it found that 43% of all SMEs (innovators and non-innovators) are engaged in such partnerships, of which 22% collaborate with HEIs. As with the CIS, it found that other types of partners are more common, such as suppliers (50%), customers (50%) and firms in a similar line of business (59%). It also found that innovative SMEs are more likely to collaborate in general and specifically with HEIs, that is, there are around two innovative collaborators for every non-innovative collaborator.

9.1.5 Although the number of collaborative or cooperative partnerships with HEIs is lower than with other organisations, their scale may be larger. Moreover, organisations may contract out work to HEIs as opposed to collaborate/cooperate with them. This is particularly important given that the CIS explicitly states that "pure contracting out of work is not defined as cooperation in this survey". It is therefore also useful to assess HEIs as sources of information.

9.1.6 HEIs can be useful sources of information, whether as part of a cooperative arrangement or not. The 2006 CIS found that 25% of innovation active enterprises consider HEIs to be of some importance (low, medium or high) as a source of information, with 9% believing the information of medium or high importance. Table 9.3 lists the percentage of enterprises which consider the information from a range of

[64] For further details and results of the surveys see *British Enterprise: thriving or surviving? SME growth, innovation and public policy 2001-2004,* edited by Andy Cosh and Alan Hughes, 2007, CBR

sources to be of a medium or high degree of importance. This suggests that information from HEIs is of less importance for technological innovation than information from suppliers, clients, competitors or within the enterprise. However, caution must be taken over drawing firm conclusions. This is because of the CIS only reporting direct sources of information.

Table 9.3 Source of information for technological innovation active enterprises, 2002-04

Source of information		Importance of sources of information (% innovation active enterprises considering source medium/high importance)	
		2002-2004	2004-2006
Internal	Within your enterprise or enterprise group	67	55
Market sources	Suppliers	64	59
	Clients or customers	71	67
	Competitors	49	48
	Consultants, commercial labs, private R&D institutes	20	16
Institutional sources	Universities or other HEIs	10	9
	Government or public research institutes	10	9
Other sources	Conferences, trade fairs, exhibitions	34	29
	Scientific journals	31	23
	Professional and industry associations	35	30
	Technical, industry or service standards	37	32

Source: UK Innovation Survey 2005 (DTI)

9.1.7 If HEIs provide more information indirectly than other sources, then the direct results of the 2006 CIS may underestimate the total contribution of HEIs relative to other sources. However, using 2000 CIS data in a report to the DTI, Swann (2002)[65] found no evidence to suggest that this would be the case. Swann did find that HEIs are more important as an indirect source, although this will unlikely change their low rank in the league table of information sources. Another key finding by Swann (2002) was that the probability of cooperating with an HEI was higher than expected, given how little they are used as a source of information. Swann found evidence which suggests that this is because of cooperation with HEIs having a greater effect on innovative performance than using them as a source of knowledge. This view is supported by the case study evidence of the Lambert Review (2003), where the Cambridge-MIT Institute argued that "without programmes that foster in-depth and interpersonal business-[HEI] engagement, the contribution such collaborations can make to the economy is likely to be modest." It would therefore appear that the frequency of cooperative agreements is a useful indicator of the overall (in number and scale) interaction between HEIs and enterprises.

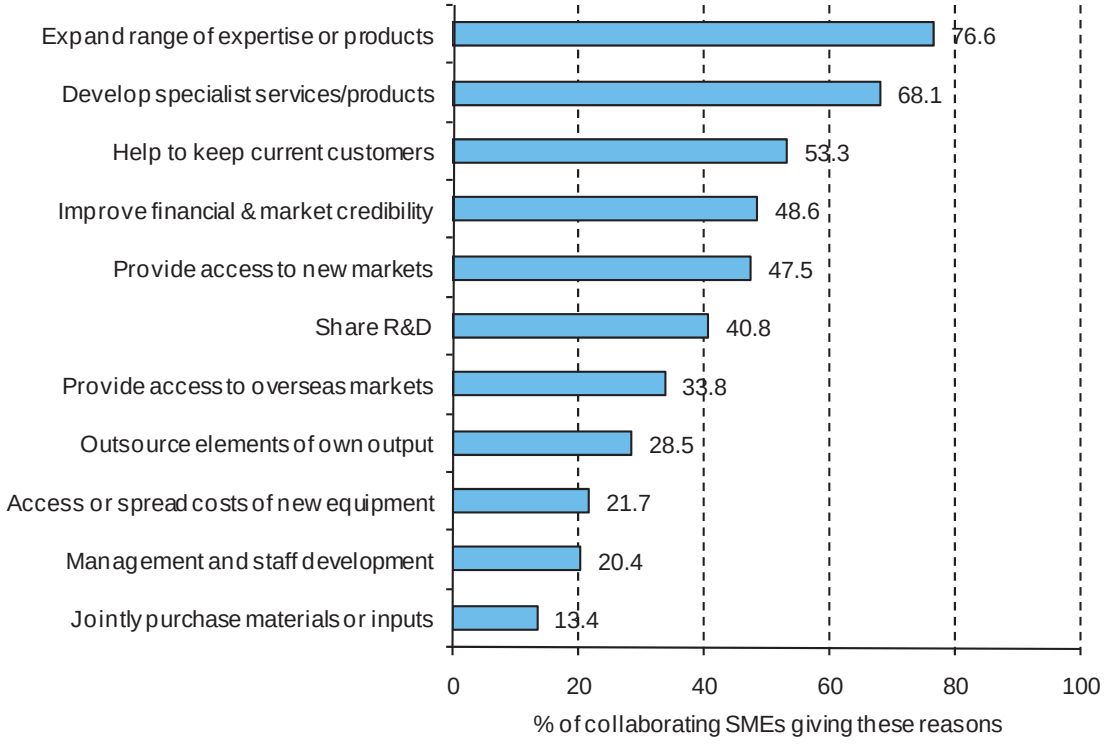
9.2 External organisations' motives for collaborating

9.2.1 It is useful to explore the reasons organisations collaborate, especially when considering the demand for HEI expertise and facilities. The CBR National SME Survey proves useful for this purpose (Figure 9.1). SMEs particularly seek to

[65] G. M. P. Swann (2002) *Innovative Businesses and the Science and Technology Base: An Analysis Using CIS3 Data*, Manchester Business School

collaborate in the development of expertise, products and services. Swann (2002) found that cooperation with HEIs is particularly important and effective for those engaged in process innovations, but less so for those engaged in product innovation. The use of clients, competitors and consultants is more important for the latter (as is demonstrated by the work of Von Hippel on 'lead users').[66] SMEs may therefore collaborate less with HEIs because of their greater interest in product innovations (though the CBR survey does not explicitly include process improvements as an option). There is less demand by SMEs to share R&D or to access/spread costs of new equipment, which are the areas where HEIs are likely to have a competitive advantage. Indeed, Swann (2002) found that cooperating with HEIs is more important when companies are engaged in external or intramural R&D.

Figure 9.1 Reasons for SMEs to collaborate



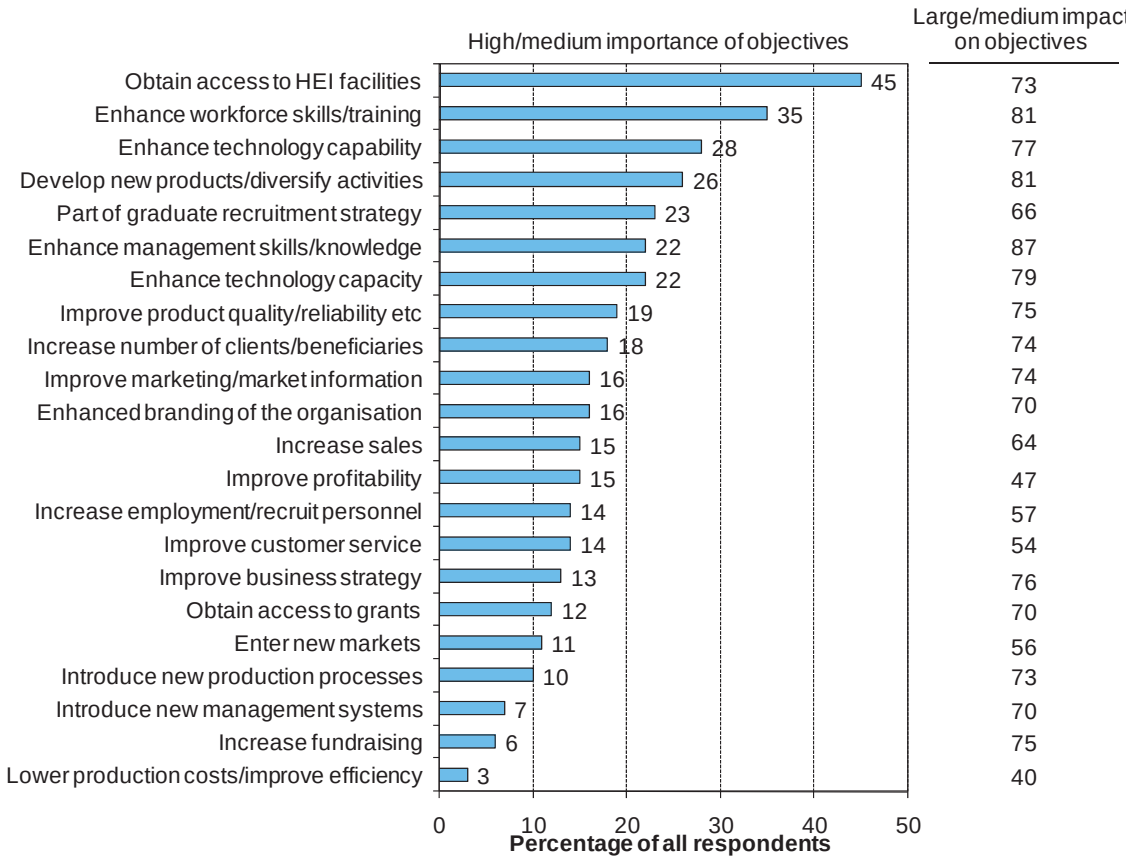
Note: SMEs in the UK with fewer than 500 employees
Source: CBR National SME Survey 2001-04

9.2.2 The PACEC/CBR survey of external organisations 2008, carried out for this research programme, specifically focused on organisations that interact with HEIs. The subsequent results are therefore not intended to represent the full population of external organisations. Furthermore, there were significant barriers in obtaining a list of all external organisations that interacted with an HEI. As an alternative, each HEI was asked to select a random sample of external organisations with which it interacted. However, there are some risks that the sample may not be a complete representation of the actual population of external organisations which interact with HEIs. Some of the results may therefore be subject to sample bias, particularly those

[66] See, for example, Von Hippel, E. (1986) "Lead Users: A Source of Novel Product Concepts", *Management Science*, Vol. 32, No. 7, pp. 791-805

regarding the overall success/importance of the interaction. One should bear this in mind when interpreting the results. Further details of the sample are outlined in Appendix D.

Figure 9.2 Motivations of external organisations engaging with HEIs



Question: Which of the following have been the motivations and objectives of your organisation when interacting with the particular HEI?

Number of respondents: 367

Source: PACEC/CBR survey of external organisations 2008

9.2.3 Figure 9.2 reports the objectives for engaging with HEIs in the sample from the PACEC/CBR survey of external organisations. The most common motivation for interacting with HEIs was to access their facilities. It is also clear from the survey evidence that external organisations particularly turn to HEIs to enhance their technology, increase their skills base and develop their products. It seems that the most popular objectives relate to input/R&D improvements within these organisations, such as using HEI facilities. As noted previously, these are demanded less by all SMEs which collaborate (not just those that interact with HEIs), and provides further support as to why there appears to be less collaboration with SMEs than organisations of other sizes. However, the 'specific introduction of new production process' was less sought after than the 'development of new products/activities' for organisations interacting with HEIs. The evidence is therefore at odds with the findings of Swann (2002), which suggested that collaboration is more likely to take place in process innovations. It is difficult to establish if this is because of HEIs increasing their support in product development since 2000.

9.2.4 Motivations varied across sectors. Most of the variations were as one would expect, such as less importance in public sector interactions on profitability, sales, branding and product development/quality. In the non-services sector there was greater demand for technology enhancement and product development. Interestingly, interacting with HEIs in improving management and workforce skills/knowledge was considered more important in the public sector than in the private sector.

9.2.5 There was also variation in motivations by the size of an organisation. Micro-organisations (fewer than five employees) particularly demanded access to HEI facilities and the enhancement of their branding, business strategy and marketing through their interaction with HEIs. These motivations reflect the reputational difficulties facing many micro-companies and the benefits of economies of scale in many of these activities. Large organisations (more than 200 employees) were particularly concerned with improving business strategy, recruitment and training. There were no particular sharp contrasts in motivations from the average for small (5-49 employees) and medium-sized (50-199 employees) organisations.

9.2.6 External organisations that interact with HEIs turn to different types of HEIs for different forms of support (Table 9.4). The six most research intensive HEIs are particularly demanded for enhancing technology, product development and increasing sales, but not so much for workforce training and graduate recruitment strategy support. The facilities of high research intensive HEIs are in the most demand relative to other HEIs, but they are not targeted as much for graduate recruitment strategy support. In contrast, at medium research intensive HEIs there is greater demand than average for workforce training, management systems and graduate recruitment strategy support, and less demand for their facilities and technological capabilities. There is a wider spread of strong demand for low research intensive HEIs, which includes access to grants and their facilities, support for customer growth, and enhanced branding, marketing and recruitment. However, they are demanded less in product development. Arts-focused HEIs are in particular demand for branding, marketing and customer service improvement. Surprisingly, the facilities of arts-focused HEIs are in less demand than at other HEIs. However, this result should be treated with caution because of the low sample size for external organisations which interacted with this type of HEI.

Table 9.4 Motivations of external organisations engaging with HEIs, breakdown by HEI cluster, % respondents high or medium importance

Motivation	Total	Cluster				
		Top 6	High	Med	Low	Arts
Obtain access to HEI facilities	45	48	**65**	**36**	**55**	**8**
Enhance workforce skills/training	35	**18**	25	**44**	39	42
Enhance technology capability	28	**43**	36	24	20	25
Develop new products/diversify activities	26	**44**	36	20	**17**	41
Part of graduate recruitment strategy	23	**11**	**9**	**38**	18	8
Enhance technology capacity	22	**34**	31	**15**	18	17
Enhance management skills/knowledge	22	17	17	26	26	41
Improve product quality/reliability etc	19	**28**	16	15	20	25
Increase number of clients/beneficiaries	18	12	24	**6**	**38**	17
Enhanced branding of the organisation	16	19	11	**7**	**27**	**50**
Improve marketing/market information	16	16	9	12	**23**	**50**
Improve profitability	15	13	14	16	19	17
Increase sales	15	**25**	9	11	16	25
Improve customer service	14	13	6	**5**	**24**	**50**
Increase employment/recruit personnel	14	12	14	12	**22**	16
Improve business strategy	13	13	5	13	17	**33**
Obtain access to grants	12	16	10	**6**	**19**	25
Enter new markets	11	16	9	**6**	13	25
Introduce new production processes	10	15	14	8	6	16
Introduce new management systems	7	3	2	**12**	4	**25**
Increase fundraising	6	**16**	4	**2**	2	17
Lower production costs/improve efficiency	3	4	2	4	6	0

Note 1: Owing to the small size of the 'arts' sample, caution should be taken when interpreting their results.
Question: Which of the following have been the motivations and objectives of your organisation when interacting with the particular HEI?
Number of respondents: 367
Note 2: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of external organisations 2008

9.3 Regional and sub-regional engagements

9.3.1 The differences in motivations by type of firm, particularly by size, are an important factor for HEIs to consider in their regional roles. Richard Lester (2005)[67] outlined four pathways to regional innovation-led growth: indigenous creation of new industry; transplantation of new industry into a region; diversification of existing industry into new areas/markets; and the upgrading of mature industry. If HEIs are to align their efforts with the objectives in the local economy, the mix of micro-enterprises relative to large corporations is important. HEIs servicing large enterprises need to ensure that they offer support in recruitment, training and business strategy, whereas for micro-enterprises branding and marketing are more important.

[67] Lester, R. (2005) *Universities, Innovation, and the Competitiveness of Local Economies: summary report from the local innovation project - phase 1*, MIT IPC Working Paper IPC-05-010

9.3.2 As part of this study, 11 regional/sub-regional development stakeholders, including RDAs, were interviewed. During these interviews it was found that HEIs' support to their regional economies is marked by their increased engagement with England's RDAs and other local/regional development stakeholders. These interactions have not only increased in number and value, but have also widened in scope and become more strategic. Major initiatives with regional/sub-regional development stakeholders include science parks, incubation centres, graduate employability, Knowledge Transfer Partnerships, and proof of concept funds.

9.3.3 Regional/sub-regional stakeholders see HEIs as key assets in the regional/local economy, particularly as a source of knowledge. They generate skills and knowledge that are part of the supply chain of value into the economy. In addition, they provide an effective route for RDAs to support regional businesses.

Impact of HEIs on regional economic development

9.3.4 Almost all RDAs and other regional stakeholders believed that interactions with HEIs are very or critically important for the development of their economic strategies. HEIs are formally consulted with, provide views on the strengths and weaknesses of different industrial sectors, and future market trends, and help to produce the evidence base necessary for the development of regional economic strategies or forms of regional strategies.

9.3.5 Furthermore, they also reported that their interactions with HEIs positively impact on their ability to effectively deliver their economic development strategies. HEIs are becoming key stakeholders in the delivery of such strategies. Almost all of the regional and sub-regional stakeholders viewed HEIs as critically or very important for raising the innovative capability of companies in their region. They also believed that HEIs are important for raising the level of enterprise and skills in the regional economy. HEIs act as an important source of knowledge generation for the businesses in the region, and in select cases provide a source of spin-outs. Many regional stakeholders also saw their HEIs as large, important employers and landowners that can help to contribute to economic regeneration.

9.3.6 In addition, most planned to increase their interaction with HEIs in the future.

Obstacles facing HEI interactions with external organisations

9.3.7 Nonetheless, the engagements between regional stakeholders and HEIs are not always easy to initiate, with a few regional/sub-regional development stakeholders reporting that the identification of the most appropriate staff was sometimes difficult. Other key constraints identified by a few regional/sub-regional development stakeholders included bureaucracy and inflexibility of HEI administrators, cultural differences, lack of capability of HEI staff and difficulty in reaching agreement on the terms of the interaction. In overcoming these constraints, the regional/sub-regional development stakeholders supported the development of HEI strategic missions to include a focus on working with business. They thought that there was a need to

increase the consistency of engagements and to make services more accessible, approachable and business friendly. Other institutional improvements supported included academic remuneration and career progression in knowledge exchange, a more flexible academic working environment to accommodate business timescales/budgets, and the continuity of knowledge exchange support staff to facilitate access to HEI expertise.

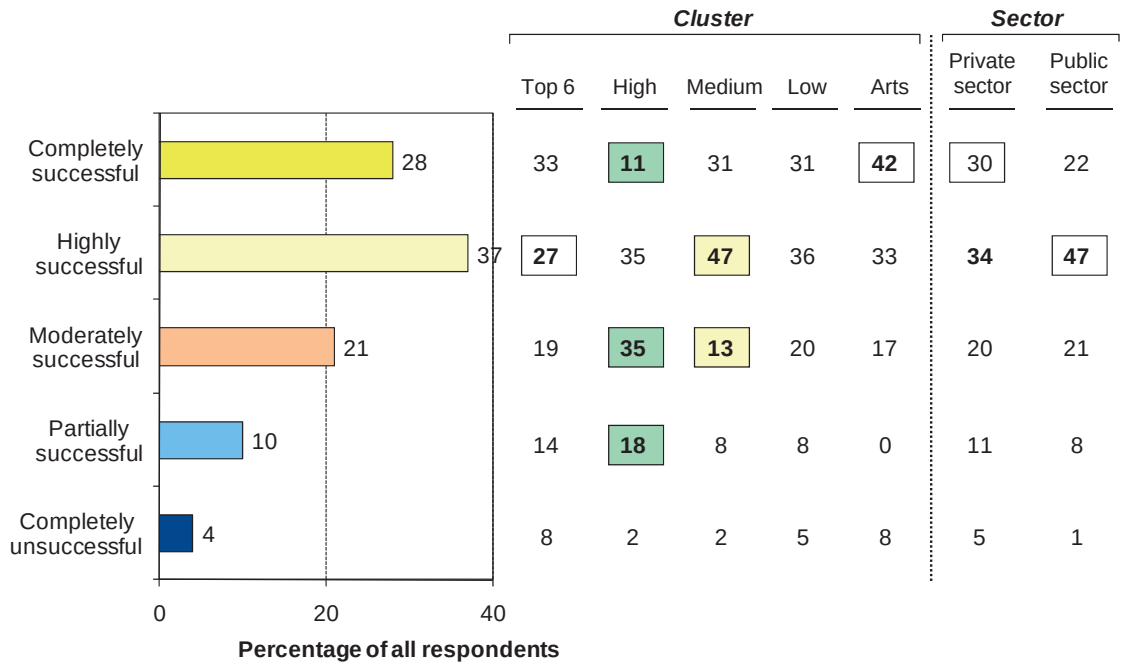
9.3.8 Particular growth areas noted by regional/sub-regional development respondents included greater HEI involvement in partnerships, more SME support, increased coordination in knowledge exchange between all HEIs in a region, and the further development of KTPs and other applications of research.

9.4 Impact of interactions: HEI support and absorptive capacity

9.4.1 The overall success and impact of HEI interactions with external organisations are not only dependent on the support of an HEI, but also on an organisation's absorptive capacity. The latter is particularly important for an external organisation to take advantage of the research developed within the HE sector. It is important to consider these two factors when analysing the success and impacts of interactions between HEIs and external organisations.

9.4.2 HEI interactions with external organisations over the HEIF period, in most cases, have been successful. Figure 9.3 reports the overall success of these interactions. It is clear that those organisations that have interacted with HEIs value working with them, with 65% considering the interactions as completely or highly successful. However, this may be an overestimation due to the potential sample bias in the PACEC/CBR survey of external organisations.

Figure 9.3 Overall success of HEI interactions



Source: PACEC/CBR survey of external organisations

Question: Overall, how successful in meeting your objectives has your interaction as a whole with the HEI been?

Number of respondents: 351

9.4.3 Interactions between external organisations and HEIs of medium research intensity are particularly successful; 78% of external organisations reported that their interaction with them was either completely or highly successful compared with the 65% average for all HEIs. In contrast, external organisations which interacted with high research intensive HEIs reported a particularly high proportion of interactions that were either moderately or partially successful. The success of interactions with the six most research intensive HEIs, low research intensity HEIs or arts-based HEIs was similar to the average. There are many possible drivers of these trends. For example, medium research intensive HEIs may have a stronger institutional infrastructure for supporting these interactions, or alternatively their engagements may be less ambitious.

9.4.4 Interactions with the private sector are slightly more successful relative to the public sector, with more businesses than public sector organisations reporting completely successful interactions. There were also differences within the private sector: there were more successful interactions in services (73% completely or highly successful) than in the non-services (57%). It is difficult to distinguish whether this is because of HEIs' capabilities or the difference in absorptive capacity in the public and private sectors. Focusing further on absorptive capacity, there was no significant difference in the success of interactions between organisations of different sizes (by number of employees). There were also no significant differences to suggest that proximity had any effect on the success of an interaction. However, this does not necessarily suggest that absorptive capacity is unimportant. For example, Swann (2002) investigated a firm's absorptive capacity to work with HEIs and found that companies

with a greater proportion of employees with science or engineering degrees are more likely to cooperate with an HEI. In addition, Swann found that enterprises with a higher proportion of scientifically qualified staff consider HEIs as a more important source of information.

9.4.5 The PACEC/CBR survey of external organisations also provides evidence on the effect of interactions on their specific objectives. The results are presented in Figure 9.2 in a previous section. Figure 9.2 has already been used to show the range of objectives of external organisations for interacting with HEIs. The percentage of organisations with a specific objective can be compared with the impact of the interaction on that objective. There is some correlation between objectives and impacts (there is a correlation coefficient of 0.48). For example, the top four objectives had a high impact; HEIs appear to be particularly supportive in terms of providing access to their facilities, enhancing workforce skills and technological capability, and developing new products/diversifying activities. However, there are exceptions: though many external organisations seek support with their graduate recruitment strategies, there is scope for much higher impacts; and though there is not as much demand for HEIs to support the development of new production processes, the interactions had high impacts (contrary to the findings of Swann (2002)).

9.4.6 The impact of external organisation engagement on specific objectives varies by HEI cluster (Table 9.5). The six most research intensive HEIs have significantly higher impacts on product development and technology enhancement, but are not so strong on support for graduate recruitment and employment growth. The relatively higher impacts of medium research intensive HEIs are in business strategy, management systems, sales growth, graduate recruitment and employment growth. The relatively lower impacts of high research intensive HEIs are on no single objective, but across many. Low research intensive HEIs have a similar number of strengths and weaknesses. Though they are strong on marketing, branding, recruitment support and profit growth, they are weaker on product development and technology enhancement. The sample size of arts-based HEIs was too small to make reliable distinctions on their strengths and weaknesses.

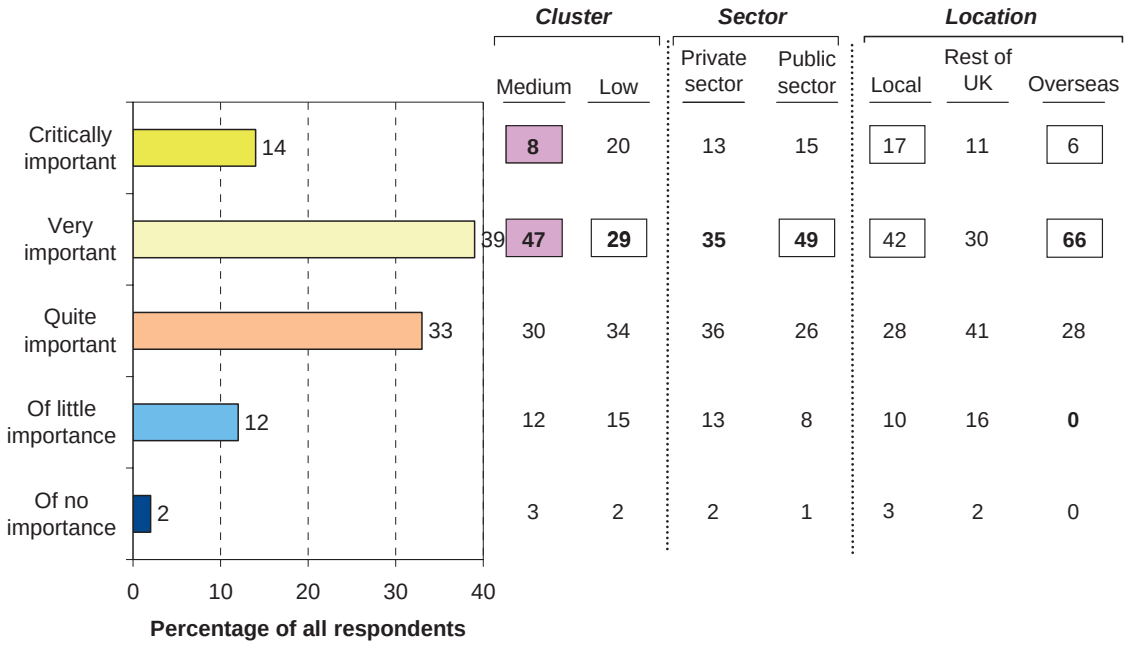
Table 9.5 Effect on external organisation objectives, breakdown by cluster, % large or medium effect of organisations with objective

Motivation	Total	Cluster				
		Top 6	High	Med	Low	Arts
Enhance management skills/knowledge	87	82	**67**	**97**	85	100
Develop new products/diversify activities	81	**92**	**69**	77	**69**	100
Enhance workforce skills/training	81	77	75	85	82	80
Enhance technology capacity	79	**97**	73	**71**	**69**	**50**
Enhance technology capability	77	85	82	79	**55**	67
Improve business strategy	76	69	0	**94**	69	75
Improve product quality/reliability etc	75	76	**60**	**84**	67	**100**
Increase fundraising	75	82	0	**67**	100	**100**
Improve marketing/market information	74	**50**	80	**84**	**83**	83
Increase number of clients/beneficiaries	74	69	**58**	**88**	80	66
Obtain access to HEI facilities	73	74	79	**65**	76	50
Introduce new production processes	73	69	**58**	75	80	**100**
Introduce new management systems	70	**60**	0	**84**	75	66
Enhanced branding of the organisation	70	**57**	**50**	43	**95**	83
Obtain access to grants	70	74	**50**	63	76	66
Part of graduate recruitment strategy	66	**40**	**34**	**76**	63	**0**
Increase sales	64	64	20	**83**	**53**	**100**
Increase employment/recruit personnel	57	**38**	18	**76**	**72**	**100**
Enter new markets	56	56	**33**	57	59	75
Improve customer service	54	45	**33**	50	63	50
Improve profitability	47	**28**	**25**	**55**	**57**	**100**
Lower production costs/improve efficiency	40	38	100	14	75	n/a

Question: Indicate the effect that the interaction had in meeting your objective for that form of interaction. It is important to exclude any outcomes which would have happened anyway.
Number of respondents: 354
Note: A number is shown in bold where, taking into account the margin of error due to sampling, we are 95% certain that it is different from the total (using a Chi-Squared statistical test)
Source: PACEC/CBR survey of external organisations

9.4.7 The success of these objectives clearly impacts overall organisational performance, with over half reporting that their interactions with the HEI are critically or very important (Figure 9.4). However, this is likely owing to the nature of the sample, which focused on external organisations that have interacted with HEIs.

Figure 9.4 Impact of interactions on organisational performance



Source: PACEC/CBR survey of external organisations

Question: Overall, in terms of your organisation's performance, how important are your interactions as a whole with the HEI?

Number of respondents: 365

9.4.8 HEIs of varying research intensity had a similar level of impacts on the external organisations they engaged with. The only significant difference of interest is that HEIs of medium research intensity had fewer critically important impacts and more highly important impacts than for other HEIs. This suggests that interactions with medium research intensive HEIs have slightly smaller impacts than other HEIs. This is intriguing, given that the success rate of interactions with medium research intensive HEIs is higher. One possible explanation, given previously, for the high success rate of interactions with medium research intensive HEIs is that their engagements are less ambitious or that they are still developing and improving their KE portfolio. This would also help to explain why their impacts are lower.

9.4.9 Interestingly, the interactions were slightly more important to the public sector than to the private sector, with 64% of public sector organisations compared with 48% of private sector organisations considering the impact of interactions on organisational performance as either 'critically important' or 'very important'. There were also more micro-organisations (fewer than five employees) that considered impacts 'critically important' than organisations of any other size. This is more likely to be because of the scale of the interaction relative to the size of these organisations than variations in absorptive capacity.

9.4.10 Proximity also appears to be a key driver for the impact of an interaction. The impacts were high for organisations located either abroad (72% citing it as critically or very important) or within 30 miles of the HEI (59% citing it as critically or very important),

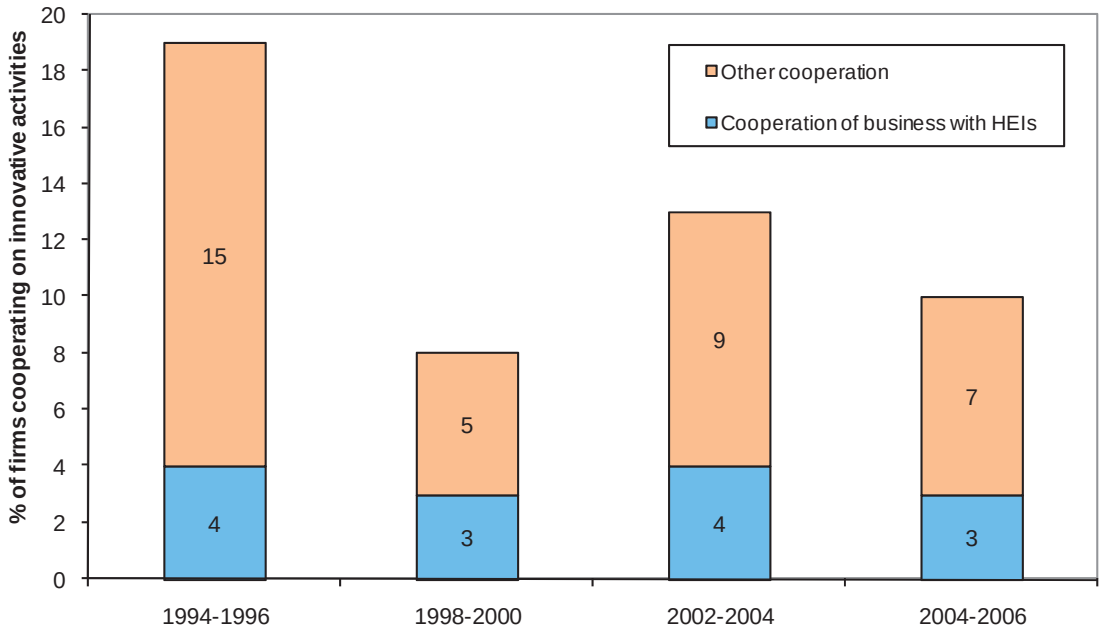
but not so high for other organisations located in the UK (41% citing it as critically or very important). This is interesting, given that the survey evidence suggests that proximity plays no role in the success of an interaction. One possible explanation is that organisations with large interactions with an HEI may locate near it to reduce costs. Larger interactions may also be more important, but not necessarily more successful. Organisations from overseas are likely to rate the interaction as more important because the HEI offers them a unique service which is not available in their country. Equally, this does not necessarily mean that the engagement will be more successful.

9.5 Variations in interaction over time

9.5.1 A useful indicator of how the impacts of HEIs on external organisations have varied over time is the change in the number of interactions and the use of HEIs as a source of information. Though caution should be taken when inferring impacts with outputs, it can lead to partial insights. For example, if the use of HEIs increases and HEIs can charge higher rates, this would suggest that demand for HEIs' capabilities has increased. This serves as an indication that HEIs are more highly valued.

9.5.2 Data from HEBCI shows that the number of interactions between external organisations and HEIs has increased by around 90% since 2002. The Community Innovation Survey also has time-series data on interactions between HEIs and the private sector. Firstly, it shows that around 3% of all enterprises in the UK had cooperative arrangements with HEIs on innovative activity in 2004-06 (Figure 9.5). Secondly, this has remained relatively stable between the periods before and after HEIF funding. This is despite large variation in overall cooperation of enterprises with all types of organisations over the same time. This is in contrast to the trends reported by HEBCI data. However, the CIS data in Figure 9.5 focuses only on interactions which involve cooperation on an innovative activity and it explicitly states that contract research is excluded. It is also difficult to draw robust conclusions about the change in overall cooperation. For example, the scale and success of individual cooperations may have increased, despite the overall number remaining constant.

Figure 9.5 HEI-enterprise interactions in innovation



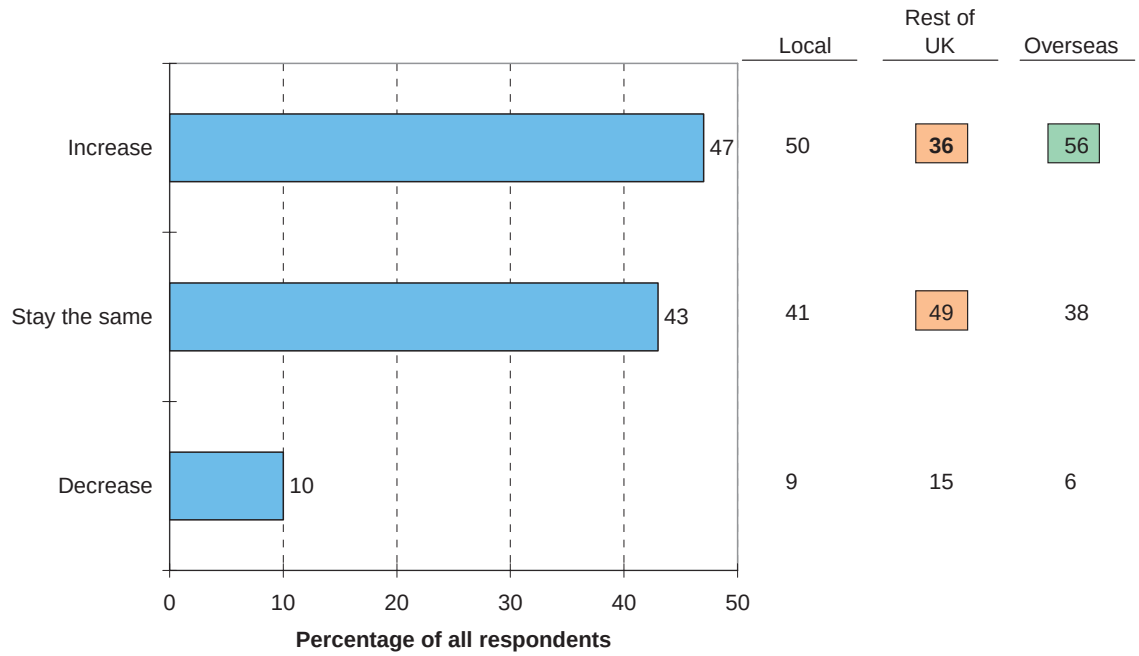
Note: Includes cooperation with HEIs outside the UK. Some figures are subject to rounding errors from the source data.
Source: UK Innovation Surveys (DTI)

9.5.3 CIS data on HEIs as a source of information for innovative activities is more consistent with the HEBCI data. Here, the use of HEIs as a source of information increased from 17% in 1998-2000 to 25% in 2004-06. However, data from the CBR National SME Survey indicates very little change. Around 5% of SMEs considered HEIs as a very significant or crucial information source for innovation in 1994-97, compared with 3% in 2002-04. It is therefore difficult to draw robust conclusions from this data about whether HEIs are more highly valued.

9.6 Future external HEI interaction

9.6.1 Investment in knowledge exchange has the potential to not only promote interactions now, but also in the future. Though there is no data on potential demand from external organisations without links to HEIs, almost half of the external organisations already working with HEIs planned to increase their engagement in the future (Figure 9.6). This may be affected by the sample biases described in 9.2.2. However, unless the sampling bias is particularly strong, the demand for increased engagement from existing organisations with links to HEIs can be expected to rise. As the growth in demand from external organisations without links cannot be negative, overall demand for HEI support is likely to increase. Of the organisations with existing links, those based overseas were particularly positive about increasing their engagement. However, UK-based organisations which were not based near the HEI were less positive.

Figure 9.6 Future plans of external organisations for engagement with the HEI



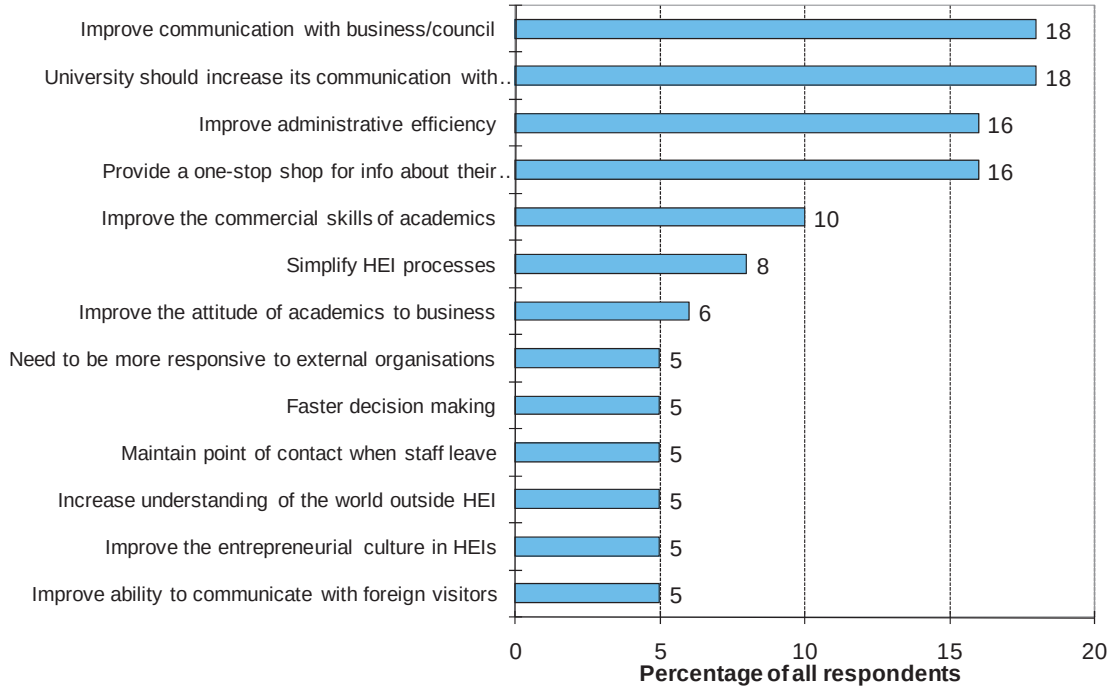
Source: PACEC/CBR survey of external organisations

Question: In the next few years how is your organisation likely to change in its interaction with the HEI?

Number of respondents: 361

9.6.2 HEIs can also make further improvements in supporting external organisations. Though only 28% of organisations with existing links with HEIs reported that the assistance offered could be improved, a key priority for these organisations was for HEIs to improve/increase communication with them (Figure 9.7) and improve administrative efficiency. In addition, there were some calls for HEIs to provide better 'one-stop shop' facilities for information regarding KE requirements. A few also thought that the commercial skills and attitudes of academics could be improved and that the decision-making process could be accelerated.

Figure 9.7 Top 13 potential improvements of HEIs when offering assistance to external organisations



Source: PACEC/CBR survey of external organisations

Question: Are there any ways in which the HEI could improve the assistance it offers to external organisations?

Number of respondents: 62

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Appendix B Acronyms

Acronym	Definition
AURIL	Association for University Research and Industry Links
AUTM	Association of University Technology Managers
BERR	Department for Business, Enterprise and Regulatory Reform
CAGR	Compound annual growth rate
CBBS	Cost-benefit balance sheet
CIS	Community Innovation Survey
CKE	Centre for Knowledge Exchange
CPD	Continuing professional development
CVE	Continuing vocational education
DfES	Department for Education and Skills
DIUS	Department for Innovation, Universities and Skills
DTI	Department of Trade and Industry
ERDF	European Regional Development Fund
ESF	European Social Fund
FTE	Full-time equivalent
GVA	Gross value added
HE	Higher education
HEACF	Higher Education Active Community Fund
HEBCI	Higher Education Business and Community Interaction
HEFCE	Higher Education Funding Council for England
HEI	Higher education institution
HEIF	Higher Education Innovation Fund
HEROBC	Higher Education Reach Out to Business and the Community
HESA	Higher Education Statistics Agency
HL	Humanities and languages
ICT	Information and communications technology
IKT	Institute for Knowledge Transfer
IP	Intellectual property
IPR	Intellectual property rights
KE	Knowledge exchange
KEO	Knowledge exchange office
KTCF	Knowledge Transfer Capability Fund
KTPs	Knowledge Transfer Partnerships
LDA	London Development Agency
MSET	Medical, science, engineering, technology
NWDA	North West Development Agency
OLS	Ordinary least squares
OSI	Office of Science and Innovation
PoC	Proof of concept
PR	Public relations
R&D	Research and development
RAE	Research Assessment Exercise

RDA	Regional Development Agency
SEC	Science Enterprise Challenge
SME	Small and medium-sized enterprises
TF	Teaching Fellows
UCF	University Challenge Seed Fund
UNICO	University Companies Association
VC	Vice-chancellor

Appendix C Cost-benefit Balance Sheets for the Clusters

Table C1.1 Cost-benefit balance sheet: top six research cluster

Inputs per HEI			Quantifiable outputs per HEI		
			Type	Period	Total output
HEFCE third stream funding (£k per HEI)	UCF	3,004	Collaborative research (£m)	2001-07	126
	SEC	1,720	Contract research (£m)	2001-07	182
	HEROBC	1,573	Consultancy (£m)	2001-07	24
	HEIF	4,962	Facilities and equipment (£m)	2001-07	13
	HEACF	503	Courses (£m)	2001-07	39
	KTCF	87	Regeneration/development (£m)	2001-07	4
	CKE	57	IP Revenues (£m)	2001-07	18
	Other	775			
Total HEFCE third stream funding 2001-07 (£k) per HEI		12,680	Total income (£m)		407
Non-HEIF funding		n/k			
Allocation of expenditure to inputs (% HEIF 4 expenditure)			Non-income outputs per HEI		
Allocation of expenditure to inputs (% HEIF 4 expenditure)	Dedicated KE staff	67.2	Number of course days	2004-07	109,503
	Support for staff engagement	3.9	Number of patents granted	2001-07	249
	Seed/PoC funds	10.4	Number of non-software licences	2001-07	238
	PR/marketing	6.4	Number of software licences	2001-07	38
	Collaboration/partnerships/networks	1.1	Number of spin-offs with HEI ownership	2001-07	34
	CPD, enterprise education, student enterprise and employer engagement	0.1	Number of formal spin-offs	2001-07	4
	Training/staff development	2.1	Number of staff spin-offs	2002-07	6
	Engagement support services and other internal/external KE support	0.5	Number of graduate spin-offs	2001-07	37
	KE units, institutes and research centres	0	Total patent stock (active patents)	n/a	571
	Development funds	1			
	General KE support costs	1.1	Free public lectures (attendees, 000s)	2004-07	65
	KE initiatives and projects	0	Free performance arts (attendees, 000s)	2004-07	13
	Investment in spin-outs	0	Free exhibitions (attendees, 000s)	2004-07	937
	Incubation	0	Free museum education (attendees, 000s)	2004-07	101
	Community outreach	0	Free other events (attendees, 000s)	2004-07	93
	Other KE staff	0.2	Charge public lectures (attendees, 000s)	2004-07	7.1
	Consultancy	0	Charge performance arts (attendees, 000s)	2004-07	4.1
	Awards/events/culture change initiatives	0	Charge exhibitions (attendees, 000s)	2004-07	157
	Other expenditure	2.6	Charge museum education (attendees, 000s)	2004-07	25
	Unaccounted expenditure	3.3	Charge other events (attendees, 000s)	2004-07	4.7
Number of staff days for events 2001-07 (000s)		10	Total number of attendees at events (000s)	2004-07	1,407

		Gross ***additional*** income (£m per HEI)	Upper estimate	Lower estimate
Total HEFCE third stream funding (£m) per HEI	12.7	Collaborative research	55.1	26.3
		Contract research	97.6	66.9
		Consultancy	14.3	8.1
		Facilities and equipment	3.8	3.7
		Courses	8.8	2.0
		Regeneration/development	0.2	0.0
		IP	7.3	3.6
		All income streams	180.0	101.8
		Average additional impact	14.2	8.0

*Gross additionality excludes any displacement effects that may arise out the knowledge exchange activity
Financial values are in constant 2003 prices
Sources: HEBCI surveys, HEIF 4 strategies, HEFCE data, PACEC/CBR analysis

Table C1.2 Cost-benefit balance sheet: high research cluster

Inputs per HEI			Quantifiable outputs per HEI		
			Type	Period	Total output
HEFCE third stream funding (£k per HEI)	UCF	655	Collaborative research (£m)	2001-07	41
	SEC	619	Contract research (£m)	2001-07	47
	HEROBC	961	Consultancy (£m)	2001-07	17
	HEIF	3,637	Facilities and equipment (£m)	2001-07	6
	HEACF	223	Courses (£m)	2001-07	20
	KTCF	52	Regeneration/development (£m)	2001-07	10
	CKE	234	IP revenues (£m)	2001-07	2
	Other	797			
Total HEFCE third stream funding 2001-07 (£m)		7,179	Total income (£m)		144
Non-HEIF funding		n/k			
Allocation of expenditure to inputs (% HEIF 4 expenditure)			Non-income outputs per HEI		
Allocation of expenditure to inputs (% HEIF 4 expenditure)	Dedicated KE staff	55.7	Number of course days	2004-07	56,481
	Support for staff engagement	11.4	Number of patents granted	2001-07	51
	Seed/PoC funds	5.9	Number of non-software licences	2001-07	73
	PR/marketing	4.2	Number of software licences	2001-07	27
	Collaboration/partnerships/networks	2.4	Number of spin-offs with HEI ownership	2001-07	11
	CPD, enterprise education, student enterprise and employer engagement	2.8	Number of formal spin-offs	2001-07	1
	Training/staff development	2.6	Number of staff spin-offs	2002-07	2
	Engagement support services and other internal/external KE support	3.1	Number of graduate spin-offs	2001-07	14
	KE units, institutes and research centres	1.1	Total patent stock (active patents)	n/a	94
	Development funds	1.2			
	General KE support costs	0.7	Free public lectures (attendees, 000s)	2004-07	22
	KE initiatives and projects	1.3	Free performance arts (attendees, 000s)	2004-07	10
	Investment in spin-outs	0.5	Free exhibitions (attendees, 000s)	2004-07	44
	Incubation	0.4	Free museum education (attendees, 000s)	2004-07	3.5
	Community outreach	0.2	Free other events (attendees, 000s)	2004-07	40
	Other KE staff	0.2	Charge public lectures (attendees, 000s)	2004-07	3.2
	Consultancy	0.1	Charge performance arts (attendees, 000s)	2004-07	50
	Awards/events/culture change initiatives	0.3	Charge exhibitions (attendees, 000s)	2004-07	12
	Other expenditure	3.1	Charge museum education (attendees, 000s)	2004-07	1.8
	Unaccounted expenditure	2.8	Charge other events (attendees, 000s)	2004-07	112
Number of staff days for events 2001-07 (000s)		1.2	Total number of attendees at events (000s)	2004-07	299

		Gross ***additional*** income (£m per HEI)	Upper estimate	Lower estimate
Total HEFCE third stream funding (£m)	7.2	Collaborative research	21.8	17.5
		Contract research	13.3	8.3
		Consultancy	5.1	2.5
		Facilities and equipment	2.0	0.7
		Courses	4.1	3.0
		Regeneration/development	3.8	3.6
		IP	1.3	1.2
		All income streams	48.1	34.0
		Average additional impact	6.7	4.7

*Gross additionality excludes any displacement effects that may arise out the knowledge exchange activity
Financial values are in constant 2003 prices
Sources: HEBCI surveys, HEIF 4 strategies, HEFCE data, PACEC/CBR analysis

Table C1.3 Cost-benefit balance sheet: medium research cluster

Inputs per HEI		
HEFCE third stream funding (£k per HEI)	UCF	19
	SEC	213
	HEROBC	917
	HEIF	2,553
	HEACF	285
	KTCF	58
	CKE	426
	Other	266
Total HEFCE third stream funding 2001-07 (£m)		4,738
Non-HEIF funding		n/k
Allocation of expenditure to inputs (% HEIF 4 expenditure)		
Allocation of expenditure to inputs (% HEIF 4 expenditure)	Dedicated KE staff	46.5
	Support for staff engagement	17.2
	Seed/PoC funds	5
	PR/marketing	3.7
	Collaboration/partnerships/networks	3.1
	CPD, enterprise education, student enterprise and employer engagement	1.4
	Training/staff development	2.4
	Engagement support services and other internal/external KE support	1.9
	KE units, institutes and research centres	4
	Development funds	1.7
	General KE support costs	3.6
	KE initiatives and projects	1.5
	Investment in spin-outs	1.8
	Incubation	0.5
	Community outreach	0.7
	Other KE staff	0.5
	Consultancy	0.4
	Awards/events/culture change initiatives	0.1
	Other expenditure	2.3
	Unaccounted expenditure	1.9
Number of staff days for events 2001-07 (000s)		1.4
Total HEFCE third stream funding (£m)		4.7

Quantifiable outputs per HEI		
Type	Period	Total output
Collaborative research (£m)	2001-07	15
Contract research (£m)	2001-07	12
Consultancy (£m)	2001-07	7
Facilities and equipment (£m)	2001-07	1
Courses (£m)	2001-07	13
Regeneration/development (£m)	2001-07	10
IP Revenues (£m)	2001-07	0.9
Total income (£m)		60
Non-income outputs per HEI		
Number of course days	2004-07	113,404
Number of patents granted	2001-07	16
Number of non-software licences	2001-07	110
Number of software licences	2001-07	37
Number of spin-offs with HEI ownership	2001-07	6
Number of formal spin-offs	2001-07	1
Number of staff spin-offs	2002-07	3
Number of graduate spin-offs	2001-07	35
Total patent stock (active patents)	n/a	32
Free public lectures (attendees, 000s)	2004-07	10
Free performance arts (attendees, 000s)	2004-07	3.9
Free exhibitions (attendees, 000s)	2004-07	32
Free museum education (attendees, 000s)	2004-07	0.6
Free other events (attendees, 000s)	2004-07	10
Charge public lectures (attendees, 000s)	2004-07	0.9
Charge performance arts (attendees, 000s)	2004-07	8
Charge exhibitions (attendees, 000s)	2004-07	0.9
Charge museum education (attendees, 000s)	2004-07	0.02
Charge other events (attendees, 000s)	2004-07	2.2
Total number of attendees at events (000s)	2004-07	69

Gross ***additional*** income (£m per HEI)	Upper estimate	Lower estimate
Collaborative research	7.9	5.8
Contract research	4.9	3.6
Consultancy	3.9	3.4
Facilities and equipment	1.1	0.8
Courses	5.9	3.7
Regeneration/development	4.5	4.1
IP	0.7	0.7
All income streams	28.9	22.1
Average additional impact	6.1	4.7

*Gross additionality excludes any displacement effects that may arise out the knowledge exchange activity
Financial values are in constant 2003 prices
Sources: HEBCI surveys, HEIF 4 strategies, HEFCE data, PACEC/CBR analysis

Table C1.4 Cost-benefit balance sheet: low research cluster

Inputs per HEI			Quantifiable outputs per HEI		
			Type	Period	Total output
HEFCE third stream funding (£k per HEI)	UCF	18	Collaborative research (£m)	2001-07	3.1
	SEC	48	Contract research (£m)	2001-07	3.4
	HEROBC	575	Consultancy (£m)	2001-07	3.0
	HEIF	1,395	Facilities and equipment (£m)	2001-07	0.7
	HEACF	183	Courses (£m)	2001-07	8.3
	KTCF	85	Regeneration/development (£m)	2001-07	7.1
	CKE	324	IP Revenues (£m)	2001-07	0.1
	Other	66			
Total HEFCE third stream funding 2001-07 (£m)		2,693	Total income (£m)		26
Non-HEIF funding		n/k			
Allocation of expenditure to inputs (% HEIF 4 expenditure)			Non-income outputs per HEI		
Allocation of expenditure to inputs (% HEIF 4 expenditure)	Dedicated KE staff	47.1	Number of course days	2004-07	196,358
	Support for staff engagement	23.9	Number of patents granted	2001-07	4
	Seed/PoC funds	3.5	Number of non-software licences	2001-07	4
	PR/marketing	5.1	Number of software licences	2001-07	17
	Collaboration/partnerships/networks	3.8	Number of spin-offs with HEI ownership	2001-07	1
	CPD, enterprise education, student enterprise and employer engagement	2.9	Number of formal spin-offs	2001-07	0
	Training/staff development	2.7	Number of staff spin-offs	2002-07	2
	Engagement support services and other internal/external KE support	1.4	Number of graduate spin-offs	2001-07	49
	KE units, institutes and research centres	1.5	Total patent stock (active patents)	n/a	5
	Development funds	3			
	General KE support costs	0.4	Free public lectures (attendees, 000s)	2004-07	5.6
	KE initiatives and projects	0.8	Free performance arts (attendees, 000s)	2004-07	4.2
	Investment in spin-outs	1	Free exhibitions (attendees, 000s)	2004-07	17
	Incubation	1	Free museum education (attendees, 000s)	2004-07	0.9
	Community outreach	0	Free other events (attendees, 000s)	2004-07	80
	Other KE staff	0.1	Charge public lectures (attendees, 000s)	2004-07	1.6
	Consultancy	0	Charge performance arts (attendees, 000s)	2004-07	8.0
	Awards/events/culture change initiatives	0	Charge exhibitions (attendees, 000s)	2004-07	7.8
	Other expenditure	1.5	Charge museum education (attendees, 000s)	2004-07	1.0
	Unaccounted expenditure	0.1	Charge other events (attendees, 000s)	2004-07	5.1
Number of staff days for events 2001-07 (000s)		0.7	Total number of attendees at events (000s)	2004-07	132

		Gross ***additional*** income (£m per HEI)	Upper estimate	Lower estimate
Total HEFCE third stream funding (£m)	2.7	Collaborative research	2.1	1.8
		Contract research	1.6	1.0
		Consultancy	2.2	1.4
		Facilities and equipment	0.5	0.4
		Courses	4.3	2.7
		Regeneration/development	4.7	3.7
		IP	0.0	0.0
		All income streams	15.6	11.3
		Average additional impact	5.8	4.2

*Gross additionality excludes any displacement effects that may arise out the knowledge exchange activity
Financial values are in constant 2003 prices
Sources: HEBCI surveys, HEIF 4 strategies, HEFCE data, PACEC/CBR analysis

Table C1.5 Cost-benefit balance sheet: arts cluster

Inputs per HEI		
HEFCE third stream funding (£k per HEI)	UCF	0
	SEC	0
	HEROBC	195
	HEIF	695
	HEACF	33
	KTCF	60
	CKE	97
	Other	5
Total HEFCE third stream funding 2001-07 (£m)		1,086
Non-HEIF funding		n/k
Allocation of expenditure to inputs (% HEIF 4 expenditure)		
Allocation of expenditure to inputs (% HEIF 4 expenditure)	Dedicated KE staff	63.1
	Support for staff engagement	7.1
	Seed/PoC funds	4.8
	PR/marketing	2.8
	Collaboration/partnerships/networks	0.8
	CPD, enterprise education, student enterprise and employer engagement	0.8
	Training/staff development	2.6
	Engagement support services and other internal/external KE support	0.1
	KE units, institutes and research centres	0
	Development funds	0
	General KE support costs	0.5
	KE initiatives and projects	3.1
	Investment in spin-outs	2.1
	Incubation	0
	Community outreach	0.4
	Other KE staff	0
	Consultancy	0
	Awards/events/culture change initiatives	0.9
	Other expenditure	3.3
	Unaccounted expenditure	7.7
Number of staff days for events 2001-07 (000s)		2.1
Total HEFCE third stream funding (£m)		1.1

Quantifiable outputs per HEI		
Type	Period	Total output
Collaborative research (£m)	2001-07	0.5
Contract research (£m)	2001-07	0.3
Consultancy (£m)	2001-07	0.6
Facilities and equipment (£m)	2001-07	0.2
Courses (£m)	2001-07	1.5
Regeneration/development (£m)	2001-07	1.0
IP Revenues (£m)	2001-07	0.1
Total income (£m)		4

Non-income outputs per HEI		
Number of course days	2004-07	20,248
Number of patents granted	2001-07	1
Number of non-software licences	2001-07	6
Number of software licences	2001-07	0
Number of spin-offs with HEI ownership	2001-07	1
Number of formal spin-offs	2001-07	0
Number of staff spin-offs	2002-07	1
Number of graduate spin-offs	2001-07	40
Total patent stock (active patents)	n/a	10
Free public lectures (attendees, 000s)	2004-07	7.6
Free performance arts (attendees, 000s)	2004-07	23
Free exhibitions (attendees, 000s)	2004-07	194
Free museum education (attendees, 000s)	2004-07	3.4
Free other events (attendees, 000s)	2004-07	107
Charge public lectures (attendees, 000s)	2004-07	1.7
Charge performance arts (attendees, 000s)	2004-07	43
Charge exhibitions (attendees, 000s)	2004-07	22
Charge museum education (attendees, 000s)	2004-07	0.2
Charge other events (attendees, 000s)	2004-07	2.1
Total number of attendees at events (000s)	2004-07	405

Gross ***additional*** income (£m per HEI)	Upper estimate	Lower estimate
Collaborative research	n/a	n/a
Contract research	n/a	n/a
Consultancy	n/a	n/a
Facilities and equipment	n/a	n/a
Courses	n/a	n/a
Regeneration/development	n/a	n/a
IP	n/a	n/a
All income streams	n/a	n/a
Average additional impact	n/a	n/a

*Gross additionality excludes any displacement effects that may arise out the knowledge exchange activity
Financial values are in constant 2003 prices
Sources: HEBCI surveys, HEIF 4 strategies, HEFCE data, PACEC/CBR analysis

Appendix D Case Study HEIs, Stakeholders and Survey Characteristics

Table D1.1 Case study HEIs and the number of interviews conducted at each HEI

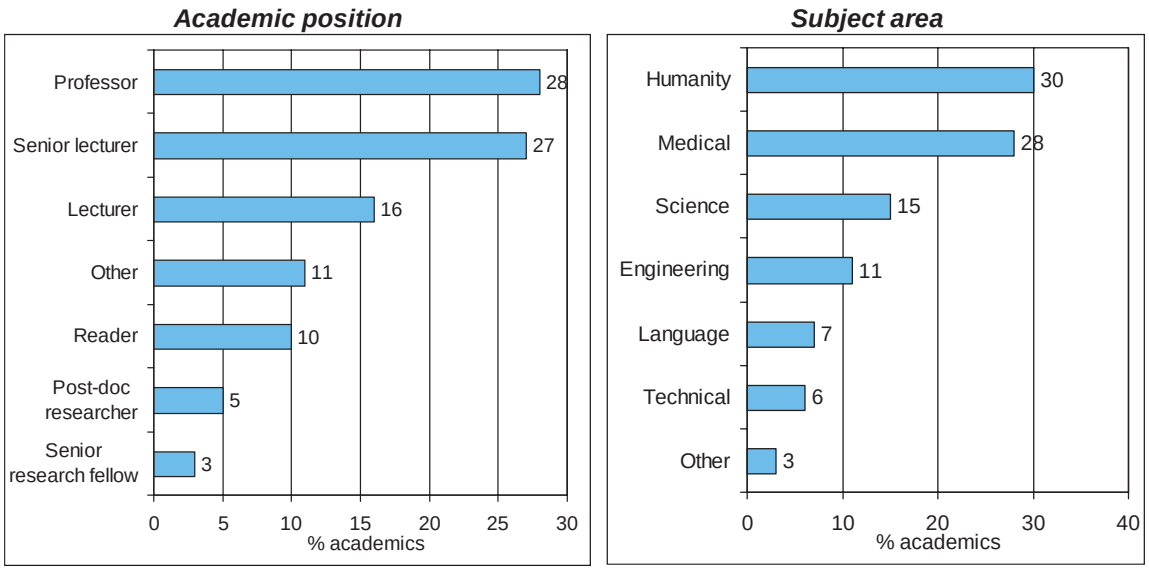
Cluster	Number of HEIs	HEIs studied	Number of Interviews
Top six research	6	University of Cambridge	3
		Imperial College London	6
		King's College London	6
		University of Manchester	1
		University of Oxford	7
		University College London	2
High research	6	Cranfield University	3
		University of Birmingham	8
		Institute of Education	3
		London School of Hygiene and Tropical Medicine	2
		University of Sheffield	5
		University of Southampton	5
Medium research	6	Oxford Brookes University	7
		Brunel University	6
		University of Hertfordshire	5
		School of Oriental and African Studies	3
		University of Plymouth	5
		University of Sunderland	5
Low research	8	Bishop Grosseteste University College Lincoln	3
		University of Derby	4
		Liverpool Hope University	5
		Southampton Solent University	6
		Writtle College	6
		University of Cumbria	4
		Leeds Metropolitan University	1
		University of Lincoln	7
Arts	4	Arts Institute at Bournemouth	4
		Dartington College of Arts	5
		University of the Arts London	4
		Royal Academy of Music	1
Total	30		132

Table D1.2 Regional Development Agencies and other key stakeholders interviewed

Code	Organisations
1	South West Regional Development Agency
2	Greater Cambridge Partnership
3	London Development Agency
4	Advantage West Midlands
5	Wiltshire Strategic Economic Partnership
6	North West Development Agency
7	One Northeast
8	Humber Economic Partnership
9	Oxfordshire Economic Partnership
10	Manchester City Council
11	Hertfordshire Prosperity Ltd

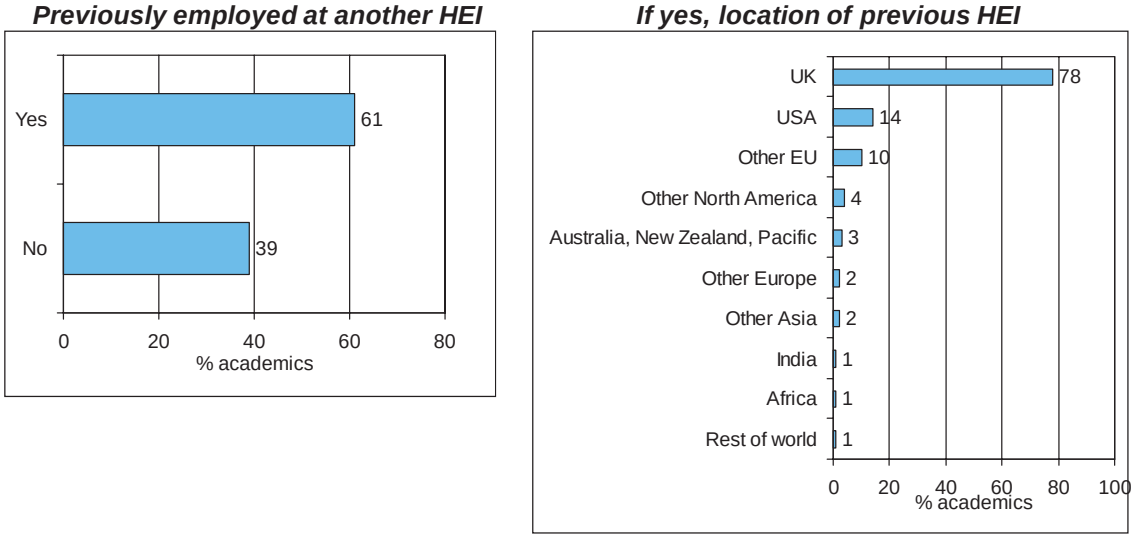
D2 Survey of Academics: Characteristics

Figure D2.1 Breakdown of respondents by academic position and academic discipline



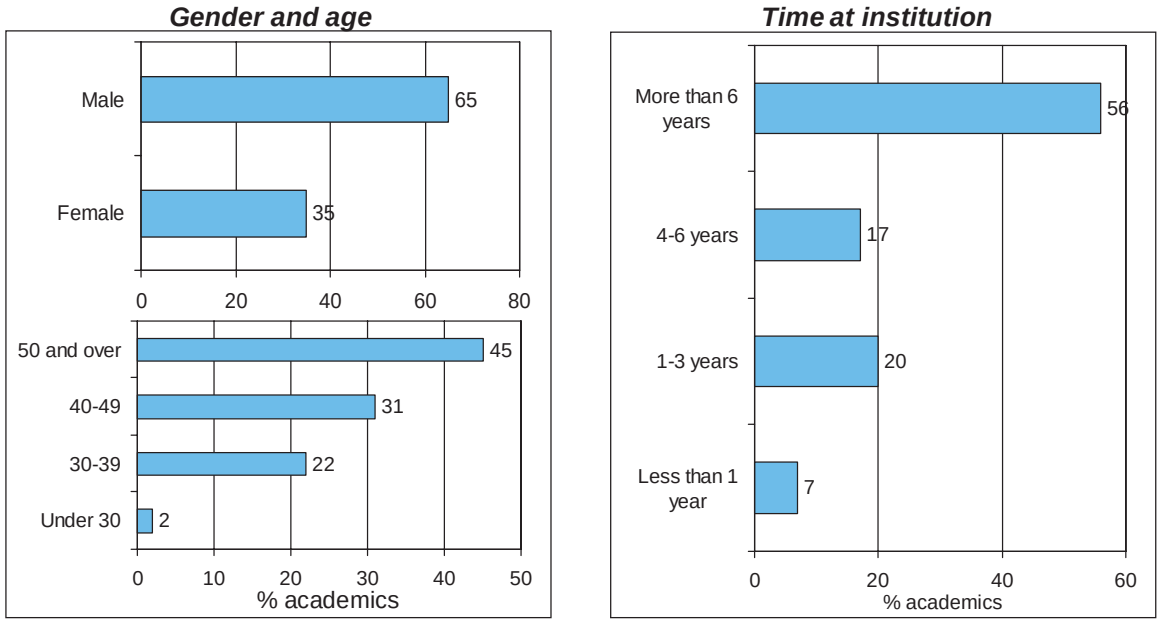
Source: PACEC/CBR survey of academics 2008

Figure D2.2 Breakdown of respondents by previous employment and its location



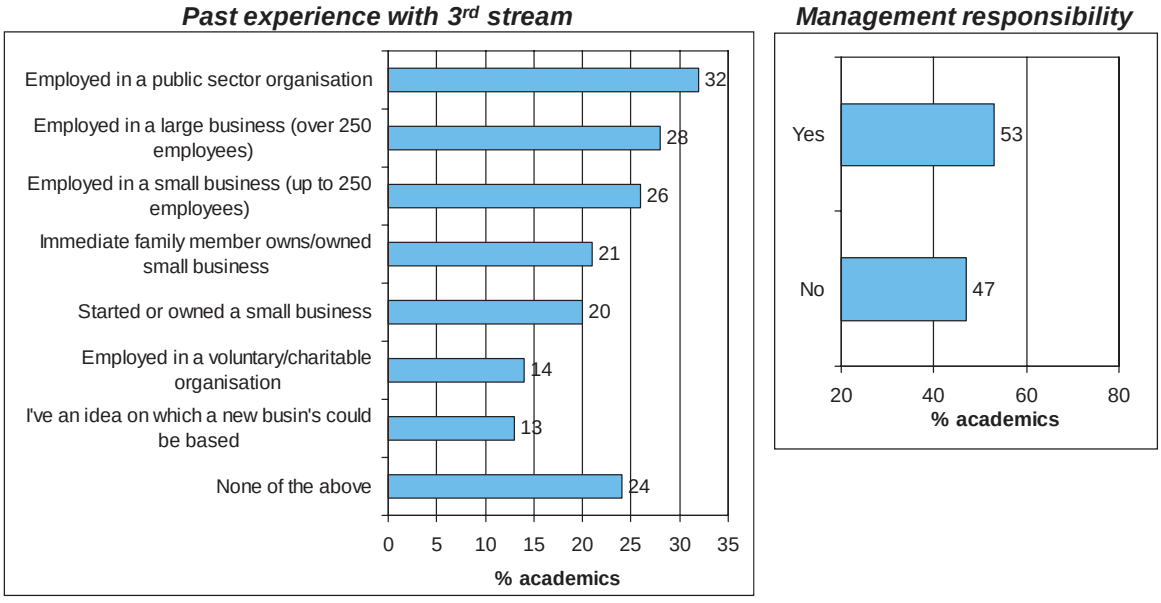
Source: PACEC/CBR survey of academics 2008

Figure D2.3 Breakdown of respondents by gender and length of time at institution



Source: PACEC/CBR survey of academics 2008

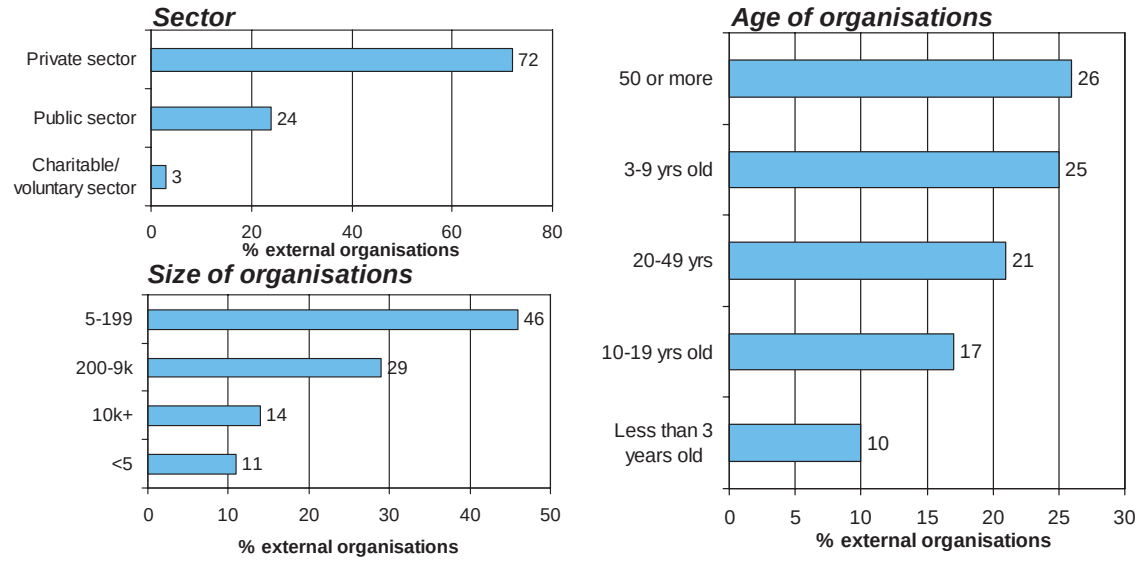
Figure D2.4 Breakdown of respondents by past experience in third stream and management responsibility



Source: PACEC/CBR survey of academics 2008

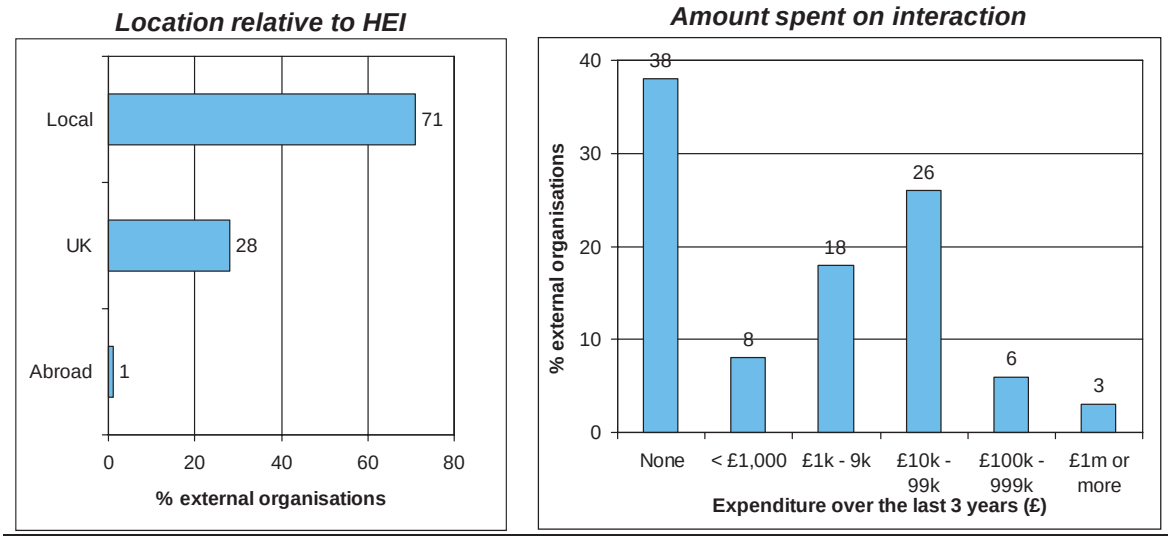
D3 Survey of External Organisations: Characteristics

Figure D3.1 Breakdown of respondents by sector, size and age of external organisation



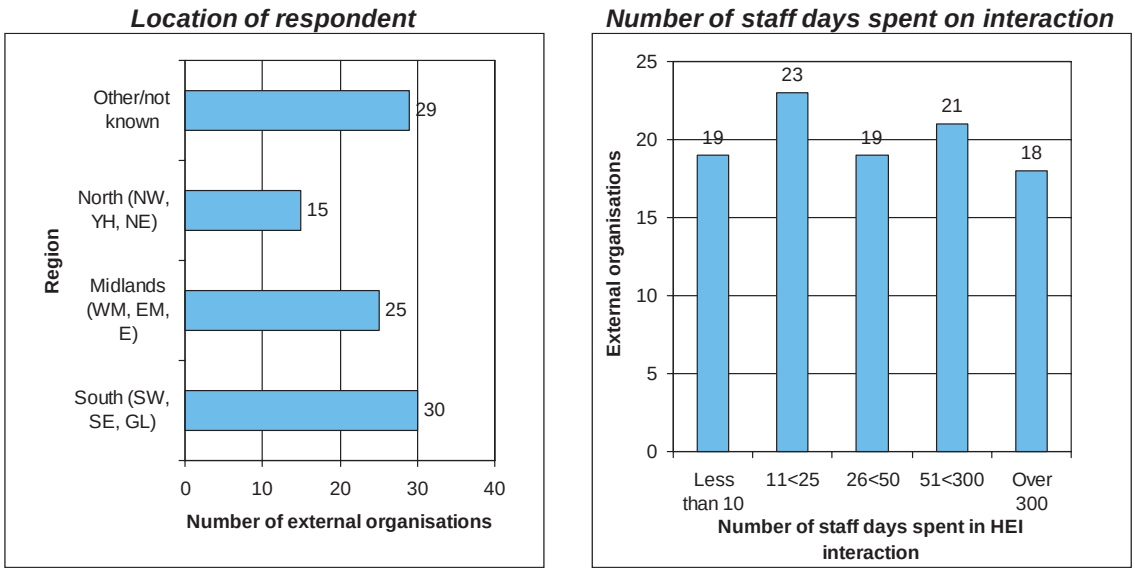
Source: PACEC/CBR survey of external organisations 2008

Figure D3.2 Breakdown of respondents by location relative to HEI and amount spent on interaction



Source: PACEC/CBR survey of external organisations 2008

Figure D3.3 Breakdown of respondents by location of respondent and the number of staff days spent per year on the interaction



Source: PACEC/CBR survey of external organisations 2008

Appendix E HEI Clusters

Table E1.1 Clusters of HEIs – top six research and high research HEIs

Top 6 research intensity cluster		High research intensity cluster 1	
HESA code	HEI name	HESA code	HEI name
H-0132	Imperial College London	H-0002	Cranfield University
H-0134	King's College London	H-0133	Institute of Education
H-0149	University College London	H-0138	London School of Hygiene and Tropical Medicine
H-0114	University of Cambridge	H-0110	University of Birmingham
H-0204	University of Manchester	H-0159	University of Sheffield
H-0156	University of Oxford	H-0160	University of Southampton
		High research intensity cluster 2	
		H-0121	Keele University
		H-0188	Institute of Cancer Research
		H-0123	Lancaster University
		H-0135	London Business School
		H-0137	London School of Economics and Political Science
		H-0152	Loughborough University
		H-0139	Queen Mary, University of London
		H-0141	Royal Holloway, University of London
		H-0143	Royal Veterinary College
		H-0147	School of Pharmacy
		H-0145	St George's Hospital Medical School
		H-0109	University of Bath
		H-0112	University of Bristol
		H-0116	University of Durham
		H-0117	University of East Anglia
		H-0118	University of Essex
		H-0119	University of Exeter
		H-0122	University of Kent
		H-0124	University of Leeds
		H-0125	University of Leicester
		H-0126	University of Liverpool
		H-0154	University of Newcastle upon Tyne
		H-0155	University of Nottingham
		H-0157	University of Reading
		H-0161	University of Surrey
		H-0162	University of Sussex
		H-0163	University of Warwick
		H-0164	University of York

Source: PACEC/CBR analysis

Table E1.2 Clusters of HEIs – medium research and low research HEIs

Medium research intensity cluster 1		Low research intensity cluster 1	
HESA code	HEI name	HESA code	HEI name
H-0113	Brunel University	H-0007	Bishop Grosseteste University College, Lincoln
H-0072	Oxford Brookes University	H-0048	Bath Spa University
H-0146	School of Oriental and African Studies	H-0064	Leeds Metropolitan University
H-0060	University of Hertfordshire	H-0023	Liverpool Hope University
H-0073	University of Plymouth	H-0038	University of Cumbria
H-0078	University of Sunderland	H-0057	University of Derby
		H-0062	University of Lincoln
		H-0189	Writtle College
Medium research intensity cluster 2		**Low research intensity cluster 2**	
H-0047	Anglia Ruskin University	H-0052	Birmingham City University
H-0108	Aston University	H-0050	Bournemouth University
H-0127	Birkbeck College	H-0009	Buckinghamshire New University
H-0115	City University, London	H-0012	Canterbury Christ Church University
H-0056	Coventry University	H-0016	Edge Hill University
H-0068	De Montfort University	H-0018	Harper Adams University College
H-0131	Goldsmiths College, University of London	H-0063	Kingston University
H-0065	Liverpool John Moores University	H-0040	Leeds Trinity and All Saints
H-0076	London South Bank University	H-0202	London Metropolitan University
H-0066	Manchester Metropolitan University	H-0067	Middlesex University
H-0001	Open University	H-0028	Newman University College
H-0031	Roehampton University	H-0071	Nottingham Trent University
H-0075	Sheffield Hallam University	H-0037	Southampton Solent University
H-0077	Staffordshire University	H-0039	St Mary's University College
H-0049	University of Bolton	H-0080	Thames Valley University
H-0111	University of Bradford	H-0017	University College Falmouth
H-0051	University of Brighton	H-0014	University College Plymouth St Mark and St John
H-0059	University of Greenwich	H-0026	University of Bedfordshire
H-0061	University of Huddersfield	H-0053	University of Central Lancashire
H-0120	University of Hull	H-0011	University of Chester
H-0027	University of Northampton	H-0082	University of Chichester
H-0069	University of Northumbria at Newcastle	H-0058	University of East London
H-0074	University of Portsmouth	H-0054	University of Gloucestershire
H-0158	University of Salford	H-0021	University of Winchester
H-0079	University of Teesside	H-0085	University of Wolverhampton
H-0081	University of the West of England, Bristol	H-0046	University of Worcester
H-0083	University of Westminster	H-0013	York St John University

Source: PACEC/CBR analysis

Table E1.3 Clusters of HEIs – arts and design HEIs

Arts and design	
HESA Code	HEI Name
H-0197	Arts Institute at Bournemouth
H-0010	Central School of Speech and Drama
H-0199	Conservatoire for Dance and Drama
H-0201	Courtauld Institute of Art
H-0015	Dartington College of Arts
H-0208	Guildhall School of Music and Drama
H-0207	Leeds College of Music
H-0209	Liverpool Institute for Performing Arts
H-0190	Norwich School of Art and Design
H-0030	Ravensbourne College of Design and Communication
H-0032	Rose Bruford College
H-0033	Royal Academy of Music
H-0003	Royal College of Art
H-0034	Royal College of Music
H-0035	Royal Northern College of Music
H-0041	Trinity Laban Conservatoire of Music and Dance
H-0200	University College Birmingham
H-0206	University College for the Creative Arts at Canterbury, Epsom, Farnham, Maidstone, Rochester
H-0024	University of the Arts London

Source: PACEC/CBR analysis

Appendix F Academic Discipline Groups and Definitions

Table F1.1 Academic discipline groups and definitions

Academic discipline	RAE unit of assessment
Medical	Clinical Laboratory Sciences
	Community-based Clinical Subjects
	Hospital-based Clinical Subjects
	Clinical Dentistry
	Pre-Clinical Studies
	Anatomy
	Physiology
	Pharmacology
	Pharmacy
	Nursing
	Other Studies and Professions Allied to Medicine
	Psychology
Science	Biological Sciences
	Agriculture
	Food Science and Technology
	Veterinary Science
	Chemistry
	Physics
	Earth Sciences
	Environmental Sciences
Technical	Pure Mathematics
	Applied Mathematics
	Statistics and Operational Research
	Computer Science
Engineering	General Engineering
	Chemical Engineering
	Civil Engineering
	Electrical and Electronic Engineering
	Mechanical, Aeronautical and Manufacturing Engineering
	Mineral and Mining Engineering
	Metallurgy and Materials
	Built Environment
	Town and Country Planning
Humanities	Geography
	Law
	Anthropology
	Economics and Econometrics
	Politics and International Studies
	Social Policy and Administration
	Social Work
	Sociology
	Business and Management Studies
	Accounting and Finance
	American Studies
	Middle Eastern and African Studies
	Asian Studies
	European Studies
	Celtic Studies
	English Language and Literature
	Archaeology
	History
	History of Art, Architecture and Design
	Library and Information Management
	Philosophy
	Theology, Divinity and Religious Studies
	Art and Design
	Communication, Cultural and Media Studies
	Drama, Dance and Performing Arts
	Music
Languages	French
	German, Dutch and Scandinavian Languages
	Italian
	Russian, Slavonic and East European Languages
	Iberian and Latin American Languages
	Linguistics
	Classics, Ancient History, Byzantine and Modern Greek Studies
Other	Education
	Sports-related Subjects

Source: HESA, PACEC/CBR analysis

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