PACEC

Public and Corporate Economic Consultants

Strengthening the Contribution of English Higher Education Institutions to the Innovation System: Knowledge Exchange and HEIF Funding

A report for HEFCE

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April 2012

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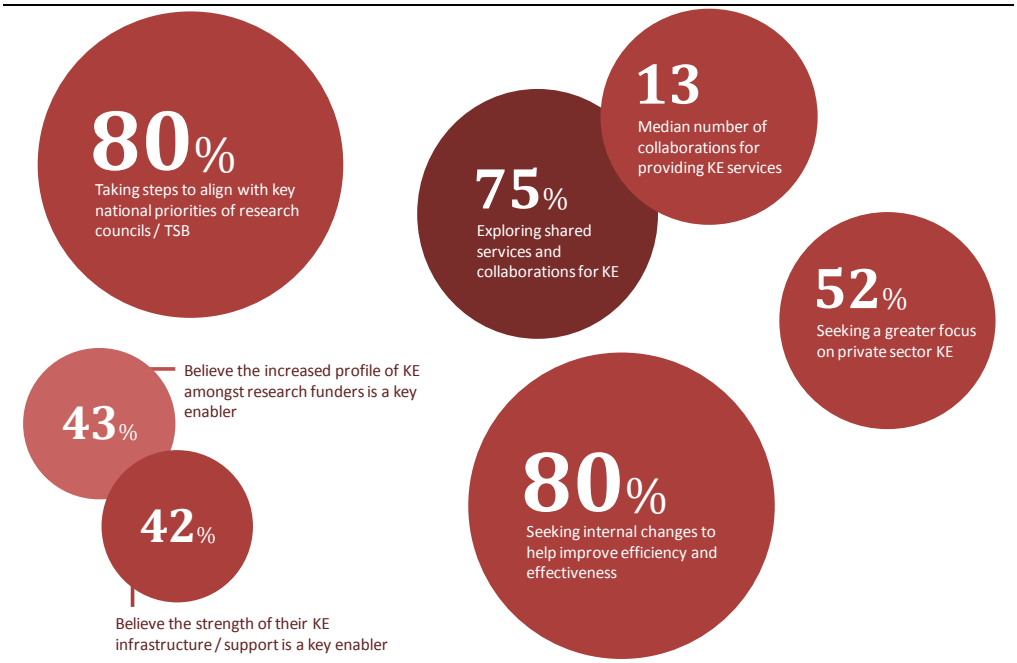
Executive Summary

X1.1 The report seeks to analyse the current state and future development of knowledge exchange in the English Higher Education sector. It comes at a time when the role of Higher Education Institutions (HEIs) in supporting economic growth and development has taken centre stage as governments around the world push for private-sector led, innovation driven economic recoveries from the current, deep economic downturn. Drawing on the rich evidence base provided by the institutional strategies submitted by HEIs to the Higher Education Funding Council for England as part of the HEIF funding programme, it aims to develop a detailed framework for understanding the many contributions they make to the economy and society.

X1.2 The KE landscape has experienced a number of key seismic shifts over the last four years that have fundamentally changed some of the incentives impacting on HEIs. Not least among them are the changes to the research impact agenda and the student fees regime. In addition the economic recession has introduced a large degree of uncertainty over potential demand for KE and has led to the refocusing of government policy to target its public investments – including in HE – to stimulate private sector growth. Accompanying this is a longer term trend towards open innovation in many industrial sectors. These factors provide both challenges and opportunities but, as the University of Cambridge put it: '*the intended outcome is the demonstration (to University, industry and Government) that longer-term University-industry partnerships are effective in initiating excellent, innovative research that is more readily exploited by those outside the HE sector. Research excellence and return to the UK economy should be a common goal*". The same is reflected in strategies in terms of excellence in teaching and particularly supporting the student and graduate, and economic and societal goals.

Figure X1 Strategic response of HEIs in developing their KE



Key findings on the strategic response of HEIs in adapting and developing their knowledge exchange activities over the period 2011-15
(Number in bubbles is the % HEIF2011-15 strategies citing the development with the exception of the number of collaboration which refers to the median number per HEI)

Source: HEIF2011-15 strategies, PACEC analysis

X1.3 This turbulence in the underlying landscape is changing the nature of the barriers and enablers facing HEIs and requires a response to maintain their competitive position. The HEIF2011-15 strategies highlight the dynamic processes of learning and adaptation at play (Figure X1).

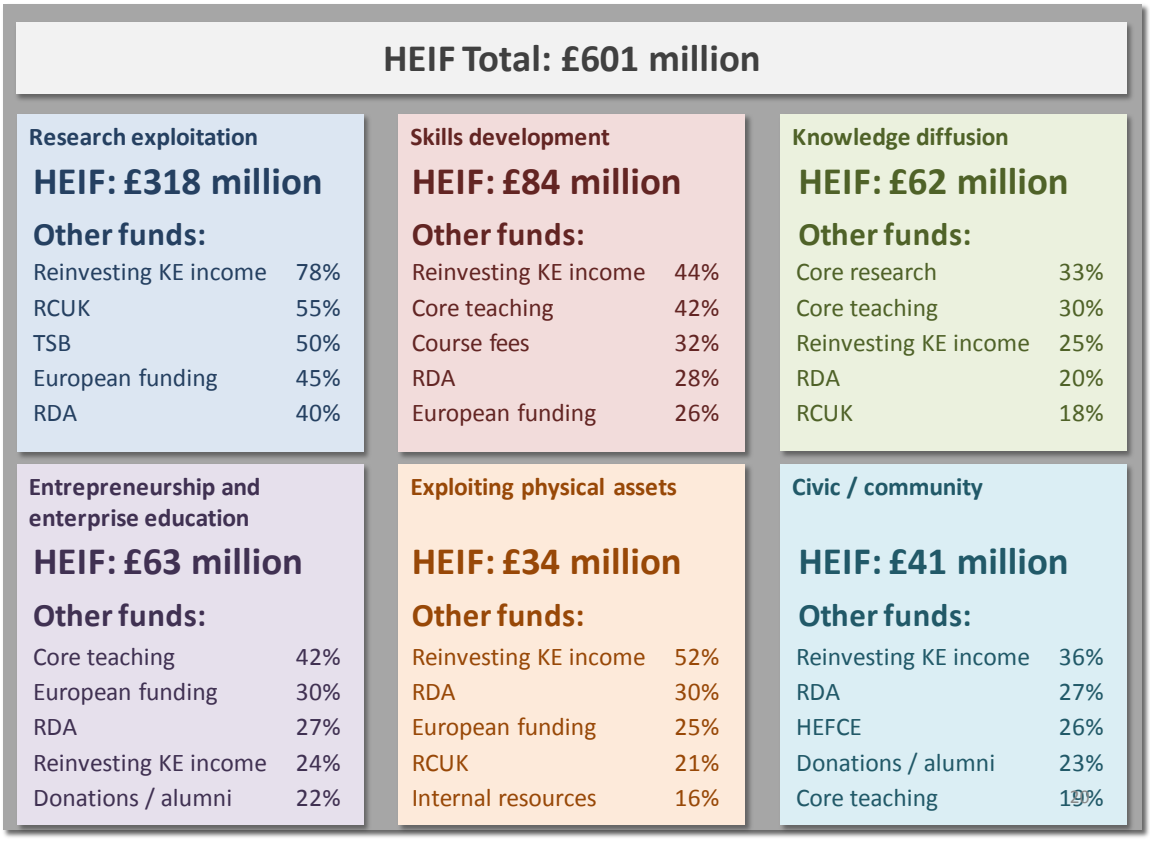
X1.4 Key strategic developments include:

- KE now finally looks to be permanently embedded within many HEIs and has become a strategic activity working to support and enhance research and teaching. Over half of the HEIF2011-15 strategies are actively seeking to exploit the synergies that exist between the activities;
- The urgent need for academics to engage with the research impact agenda and the high profile debate the surrounds it is also helping to raise the profile of KE. HEIs are streamlining their research and KE related support and, in some cases are seeing an increased number of academics approaching KE staff to engage.
- Over half of HEIs are seeking to refocus their activities on the private sector, driven partly by the loss in demand for KE from other sectors of the economy and the heavy focus by the Government on targeting public investments towards a innovation-led, private-sector driven recovery. However, there remains a question over whether sufficient private sector demand will materialise to meet the desired supply of KE;
- Recognising this risk, HEIs are also taking steps to diversify overseas into key markets including USA, China, and India;
- 80% also seeking to align themselves in some way with the priorities of the national research and innovation funding agencies such as the Research Councils and the TSB. This implies a critically important 'coordination' role for these organisations in identifying the key priority research areas, reacting both

to current and likely future industrial and societal needs as well as fruitful areas of fundamental research. However, in aligning strongly, HEIs need to be realistic in their assessment of their capabilities and the likely competition for funding as the growing competition for increasingly scarce research and KE funds may mean a concentration of funding in the HE sector;

- Most HEIs (80%) are making changes to their internal infrastructure in attempts to improve the efficiency and effectiveness of their KE investments.
- Three quarters of HEIs are moving towards greater collaboration and shared services to improve the efficiency and effectiveness of their support for KE. This is partly driven by a need by many to find ways to preserve the level of support for KE at significantly lower levels of funding;

Figure X2 Allocation of HEIF funds by different types of KE infrastructure over the period 2011-15 (£ million, current prices) and the other sources of funding used to support the infrastructure in 2011 (% HEIF2011-15 strategies)



Source: HEIF2011-15 strategies, PACEC analysis

X1.5 The range of KE infrastructure is funded through a complex web of funding sources, including, significantly, the £601 million invested through HEIF funding to help raise the economic and social impacts of HEIs through KE. Other key sources include the reinvestment of KE income; until recently, RDA funding; TSB and Research Council funds; and European Union funds (Figure X2).

X1.6 HEIF funding, however, is an important and distinctive funding source. Much of the distinctiveness stems from its stability and predictability, flexibility, and discretion to use to support any forms of KE where many of the other funding sources are much more restrictive. It also allows them to innovate and experiment with new models of

KE. Critically, it is one of a dwindling number of funds that can be used as leverage, to secure significant other sources of funds for KE. However, this also presents HEIs with a major risk: when they experience a loss in HEIF funding, with the overall losses magnified through the loss of the leveraged funding.

X1.7 A crude estimation of the impact of the funding suggests that, for every £1 of HEIF invested, it returns £6 in gross additional KE income. However, this likely represents an underestimate of the total benefits to the economy and society due to the potentially large impacts that are very hard to capture and the long term benefits arising from the positive behavioural and attitudinal changes it has had on academics towards knowledge exchange.

Figure X3 Cost-benefit-balance-sheet summarising the quantifiable KE outputs and the extent of attribution to HEIF funding

HEFCE KE funding 2003-2010

£877 million

Other funding sources

Source	% HEIs
Reinvesting KE income	88
HEFCE core	76
RDA	66
RCUK	66
EU	64
TSB	54
Course / other fees	53
HEFCE specific	39
Endowments, alumni, donations	35

KE Outputs 2003-2010

		Total income (£m)	Gross additionality (%)*
Income metrics	Collaborative research	3,962	38
	Contract research	5,449	36
	Consultancy	1,848	39
	Facilities / equipment services	570	26
	CPD	2,913	21
	Regeneration / development	1,263	33
	IP revenues	445	39
	KE income	16,449	34

		Total number	Gross additionality (%)
Non-income metrics	Disclosures	22,401	41
	Patent applications	10,486	43
	Licenses	20,649	35
	HEI and formal spin-offs	1,120	43
	Staff start-ups	221	44
	Graduate start-ups	8,244	42
	Public events (attendance)	42,543,000	22

Gross Additional KE Income 03-10 per £ HEFCE KE funding 03-10*: 6

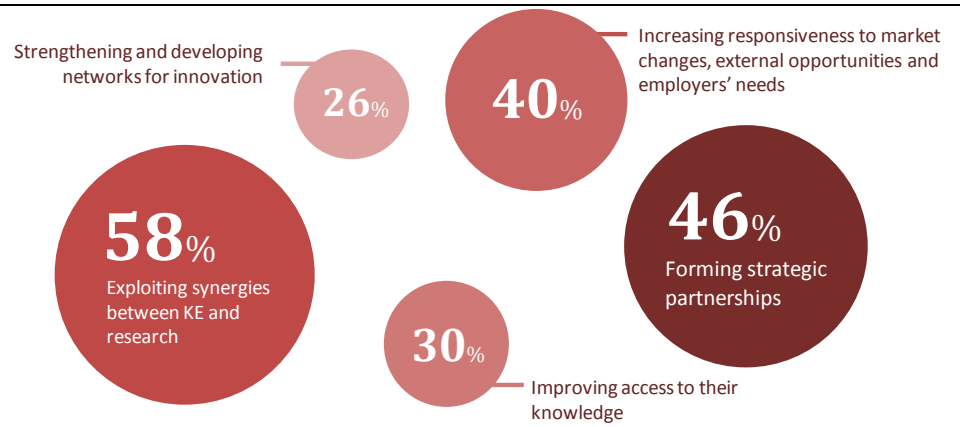
** Based on weighted average of HEI responses to HEIF2011-15 strategies excluding those estimating additionality based on the share of inputs formed by HEIF.*

Note: Total column and HEFCE KE funding is based on the total population. The estimation of gross additionality is based on the subset of HEIs excluding those where additionality was clearly estimated based on share of inputs from HEIF.
Source: HEIF2011-15 strategies, HEBCI surveys 2002/03 – 2009/10, PACEC analysis

X1.8 The HEIF2011-15 strategies emphasise a range of initiatives and developments within HEIs as they seek to build on the infrastructure and improve the direct support they provide for innovation and become more active partners in the process. This includes addressing the growing importance of externally derived knowledge for

innovation, which places the absorptive capacity of innovators front and centre. While increasing absorptive capacity fundamentally requires the improvement of the capabilities of innovators, the HEIF2011-15 strategies suggest that the KE-related activities of HEIs are working to remove some of the barriers at key points of the process: making their knowledge 'offer' more visible; improving access; and providing services better targeted at user need.

Figure X4 Becoming more dynamic innovation partners



Key developments in HEIs as they become more direct innovation partners
(Number in bubbles is the % HEIF2011-15 strategies citing the development)

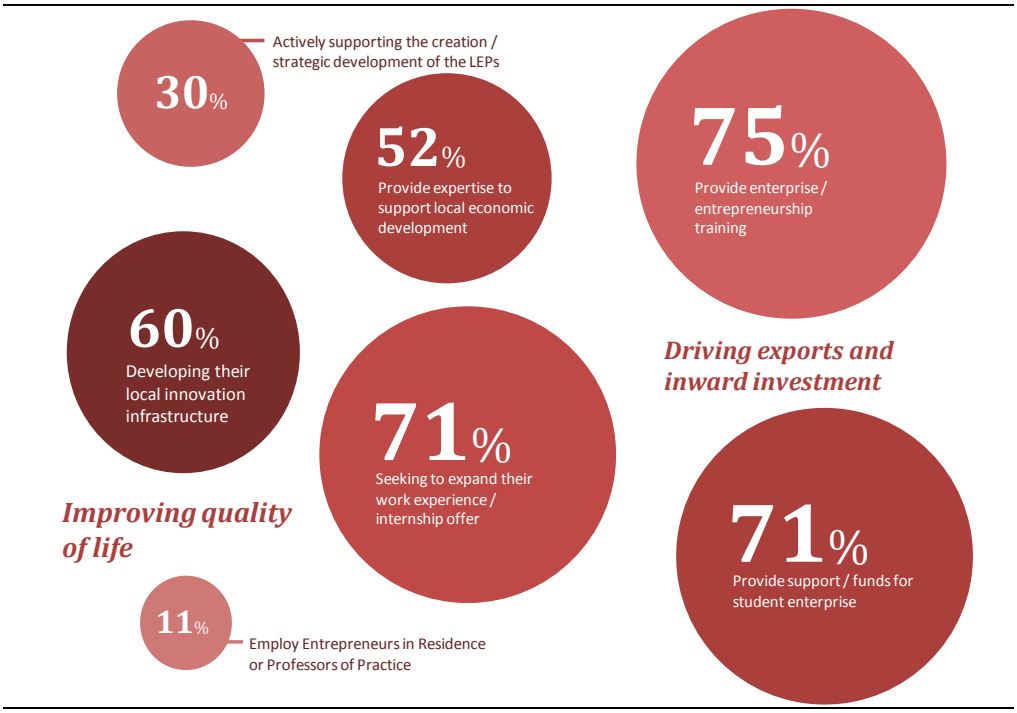
Source: HEIF2011-15 strategies, PACEC analysis

X1.9 Key developments include (Figure X4):

- A growing number of HEIs (46% of strategies) are emphasising the need to develop longer-term relationships and strategic partnerships with users rather than focusing on single transactions. HEIs are recognising the mutual benefits of these types of relationships not least the synergies with research and teaching but also the potential for growing repeat, deeper interactions;
- Staff exchanges are also thought to greatly aid the dialogue between academics and users. However, while it appears that such initiatives are on the increase, and where they exist, HEIs are emphasising the both the inward and outward exchange of staff, it still remains a minority activity in the sector.
- Continuing efforts to improve access to HEI knowledge by at least 30% of HEIs. This includes collaborating with each other to improve access; creating highly visible points of entry into the HEI; simplifying access; seeking to become 'easy to do business with'; and exploiting public spaces to bring SMEs onto campus;
- Innovation in the types of KE services on offer with some HEIs responding to the turbulence and reduction in key national schemes by setting up their own, tailored ones using alternative sources of funding. For example, 15 HEIs – either alone or in collaboration – are introducing their own innovation vouchers.

X1.10 The HEIF2011-15 strategies also highlight important developments in the support HEIs provide for strengthening the underlying innovation conditions of place, helping their local and regional economies to become more competitive, which includes developing skills, entrepreneurial and innovative people.

Figure X5 Strengthening the underlying innovation conditions



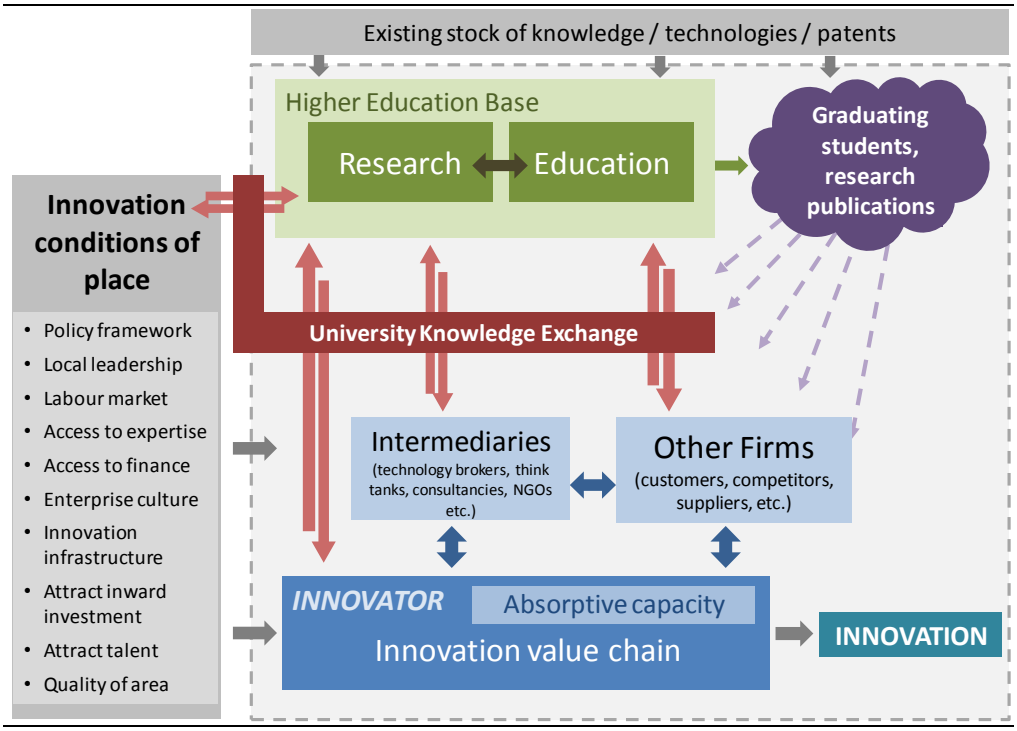
Source: HEIF2011-15 strategies, PACEC analysis

X1.11 The key developments in this area include:

- A very large, and growing, emphasis on enhancing student employability and enterprise partly in response to the changes to the student fee regime as well as the ongoing difficulties in the graduate job market. A core focus is an expansion of the provision of work experience opportunities. However, HEIs may find it difficult to realise their desired growth. Entrepreneurship and enterprise education is also becoming much more widespread;
- Approximately a third of HEIs are also active in supporting the emerging Local Enterprise Partnerships, often at the board level. While many are uncertain of the role that LEPs will play, others see this an opportunity to place their HEIs at the heart of the local growth and innovation strategies;
- 60% highlight the significant innovation infrastructure they provide for their local economies. This can act a highly visible point of entry into the wider HEI as well bringing together the various innovation support services. Thought needs to be given to the design of both the hard and soft infrastructure and how it integrates with the wider capabilities available;
- HEIs are playing an increasing role in supporting exports in the UK. They contribute through the research, education and KE that directly supports the development of goods and services demanded by key export markets. They are also increasingly becoming exporters themselves, providing KE services to key overseas markets. A small but growing number appear to be using their experience and presence in key export markets to provide a route to market for local SMEs.

X1.12 The report also aims to develop a detailed framework for understanding the economic and social contributions of HEIs within a wider, complex set of knowledge flows and capabilities required to support the innovation process that is often masked by user surveys on innovation (Hughes, 2007). This seeks to address the apparent disjunction between the common low profile of universities within user surveys on innovation and the high importance placed on the roles of universities by governments around the world seeking knowledge-led growth and competitiveness. The framework emerges out of the practical examples provided in institutional strategies, building on the wider body of research on the role of HEIs in the economy; and provides the basis for further investigation, including measurement, of the role of HE in innovation and growth in the future.

Figure X6 A framework for understanding the role of HEIs in supporting innovation



Source: PACEC

X1.13 The framework is shown in Figure X6 and breaks the contributions of HEIs down into the following key areas: the role they play in contributing to the stock of knowledge through publications and in educating the future workforce; the direct contributions they make to support innovation; and the important roles they play in creating and strengthening the underlying innovation conditions of place: the factors that create a conducive environment for innovation and lead to a competitive place that can attract and retain resources and high value added, innovation-driven organisations.

X1.14 The framework highlights the important role of knowledge exchange policies as operating at the interface between the HE sector and innovators. They are primarily concerned with affecting the patterns of networking and collaboration, and more generally the institutional framework of norms and cultural values affecting the interactions that cross these boundaries.

X1.15 It also reflects the increasing recognition of the two-way knowledge flows, with users having an important role to play in helping to shape and influence the research and teaching agendas. The precise manner through which innovators in different value chains, and at different points in the value chain, interact with HEIs, can differ dramatically, and the diversity of HEIs and disciplines engaged in KE is therefore strength that needs to be celebrated.

X1.16 In conclusion, the HEIF2011-15 strategies demonstrate a dynamic HE sector that is in the process of adapting to a significant amount of change in the underlying landscape for KE, not least due to the changing incentives associated with research impacts and student funding, as well as the uncertainties arising from the economic recession. Over the next period, many HEIs are planning on increasing their direct interactions with the private sector, supporting innovation and productivity growth within these organisations. Importantly, they are investing resources to strengthen the capabilities of students emerging from their institutions who will form the workforce of tomorrow and will be critical to drive forward the competitiveness of the UK and solve the challenges facing industry, the public sector and wider society.

Acknowledgements

PACEC would firstly like to extend their gratitude to the Higher Education Institutions for providing the very rich source of evidence – both qualitative and quantitative – upon which this report is based through the completion of the Higher Education Innovation Fund institutional strategies 2011-15. The evidence has allowed us to deepen our understanding of the many diverse ways through which HEIs contribute to the economy and society, and has highlighted the key developments within the English HE sector working to strengthen their insertion into the innovation system.

We would also like to thank all those at HEFCE who reviewed and commented on the various drafts of the report, with particular thanks to Alice Frost and Jenni Chambers for their invaluable contributions and assistance throughout the project.

Finally, we are very grateful for time of the Expert Group, which consisted of members from a range of government departments, government agencies, research councils and industry, and would like to extend our thanks to them for their very helpful feedback on the key findings as they emerged and their detailed comments on the draft report.

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April 2012

1 Introduction

1.1.1 The core aim of this report is to assess the many and varied contributions that Higher Education Institutions (HEIs) make to the economy and society, both through the direct support they provide to the innovation process, and their role in strengthening the underlying conditions for innovation[1]. Importantly, it seeks to analyse the dynamic process of learning and adaptation clearly at play as HEIs respond to key shifts in the underlying landscape for knowledge exchange (KE).

1.1.2 The report comes at a time when the role of HEIs in supporting economic growth and development has taken centre stage as governments around the world push for private-sector led, innovation driven economic recoveries from the current, deep economic downturn. It is often argued that they constitute a unique and critical part of the infrastructure of the innovation system, sitting at the intersection of research, education and innovation, and providing access to local, national and often global networks of knowledge, infrastructure and talent for innovators.

1.1.3 Despite their perceived importance for economic growth and societal development, their contribution to innovation and their participation in the innovation system has historically been limited to a narrow range of activities, focusing heavily on research publications, graduating students and very limited (and often linear) models of knowledge transfer. More recently, however, research has helped to illuminate the much wider set of complex, dynamic, and inherently two-way linkages that form between the knowledge production network and innovators. At the same time, research into the innovation process itself is helping us to understand the contributions that different sources of knowledge makes to the innovation process.

1.1.4 However, there still appears to lack a detailed framework that brings together these different strands of research to highlight the many and varied contributions that HEIs make both directly to the innovation process, and more indirectly through the strengthening of the underlying innovation conditions of local economies that influence the ability of innovators to innovate.

1.1.5 This report seeks to address this important gap. It draws on the rich source of qualitative and quantitative evidence provided by HEIs in their recent knowledge exchange strategies submitted to the Higher Education Funding Council for England (HEFCE) for the release of the next round of the HEIF 2011-15 (hereinafter referred to as the HEIF2011-15 strategies). It is the culmination of a project undertaken by PACEC for HEFCE to assess and analyse the strategies with a core aim to establish the present state of development of knowledge exchange in the English higher education sector and prospects for the future. In addition, we draw upon the substantial body of evidence gathered by PACEC/CBR over the past five years of research into knowledge exchange in England as well as the research of others in this field.

[1] The report focuses primarily on the knowledge exchange activities of HEIs. The publication of research outputs and the movement of graduating students are, of course, important mechanisms for knowledge diffusion, and are recognised as such in the framework we have developed.

1.2 Seismic Shifts in the Underlying Landscape for Knowledge Exchange

1.2.1 However, before the report gets underway, it is important to reflect on the changing landscape for KE. Since 2008 – the last time HEIs had to submit institutional KE strategies to HEFCE – a number of seismic, systemic 'shocks' have impacted the HE system, resulting in fundamental changes to the underlying landscape for KE. These are having a seemingly powerful influence over the way HEIs operate, including how they adapt and strategically position and shape their KE activities.

1.2.2 The HEIF2011-15 strategies bring to the fore four key 'shocks' to the KE landscape:

- The effects of the economic recession
- The introduction by the research funding bodies of an impact aspect to research assessment and funding;
- The fundamental changes to the student fee regime with a greater share of the cost of undergraduate degrees being shifted towards the student;
- The reconfiguration of the regional landscape with the abolition of the Regional Development Agencies

1.2.3 In addition to these recent and relatively abrupt shocks, there are much longer term trends in the economy, not least the movements towards open innovation by many industrial sectors, and the globalisation of R&D activities.

The effects of the economic recession

1.2.4 The current economic recession has led to large scale austerity measures being put into place by the Coalition Government in a drive to reduce the scale of the structural budget deficit, and reduce the nation's debt. The recent 2010 Comprehensive Spending Review (HM Treasury, 2010) committed the Government to reduce public spending by £81 billion by 2014/15. It is also focusing its investments (including those in HE) much more heavily on initiatives that stimulate economic growth, rebalancing the economy, and a private sector, export and innovation-led recovery.

1.2.5 Importantly, while the Department for Business, Innovation and Skills had to adjust to a 25% reduction in its programme and administrative budgets, and 52% reduction in its capital budget, both the Science budget and HEIF funding were protected in cash terms. This highlights the Government's belief (consistent with worldwide and academic views discussed elsewhere in this report) that world class research and effective knowledge exchange are core to the economic recovery. More recently, an additional £200 million in research capital has been provided by Government related to research and its economic impacts. The Universities Minister set out in a speech in January this year that he was setting a target for HE to increase total KE income by 10 per cent over the next three years.

1.2.6 However, in this new world, many government departments are having to make difficult adjustments, with many have to finding savings of over 20% in real terms over the period 2010/11 – 2014/15. For example, the Department of Transport suffered a

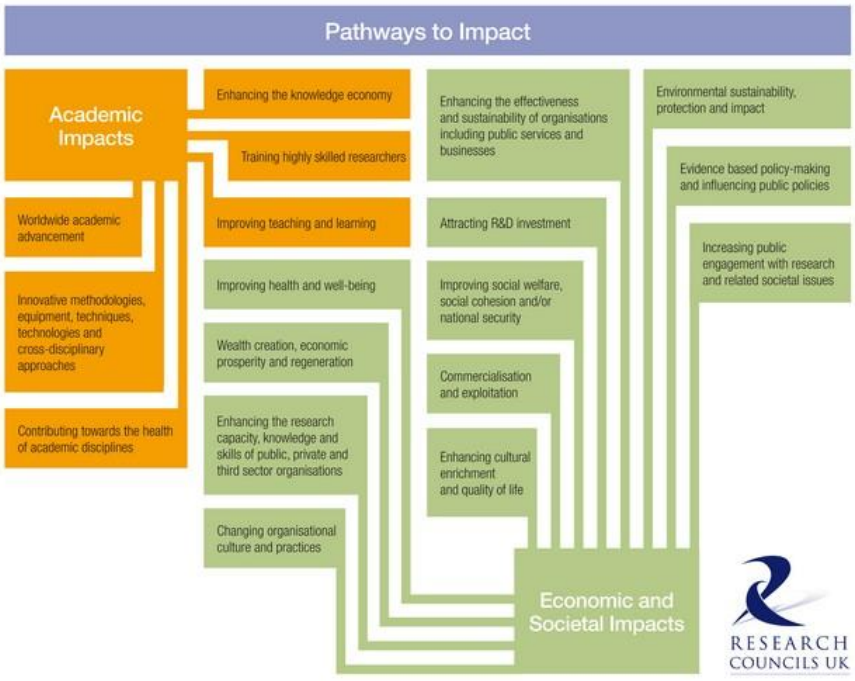
reduction in the programmes and administration budget of 21% while the Department for the Environment, Food and Rural Affairs suffered a 29% reduction. Spending has been protected for the National Health Service and the Department for Education will see only a slight decrease of -3.4% over the period 2010/11 – 2014/15. In 2009/10, HEIs secured over £1 billion from KE contracts with non-commercial organisations (including public and third sector organisations), accounting for approximately 40% of their total KE income[2]. This has increased significantly since 2003/04 when they secured just 30% of their income from these types of partners, reflecting overall growth in the public sector[3]. Depending on how the spending cuts are implemented, these substantial reductions in public spending could feed through as significantly reduced public sector demand for HE KE activity and may have a significant impact on particular types of HEIs that had developed the expertise and services being demanded by these types of organisations.

1.2.7 The HEIF2011-15 strategies show that many HEIs are reacting to the uncertainties in demand from the public sector, as well as the government's desire to drive private sector innovation and economic growth, by taking steps to realign their activities on the private sector.

The increasing focus on research impacts

1.2.8 The last few years have seen major shifts in the way research funding is being distributed, with a much greater emphasis on excellence with impact than was hitherto the case.

Figure 1.1 Pathways to impact highlight by the Research Councils



Source: Research Councils UK, http://www.rcuk.ac.uk/kei/impacts/Pages/meanbyimpact.aspx

[2] HEBCI 2009/10 survey results
[3] Analysis of HEBCI 2003/04 survey

1.2.9 The seven Research Councils distribute approximately £3 billion in research funding each year[4] and research impact and knowledge exchange are important aspects to their policies and funding through Pathways to Impact and a wide range of business/user-related research funding and partnerships. They are also major supporters of public engagement, through initiatives such as the Concordat for Engaging the Public with Research. The many areas of potential impacts highlighted by Research Councils are shown in Figure 1.1.

1.2.10 The substantially increased emphasis on research impact by both research funders and assessors, importantly tied to the distribution of funding for research as well as the perceived reputation of individual institutions more widely than with the research funders, provides a very powerful incentive for HEIs and academics. The HEIF2011-15 strategies suggest that these changes to the incentive structure are having important impacts on HEIs' approaches to KE and the structures put into place to support it, including a much greater recognition of, and attempts to exploit, the synergies between research and knowledge exchange.

Changes to the Student Funding Regime

1.2.11 Also evident in the HEIF2011-15 strategies is the influence of the very recent reforms to the student funding regime and educational experience. The planned reforms are presented in full in the 2011 BIS White Paper 'Students at the Heart of the System' (BIS, 2011). One of the key reforms is the increase in tuition fees for students of up to £9,000. This will see a dramatic shift of the burden of financing undergraduate education away from the general taxpayer and onto the individual student[5]. The new student regime is set to have a profound impact on the HE sector in England, particularly placing an increased focus on employability, as HEIs will be concerned to address the career and hence salary prospects of students, to be able to pay over their loans. The difficulties of the present employment market seem also to be placing a focus on support for student enterprise, to increase employability but also employment prospects. The nature of the powerful influences these changes are having are captured in the HEIF2011-15 strategies, with many HEIs talking about how KE activities can support the student experience.

Abolition of the Regional Development Agencies and the Wider Funding Regime for KE

1.2.12 The sub-national landscape has changed dramatically between 2008 and 2011 with consequent impacts for HE KE. The Regional Development Agencies (RDAs) – until 2011, one of the main sub-national public bodies involved in supporting innovation and economic growth – have been abolished and powers further decentralised to more local levels. In their place, the Government is supporting the creation of Local Enterprise Partnerships (LEPs) – locally-owned partnerships between local authorities and businesses that are intended to play a central role in determining local economic priorities and undertake activities to drive economic growth and create local

[4] http://www.rcuk.ac.uk/pages/home.aspx
[5] Students are not expected to make any contributions up front, but rather repay their student loans only after their salaries pass £21,000 and linked to their salary level.

jobs. Unlike RDAs, LEPs will have to seek much of their own funding (e.g. by bidding to specific initiatives such as the Regional Growth Fund or the recent Enterprise Zone scheme).

1.2.13 For some HEIs, RDAs were both funders of major KE initiatives (e.g. funding innovation centres and science parks) [6] as well as major customers for the knowledge exchange services of HEIs (e.g. buying economic intelligence). Cranfield University note in their strategy that they have "*been a significant beneficiary of investment for KE from our RDA. The demise of RDAs has removed completely this complementary third-party investment.*" In 2009/10 HEIs received £82 million from the RDAs for KE. With the loss of the RDAs comes the loss of much of this income. This is equivalent to over half of the annual HEIF budget and reflects an overall reduction of 34% in the real value of government funding for KE through RDA and HEIF sources. HEIs are having to reassess the funding opportunities for KE and their ability to access them (e.g. TSB Catapults, research capital investments).

1.2.14 Many HEIs query whether the Local Enterprise Partnerships will fill the large gap left by the RDAs. There is also a belief that any funding that LEPs do secure in the short- to medium-term may be targeted at shorter term projects focusing on more immediate job creation needs. Regardless, LEPs are only just beginning to take shape and it will take a while longer before their exact role in supporting innovation and local economic growth, and their likely influence becomes clear.

1.2.15 In addition to providing large capital investments to support HEIs in building their innovation infrastructure, RDA funding also acted as match funding for other sources such as European Regional Development Funding (ERDF). HEIs have now lost this leverage capability and are increasingly using HEIF to fill this gap.

1.2.16 The effects of the combined loss of a major customer for KE services for some HEIs, a large funder of activities for HEIs in certain regions, and the uncertainties surrounding the development of the LEPs are reflected in their HEIF2011-15 strategies. The HEIs most impacted are realigning their KE activities on different target groups – largely the private sector – or are planning for a reduction in KE demand until new customer bases can be developed. However, rigidities in the system mean that the adjustment will inevitably take time to implement. The active involvement of many HEIs with the creation and development of the LEPs will allow them to help shape the new local landscape and position themselves as one of the core infrastructures supporting innovation and growth.

[6] Some examples include: the North West Development Agency (NWDA) invested £67 million in the Daresbury Science and Innovation Campus which brings together a range of key stakeholders in the innovation ecosystem including the Universities of Liverpool, Lancaster and Manchester; the London Development Agency was investing in bioscience incubators in key HEIs in London including Queen Mary's University of London, Imperial College London and £4 million in the London Bioscience Innovation Centre located at the Royal Veterinary College in Camden; Yorkshire Forward provided universities in Yorkshire and Humber funding to develop 'Centres of Industrial Collaboration' to improve the exploitation of the science base in the region to enhance regional competitiveness and productivity; Cranfield University benefited from funding from the East of England Development Agency to match fund their Integrated Vehicle Health Management Centre of Excellence which brings together major industry players and the University

Wider funding regime changes

1.2.17 In addition to the loss of RDA-linked funding, there have also been some other major changes to the KE funding regime. Innovation support programmes such as Knowledge Transfer Partnerships (KTPs) and innovation vouchers that have become very popular amongst HEIs, have been reduced in scale. Note that at the time of writing the HEIF2011-15 strategies HEIs believed that the innovation voucher programme had been abandoned and they planned accordingly. However, the Innovation and Research Strategy published by BIS in December 2011 (BIS, 2011b) announced the introduction of a new national innovation voucher programme.

1.2.18 Despite the reduction in national KTPs available, some HEIs have access to similar, alternatively funded programmes such as the ERDF-funded East of England Low Carbon KEEP Programme. These programmes may help to offset the reductions in national KTPs but may also result in more patchy access to HE knowledge for SMEs in different regions.

1.2.19 The resulting impact of these changes to the KE funding regime remains to be seen. The intention is that the improved targeting of resources and better designed funding programmes to increase efficiency and effectiveness, even at lower levels of funding, may well lead to an increase in KE outputs and impacts.

1.3 The Higher Education Innovation Fund 2011-15

> "*HEIF's primary focus will remain the support of knowledge exchange activities with all forms of external partners – businesses, public and third sectors, community bodies and the wider public – to achieve maximum economic and social impact for this country*"[7].

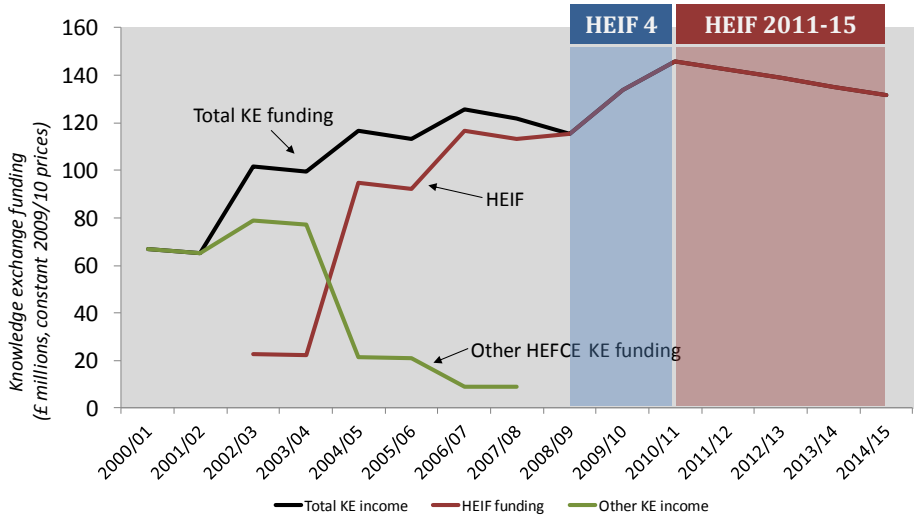
1.3.1 The UK Government emphasised its commitment to knowledge exchange in the 2010 Comprehensive Spending Review. HEIF funding was maintained in cash terms at the same level as the final year of HEIF 4, at £150 million per annum (Figure 1.2), pumping £601 million (in cash terms) into the sector for KE over the period 2011-15. The period covered by the funding has been extended from three years to four years and continues to be allocated based on an agreed formula.

1.3.2 However, there are some key differences in the way in which the funding has been distributed (Table 1.1) (HEFCE, 2011c). During HEIF3 and HEIF4, all HEIs received some level of support for KE through HEIF recognising the need for a degree of capacity and capability building to engage more directly and effectively with users in the economy and society. To this end, 40% of the HEIF4 formula was based on the scale of the institution and all institutions received a minimum of £100,000. HEIF2011-15 sees a departure from this, with the formula focusing solely on performance in KE, as measured by KE income. This reflects both the maturity of KE – all HEIs have had at least five years of funding with which to build the necessary

[7] HEFCE (2011) *Higher Education Innovation Funding 2011-12 to 2014-15: Policy, final allocations and request for institutional strategies*, request for information May 2011/15, p. 6

infrastructure and capability to engage – and the need to provide assurances that the funds are being used most effectively in tighter fiscal times. The changes aim to reward those with a superior performance in KE, and incentivise a future increases in this performance. To achieve this, a threshold to the allocations was introduced into the formula. HEIs that did not meet a minimum threshold of £250,000 are not eligible for HEIF2011-15 funding.

Figure 1.2 Evolution of HEFCE funding for knowledge exchange



Note: The funding data has been deflated using the GDP deflator provided by HM Treasury. However, over half of HEIF funding is spent on supporting the wage bill for dedicated KE staff. Given this, the expected reduction in HEIF funding in real terms over the next period may be less severe if wage inflation is capped below price inflation.
Source: HEFCE, PACEC analysis

Table 1.1 Key differences between HEIF4 and HEIF 2011-15

	HEIF 4 (2008-11)	HEIF 2011-15
Number of HEIs receiving funding	All 129 English HEIs	99 English HEIs
Max./min. funding per HEI per annum	Max: £1.9 million Min: £100 k	Max: £2.85 million Min: £254 k
Funding allocation method	Formula based partly on income performance (double weighting of SMEs); partly capacity building	Formula based solely on income performance (double weighting of SMEs). Threshold allocation exists

Source: HEFCE (2011) *Higher Education Innovation Funding 2011-12 to 2014-15: Policy, final allocations and request for institutional strategies*, request for information May 2011/15

1.3.3 In addition to the minimum threshold allocation, the maximum possible funding allocated to an institution per annum was raised from £1.9 million under HEIF4 to £2.85 million. However, the allocation was moderated to limit the maximum increase to 50%, and ensure that no eligible institution's funding was reduced by more than 50% of its previous allocation.

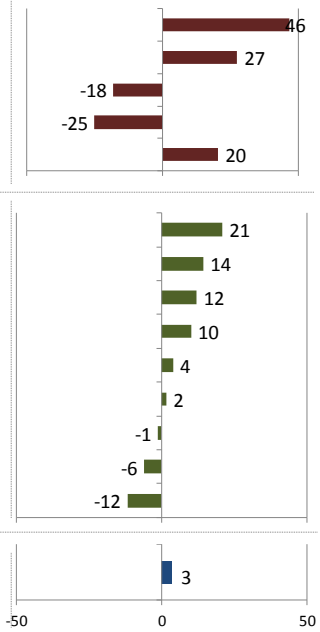
1.3.1 The combined effect of the above changes has been a concentration of HEIF funding amongst English HEIs, with the top 6 and high research intensive institutions securing a much greater share of the funding compared to the last year of HEIF 4 (Figure 1.3).

Most of the institutions to lose all funding were in the low research intensive and arts clusters.

1.3.2 For those that received funding, the higher research intensive HEIs have seen large increases in their allocations (e.g. allocations to the top 6 research intensives has grown by 46% in real terms) while those in the medium and low research intensive clusters have received significantly less funding (e.g. low research intensity HEIs received, on average, 25% in real terms less than the final year of HEIF4). While many specialist arts institutions lost all of their HEIF allocations, those that passed the threshold, secured, on average, 20% more than the final year of HEIF4.

Figure 1.3 Distribution of HEIF funding in 2011/12 (first year of HEIF2011-15 funding) and absolute and % change last year of HEIF4 (2010/11), by research intensity cluster and by region

		Number of HEIs		Share of HEIF (%)		HEIF per HEI for eligible insitutions	
		All English HEIs	Eligible for HEIF2011-15	2010/11	2011/12	2011/12 (£000s)	Change 2010/11 – 11/12 (%)
Research intensity cluster	Top 6	6	6	8%	11%	2,700	46
	High	34	32	35%	45%	2,010	27
	Medium	33	33	34%	28%	1,210	-18
	Low	35	22	20%	13%	820	-25
	Arts	18	6	4%	3%	620	20
Region	East of England	10	7	7%	9%	1,800	21
	North West	14	11	11%	11%	1,460	14
	West Midlands	12	8	10%	10%	1,850	12
	Yorkshire & the Humber	11	8	9%	10%	1,810	10
	South West	12	8	8%	8%	1,410	4
	North East	5	5	6%	6%	1,760	2
	London	40	29	25%	24%	1,190	-1
	South East	17	15	15%	14%	1,340	-6
	East Midlands	9	8	8%	7%	1,260	-12
	All HEIs	129	99	100%	100%	1,440	3
	Total (£ millions)			£145.6m	£142.6m		



Note: Research intensity clusters are defined in PACEC/CBR (2009) Evaluation of the effectiveness and role of HEFCE/OSI third stream funding, Issues Paper 2009/15 for HEFCE. They separate out the top 6 research intensive HEIs, and arts-based institutions. The remaining HEIs were clustered into three groups: high, medium and low, with research intensity being the key factor that maximised the differences between groups.
Source: HEFCE, PACEC analysis

1.3.3 Despite the concentration amongst types of HEIs, the change in the regional distribution was not as pronounced, with share of HEIF funding going to the regions broadly similar under HEIF2011-15 as the final year of HEIF4.

1.4 Structure of the Report

1.4.1 Following this introduction, Chapter 2 presents the conceptual framework that we have developed for considering how HEIs contribute to the innovation system. Chapters 3-6 then turn to the evidence from the HEIF2011-15 strategies to provide empirical support for the framework and explore the dynamic learning and adaptation

processes at play. Chapters 3 and 4 explore the different mechanisms through which HEIs engage using examples from the strategies. Chapter 5 then examines the strategic response of HEIs in developing their KE strategies for the next four years. Chapter 6 looks at the infrastructure put into place to support KE and the scale of HEIF contribution to different types of infrastructure, and concludes by assessing the importance and distinctiveness of HEIF funding in supporting KE over the period 2011-15.

2 Positioning Higher Education Institutions in the Innovation System

2.1.1 Typically, HEIs take a low profile in user surveys of sources of innovation. However, most governments increasingly focus on HE and research as means to drive innovation and growth, and evidence suggests a great number and range of contributions that HE make to the economy and society. This chapter seeks to explore this apparent contradiction by developing a conceptual model to expose the full HE contribution to innovation.

2.1.2 Stimulating and driving innovation is at the heart of many nations' strategies for recovery from the current severe economic crisis. Introducing new or improved products or services to add value to the economy, creating new processes of production, or improving existing ones to help improve productivity, and finding new ways of organising innovative activities to raise added value, are now seen as central to enhancing economic growth. Innovation is no longer seen as the domain of high technology firms, but rather occurring in all types of organisations – private, public, charitable and voluntary, and social – as they seek to solve particular industrial or societal challenges. For example, in the public sector, the NHS undertakes a significant amount of service, process and organisational innovation as it seeks to improve medical care while meeting government requirements to provide a health service free at the point of delivery. Public bodies in general are constantly under pressure to find more efficient and effective methods for delivering public services. Henceforth we refer to all these types of innovating organisations as 'innovators'.

2.1.3 Placing innovation – and innovators in all sectors of the economy – at the core of our economic development framework allows us to emphasise the critical roles that HEIs can play in supporting the economic recovery, both directly and indirectly. The process is naturally complex, reflecting the many different short-term and long-term innovation challenges that are faced by the wide variety of different types of innovators. They exist in a wide range of sectors, and vary in their ability to use knowledge generated external to them for the purpose of innovation.

2.1.4 In addition to their direct contributions to helping solve specific industrial and societal challenges HEIs have the potential to play a critical role in to helping raise the 'innovation competitiveness of place': the factors of the local area in which innovators are located that enable them to innovate successfully, including the institutional framework.

2.1.5 In developing the framework, we draw upon the wealth of information provided in the HEIF2011-15 strategies on the many different mechanisms through which HEIs contribute to innovation and society. We combine this with evidence gathered through the recent research we have undertaken on knowledge exchange and by others in this field, to present a holistic framework for positioning HEIs in the innovation system as it configures and reconfigures itself to solve industrial and societal challenges.

2.2 Innovation Systems, Innovation Value Chains and Open Innovation

2.2.1 To systematically analyse the many diverse ways through which HEIs contribute to innovation and wider economic development, we bring together the concepts of innovation systems, innovation value chains and open innovation. Together, these allow us to address the complex demand and supply dynamics and feedback loops between the producers of knowledge and their users through both market and non-market, formal and informal interactions, and the institutional framework within which these take place. Importantly, it brings to the fore the potential for the diversity of contributions by different types of HEIs and disciplines to different stages of the innovation value chain.

Innovation systems

2.2.2 *Systems* of innovation are conceived here as organic phenomena emerging from innovation *ecologies* – collections of different agents and institutional structures (rules of the game) – organising themselves in a particular way to address a specific innovation challenge. They are seen to consist of economic agents interacting with each other and their institutional, technological and industrial environment (Metcalfe, 2007).

2.2.3 The core elements of an innovation *ecology* are the agents, covering organisations well beyond the typical market based firms of a conventional economic approach. These agents (firms and their customers, suppliers, and competitors; universities; public and private sector research institutions; technology bridging organisations; social enterprises, think tanks, government bodies; regulators etc.) operate within socially constituted institutional environments whose workings are shaped by the public policies (e.g. towards research and knowledge exchange); social and legal environment, including contract law and intellectual property arrangements; and the broader systems of norms, rules and cultural attitudes affecting interactions and behaviour between agents. The innovation *system* forms when the different elements come together to solve a specific industrial or societal challenge, highlighting the importance of the final element of innovation systems: the structure of formal and informal linkages and networks between the different agents in the ecology. These link the agents and are the threads through which inter-organisational and inter-agent market and non-market transactions are mediated, facilitating flows of knowledge around the system. A well functioning economy will therefore have transient innovation systems, reforming as the nature of the problems change or new challenges emerge. These systems can cross geographical, sectoral and technological boundaries.

2.2.4 The innovation system framework importantly allows us to consider how HEIs operate within the wider system of agents, interactions and the institutional environment that shapes the innovation process. It emphasises that not all knowledge flows take place through market-based interactions involving a price; an important consideration given

that we now know that a significant amount of interactions between academics and users in which knowledge is exchanged is through the less formal interactions (PACEC/CBR, 2009).

2.2.5 The notion of technological and innovation trajectories is a constituent part of modern theories of innovation (Dosi, 1982). Trajectories of change emerge because the discovery processes leading to innovation are not random and because knowledge accumulates over time along sequences of trial-and-error experiments led by the search for solution to scientific, technological and market problems (Metcalfe et al., 2005). As such, a cumulative stock of technology-specific knowledge is built up that influences the way firms identify which innovation pathway to follow. Nightingale et al., 2006, argue that the innovation pathways are a consequence of "*neither changes in market demand (market-pull) nor changes in science (science push)…* [but] *the effects of both are mediated by the* [innovators] *themselves and the particular bodies of knowledge they have accumulated*".

2.2.6 The systems of innovation framework brings to the fore important institutional failures that arise from differing norms and values that govern the behaviour of agents in the HE base on the one hand, and innovators on the other. This can lead to a systemic failure causing major underinvestment in relation to interactions between the knowledge base and potential innovators seeking to access and exploit this knowledge. These systemic failures prompted the introduction of HEFCE KE funding to address the historically resistant culture and attitudes amongst academics towards KE engagement, and a systemic underinvestment in the capacity and capability of HEIs to support the KE engagement process.

Innovation value chains within an innovation system framework

2.2.7 The focus of innovation systems forming around specific innovation challenges highlights the centrality of the innovation value chain from spotting opportunities and ideas to development and finally to implementation and emergence in the market. Critical stages of the innovation value chain include[8]:

- Generating the idea and identifying an opportunity
- Selection of ideas to develop
- Developing a strategy to develop the innovation
- Identifying and securing the resources and inputs required (including finance, knowledge) either from within or from outside the firm
- Developing the prototype product or process
- Scaling up to production or full-scale implementation of processes
- Going to market (branding, marketing, distribution etc.)

2.2.8 The different parts of the innovation ecology (the different agents within the specific context) organise themselves around the innovation value chain to address the specific industrial or societal challenge, moving the knowledge along its development

[8] Adapted and developed from Hansen, M. (2007) "The Innovation Value Chain", Harvard Business Review, June 2007

pathway. Some innovators will operate across the whole innovation value chain while others focus on specific parts, creating a network of partners for innovation (Levy and Reid, 2011).

2.2.9 Another important concept within the evolutionary framework is the notion of the innovation lifecycle. The structure of the innovation system, and the factors that shape the innovation development pathway might well change depending on the position within this lifecycle. In addition, the geographic location of the innovation partners may well change as the innovation matures (Tassey, 2009).

Movement of innovators towards open innovation

2.2.10 The past decade or so has seen the opening up of the innovation value chain for many types of innovators who are increasingly exploiting knowledge generated external to their organisations both to develop the innovation, as well as to find new, or more effective, routes to market (see e.g. Cosh and Zhang, 2011; OECD, 2008, Chesbrough, 2003).

2.2.11 The opening up of the innovation process can apply equally to the private sector – on which much of the open innovation literature is focused – as to the public and other sectors. For example, policymakers often commission research and other policy development related services from academics, think tanks and consultants to support and develop policy decisions and recommendations. There is also an increasing trend towards seeking user feedback and incorporating it back into the policy design and delivery process. Both of these could be considered as aspects of an open innovation type model for policymaking.

2.2.12 Central to this drive towards open innovation is the recognition that the knowledge necessary for innovation is increasingly distributed in nature, both geographically, as well as in different organisations around the innovation system. In addition, the increasing recognition of the benefits from collaborative working in terms of access to markets, resources and talent, as well as cost efficiencies, are also important in driving the shifts.

2.2.13 A recent 2011 survey of firms in the UK by the UK Innovation Research Centre (Cosh and Zhang, 2011) highlighted the many different partners used as sources of knowledge for innovation including (in order of frequency used): customers and users; professional and industry associations, technical/trade press and databases; professional conferences, meetings, fairs and exhibitions; suppliers; competitors; consultants; standards or standard setting bodies; universities or HEIs; public sector research organisations; and commercial laboratories / R&D enterprises. This survey, like other surveys exploring the sources of knowledge for innovation (e.g. Hughes, 2007), finds strong evidence of a distributed innovation knowledge system. An effective innovation system in an open innovation paradigm therefore, requires that knowledge needs to flow (a) between agents in different parts of the system; and (b) between individuals within the innovators.

2.2.14 These surveys also typically find that the frequency of use of university/HEI derived knowledge is much lower than other, firm-based sources. However, according to Hughes (2007), "*this does not mean that they are not important, but it does mean that their contribution has to be seen in the context of a much wider and complex system of innovation information flows*". In addition, he also found that "*although customers, suppliers and competitors and the internal knowledge base of the [innovator] are the most frequently used… they are almost never used in isolation*". The use of multiple external sources of knowledge for innovation makes its effective absorption into the internal innovation value chain that much more challenging.

Absorptive capacity is critical in an open innovation world

2.2.15 For the externally generated knowledge to be of use in the innovation value chain, it has to be combined effectively with the internally generated inputs. The movement towards open innovation has therefore led to the increasing recognition of the critical importance of the 'absorptive capacity' of innovators to be able to effectively access, acquire and implement the external knowledge.

2.2.16 One can usefully think of absorptive capacity as four distinct stages of a process beginning with the ability of the innovator to identify challenges that need to be solved to strengthen their competitive advantage. Once the challenges have been identified, they have to be able to find the right partners – internal or external – to help develop the solution. This introduces potentially prohibitive search costs. Following the identification of an appropriate partner, they have to negotiate and acquire the services of the partner to develop a solution. This results in transaction costs that need to be funded. Finally, once the solution has been developed, it needs to be implemented back into the innovator to overcome the challenge (e.g. incorporating external knowledge into the internal innovation process) (Figure 2.4).

Figure 2.4 Framework for analysing absorptive capacity

Source: PACEC, building on Bessant, J., Phelps, B., and Adams, R. (2005) A Review of the Literature Addressing the Role of External Knowledge and Expertise at Key Stages of Business Growth and Development, final report for the UK Department of Trade and Industry

2.2.17 Poor levels of absorptive capacity of the innovators place potentially serious limits the overall scale of impacts that HEIs can realise from their KE endeavours, regardless of any improvements they make internally. Ultimately, increasing the absorptive capacity of innovators comes down to their skills and capabilities. Their innovation related skills play a large role in determining both their ability to identify the innovation challenges they need to address as well as their ability to absorb and implement any externally generated knowledge. Therefore, better educated graduates, with skills better aligned to the needs of industry (including enterprise and entrepreneurship skills and more generic employability skills) is fundamental to raising the long term absorptive capacity and innovative capability of the economy. In addition, graduates

that are more aware of how HEIs can contribute to innovation may also help improve future KE demand. However, both of these effects are more longer term and as such, more direct, short term interventions are required. The actions taken by HEIs to help improve their KE processes (e.g. improving access to KE) are likely to help improve the over absorptive capacity of innovators. The specific mechanisms are discussed in Chapter 3.

Open innovation as a mechanism for expanding markets

2.2.18 Finally, open innovation is also thought to help innovators expand the potential markets for their internal knowledge. Professor Henry Chesbrough, who published the seminal research on open innovation in 2003, defined open innovation as: "*the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively*"[9]. Focusing additionally on the route to market as well as the internal innovation process, Chesbrough highlights that the greatest value added from the innovation may not always be secured by the innovator taking it to market themselves, but rather through a third party, or in collaboration with them. This can be very important for small firms and start-ups that, for example, may not have the reputation necessary to easily access key export markets. Partnering with larger organisations – including with HEIs – can help carry these small firms into these markets. Indeed, the 2011 UK~IRC survey on open innovation found that the most frequently cited important or extremely important motivation for outbound open innovation linkages was to enhancing the firm's reputation (76% of respondents). Gaining access to overseas markets was similarly important for 38% of respondents (Cosh and Zhang, 2011).

An important role for knowledge exchange policy

2.2.19 Knowledge exchange policies operate at the interface between the HE sector and innovators. They are primarily concerned with affecting the patterns of networking and collaboration, and more generally the institutional framework of norms and cultural values affecting the interactions that cross these boundaries. The 'failure' being addressed is therefore not simply a market failure in terms of inadequate price signals but a systems failure which relates to the inability or relative lack of ability of system to adapt in terms of changing patterns of behaviour. It is also due to the rules and norms affecting inter-agent interactions which in the case of knowledge exchange, arise from broad underlying technological and other changes affecting the actual roles of universities in the innovation ecology (Smith, 2000, Lundvall and Borrás, 2005, Edqvist, 2005).

[9] Chesbrough, H. (2006) "Open Innovation: A New Paradigm for Understanding Industrial Innovation" in Chesbrough, H., Vanhaverbeke, W., and West, J. (eds) *Open Innovation: Researching a New Paradigm*, Oxford: Oxford University Press

2.3 Knowledge Generation within the Innovation System

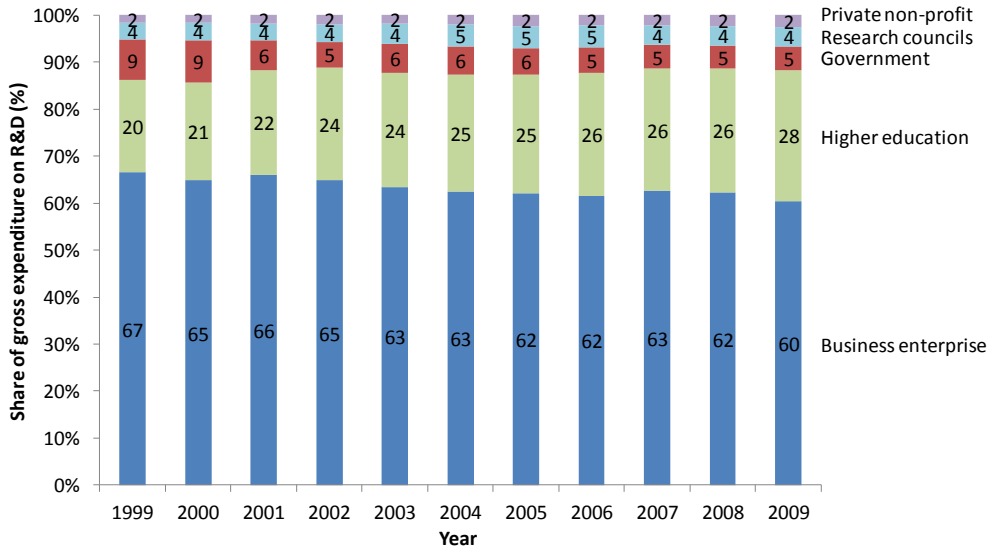
2.3.1 Within the innovation system, HEIs form part of the infrastructure that produces the critical knowledge inputs into the innovation process of firms in the region. They exist alongside the investments in research and development made by public and private research establishments and the R&D activities of the innovators themselves. Indeed, in 2009, £25.9 billion was invested across the innovation system in R&D with 60% (£15.6 billion) being undertaken by 'business enterprises' (Figure 2.5). However, this has increased by just 0.8% per annum over the past decade. By contrast, HEIs were responsible for much of the rest of the investments in R&D, capturing 28% in 2009 (£7.2 billion). Unlike business enterprise R&D activity, HEI-based R&D investments have increased rapidly at a rate of 5.5% per annum since 1999.

Figure 2.5 Gross expenditure on research and development (£billions, constant 2009 prices), and the share undertaken by different types of organisations (%), 1999-2009

(a) Gross expenditure on R&D (£billions, constant 2009 prices)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Growth p.a. 1999-09 (%)
Total	**21.7**	**22.4**	**22.9**	**23.0**	**22.9**	**22.9**	**24.6**	**24.7**	**26.2**	**26.2**	**25.9**	**1.8**
Of which:												
Business enterprise	14.4	14.5	15.1	14.9	14.5	14.3	15.3	15.2	16.4	16.3	15.6	0.8
Higher Education	4.2	4.7	5.1	5.5	5.6	5.7	6.2	6.5	6.8	6.9	7.2	5.5

(b) Share of gross expenditure on R&D by different types of organisations (%)



Source: Office of National Statistics (2011) *UK gross domestic expenditure on research and development 2009*, Statistical Bulletin

2.3.2 While the chart helps to highlight the growing role of HEIs in the innovation process, it hides the many different types of knowledge that need to be generated through R&D investments to support the innovation process across the full spectrum from fundamental research to applied research to development activities. The knowledge requirements and the role that different types of knowledge generators play along the innovation value chain inevitably vary. Accepting this highlights the important

question of how these different knowledge providers work together within the wider system to increase the efficiency and effectiveness of the innovation process.

2.4 Education and Skills Development in the Innovation System

2.4.1 The capabilities of workers accumulated through education and experience is seen as central to the economic development performance of cities and regions (Glaeser, 1995). The Leitch Review (HM Treasury, 2006) argued that the *"ability of firms to succeed in the face of growing international competition depends increasingly on the skilled labour force they can draw from. Skilled workers are better able to adapt to new technologies and market opportunities. Higher levels of skills drive innovation, facilitate investment and improve leadership and management. For innovation to be effectively implemented, businesses must be able to draw on a flexible, skilled workforce.*"

2.4.2 The economic and social benefits of a higher skilled population therefore make universities – with the education of the future (and increasingly current) workforce a core mission – a core part of a well-functioning innovation system, necessary for driving innovation and economic growth in the 21st century. Florida and Cohen (1999) conclude that rather than being a direct engine of economic development, their influence is more subtle and nuanced, with universities forming one of the critical infrastructures of the innovation system to enable technological and economic development.

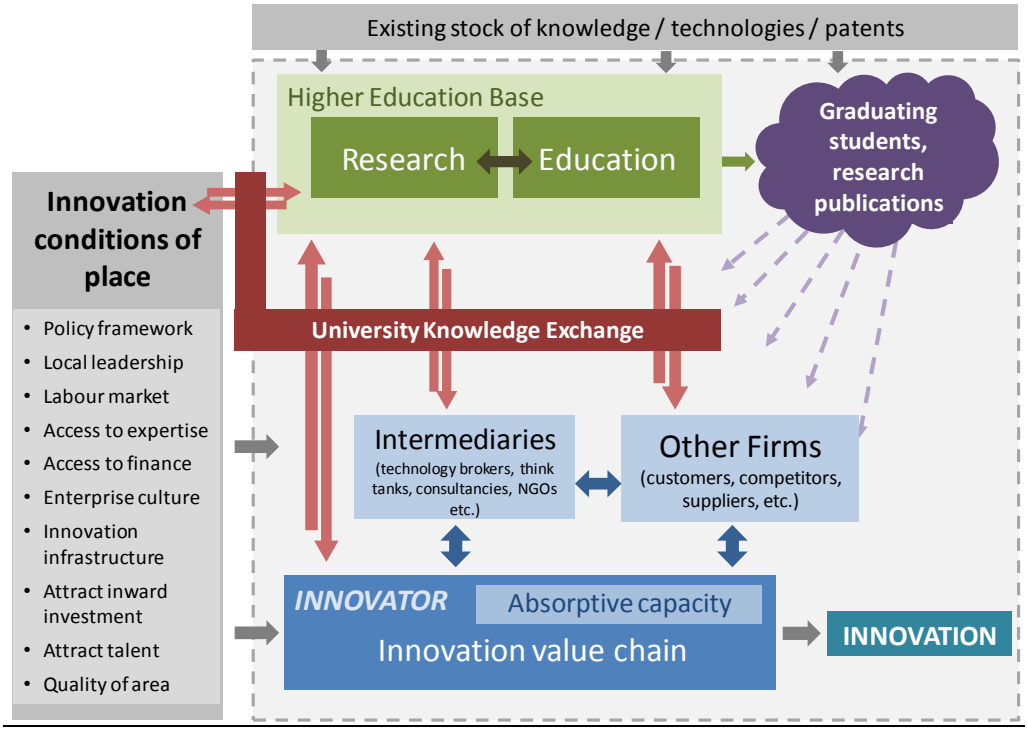
2.4.3 In 2010/11 English HEIs were educating 1.13 million undergraduate students and 257,000 postgraduate students full-time, and a further 480,000 undergraduates and 234,000 postgraduates part-time[10]. In addition, in 2009/10 (the latest year available) they provided 3.22 million course learner days to support the development of skills in the existing workforce and society through continuing professional development (CPD) and continuing education activities[11].

2.5 Towards A Holistic Framework

2.5.1 Figure 2.6 brings together the concepts discussed thus far and builds on our understanding of how HEIs operate within the innovation system, supporting innovation along the value chain and helping to strengthen the innovation conditions.

[10] Obtained from the Higher Education Statistics Agency (HESA) website in December 2011
[11] HEBCI survey 2009/10

Figure 2.6 A framework for understanding the role of HEIs in supporting innovation



Source: PACEC

2.5.2 The framework recognises the importance of the traditional focus on the role of HEIs in contributing to the overall stock of knowledge through publications that can be accessed by innovators, and of graduating students carrying knowledge into the economy gained through their education. However, while research publications enables the diffusion of knowledge to a potentially vast audience, it carries with it potentially high costs associated with the need of innovators to search out the relevant publications, understand it, and adapt it to their specific innovation needs. This requires a specific set of capabilities which many may not adequately possess. Similarly, the diffusion of knowledge through students can incur important costs for employers. These include search costs incurred by both the innovator and the student as part of the job search process, as well as costs associated with the necessary customisation of the student's skills to the specific internal needs of the employer before they can be fully utilised.

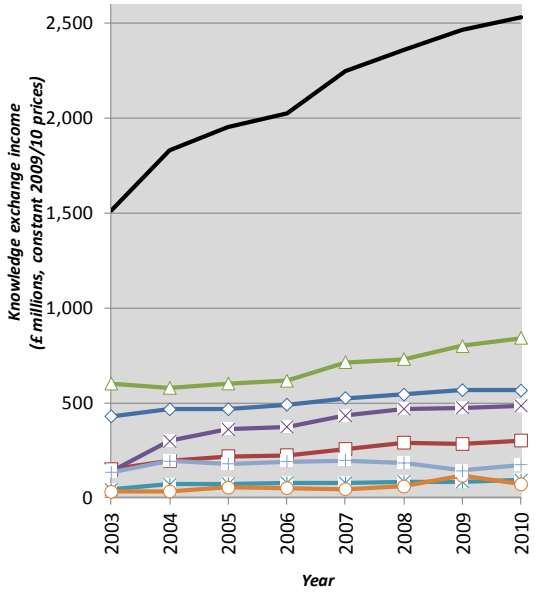
2.5.3 In addition to these more indirect knowledge diffusion mechanisms, HEIs are increasingly contributing to innovation both through an increasingly active and direct contribution to the innovation process and through helping to create and strengthen the underlying conditions for innovation.

The Emergence of HEIs as Direct Contributors to Innovation

2.5.4 The past few decades have seen the proliferation of a diverse range of much more direct linkages being formed with innovators to exchange knowledge. This has resulted in a much more active role for HEIs in directly supporting the innovation

process. The knowledge can be channelled directly to the innovator or through other organisations in the value chain through an equally diverse set of channels.

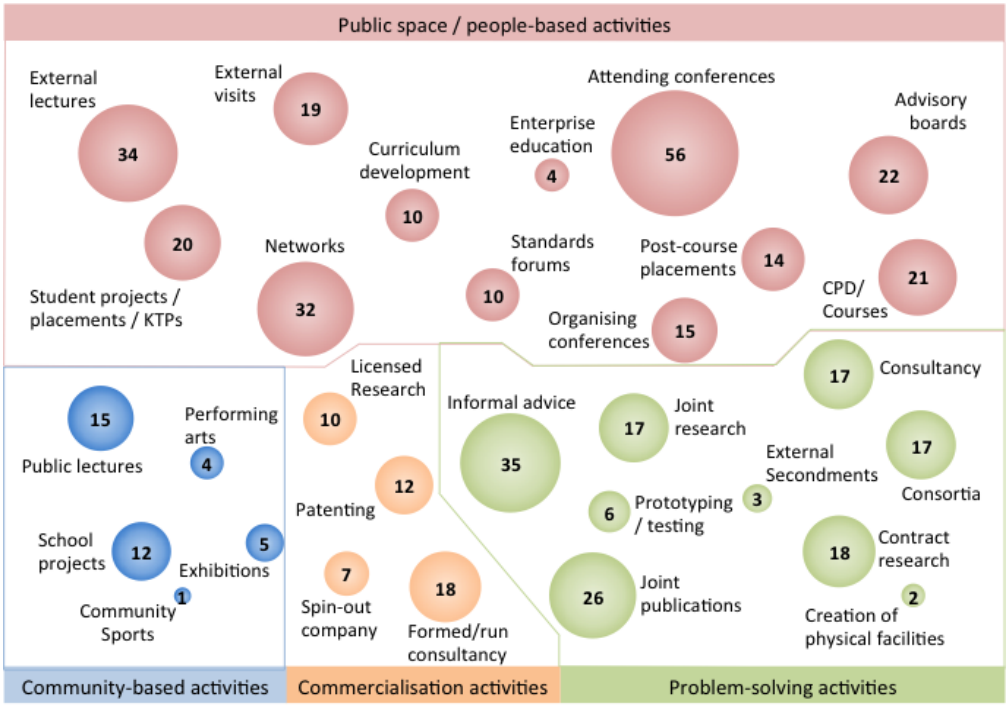
Figure 2.7 Evolution of KE income 2003-2010 (£ millions, constant 2009/10 prices)



Income stream	2010 income (£m)	2010 share of total (%)	CAGR 03-10 (%)	Growth 09-10 (£million)
KE income (real)	2,528	100	10.4	65
Contract research	842	33	7.7	44
Collaborative research	564	22	6.7	-2
Courses	484	19	22.4	10
Consultancy	301	12	13.3	18
Regeneration	174	7	6.6	33
Facilities and equipment	92	4	14.4	8
IP revenues	70	3	15.4	-46

Source: HEBCI surveys 2002/03 – 2009/10; PACEC analysis

Figure 2.8 Academic engagement in different types of knowledge exchange mechanisms in 2008



Number in bubbles is the % of academics engaging at least three times over the past three years in that mechanism, or at least once in the past three years for commercialisation activities.

Source: PACEC/CBR (2009b) *The Evolution of the Infrastructure of the Knowledge Exchange System*, a report to HEFCE

2.5.5 The Higher Education Business and Community Interaction (HEBCI) survey highlights the rapid increases in KE activity with innovators in public, private and third sectors over the period 2003-10 (Figure 2.7). A recent survey by PACEC/CBR (2009b) provided evidence of a much wider set of knowledge exchange mechanisms than is captured by HEBCI (Figure 2.8). What is striking about the evidence is the diversity of modes of engagement for KE and the fact that significant activity occurs well beyond traditional 'technology transfer' (licensing and spin-outs). Significant activity occurs through the 'people-based' and 'public-space' mechanisms, in particular, with academics attending conferences with external organisations, giving invited lectures to external organisations, providing employer training, and participating in networks with external organisations. There is also significant activity in the more traditionally recognised KE activities in the problem solving category. Of particular note is the relatively widespread transmission of knowledge through informal advice.

2.5.6 Despite the substantial prominence given to commercialisation-related activities of HEIs in the public debate over knowledge exchange, the level of engagement in these activities is much lower than for other types of KE. 18% of academics respondents claimed they had set up or run a consultancy within the three years prior to the survey in 2008, 12% claimed they had taken out a patent and 10% claimed they had licensed research. Just 7% claimed that they had formed a spin-out company to commercialise their research outputs.

The role of networks

2.5.7 Formal and informal networks play an important role in stimulating the formation of interactions between different parts of the innovation system. Once formed, they can also help to reduce the search costs involved with the innovator identifying the right source of knowledge as well as providing access points to new markets for ideas. They can also help academics gain access to knowledge about industrial needs that can help them shape their research.

2.5.8 In addition there is also some anecdotal evidence that the bringing together of academics and innovators into common networks can help the formation of links between two parts of the innovation value chain that would otherwise not have formed (or would have taken much longer to form). These arise because academics undertaking KE activities may well engage with organisations at different parts of the innovation value chain, gaining an understanding of the needs, challenges and potential markets for different parts of the value chain. Through these networks they are well placed to facilitate introductions between innovators at different points in the chain that may be unaware of how their capabilities could lead to mutually beneficial outcomes.

2.5.9 In addition, the hosting of networking events by HEIs can also help bring innovators in contact, brokering connections between different parts of the innovation value chain that might not have otherwise formed. These meetings, while informal in the first

instance, could result in future collaborations or sharing of knowledge between companies.

The public space and brokerage roles of HEIs

2.5.10 Research into the roles of HEIs in the innovation system is increasingly emphasising the 'public space' role that they play. This set of activities focus on exploiting the nature of HEIs as stable, neutral environments, typically absent of any political or industrial agenda, to catalyse interactions between disconnected members of the innovation community including between academics and innovators as well as between innovators in different parts of the value chain (Hughes, 2011). These, often informal, interactions can, among other things, facilitate the sharing of knowledge and ideas, as well as help create and nurture the development of networks that can reduce the search costs for the knowledge necessary for innovation. Importantly, they have the potential to lead to further and deeper patterns of more formal activities between academia and external organisations (Abreu et. al, 2009, Hughes, 2011).

User dialogue, two-way knowledge flows and dynamic feedback between innovators and academics

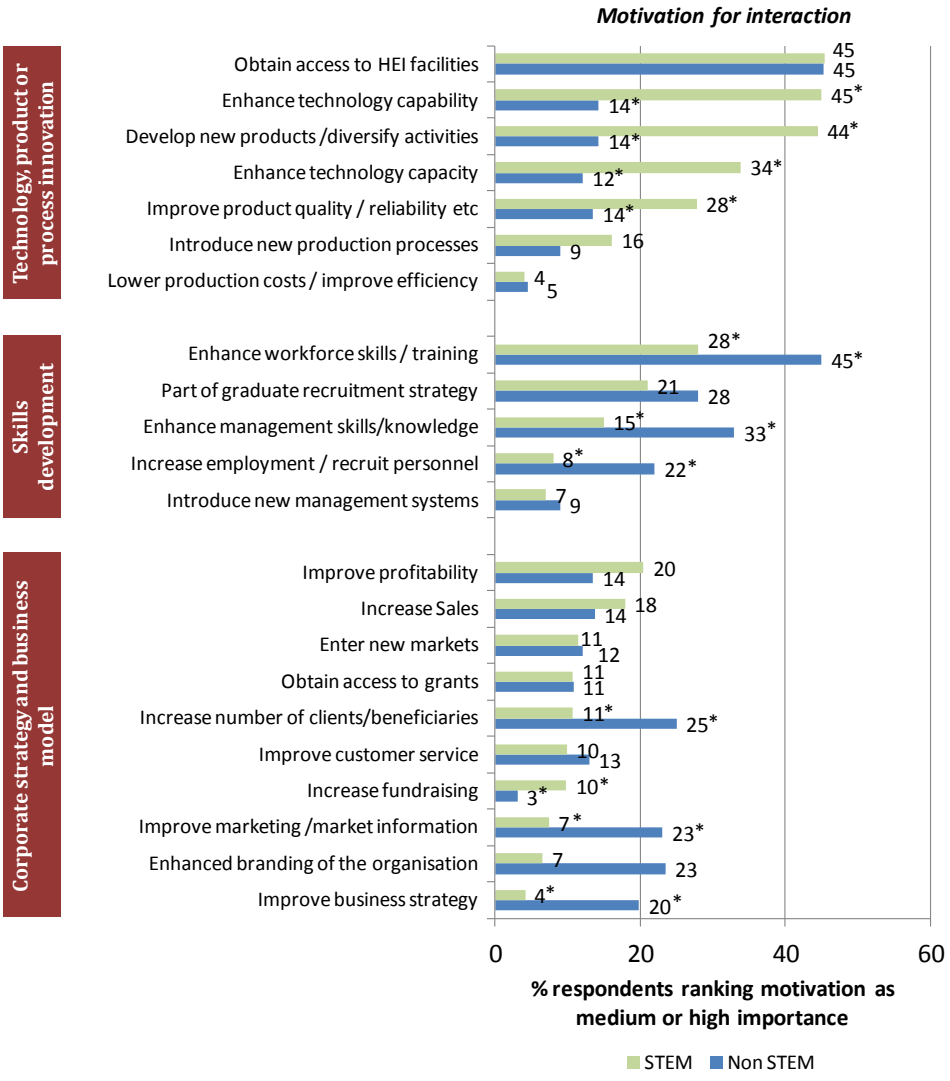
2.5.11 A recognition and understanding of the needs, capabilities and constraints facing all stakeholders in the innovation process and how best to form the linkages to exchange knowledge is likely to be a necessary condition for HEIs to become dynamic and responsive partners in innovation, and for maximising the effectiveness of KE. It is critical that academics understand the nature of the challenges faced by innovators, as well as any constraints they face (e.g. through standards or regulations, or limits on their ability to absorb knowledge in particular forms) in the innovation process. Similarly, it is important that innovators understand what it may be possible to achieve through engaging with HEIs through knowledge exchange in the short-, medium- and long-term to ensure that they can effectively manage their innovation processes, and their expectations on what HEIs can realistically deliver. The focus, therefore, must not be solely on making research more demand-led, driven by user needs, but on fostering the dialogue that takes place between academics and innovators on the needs, capabilities and constraints, and how best to structure research programmes and exchange knowledge in support of innovation.

2.5.12 The positive synergies between KE, research and teaching are becoming increasingly well recognised. In addition to the flow of knowledge from the academic base to users, research has shown that knowledge also flows the other way with users making important contributions to academic research and teaching activities (PACEC/CBR, 2010). KE has the potential to create much more direct feedback loops and two-way knowledge flows than is possible through research publications and graduating students can generate. These positive feedback loops may well be reinforced in future as the economy becomes increasingly knowledge-driven.

Different roles for different HEIs and disciplines along the innovation value chain

2.5.13 The extent and nature of openness along the innovation value chain will inevitably vary. For example, the nature of the external knowledge that is exploited for a technological invention during the idea generation and initial stages of the prototype development will be very different from external knowledge used to help shape the branding or go-to-market strategies for the same innovation. Similarly the format and mechanisms through which the knowledge most effectively flows may vary according to the stage in the innovation value chain, particularly if the exchange of tacit, uncodified knowledge is important.

Figure 2.9 Motivations for engaging with HEIs for knowledge exchange (% external organisation respondents who cite factor as medium or high importance)



* indicates that we are 95% certain that the values in the two categories are statistically different from each other, taking into account the margin of error due to sampling (based on a Chi-Squared statistical test).
Source: PACEC/CBR survey of external organisations 2008

2.5.14 The sheer diversity of innovation challenges and innovator capabilities that exist mean that the motivation to engage, and hence the most appropriate HEI partner

(institution ***and*** discipline) will naturally vary considerably. Therefore, diversity in the innovation system, including amongst the knowledge generators, is important. Different HEIs and even the different disciplines within the HEIs play very different roles in supporting the innovation process.

2.5.15 Highlighting the differing roles of different disciplines, a survey of external organisations by PACEC/CBR (2009) shows that innovators often engage in KE with science, technology, engineering and mathematics (STEM) disciplines because of the support these disciplines can provide for technology, product or process innovation activities including enhancing technological capability and capacity, developing new products and improving product quality or reliability (Figure 2.9). Innovators that engage with non-STEM disciplines (e.g. social sciences and arts and humanities) do so for very different reasons. These include support for workforce and management skills development, improving marketing or market information, enhancing the branding of the organisation and developing business strategies.

Supporting the underlying innovation conditions

2.5.16 Complementing their direct contributions to helping solve specific industrial and societal challenges HEIs are also critically important local 'anchor' institutions that help to create and strengthen the underlying 'innovation conditions of place': the factors that create a conducive environment for innovation and lead to a competitive place that can attract and retain resources and high value added, innovation-driven organisations (left had box in Figure 2.6). These underlying innovation conditions can have an important influence on the competitiveness of the local economy and its ability to compete for, and retain, resources and high value added organisations.

2.5.17 The specific ways in which HEIs strengthen these innovation conditions range from helping to supporting local leadership in key areas surrounding innovation; contributing to the development of the local policy framework; building stronger, more highly skilled labour markets; helping to develop a more conducive culture towards enterprise and innovation; helping to attract inward investment and talent to the area; providing support for key export sectors as well as routes into global value chains for innovators; and working to improve the quality of the local area which is believed to have implications for the location decisions of organisations. In addition, HEIs also appear to have become important mediators in the innovation system. They are one of the few agents in the system operating at the interface between the local and national policy sphere, having to reconcile the tensions and maximise the synergies between the two.

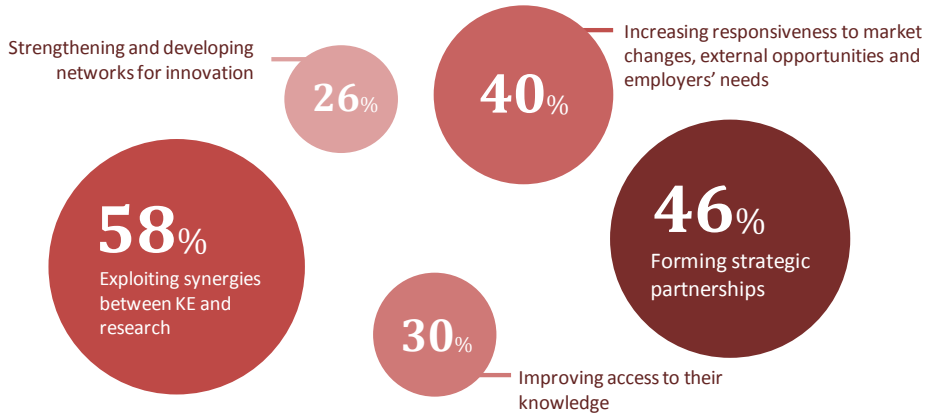
2.5.18 HEIs can also be large providers of innovation infrastructure in their local economies. Appropriately designed and targeted, innovation infrastructure can be important for a number of reasons. Firstly, it helps to provide the appropriate physical premises for new start-ups and high growth innovators. As the open innovation paradigm proliferates, this type of infrastructure can provide opportunities for innovators to co-locate near the knowledge base to help improve the knowledge exchange linkages for the innovation process. Given that much of the new knowledge may be tacit (i.e.

cannot be easily transmitted in a codified form), geographical proximity is thought to be important in facilitating effective knowledge exploitation. It also provides for much greater opportunities for a strategic dialogue to take place to better understand how the needs of the innovator can be supported by the capabilities of the HEI.

2.5.19 The specific role of individual institutions is conditioned by their internal capabilities and their specific contexts, the demands and needs of local innovators, and their strength and breadth of their relationships with other institutions locally (e.g. the local council, chamber of commerce) as well as the existence of other HEIs in the local area.

2.5.20 This report now applies the conceptual framework described in this chapter to the evidence in HEIF 2011-15 strategies.

3 HEIs as Direct Innovation Partners



Key developments in HEIs as they become more direct innovation partners
(Number in bubbles is the % HEIF2011-15 strategies citing the development)

3.1.1 The report now turns to the evidence gathered through the HEIF2011-15 strategies to evidence the many ways through which HEIs are working to increasingly integrate and embed themselves into the innovation system. Importantly, the strategies highlight the moves by HEIs to become more dynamic and responsive innovation partners; the steps being taken to improve access to knowledge; and the impacts these improvements may have on helping innovators raise their absorptive capacity.

3.2 Becoming More Dynamic and Responsive Innovation Partners

3.2.1 The HEIF2011-15 strategies provide strong evidence that HEIs are seeking to become more active in directly supporting the innovation process along the innovation value chain as it increasingly opens up. A number of key developments are evident to support this: many HEIs are moving towards strategic, longer term partnerships with users to support a wide range of innovation-related activities; many, including large research intensives, are emphasising the need to improve understanding user needs and engage with them to shape both research and knowledge exchange agendas; and there are signs that some are seeking to increase the flexibility of their engagement process to become more dynamic and responsive innovation partners for a wider range of organisations.

The rise of strategic partnerships

3.2.2 As the economy moves increasingly towards knowledge-intensive sectors and the open innovation paradigm proliferates, the demand by innovators for externally derived knowledge will inevitably increase. HEIs have the opportunity to become more active, long-term partners in the process, engaging alongside innovators to jointly shape the KE agenda. In addition, given the diverse set of capabilities embodied within an HEI, from knowledge generation in a wide range of disciplines to

skills development and education activities, HEIs have the potential to become significant innovation partners across the full innovation value chain.

3.2.3 During the infancy of knowledge exchange, many HEIs focused on driving individual transactions with users which would address specific issues in the innovation process. Less regard was paid to the set of mutual benefits that could be realised from developing deeper understanding through longer-term relationships of how the wide range of HEI capabilities could support the full spectrum of the needs of the innovator. However, this appears to be changing, with 46% of HEIF2011-15 strategies emphasising a desire to form strategic, long-term partnerships with users in the private, public or third sectors.

3.2.4 The strategies suggest that appropriately designed strategic, long-term partnerships and relationships allow for the two parties to develop much deeper understandings of each others' organisations and their specific needs and capabilities. Critically, it allows the two parties to figure out how best to work together and which mechanisms of KE are most effective for maximising the benefits from the interactions and the chance of successful absorption of the knowledge into the user's innovation processes. They can also help to realise greater synergies back into the research and teaching activities of HEIs, and help to build trust between the two organisations which is thought to be very important for successful partnering for innovation.

Developing strategic partnerships

"Over recent years Cranfield has begun to shift its business engagement from a transactional portfolio to a model based on strategic partnership to better address the needs of our partners, the sectors in which they operate and the economy in general.

… Through the establishment of strategic framework agreements it has also enabled the development of a more sophisticated approach to collaboration, contracting and intellectual property.

… We have identified strong demand from our strategic partners for two-way access to a full-spectrum of partnership information including partner capabilities, company innovation roadmaps, research and education portfolios, unencumbered IP, and sources of third-party funding for future collaboration. … This will enable us to develop a richer and more structured engagement with our strategic partners."

Cranfield University

Strengthening the link between innovator's needs and research

3.2.5 There is clear evidence through the HEIF2011-15 strategies that an increasing number of HEIs – including a number of large research intensives – are taking steps to better understand the needs of potential users of the knowledge they generate and link this back to shaping both the design of research programmes and the way in which they interact with innovators through knowledge exchange. Indeed one of the key benefits from the move towards strategic, long-term partnerships is the building up of strong relationships between HEIs and innovators that can facilitate the type of effective dialogue outlined above. The University of Cambridge argues in their strategy that "*the intended outcome is the demonstration (to University, industry and Government) that longer-term University-industry partnerships are effective in initiating excellent, innovative research that is more readily exploited by those outside*

the HE sector. Research excellence and return to the UK economy should be a common goal".

3.2.6 40% of HEIF2011-15 strategies aim to become more responsive to market changes, external opportunities and employers' needs. Beyond strategic partnerships, HEIs are also using a range of other mechanisms to improve their understanding of user needs. Many are seeking greater use of market intelligence through market research, external advisory groups and closer consultations with industry and other user groups (e.g. Imperial College London, University of Manchester, University of Teesside and the University of Sussex). For example, 17% of HEIF2011-15 strategies explicitly talk about strengthening the 'dialogue' with users to better understand their needs while 28% discuss the need to improve the analysis of market demand as a key to improving the efficiency and effectiveness of their KE activities.

3.2.7 A number of HEIs emphasise their attempts to better understand the barriers to KE engagement faced by key target user groups and link this back to improving their KE initiatives and raise the probabilities of successful interactions. For example, Cranfield University has designed its SME engagement initiatives recognising the many difficulties faced by such firms in identifying HEI partners. They will seek to exploit the supply chain linkages through their larger partners as well as links with key bodies such as the Confederation of British Industry (CBI) to raise the visibility of the University amongst this target group. The University of Exeter has designed a multi-level partnership model that recognises the different needs of different types of partners at different stages of the KE process.

3.2.8 Networks, forums and showcases are also being used by HEIs to provide important venues for bringing together academics and users to exchange information about user needs and help improve the link with research.

3.2.9 Importantly, those HEIs that are deploying their improved understanding of user needs most effectively are ensuring that this information influences their research, not just the way in which they structure their KE offer to exploit the research outputs available. 58% of HEIF2011-15 strategies are seeking to better exploit the synergies between KE and research, creating closer linkages between the two activities. A few HEIs acknowledged this explicitly, including the University of Durham: that to fully build the necessary pathways to impact and maximise the benefits from research "*requires development of multi-level links with business and community organisations that inform the content and framing of research proposals rather than looking to exploit outputs*".

Strengthening the dialogue through staff exchanges and Professors of Practice

3.2.10 Staff exchanges are also thought to greatly aid the dialogue between academics and users. The embedding of staff within each others' organisations exposes the two sides directly to the innovation challenges of the users and the capabilities and constraints faced by each side in designing an appropriate innovation solution. The

close working facilitates the exchange of tacit knowledge and can build the trust between the academics and users to increase the effectiveness of the relationship.

3.2.11 The emphasis on staff exchanges is thought to have increased in the current round of HEIF2011-15 strategies compared with previous rounds, although it is still only in a minority of HEIs. However, it is encouraging that those that do promote this type of scheme are focusing on both outward staff secondments (academics spending time within partner organisations) ***and*** inward secondments where researchers from partner organisations locate within the HEI for a period of time. For example, the Universities of Exeter explicitly supports "*secondments between industry and the University and vice-versa*" as part of its new Open Innovation Platform, while the Universities of Bath and Sussex both have this type of activity as a key activity for achieving the objectives of their HEIF2011-15 strategies.

3.2.12 Similar to the staff exchanges, a small number of HEIs have introduced, or are expanding their 'Professors of Practice' or equivalent schemes which bring users into the HEI into close contact with both academics and students. The Newcastle University scheme provides a good example, providing opportunities for high calibre individuals from industry/business to work part-time within the University. Brunel University have introduced the Knowledge Exchange Secondments Scheme to bring senior representatives from outside academia to develop KE projects in collaboration with academic staff.

Professors of Practice

"Newcastle University has long held the aim of increasing the number of entrepreneurial academics and encouraging our staff to engage with business and industry through both out-going and in-going secondments. Our success in this area has been recognised nationally (by for example NESTA) and is clearly in line with national HE policy. We provide support to these activities through providing resource to buy out staff time (for example, in the early stages of spin -out company formation support of this kind is crucial) and through our Professors of Practice scheme (through which we provide opportunities for high calibre individuals from industry/business to work perhaps part-time within the University)."

Newcastle University

A flexible partner

3.2.13 Some HEIs – albeit not many – have acknowledged the need to increase the flexibility of their KE engagement process. One key issue is that the timescales of industrial and other external partners can often be inconsistent with academics, who are constrained by their research and teaching duties[12]. Another difficulty is that 'one-size-fits-all' contracts are likely not appropriate for all types of partners, who inevitably have different objectives for engaging with HEIs.

3.2.14 A small number of HEIs have introduced more flexible partnership models for different stages of the engagement process. Perhaps the most prominent under

[12] A survey of academics in 2008 (PACEC/CBR, 2009) found that 27% believed that the timescales required to meet external deadlines was a constraint. However, a survey of 26 heads of knowledge exchange offices in 2010 showed that 77% believed that differences in timescales between academics and users was a constraint, although 64% thought it had improved since 2007.

HEIF 4 was the Coventry University Partnership Stairway Model moving along the value chain from targets and initial contacts and activities to multi-touch and strategic partners, with those at the strategic level becoming closely involved in assisting the University develop its KE strategy. Coventry University's HEIF2011-15 strategy claims this to have been a success, with over 50 strategic partnerships and over 50% of live accounts now multi-touch or multi-activity with "*significant mutual organisational benefits realised*"[13].

3.2.15 Other HEIs have introduced similar philosophies to their partnership models. The University of Exeter has introduced an 'Open Innovation Approach' which recognises the different requirements as a relationship develops. To this end they have introduced collaborative incentives at three levels: "*Link Vouchers to support the development of new links with industrial partners; Innovation Vouchers for feasibility studies and shorter projects to build relationships; and Partnership Schemes to promote the development of strategic partnerships*", with a focus on the co-production and co-funding of KE.

3.2.16 Another aspect of flexibility is addressing the constraint of differing timescales between academics and users. Only a few HEIs explicitly discussed how they would address this. One example was the University of Hertfordshire. They have introduced the "*Knowledge for Business (K4B), a unique knowledge transfer package developed at UH*" to help improve access to the University's expertise for SMEs. The University is keen to emphasize its flexibility and that it fits within the resource plans of the academic schools. Alternatively, the University of Southampton has creating dedicated 'professional teams' who work solely on projects with external organisations. These teams act to bridge the gap between the knowledge generation base of the innovation system and the innovators, helping to understand the needs of users, and accessing and exploiting the necessary knowledge generated within the wider University (or elsewhere) to address the specific challenge of the innovator.

3.3 Improving Access to Knowledge for Innovation

3.3.1 Almost all HEIs in England have some form of central enquiry point (for SMEs) and provide assistance to SMEs in specifying their needs (HEBCI survey, 2009/10). However, we also know that 27% of firms engaging with HEIs believe that difficulties in finding appropriate partners are constraining their KE interactions (PACEC/CBR, 2010b). Therefore, the moves to become more dynamic and responsive innovation partners must also be accompanied by improved accessibility by innovators to HEI knowledge (which in turn may be constrained by their capabilities).

3.3.2 Almost 30% of the HEIF2011-15 strategies directly address this issue while others discuss initiatives that will likely make themselves more accessible to innovators, even if this isn't the primary objective.

[13] Coventry University HEIF2011-15 strategy

Raising awareness of HEIs as innovation partners

3.3.3 As mentioned earlier, helping innovators understand what benefits HEIs can bring to the innovation process is important. The role that HEIs can play is often not well understood by many – particularly smaller – external organisations and raising the awareness of these benefits can help bring a wider set of users into contact with the HEI. Such awareness raising efforts can also help to prevent unrealistic expectations from forming, building trust between academics and users.

3.3.4 The visibility of HEIs as potential innovation partners is being enhanced through a number of different mechanisms. These include building the branding and prominence of HEI innovation infrastructure in the local, regional and national economies. This type of infrastructure can act as an important 'shop window' into the HEI, providing information on the different types of KE services available and how these can support the innovation process. There are some signs in the HEIF2011-15 strategies that HEIs are strengthening these types of linkages.

3.3.5 Another important method for raising the visibility of HEIs is through the events they hold for innovators. HEIs appear to be increasingly hosting these types of events either to showcase technologies, providing professional development and networking opportunities or workshops and seminars addressing key innovation and business challenges (e.g. how to survive the economic downturn).

3.3.6 Large scale geographical HE collaborations such as N8, Westfocus and SETsquared are also helping to raise the visibility of HEIs as innovation partners. The scale of KE activity in their regional economies can help to develop and reinforce an innovation related branding. This can then be exploited to jointly market and communicate the collective KE services to potential innovators who may not have been aware of HEIs as partners.

3.3.7 There is sometimes a debate about whether HEIs should create dedicated gateways to channel their KE activities, or whether more porous, open universities should be created that maximise the potential for interactions to form between the academics and innovators. It is likely that both are necessary and that ensuring flexibility in the route of access should be the priority – i.e. the 'no wrong door' philosophy. While the vast majority of KE interactions are formed by direct contact between the academic and innovator (see e.g. PACEC/CBR, 2009, Abreu et al., 2010) which suggests the latter should be emphasised, there are nonetheless likely to be a potentially large set of potential users who find it difficult to access these types of networks to create the initial interaction. In these cases, gateways are important for becoming the visible point of contact and improving their ability to route enquiries to the most appropriate place within the HEI becomes paramount.

Improving access points and being 'easy to do business with'

3.3.8 A number of HEIs talk about the need to make it easier for potential users to access the institution. They are reviewing their internal, process, policies practices and

attitudes affecting KE engagement and reforming their structures to improve the access routes for external organisations. They are innovating in the KE services they provide to better meet the needs of users, providing better signposting of access routes, and streamlining structures. Some have gone as far as pledging within their strategies to become 'easy to do business with', providing a clear commitment to improve access. Cranfield University highlights this trend, noting that "*strategic university / business engagement needs simple and coordinated engagement through easily accessible one-stop shops*'.

3.3.9 However, being 'easy to do business with' is not just about access points and a willingness of the HEI to engage, but also ensuring that the KE activities being undertaken directly meets the challenges faced by potential users.

Improving access to intellectual property

3.3.10 Access to intellectual property held by HEIs has often been described as a barrier to the commercialisation process. A recent study by PACEC/CBR (2010b) into the IP regime showed that this was indeed a constraint, but it was limited to certain disciplines, research intensive HEIs, and certain types of KE mechanisms. The HEIF2011-15 strategies suggest that HEIs are actively seeking to reduce this barrier, both through simplifying access as well as collaborating to improve access. Section 5.5 discusses how the commercialisation process itself is being improved.

Simplification of access

3.3.11 HEIs are also taking a range of steps to improve access to the intellectual property they generate within their institutions. The most prominent example (but not the only one) is the collaborative effort by King's College London, the University of Bristol and the University of Glasgow, who have been developing 'Easy Access Innovation' to promote new ways of sharing intellectual property with industry. They plan to roll out a suite of short and simple contracts, developed through the partnership. The programme will see a proportion of their earlier stage and higher risk IP opportunities made freely available through the Easy Access IP portfolio to encourage companies to commercialise these technologies and assuming a greater proportion of the development risk.

3.3.12 Other HEIs are also working to simplify their IP regimes. Cranfield University argues strongly that "national policy imperatives to grow University/Business collaboration depend critically on the ability of partners to rapidly agree commercial terms", requiring a simple commercial arrangements that can act as a clear starting point for negotiations. Cranfield commits themselves to the use of the 'Lambert Agreements', a set of best practice simple commercial arrangements.

Collaborating to improve access to IP

3.3.13 While many HEIs generate IP, they do not generate it in large quantities. Innovators therefore have to search many different institutions IP portfolios in attempts to identify

the right technology to exploit. Their networks (academic or otherwise) may help narrow down the search process, but it can nevertheless prove costly. The HEIF2011-15 strategies suggest that there has been a shift towards greater collaboration and shared services with to help the visibility and access to IP. By pooling IP between institutions, HEIs create a single access point to a much larger portfolio of technologies which helps to reduce the search costs.

3.3.14 One example of this is the coming together of a group of universities in the south – universities of Surrey, Sussex, and Reading, Royal Holloway and the National Physical Laboratory – to work together to create the 'South East IP Bank'. This will "*provide a means of joint promotion of our combined IP (whilst not restricting ownership or sole promotion), and allow us to share knowledge and experience in developing our IP. The IP Bank has already won funding from the IPO to support its development*."[14] In addition to providing a more effective method of marketing IP these HEIs also believe it can help provide a more cost effective method for the sourcing of IP services.

Improving access through a coordinated approach to innovation infrastructure

3.3.15 HEIs are increasingly providing significant infrastructure for use by innovators to support their innovation process, such as science and technology parks, incubators, innovation centres etc. If well coordinated, these can act as high profile, locally-based infrastructure to provide a portal into the wider innovation support and KE services offered by the HEI. Collaborations are emerging between HEIs and other local bodies such as the Chambers of Commerce, local councils and other business support organisations to improve the coordination of such infrastructure.

Exploiting high profile infrastructure to support access and drive innovation

The University of Chester is launching the Riverside Innovation Centre (£6 million initiative jointly funded by the ERDF). Two key objectives of the new Centre include (i) "*support innovation and enterprise via ready access to the research and expertise within the University and more broadly, including access to key business networks and business support agencies*"; and (ii) to "*provide a focal point within Chester for access and signposting to available business support and initiatives aimed at helping businesses*".

University of Chester

Improving access for SMEs

3.3.16 It is well known that SMEs find it difficult to engage with HEIs for a host of different reasons, not least the lack of resources to engage, the lack of capabilities to identify the right partners, and a lack of awareness of the benefits. Similarly, HEIs can find SME engagement costly not least due to the limited financial resources lead to small projects with high fixed costs. The HEIF2011-15 strategies present a range of approaches to improving access for SMEs that are being experimented with. One way this can be achieved is to exploit the public spaces of HEIs. Hosting workshops,

[14] University of Sussex HEIF2011-15 strategy

seminars, public lectures, technology showcases and other types of events can attract local SMEs and help raise awareness of the knowledge held within the HEI and how it could benefit the innovation activities of the SMEs.

Exploiting the public space role of the HEI to improve access for SMEs

The University plans to "*host regular industries 'Emerging Opportunity' seminars to share market intelligence with SMEs and engage in strategic discussions about the big commercial opportunities for innovation and the development of sales and development links to India and China*". It also provides "*SMEs with opportunities to network and present to local business leaders at showcase events around key sector themes such as environment, healthcare innovation, high end manufacturing, creative industries, infrastructure and logistics, security, risk and individual behaviour*".

University of Portsmouth

Streamlining support for SME engagement

3.3.17 Another method for improving access for SMEs being used by some HEIs is the streamlining of the (often many) existing access points and interfaces which can create difficulties in navigating the HEI and acquiring the necessary knowledge. It may also increase the potential for cross-selling of different KE services as well as helping to build longer term relationships rather than single transactions. For example, the University of Manchester "*will set up a new service – Catalyst – to bring together parts of the University which already interface with SMEs and create more opportunities for knowledge exchange with SMEs*".

Engaging with SMEs through supply chains

3.3.18 Some universities also claim that an effective way to access SMEs is through the supply chains of the larger organisations with which they engage. Cranfield argues that this is a very effective way to engage with SMEs, given the often significant barriers that these types of firms face. For example, The University of Liverpool notes: "*our approach is to build long-term trusted relationships with larger organisations and through them and their supply chains gain access to smaller organisations. We see our pan-university Research Themes as being an important agenda aligned with our engagement of larger organisations.*" This highlights a potential danger of this type of approach: while those SMEs that are part of major supply chains may well benefit, those that are not may find it harder to engage, with knowledge exchange becoming less relevant to their needs.

Innovation vouchers, Knowledge Transfer Partnerships and access

3.3.19 Almost a third of the HEIs in receipt of HEIF2011-15 funding believe that the reductions in SME support including innovation vouchers and Knowledge Transfer Partnerships would present a key barrier to their KE activities.

3.3.20 21% explicitly discussed innovation voucher schemes as something worth maintaining, providing important assistance to SMEs for accessing the HE-based knowledge and other innovation-related resources. At the time of writing the strategies, HEIs were under the impression that the innovation voucher scheme was

being abolished. In response to this belief, at least 15 HEIs are attempting to find ways of creating similar programmes, or finding other sources of funding to continue existing ones. The strategies of another 6 HEIs talk about such programmes and their value, although it is unclear as to whether they will continue them in the absence of new funding.

3.3.21 Innovation vouchers are likely to be most effective when considered within a wider set of tools to encourage engagement with HEIs in order to ensure that the initial interaction through the voucher (which is typically short in duration) leads to follow-on interactions. Both the Universities of Exeter and Chichester are explicit in their strategies that the innovation voucher is part of an 'escalator' of incentives reflecting deepening interactions.

3.3.22 Knowledge Transfer Partnerships (KTPs) are perceived to be an important part of the KE portfolio for engaging with SMEs by many – particularly less research intensive – HEIs. For example, Aston University "*has worked with a significant number of SMEs (predominantly in the West Midlands) using innovation vouchers, KTP and CASE awards, Some of these SMEs are now growing rapidly, and Aston's business development managers maintain relationships with them with a view to generating and identifying opportunities for larger TSB collaborations and commercial projects.*" However, the national reduction in numbers will mean that each application becomes much more competitive. Some HEIs are concerned that dramatically lowering the chance of success may put firms off applying altogether.

3.3.23 However, as with the reaction to the belief that the innovation voucher programme was being abandoned, a small number of HEIs are introducing KTP-like schemes adjusting for their specific local contexts. For example, the University of Hertfordshire's Knowledge for Business (K4B) scheme targeting SMEs has built on their learning of what works within their institution, and is independent of grant support, allowing for engagements outside the TSB criteria for KTPs.

Pooling resources through industry clubs to improve access

3.3.24 Many smaller companies find it difficult to individually engage with HEIs because they lack the scale and resources to commission the research and KE necessary to support their innovation activities. One method for overcoming this is to form 'clubs'. Clubs are essentially groups of individuals or organisations with similar needs (in terms of their interactions with HEIs). They typically involve a fee for joining which can then be pooled. Through the pooling of funds, the club can generate the scale to more effectively engage with the HEI through KE which is in the interest of the club as a whole. The outputs of any KE engagements are then shared with the club. There are instances of this occurring in the United States (PACEC/CBR, 2010) and the HEIF2011-15 strategies suggest that similar initiatives may be starting to appear in the UK. For example, Coventry University are focusing in part on developing SME engagement through industry clubs / cluster programmes. "*Further development of SME engagement activity through the introduction of new approaches which will be based in part on membership subscription methods employed by other HEIs to*

strengthen SME networks, and drive investment into market-led R&D (e.g. the "ProfitNet" model at the University of Brighton, and the "Virtual Centre for Industrial and Process Tomography" at the University of Leeds)."

The importance of networks

3.3.25 As discussed in section 2, just over a quarter of HEIF2011-15 strategies discussed their efforts to develop their own networking activities, many of which are targeted towards local companies and often to SMEs in particular. These are often seen as an important part of the wider KE portfolio of services. The demise of the RDAs – who oversaw the creation of a number of innovation-based networks such as the Innovation Networks (iNets) – has placed a greater burden on the role of HEIs in foster such networks.

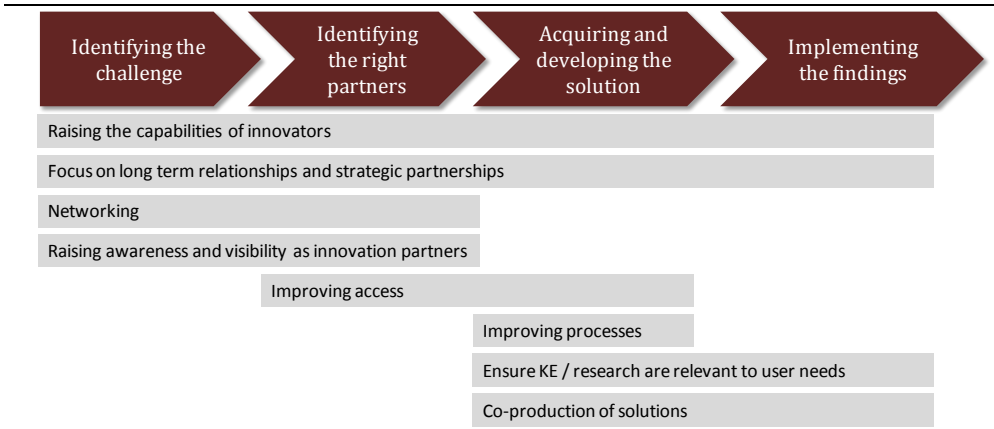
3.3.26 A number of HEIs also discussed their efforts to exploit national networks for their KE activities. One example is the TSB _connect platform which seeks to provide a web-based platform to bring together those involved in the innovation process to share among other things, knowledge, ideas, and opportunities for funding. The platform also incorporates access to each of the Knowledge Transfer Networks.

3.4 Helping to Raise the Absorptive Capacity of Innovators

3.4.1 A range of HEI KE-related initiatives and activities act to help raise the absorptive capacity of innovators, acting at different points in the process (Figure 3.10).

3.4.2 Core to this is the increasing provision of continuing professional development and other short courses. This was the fastest growing KE activity over the period 2003-10 and secured £480 million for HEIs in 2010. Appropriately designed and targeted, these types of courses can help innovators address both technical and generic (e.g. management) skills gaps. For example, some HEIs are also providing dedicated enterprise and entrepreneurship education in the local economies through, for example, their innovation centres and online portals.

Figure 3.10 Evidence from HEIF2011-15 strategies on how KE is helping to raise the absorptive capacity of innovators



Source: HEIF2011-15 strategies, PACEC analysis

3.4.3 The movement towards long term relationships will likely have an effect on absorptive capacity. Often, these involve developing a dialogue in which both sides work to understand the challenges involved and how the capabilities of the HEI can help address them, which should, at minimum, facilitate the creation of a solution which understands and adjusts for the specific implementation conditions of the innovator.

3.4.4 The steps HEIs are taking to raise awareness of the benefits that can be realised from working with them may also help to trigger diagnoses of particular innovation challenges as well as highlighting the potential partners available to support the innovation process. The University of Exeter, for example runs an event at their Innovation Centre – Innovation Fitness Test – to look at how organisations deliver innovation and helping innovators identify and address key innovation management issues and the necessary conditions to foster successful innovation.

3.4.5 Critical to the absorptive capacity of innovators is their ability to access the required knowledge. The previous sections also highlighted the many steps HEIs are taking to improve this access helping to reduce the search costs involved.

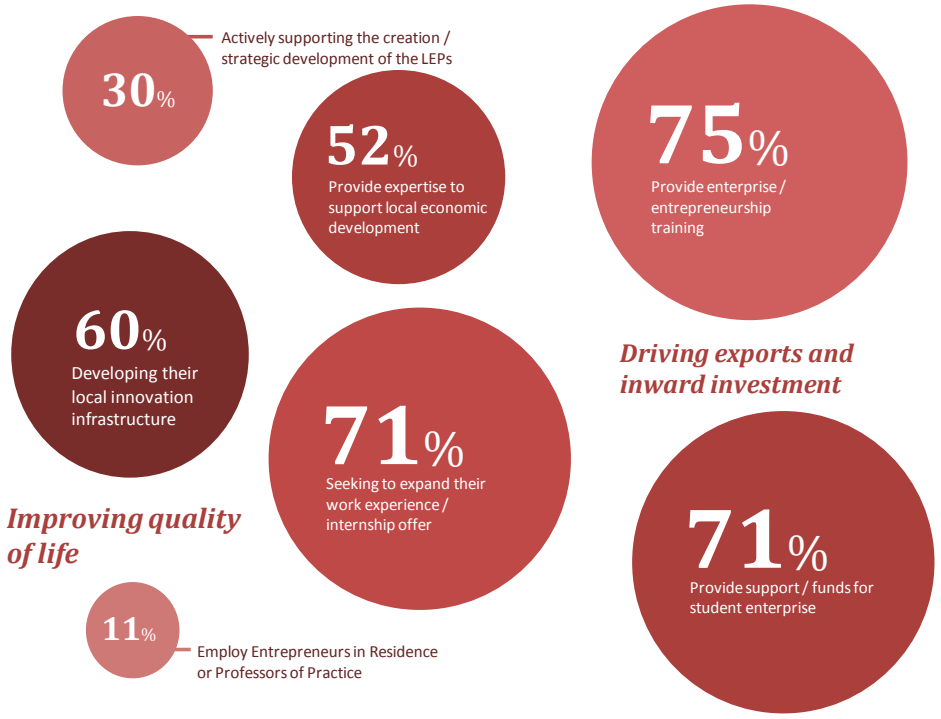
3.4.6 Once an HEI partner has been identified, the innovator has to acquire the knowledge. This often (although not always) requires the formalisation of the interaction through a contract. Some HEIs are taking steps to reduce the bureaucracy involved in forming the contracts and making commitments in their HEIF2011-15 strategies to become 'easy-to-do-business-with'.

3.5 Summary of Key Findings

3.5.1 The last few decades have seen English HEIs emerge as increasingly active and direct players in the innovation process, generating approximately £2.5 billion from their KE activities in 2009/10. Key developments include:

- A growing number of HEIs (46% of strategies) are emphasising the need to develop longer-term relationships and strategic partnerships with users rather than focusing on single transactions. HEIs are starting to recognise the significant mutual benefits of these types of relationships;
- Staff exchanges are also thought to greatly aid the dialogue between academics and users. However, while it appears that such initiatives are on the increase, and where they exist, HEIs are emphasising the both the inward and outward exchange of staff, it still remains a minority activity in the sector.
- Continuing efforts to improve access to HEI knowledge by at least 30% of HEIs. This includes a simplification of access, as well as efforts to become 'easy to do business with';
- Innovation in the types of KE services on offer with some HEIs responding to the large reduction in national schemes supporting KE by setting up their own, tailored schemes using alternative sources of funding.
- While increasing absorptive capacity fundamentally requires the improvement of the capabilities of innovators, the KE-related activities of HEIs are also working to remove barriers at key points: making their knowledge 'offer' more visible; improving access; and providing services better targeted at user needs.

4 Strengthening the Underlying Innovation Conditions



Key developments in the role of HEIs in strengthening the underlying innovation conditions
(Number in bubbles is the % HEIF2011-15 strategies citing the development)

4.1.1 It is abundantly clear from the HEIF2011-15 strategies that HEIs are also critically important local 'anchor' institutions that respond to, and help to create, the necessary fertile landscape for successful innovation. This chapter focuses on the many methods through which they achieve this. There is also ample evidence that HEIs are increasingly working together, rather than in competition with each other, to help improve the local innovation conditions.

4.2 Supporting Local Leadership and Policy Development

4.2.1 HEIs are embedded within local economies that are shaped in no small part by their local policies and leadership. It is clear from the HEIF2011-15 strategies that most HEIs (over 80%) engage with these local policy organisations (e.g. Councils, Chambers of Commerce, LEPs) and have developed some form of partnership with them. In addition 52% claim to provide some form of expertise to these bodies to support local economic development including support for strategy development, policy advice, evaluation expertise, and in some cases, managing the economic intelligence provision for the local area (e.g. the University of Essex who, in partnership with Essex County Council, will maintain and develop Insight East as the economic intelligence centre for local authorities, businesses and the LEP).

4.2.2 The sub-national institutional framework has undergone major changes in the past 12 months with the abolition of the Regional Development Agencies (RDAs) and the rise of the Local Enterprise Partnerships (LEPs). The desire of many LEPs to become the driving force behind the creation and strengthening of local knowledge economies and economic growth, provides a natural opportunity for HEIs to engage and place their institutions core to local growth strategies. Indeed, almost 30% of HEIs in receipt of HEIF2011-15 funding now have some senior representation – usually at the Vice-Chancellor or Pro Vice-Chancellor level – on the board of the LEP with other connections forming as required at appropriate levels of the two organisations. For example, some are taking responsibilities for leading innovation sub-groups within the LEP.

4.2.3 In addition to representation on the boards of the LEPs, 36% of HEIs are also ensuring that their KE strategies align with LEP priorities, recognising the importance of providing a locally consistent and harmonious support for innovation and growth.

Aligning knowledge exchange with the LEP strategy to maximise local impacts

In terms of impact, our institutional strategy very much seeks to align with the national Local Growth White Paper of rebalancing the economy, putting communities and businesses at the forefront of economic development prioritisation and tackling barriers to growth. The LEP is going to be the vehicle for change and our KE strategy is therefore designed to wrap around the economic direction set by the LEP to strengthen the economic competitiveness of Staffordshire. Deeply at the heart of its local community, this opportunity to play a leading role in the transformation of the local area to address some of its entrenched problems through supporting the growth of the private sector employment base is being seized in this strategy through the variety of innovation and enterprise stimulation interventions outlined.

Staffordshire University

4.2.4 The Universities of Cambridge and Liverpool also emphasise the benefits of having senior HE leadership leading key innovation groups within the LEP. These individuals are heavily embedded within wide networks involving academics, different arms of Government (e.g. BIS and TSB) as well as the private sector. These networks can be brought to bear when the LEPs are designing strategies and initiatives to support innovation and economic growth to ensure that they are consistent with national policy and funding availability (e.g. through the Regional Growth Fund).

4.2.5 In addition, many HEIs are playing major roles in LEP bids for funding including the recent Enterprise Zone initiative from the Department of Communities and Local Government and applications to the Regional Growth Fund (RGF). This recognises the benefits that HEI involvement in many growth-related initiatives can have, not least through the knowledge exchange expertise and innovation infrastructure they provide for the local economy.

4.3 Creating a Responsive, Highly Skilled Labour Market

4.3.1 Perhaps one of the most important – and well recognised – roles of HEIs in creating fertile innovation conditions in their local economies is through their education activities. HEIs contribute both to building the skills and capabilities of the next generation of innovators as well as supporting the current workforce as it seeks to innovate. The HEIF2011-15 strategies highlight important developments and good examples of ideas for making courses more relevant to innovator needs, and for increasing the employability of students, related in part to teaching funding changes in chapter 1.

Innovation in course design and improving content

4.3.2 The HEIF2011-15 strategies provide very good examples of how HEIs are innovating to help make courses more relevant. Some (e.g. Brunel University) are undertaking a wide-ranging review of employability which includes a detailed look at curriculum content and architecture, and how courses are delivered. One of the most frequently cited methods was increasing employer engagement to help shape course content and delivery. For some, this involves engaging in a more extensive dialogue with employers regarding skills needs and feeding this back into the curriculum. The synergies between knowledge exchange and teaching are evident here. The University of Hertfordshire best articulates this point noting that their "*academic staff can apply up-to-the minute experience of working with business and the professions directly to the curriculum, to provide engaging and stimulating learning opportunities*".

4.3.3 Some HEIs (including a number of the more research intensive HEIs such as the Universities of Durham, Birmingham and Reading, as well as others such as Lincoln and the University of the West of England) are forming strategic partnerships with firms to collaborate on curriculum design and delivery to help ensure more 'industry-ready' graduates with more relevant professional qualifications to contribute more rapidly to the activities of their employers, thus reducing the utilisations costs of employing new graduates. For example, the University of the West of England has formed collaborations with Hewlett Packard and other organisations on a "*number of joint initiatives in the areas of curriculum development and knowledge exchange, including a four year degree programme with the aim of producing 'industry-ready' graduates, who have the skills to make the leap from academia to business. This partnership, together with similar initiatives with other blue chip organisations, with be key to meeting employer needs in key growth sectors of the economy*".

4.3.4 The HEBCI survey results confirm the evidence in the strategies and suggest that many more HEIs are engaging actively with employers across all of their departments in developing the content of courses and reviewing curriculum, with the proportion of HEIs this to be the case rising from 28% in 2003/04 to 36% in 2009/10.

Table 4.2 Extent to which employers are actively involved in the development of content and regular reviewing of the curriculum 2003/04 and 2009/10 (% HEIs)

	2003/04	2009/10
5. All departments regularly consult with employers and other partners on curriculum where relevant. Specialist subjects are kept up to date and relevant to the labour market. More generic skills developed in all courses as required	28	36
4. Between 3 and 5	51	45
3. Some dialogue with employers and other bodies about the nature of courses, but limited for example to specific vocational areas, or one-off exercises	18	15
2. Between 1 and 3	1	4
1. No links with employers in development of locally oriented courses or overall shaping of the curriculum	2	1
Total (%)	100	100

Source: HEBCI surveys, PACEC analysis

4.3.5 While many strategies talked about how employer engagement was helping to improve the relevance of their courses, only a few mentioned that they sought to exploit their alumni base in this regard. Alumni have historically been approached primarily for the financial contribution they can make. Their contributions appear to support a range of KE activities (see Figure 6.17). However, focusing on the financial overlooks the very rich source of a wide range of knowledge, skills, and other capabilities that they possess, as well as the positions they attain within industry, the public sector and wider society. Strengthening these relationships may yield benefits for KE (e.g. alumni are potential customers of KE services) including student and staff enterprise, as well as the teaching activities of the HEI (e.g. through work placements with alumni, mentoring, as well as support for the development of course content). One such example is UCL, which is seeking to work more closely with its alumni base to promote the enterprise and KE at the institution including forming an 'Alumni for Enterprise' network.

4.3.6 In addition to employer engagement, some HEIs (albeit a relatively few) appear to be innovating in the way they deliver education. The University of Southampton provides a very good example of this, creating the Curriculum Innovation Programme which is designed to better meet the needs of industry and empower graduates with the business savvy skills and knowledge needed for their future employment. Importantly, the programme appears to provide significantly increased flexibility for students in designing their own courses as well as focusing heavily on the big industrial and societal challenges which have been informed by and developed in close collaboration with partners.

4.3.7 However, one HEI makes an important caveat to employer engagement for course content design. Keele University emphasises strongly that their curriculum is informed, but not dictated by employer perspectives. Course content needs to reflect both industrial and societal knowledge needs ***as well as*** reflecting the direction of the latest research in the given area. It is therefore likely to be best designed through a sustained dialogue between academics and users. The moves towards strategic partnerships and long term relationship building covering all areas of HE activity (research, teaching and KE) should help in this regard.

4.3.8 Over half of the HEIF2011-15 strategies claim to be increasingly integrating entrepreneurship and enterprise modules and other innovation-related courses into their curricula in attempts to enhance the employability of their students and make them more 'industry ready'. Changes are occurring across the HE sector including at the top research universities.

Embedding enterprise and employability training into the HEI

"The third objective is to increase the employability and enterprise abilities of our graduates. The University is setting up a University College which will champion course units to: broaden intellectual and cultural interests; challenge and equip students to confront personal values and make ethical judgements; prepare graduates for citizenship and leadership in a diverse, global environment; promote equality and diversity. One of the purposes of a Manchester Education will be to prepare graduates for professional and vocational work. The University College and Disciplines will have dual roles to provide skills valued by employers though the Manchester Leadership Programme (MLP) and other vehicles. In this way the MLP will be embedded in the University and so will no longer require support from HEIF."

University of Manchester

4.3.9 Some HEIs are also recognising the important synergies that exist with research and KE and are adjusting their teaching programmes accordingly. For example, the University of Lincoln has created a pioneering project, 'Student as Producer', reforming the way in which they interact with students. It focuses on much more active learning "*by generating knowledge through real research and projects which replicate the process of research within their chosen discipline. At Lincoln research and teaching will be connected at all levels."*

Strengthening student employability

4.3.10 The employability of students is one of the critical challenges facing HEIs. The most recent CBI education and skills survey, undertaken in February 2011, shows that the critical factors considered by employers when recruiting graduates are their employability skills (82% of employers), followed by their choice of degree subject (68% of employers) and relevant work experience / industrial placements (67% of employers).

4.3.11 The HEIF2011-15 strategies show that many HEIs are thinking much more holistically about how they can better exploit the synergies between their KE activities and infrastructure (e.g. incubators and enterprise support) to support student employability and their teaching activities. To maximise the effectiveness of these reforms, they need to create a coordinated approach, ensuring that the different activities in which students are involved support and reinforce each other, and enhance their overall employability. This includes how the moves towards user-driven course content and the inclusion of entrepreneurship and enterprise training can integrate with extra-curricular activities, work experience and student clubs as well as thinking about opportunities for students to get involved with actual KE activities.

4.3.12 Table 4.3 summarises the frequency of incidence of different initiatives and mechanisms being used by HEIs to strengthen student employability.

Table 4.3 Mechanisms for strengthening student employability and enterprise (% HEIF2011-15 strategies)

	Total (% HEIs)
Provision of entrepreneurship / enterprise training	75
Expansion of 'real world' internships / work placements / volunteering opportunities	71
Funds/support for student enterprise	71
Incorporation of enterprise / employability skills into curriculum	51
More strategic approach to student enterprise and employability	39
Closer collaboration with key employers / employer engagement	37
Business plan competitions	24
Events / workshops / seminars targeting student employability and enterprise	24
Developing networks	21
Awards / recognition for students for enterprise / employability skills	21
Integration of units (e.g. Careers Services, Placements Services and Enterprise Skills)	12
Entrepreneurs in residence / Professors of Practice	11
Improve culture for student enterprise	6
Extra-curricular activities for students / student enterprise clubs	6
Internships / work experience within HEI	5
Other	7
No information provided	1
Total (%)	100

Source: HEIF2011-15 strategies, PACEC analysis

Raising awareness of the importance of student employability

4.3.13 For the investments being made into strengthening student employability and enterprise skills to meet the needs of the economy and society to be effective, students must themselves recognise these as important. A number of HEIs are explicit in their HEIF2011-15 strategies of the need to raise awareness of this. For example, the University of Hertfordshire plans to hold flagship events "*to kick-start each 'enterprise year', placing entrepreneurship firmly on students' radar"*.

4.3.14 HEIs are also seeking to raise awareness of the importance of student employability, enterprise and entrepreneurship skills through awards and report cards with 21% pursuing such initiatives. For example, Durham University has created the 'Durham Award' which has been "*developed in partnership with students and employers to recognise all the extra skills that Durham students have the opportunity to develop outside their academic work*"[15]). Another key development is the Higher Education Achievement Record (HEAR). The HEAR records student achievements moving well beyond the traditional degree classification system and transcripts, to include a much richer set of achievements including non-credit bearing extra-curricular activities, and any awards and prizes received.

4.3.15 Some HEIs are making very clear to students the key attributes, qualities and skills they expect them to develop to become a well-rounded and qualified 'Graduate'. For example, the University of Greenwich has created the "*'Greenwich Graduate Initiative' defines the characteristics that the University aims to instil into graduates of the University. These include attributes associated with creativity and enterprise: the*

[15] Durham University website: http://www.dur.ac.uk/careers/daward/, accessed on 7th January 2012

ability to recognise and create opportunities, to generate new ideas, to communicate effectively, and to make the most of opportunities available."

Dramatic expansion of student internships and work placement offers

4.3.16 'Real world' experience can help boost a student's employability skills while also helping them to build their industrial networks and job-specific knowledge. This will help them during the graduate job search process, particularly if they decide to enter a similar industry. Most HEIs are placing internships and work experience, including volunteering opportunities at the core of their efforts to increase employability. A few HEIs are going as far as seeking to guarantee placement / internship opportunities for all students, or, at least for large proportions of the student population. Others are seeking to expand these types of opportunities for as many students as possible.

Dramatic expansion plans for internships

"The University will … invest over £2M over the next 5 years in creating nearly 8,000 additional opportunities (i.e. beyond those provided by specific recruiters) for graduates and students to participate in a range of internship, work experience, mentoring and placement programmes. These programmes aim to offer students and graduates' experience of the workplace either during their studies or shortly afterwards, extending their knowledge and skills and enhancing future employment prospects."

University of Birmingham

4.3.17 Internships and work placements can be a good way for engaging with SMEs and many are indeed with such companies. They can provide a (relatively) low cost and low risk method for interacting with an HEI, with the SME receiving a potentially valuable short term resource to contribute to their organisation, in times when taking on permanent staff may be too costly and too high a risk. It also exposes them to the academic networks, as well as helping to better understand the benefits (and challenges) that derive from working with the HEI in other ways to support other innovation challenges. However, critical to this approach is focusing on long term relationship building and strengthening the dialogue between the SME and HEI during the duration of the internship.

4.3.18 A small number of HEIs have created work experience programmes within their own institutions in recognition that they are themselves large organisations which requires a range of functions to be performed to keep it running and to ensure it remains competitive. Importantly, HEI KE activity requires support and can provide unique work experience for a student exposing them to the important process of how the knowledge of an HEI is used in practice to support innovation activities within innovators. However, only a very few HEIs appear to be engaging students in this way.

Campus-based work experience

"Frontrunners, the University's unique, campus-based work placement scheme, provides an opportunity for students to undertake meaningful employment and develop the higher-level skills necessary to compete successfully in the global workplace. These opportunities have included placements in the University's Research and Enterprise Office where students are able to contribute to knowledge exchange activities (see examples of research impact) and be exposed to aspects of research commercialisation."

University of Essex

4.3.19 However, given that there is almost a wholesale demand amongst HEIs to expand their internship and work placement opportunities for students, and given the state of the economy as it attempts to recover from the deep recession, one needs to raise the question of whether employers and other organisations will be able to meet this demand. The CBI education and skills survey 2011 shows that 42% of employers are looking to expand their internship offer, while 30% do not have any plans to expand.

Engaging students in knowledge exchange

4.3.20 The rapid expansion in, and legitimisation of, KE activities in HEIs provides an increasing wealth of opportunities for students to get engaged under the guidance of academics and KE professionals. This may well provide a more cost effective method for engaging in certain types of KE, particularly where the financial barrier proves too high for the innovator. It also provides students with critically important employability skills, experience of applying their higher level knowledge to real world problems and deepen their industrial and wider networks. Depending on the nature of the KE engagement, it can also support the development of enterprise and entrepreneurship skills of the students. It may also help to reduce the time burden on academics – often the most frequently cited constraint – by providing a low-cost extra resource for the KE activity.

4.3.21 From the HEIF2011-15 strategies it does not appear that many HEIs are actively supporting this type of student engagement in KE (other than, perhaps, volunteering activities which is often a relatively widespread activity amongst students). The University of Oxford was one of a very few that emphasised the role that students can play in delivering KE with through The Student Consultancy (TSC). The TSC provides students with the opportunity to work in teams to address a strategic issue or business problem affecting local businesses or community organisations within a supervised environment in a mentored environment[16]. The Oxford HEIF2011-15 strategy notes that "*employers regard TSC graduates as having important employability skills;* [and] *many TSC students report that the TSC project forms a key part of most interviews. Both initiatives are supported by HEIF funding"*.

Supporting student enterprise

4.3.22 Support for student enterprise is also a prominent feature in most HEIF2011-15 strategies, with a wide range of initiatives being sustained, expanded or created.

[16] http://www.careers.ox.ac.uk/about-us/whats-on/learning-and-development-programmes/programmes-for-students/, accessed on 7th January 2012

Enterprise education and training – either within the curriculum or extra-curricular – is becoming widespread. The strategies provide a range of examples of this, with the best clearly demonstrating an integrated approach to student enterprise support, drawing on range of capabilities and infrastructure held by the HEI, and thinking about the synergies between encouraging students to engage in KE and their enterprise skills. Importantly, almost 30% of strategies discuss widening their employability, enterprise and entrepreneurship support activities to cover social enterprise activity.

4.3.23 Over the past decade, HEIs have been developing a wealth of infrastructure to support enterprise – historically targeted at academic staff – including incubators, innovation centres, commercialisation and enterprise support services etc. Many are now increasingly thinking about how these can add to the student experience and support their enterprise skills and endeavours. For example, the University of Oxford will exploit its Isis Software Incubator to teach and disseminate the theory and best practice of software entrepreneurship.

4.3.24 A popular tool to support student enterprise is the business plan competition (24% of HEIF2011-15 strategies discussed this), with a number modelled along the lines of the popular television programme, 'Dragons' Den'. Many are seeking to grow the funds available to support these types of competitions and other student enterprise activities. Durham University also emphasises this type of competition as a good way of demonstrating to students the viability of self-employment as an immediate career option. These competitions typically form part of a wider set of initiatives to support student enterprise often integrating with the enterprise training provided to students, as well as enterprise events, seminars, workshops, enterprise drop-in sessions, and mentoring programmes. HEIs are also increasingly complementing financial prizes with in-kind contributions such as space in their incubators and innovation support services.

4.3.25 A small number of HEIs are seeking to expand their competitions to include innovators in the wider community, including both locally and even internationally. This inevitably helps to build networks and relationships with innovators in the local community and around the world which could yield benefits for the HEI in the future in terms of new KE markets.

4.3.26 It is clear from the HEIF2011-15 strategies that student enterprise clubs also play an important role in supporting student enterprise. These clubs can often be the most popular on campus and are receiving increase support from HEIs. They often provide enterprise training, networking opportunities with entrepreneurs, mentors and other potential innovators as well as providing the support for raising finance for student start-up companies.

Growing student enterprise societies

"In addition to providing our students with academic skills suited to the world of work we are expanding our support of Student Enterprise at Surrey. During HEIF 5 an ambitious programme is being undertaken to expand the membership of the Student Enterprise Society and set this on a sustainable footing through external sponsorship from local companies and from commercial activities run by the students themselves. Such activities will include student consultancy as well as on campus service provision and support for setting up start up companies. The University will supply mentoring and advice as well as a not-for-profit company which will provide the necessary formal framework and governance structure. Members of the University's Surrey 100 Business Angel Club have already offered their support as well as experienced Alumni."

University of Surrey

4.3.27 Another important development – and one that would merit greater attention – is the introduction or expansion of Entrepreneurs in Residence schemes in a small number of HEIs. Based on the HEIF2011-15 strategies, just 8 HEIs had introduced, or planned to introduce, such as scheme. Such schemes often provide for a part-time position within the HEI for an entrepreneur who is typically expected to mentor both students and staff and provide advice on enterprise and entrepreneurship activities. They also bring with them extensive networks with key individuals who can provide specialist advice on particular aspects of the start-up process.

4.3.28 The HEIF2011-15 strategies also highlighted a range non-HE organisations that are providing support for student enterprise and entrepreneurship, including Students in Free Enterprise (SIFE) [17], Shell Livewire[18], Young Enterprise[19], and UnLtd[20]. These can often provide awards, mentoring, funding and in some cases, formal training programmes, guides and tools to support the engagement process.

Workforce development

4.3.29 The quality of the existing labour market is believed to be a critical driver of spatial competitiveness and industrial cluster formation. Critically, it reduces the search costs for talent as innovators seek to build their human capital and capabilities to innovate. In addition, talented individuals like to operate amongst similarly skilled people, providing significant network benefits and opportunities. A high quality labour market can therefore also act as a magnet for attracting new talent to an area.

4.3.30 HEIs are playing an increasing role in supporting workforce development. The scale of provision of continuing professional development (CPD) and other courses has increased rapidly over the past decade (Figure 2.7), although the growth has been more subdued during the economic recession. Through this type of activity, HEIs are helping to provide the skills needs required by employers and other organisations as they seek to innovate and compete, raising the overall quality of the labour market, locally as well as nationally. For example, the University of Bedfordshire is working with two local unitary authorities to deliver a new 'Higher Level Skills for Innovation and Growth' project.

[17] www.sife.org
[18] http://www.shell-livewire.org/about/
[19] http://www.young-enterprise.org.uk/programmes/higher_education/start-up_programme
[20] http://www.unltd.org.uk/

Addressing the regional and national skills gaps

"York recognises the importance of CPD as a key enabler in raising skills and increasing their transferability, and continues to invest through HEIF … The University, as an anchor of the regional knowledge economy, also has a role responding to the training needs of regional companies and will maintain and build programmes of local relevance, working where necessary with other providers. In addition, the sector-wide Training Gateway will help to address skills gaps across the UK and provide a clear point of access for private and public sector organisations through which to identify UK universities and colleges who can provide the training they need."

University of York

4.3.31 Almost half (47%) of the HEIs in receipt of HEIF2011-15 funding believed that their activities in support of skills development was one of their key areas of strength of their HEIF-supported KE portfolio, or that it would be a key focus of their strategies moving forwards. In addition, 43% of strategies talked about their skills and workforce development activity as mechanism for supporting the sub-national growth agenda. For those that are engaged with LEPs, their support was typically in the context of the emerging LEP strategy towards innovation and skills development.

4.3.32 HEIs can also play a particularly important role during economic downturns in helping the labour force re-skill when faced with unemployment. Some HEIs are seeking to build on the success of the initiatives created through HEFCE's Economic Challenge Investment Fund (ECIF), to design future KE support programmes for helping SMEs through the period of economic recovery.

4.3.33 A key aspect of their support for developing high quality labour markets is the increasing of flexibility for work-based learning. Some HEIs are working to improve the accessibility of their education services, both for employers and their employees seeking short courses that fit around their strategic and operational requirements, as well as for individuals seeking to enter higher education, including higher level apprenticeships. The University of Derby believes that "*there are opportunities in our KE model to provide progression routes for apprentices. Apprenticeships are a policy priority for the coalition Government and we expect to see growth in this market. It is important that the HE sector is able to meet the requirement for vocational routes into HE for this group of learners.*" However, they also recognise that a key challenge remains raising the awareness of employers regarding the range of flexible work based learning solutions that are on offer from HEIs and the potential benefits that can be realised from the higher level skills development of their workforce.

4.3.34 In addition to the skills development aspect of the provision of CPD, short courses and executive education, they can also play an important role in development networks and stimulating interactions between innovators.

Attracting talented people

4.3.35 In addition, HEIs themselves employ some of the brightest individuals in the economy who generate new, and adapt existing, knowledge, and diffuse it into the economy through their teaching and KE activities. They can play an important role in attracting

highly skilled individuals to the local area both to work within the HEI, adding to its research, teaching and KE activities, and increasing the economic and social impact. They also help attract talented individuals to work in local innovators and other organisations who themselves have located in the area because of the highly skilled labour market and/or because of the presence of the HEI. However, despite this important role, just two HEIs (both large research intensive HEIs) recognised this as an important role in supporting sub-national growth and innovation.

4.4 Providing and Strengthening Local Innovation Infrastructure

4.4.1 HEIs are often large providers of innovation infrastructure in the local innovation system. Incubators, science and technology parks, and innovation centres are all examples of this type of infrastructure. Approximately 60% of strategies discussed the introduction or expansion of innovation infrastructure to support the innovation process; 37% talked about developments to their innovation or enterprise centres; 35% to the provision of incubators; and 22% to science, technology or innovation parks. This infrastructure provides important bridging functions between local innovators and the knowledge base and can help to create a more fertile environment for innovation. The strategies suggest that HEIs are thinking more strategically about how to deploy this type of infrastructure to help them become more dynamic and integrated agents in the innovation process, strengthening their links into the innovation system. However, HEIs operate within a wider system of institutions and innovation support agencies and the infrastructure therefore needs to work within this framework, complementing other sources of support.

4.4.2 Innovation infrastructure plays an important coordination role in the innovation system through the bringing together of the many services necessary to support the innovation process and the development of the innovator (including legal, finance, business support, admin etc.). There is strong evidence from the HEIF2011-15 strategies that HEIs are collaborating both with each other, and with other key stakeholders in the local economy (e.g. councils, chambers of commerce, and business support agencies) to provide the necessary services and access to the full range of complementary capabilities thereby providing a more coordinated set of innovation infrastructure. For example, Staffordshire University, Keele University, Keele University Business and Science Park and North Staffordshire Chamber of Commerce have formed a legal strategic partnership – the Business & Innovation Group (BIG) – to manage their combined innovation infrastructure and provide access to their joint capabilities, providing a more coordinated set of support services for local high growth SMEs. Joint KE initiatives, funded by both HEIs' HEIF allocations will be developed to support BIG.

Developing coordinated and integrated innovation infrastructure

"The Development of our Innovation Platform through the Peninsula Growth Acceleration and Investment Network (GAIN) and our network of Innovation Centres in Cornwall:

GAIN is a partnership between Plymouth University, Plymouth City Council and Tamar Science Park, bringing together the hard and soft infrastructure required to underpin a healthy business ecosystem throughout the Peninsula. Connecting people, ideas and money it catalyses action to drive the creation, growth and acceleration of successful knowledge based business whether in existing or new firms. This platform including not just Tamar Science Park but also our three Innovation Centres in Cornwall, and our pre-incubation space on the Plymouth campus; enables us to connect the expertise of our researchers and educators with businesses, supply chains and investors for commercial benefit."

University of Plymouth

4.4.3 In addition, the effectiveness of the infrastructure requires attention to the design of both the hard infrastructure (i.e. the format and location of the buildings, types of complementary infrastructure such as IT etc.), and the softer infrastructure. The latter include the governance and organisational structures; the nature of the integration with the HEI and incentives available to create linkages with academics; the culture towards innovation, enterprise and KE nurtured within the infrastructure; and the nature of the support services available (legal, finance, business support etc.) and how these dovetail with the KE services on offer by the HEI such as enterprise training, CPD contract research, consultancy and networks. While only a few HEIs explicitly recognised the importance of this in their strategies (including Plymouth University, Cranfield University and Loughborough University), many others did so implicitly through discussions of the need to build stronger links with the HEI through the innovation infrastructure.

4.4.4 The innovation infrastructure is also typically a high profile, highly visible entity in the local economy and can provide an important focal point where innovators and HEIs can come together in the spirit of open innovation. It can also provide a window into the HEI helping to raise awareness amongst innovators who are not aware of the benefits of engaging with the HE knowledge base. As such, the infrastructure can play an important role in maximising the potential for interactions with local innovators.

4.4.5 The infrastructure typically brings together innovative, high growth organisations that can stimulate a more enterprising culture in the local economy, as well as help them build networks and reduce the search costs for knowledge, labour, finance and other key innovation inputs. However, very few strategies explicitly acknowledged their role in helping to strengthen the local culture towards enterprise, although many of the KE initiatives such as local CPD targeting enterprise and innovation development skills will have this effect as well as improving the support for the business formation and innovation process for local innovators.

4.4.6 The innovation infrastructure also exposes HEIs to the immediate innovation needs and challenges of innovators which can provide important insights into the key research gaps that need to be filled in the short-, medium- and long-term. It can also provide a test-bed for research ideas, helping to translate them into practical applications. This can help demonstrate the commercial viability of the research (as

the University of Newcastle is doing testing the viability of geothermal borehole technology at their new Science Central site). By facilitating this dialogue between innovators and academics in a fertile environment that provides the necessary innovation support services, it is hoped that this prove attractive to further inward investment to the area, as well as bringing in additional academic expertise and new firms, facilitating the development of clusters.

Innovation infrastructure as an anchor for inward investment and cluster development

"Coventry University (in partnership with Coventry City Council) has officially been awarded 'Living Lab' status by the Brussels-based European Network of Living Labs (ENoLL). Membership of ENoLL will see the University's Technology Park become a real-life test and experimentation environment for low carbon innovations … It is anticipated that the Living Labs branding will help attract investment and partners from both the UK and abroad, potentially creating new jobs as companies seek to trial their eco-friendly concepts and products in a new and purpose-built environment… The plans represent a boost to Coventry's ambitions to become a genuine low carbon city by 2020, to grow and attract SMEs in this sector… The Living Lab status therefore provides an opportunity for Coventry University to significantly grow applied research activity and expertise – particularly in terms of Low Carbon Vehicles and Low Impact Buildings."

Coventry University

TSB Catapults

4.4.7 Over a quarter of HEIs discussed their willingness to lead, or become involved in some way with the TSB Catapults (Technology Innovation Centres). These have the potential to act as important bridging organisations within the innovation system, providing a link between the research base and the needs of innovators, and develop globally competitive expertise in key technology areas. Importantly, these HEIs are acting to align their research activities to the technology areas of the Catapults and the TSB and believe that their HEIF investments in KE capabilities create potentially important synergies.

4.5 Improving Access to Finance for Innovation

4.5.1 Easy access to finance is another important driver of spatial competitiveness, not least because of the role that it plays in supporting innovation and organisational growth. The HEIF2011-15 strategies provide examples of how HEIs are helping to improve access to this important resource for innovation.

4.5.2 Some are creating and managing funds to support innovation in their local economies, such as the University of Portsmouth. They worked closely with Solent LEP to develop a successful bid to the Regional Growth Fund. This will see the creation of a 'Dragon's Den' style finance package for local companies. Others are exploiting their networks with the investment community to provide a conduit for high growth businesses locating within their innovation infrastructure. Some HEIs have created formally business angel networks, while others seek to attract such investors to the area to support local innovation and business growth, creating more informal

networks of investors. Examples include the University of Nottingham, which is using its HEIF funding to unlock external investments in innovation, including through the Nottingham Angels Network, the University of Sheffield and the University of Surrey.

Improving access to finance

De Montfort University is "working with banks, financial institutions, investors and SMEs, new models for Research & Development (R&D) and subsequent downstream investment have been developed. HEIF will provide resources to test and implement these investment models. These models seek to remove risks and barriers to innovation investment for both the investor and the SME, whilst reducing dependence on public sector funding for applied university research."

De Montfort University

4.5.3 Many innovation-related government collaborative funding programmes – both UK and EU – require HEI partners. In becoming more willing and responsive innovation partners, they are improving the ability of innovators to access such funding. They also often have more experience in making applications to such bodies for funding than small companies and can bring this to bear during the bidding process to help improve the chance of success.

4.6 Driving Exports

4.6.1 One of the central priorities for the current government is to raise economic growth to aid the UK's recovery from the recent severe economic downturn. To achieve this, there is a growing emphasis on rebalancing the economy and fostering export-led growth. Exports contribute to economic growth through increasing aggregate demand and enable innovators to achieve levels of growth not otherwise attainable if limited to domestic markets alone. Innovation and non-price competition are central for the UK to successfully compete in global value chains and raise its exports. Increasing export activity is therefore seen to be more important than ever with particular pressures to increase such activity in SMEs (BIS, 2011c).

4.6.2 HEIs, through their research, education and KE activities help to drive innovation in the UK, supporting innovators in developing the goods and services that are demanded by overseas markets and that are required to compete in global value chains. However, HEIs are themselves increasingly exporting their KE (and education) services into key overseas markets such as China, India, Brazil, and the United States of America (USA), becoming exporters in their own right. Given the difficult economic conditions in the UK, many are planning to increase their diversification into key growth markets.

4.6.3 Through this increased exporting activity as well as the increasing number of collaborations with HE-partners in key overseas markets, HEIs are developing a wealth of experience in operating in these markets. In addition, as the scale of activity overseas grows, so does their international reputation and branding. Smaller firms can often lack the reputation to easily access key export markets and can also lack the experience of doing so. By partnering with HEIs, they can overcome some of

these binding constraints. To support this process, some HEIs are working with UK Trade & Investment. For example, the University of Portsmouth is working with local stakeholders, UKTI and the British Council "*equip UK business, particularly SMEs, with the expertise and knowledge to compete in global markets, through the development of university-led international collaborations under the umbrella of 'Made for India and China'*".

4.6.4 Many HEIs also have formed relationships with innovators who are deeply embedded in global value chains, either located in the UK, or overseas. Through this they develop important networks in key export markets. Where appropriate, HEIs can facilitate introductions to these networks to local innovators to improve access to these important markets.

4.6.5 In some cases, HEIs are designing the global objectives of their KE strategies to build on investments made by other innovation and research funders, such as the £12 million allocated by Research Councils in 2009 to building 'Science Bridges' – collaborations between British universities and institutions in the key markets of China, India and the US. These collaborations with overseas HEIs and other institutions provide key routes into these markets allowing HEIs to develop new opportunities for their KE and other services.

4.7 Attracting Inward Investment

4.7.1 As the innovation value chain becomes increasingly open, with knowledge being sourced from a range of external organisations, and geographically distributed around the world, the global competitiveness of firms is partly driven by their ability to access global knowledge networks and value chains, and the latest technological advances wherever they may originate. Inward investment can bring new knowledge, processes, organisational and management practices into the economy, as well as creating improved links into the global innovation system through which knowledge and technologies can flow (BIS, 2011c).

4.7.2 The strength of the underlying innovation conditions of a place is thought to play an important role in influencing the location of inward investment. As evidenced throughout this chapter, HEIs play a very important role in creating and strengthening all of these conditions, and through this set of mechanisms play a critical role – alongside other organisations in the innovation system – in attracting inward investment.

4.7.3 A distinctive contribution that HEIs make to attracting inward investment is by providing the opportunity for innovators to locate near to where knowledge is being generated. This facilitates the flow of tacit knowledge, and the development of a stronger relationship between the knowledge provider and user. This can occur both through the creating of embedded laboratories or by establishing facilities on campus technology or science parks.

4.7.4 The growing insertion of HEIs into global networks of innovators through their KE activities, and into key overseas markets through their collaborations with HEIs around the world, they act as ambassadors for the local economy in which they are embedded and can facilitate the overseas firm's entry into the UK. For example, the University of Portsmouth is "*working with business leaders to develop a new local inward partnership focused on the creation of 'Soft Landing Zones', to support inward investment in South Hampshire.*"

4.7.5 In attracting inward investment, HEIs often work in collaboration with local partners (e.g. LEPs and other economic development partners) in order to maximise the quality of the 'local offer' to overseas investment, and minimising any conflicts between different stakeholders in the innovation system.

4.7.6 A number of HEIF2011-15 strategies also noted the scale of inward investments being made into the UK to support research within their institutions as well as the commercialisation of IP. For example, Imperial College London received £63.2 research million from non-UK sources in 2009/10, while University of the Arts London has formed as partnership with Method Inc., a US digital design and service agency, to create a joint venture, Method Design Lab, to exploit student IP. This venture has attracted significant inward investment, leading to the launch of a £20 million investment fund.

4.8 Reconciling Local and National Policy to Support Innovation

4.8.1 HEIs, as large, stable employers are anchored firmly in their local economies and communities. They are often heavily involved in the shaping the local policy framework and typically have strong relationships with the local leadership in both the public and private sectors. However, they are also embedded within the national innovation system, supporting innovators at all spatial levels – local, regional, national, and often globally – and are influenced strongly by the range of national policies and innovation support agencies such as the TSB. They also receive much of their funding from central government and other national agencies. As such, they are one of the few agents in the innovation system to operate at the interface between the local and national policy sphere. This may require the reconciliation of potentially competing pressures to support the competitiveness of their specific local economies, while contributing to the overall competitiveness of the UK.

4.9 Improving Quality of Life and Supporting Community Development

4.9.1 A final, yet nevertheless important, spatial condition where HEIs have a potentially large impact is the quality of the local area and the quality of life of local residents. In addition to the social benefits of HEI engagement in communities – including, for example, more vibrant cultures, active arts and cultural programmes, improved

decision-making ability of citizens through better understanding of issues, raised aspirations, and improved safety of regenerated areas – there is also likely to be a significant degree of dynamic interplay between the community impacts of a university and the economic development of the region. Thriving, multi-cultural societies with well-educated and aspirational young people are likely to foster growth and development better than more deprived societies, whilst also making local areas attractive places to live and work, increasing the spatial competitiveness of the area, attracting businesses, and further stimulating growth.

4.9.2 HEIs, through their public engagement and community regeneration and development activities are heavily active in this type of activity, with two thirds of HEIF2011-15 strategies including, unprompted, an explicit discussion on this topic. To signify its importance for many HEIs, 41% have key aims and objectives for supporting social and cultural development.

4.9.3 The public engagement activities supported by HEIs are diverse including, among other things, student and staff volunteering, provision of cultural exhibitions and events, public lectures, working with schools to help raise education aspirations of children, and working to address community deprivation.

4.9.4 The HEIF2011-15 strategies provide examples of these diverse activities and, importantly, how they can also support key objectives such as student employability and increasing research impacts.

Enriching the local area through public engagement

4.9.5 Most HEIs host events of some kind for the wider public. Indeed, in 2009/10, HEIs attracted 7.6 million attendees to free events, and 1.85 million to chargeable events[21]. Over a fifth of strategies highlighted examples of these including hosting cultural events, art exhibitions, theatre productions and concerts providing avenues for students to explore their talents in these areas while providing cultural enrichment for the public. Some – particularly the arts-based institutions – are involved in audience development activities, working to innovate in the way audiences interact with the productions.

Strengthening student employability through volunteering

4.9.6 The HEIF2011-15 strategies also highlighted how public engagement activities can dovetail with the student employability agenda. Volunteering is often widespread within the student (and staff) populations of HEIs. In addition to the potentially important impacts it can have on local communities, such activities can provide employability skills to the students (see earlier discussion on student employability). It is thought that a significant amount of volunteering takes place informally, outside the structures of the HEI.

[21] HEBCI survey 2009/10, covering public lectures, performance arts, exhibitions, and museum education, but excluding 'other events.

Supporting regeneration and social development of local areas

4.9.7 The public engagement activities of HEIs also play an important role in supporting physical regeneration of local communities. One important manifestation of this arises from the fact that HEIs are major institutions with large local footprints. Any developments or expansions can have potentially large impacts on local communities. Some HEIF2011-15 strategies emphasise their commitment to two-way engagement and consultations with communities over developments. This can help to diffuse tensions over major developments by empowering local communities to have a say in the direction of travel, and can help to build more trusting relationships between the two parties. Other HEIs are strongly involved with their local authorities in developing 'University Quarter' education regeneration programmes (e.g. Staffordshire University) which "*anchors* [Staffordshire] *University in the economic, social and cultural fabric of our local community, both in terms of the knowledge base offer and skills provision*."

4.9.8 HEIs are also active in helping to raise the educational aspirations in their local communities, with many working closely with local schools and communities as well as increasing efforts to bring the public onto campus. A number of HEIs – across a wide range of HEI types – also lead, or are heavily involved in the production of local 'festivals' with many focusing on bring science closer to the public. Others, although fewer, target arts, humanities and social science disciplines (e.g. the Festival of Ideas in Cambridge).

Strengthening the social and cultural impacts of research

4.9.9 Many HEIs talked about the impact of their research in their strategies not just in economic terms, but also in terms of the social and cultural benefits it brings. Almost a quarter of the strategies discussed efforts HEIs are making to disseminate their research and knowledge to wider, public audiences. This includes through the use of non-traditional media such as blogs and wikis, in addition to the more traditional broadcast media activities. Similarly, café-style events where academics host the public in more informal settings to discuss topical issues also appear to be becoming more popular and help to improve the public's understanding of key issues. They also help to build relationships and dialogues with the HEIs. Public lectures are also common amongst HEIs and can provide important venues to bring the public onto campus and disseminate knowledge to a wider audience.

Improving public understanding and widening the impact of research

"Furthermore, as an institution we will continue to pursue cultural and intellectual outreach to our local and regional communities to share the joy of learning and of intellectual enquiry. We will continue to support performance art, representational art and pure forms of intellectual discourse – our 'Philosophy Café' has attracted a diverse audience from our local area. Such cost-effective and imaginative activities can demystify HE and provide effective KE in various disciplines in novel ways."

University of Essex

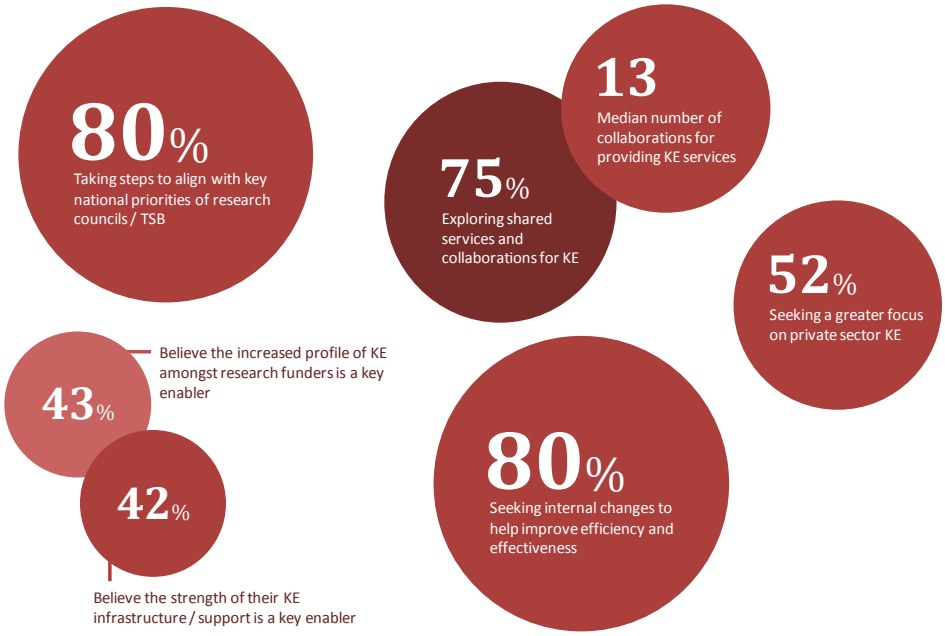
4.9.10 There have been a number of national efforts to encourage increased engagement of the public in research, not least through the Research Councils 'Concordat for Engaging the Public with Research'. The Concordat is helping to define the responsibilities of research funders, research managers and researchers, with respect to public engagement, and help embed this type of activity within HEIs. In addition, the National Coordinating Centre for Public Engagement (NCCPE) is also active in helping to support this type of activity. 12% of strategies discussed their support for the NCCPE, with 11% emphasising their commitment, or willingness to commit) to the Concordat. This includes large, research intensive institutions such the University of Oxford, Imperial College London and the University of Liverpool.

4.10 Summary of Key Findings

4.10.1 HEIs play a critical role in enhancing the underlying innovation conditions of place that help to drive the competitiveness of local economies. Key developments include:

- A very large, and growing, emphasis on enhancing student employability and enterprise partly in response to the changes to the student fee regime as well as the ongoing difficulties in the graduate job market. A core focus is an expansion of the provision of work experience opportunities. However, HEIs may find it difficult to realise their desired growth. Entrepreneurship and enterprise education is also becoming much more widespread;
- Approximately a third of HEIs are also active in supporting the emerging Local Enterprise Partnerships, often at the board level. While many are uncertain of the role that LEPs will play, others see this an opportunity to place their HEIs at the heart of the local growth and innovation strategies;
- 60% highlight the significant innovation infrastructure they provide for their local economies. This can act a highly visible point of entry into the wider HEI as well bringing together the various innovation support services. Thought needs to be given to the design of both the hard and soft infrastructure and how it integrates with the wider capabilities available;
- HEIs are playing an increasing role in supporting exports in the UK. They contribute through the research, education and KE that directly supports the development of goods and services demanded by key export markets. They are also increasingly becoming exporters themselves, providing KE services to key overseas markets. A small but growing number appear to be using their experience and presence in key export markets to provide a route to market for local SMEs.

5 Strategic Response of HEIs: A Process of Learning and Adaptation



Key findings on the strategic response of HEIs in adapting and developing their knowledge exchange activities over the period 2011-15
(Number in bubbles is the % HEIF2011-15 strategies citing the development with the exception of the number of collaboration which refers to the median number per HEI)

5.1.1 The previous chapters have built up a very detailed framework for understanding the many and varied contributions HEIs make to supporting innovation in the economy and society, both through the direct support they provide to the innovation process, and indirectly through helping to strengthen the innovation conditions of their local economies. In chapter 1 we also outlined a number of key 'seismic shifts' that are resulting in some fundamental changes in the underlying landscape for knowledge exchange and the overall incentive structure for HEIs. There has also been a much longer trend towards open innovation has been occurring in many sectors, providing greater opportunities for HEIs to become more active partners in the innovation process.

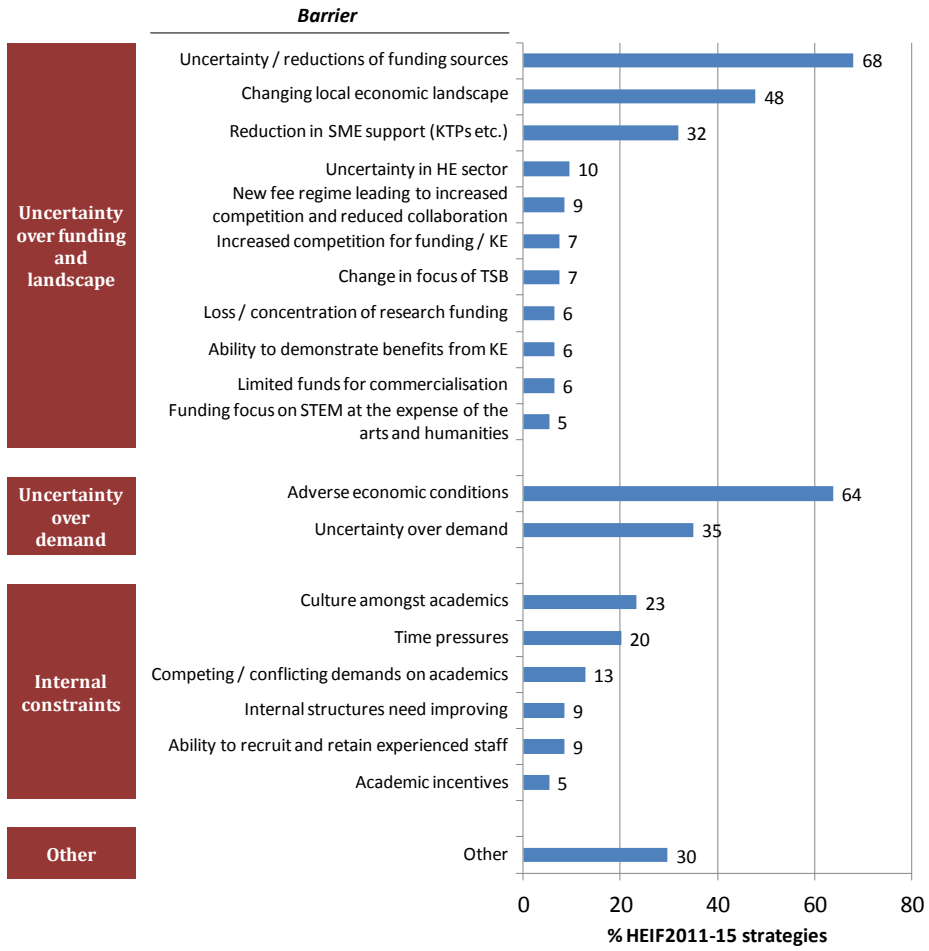
5.1.2 This chapter now turns to the strategic response of HEIs and the dynamic processes of learning and adaptation clearly at play. In designing their strategies they have the challenge of having to reconcile the changing external landscape with internal capabilities and values, strategic views and values of the leadership, and identify opportunities to meet unmet needs in the economy and society (whether knowledge-based, capability or capacity building or other). They have to act to mitigate key threats and barriers, and, importantly, adjust for any legacies and experiences of what does, or does not, work within their context. Before discussing the specifics of the strategic response of HEIs, it is therefore useful to understand the barriers that they believe may hinder their ability to achieve their strategic objectives. Their strategies reflect, in part, a need to mitigate these constraints.

5.2 Expected Barriers to Knowledge Exchange 2011-15

5.2.1 The current and expected barriers that are shaping the design of the HEIF2011-15 strategies broadly fall into four key categories (Figure 5.11):

- Uncertainty in HE landscape and adverse funding regime for KE
- Uncertainty over demand for knowledge exchange
- Lingering resistance to KE and other internal constraints

Figure 5.11 Expected barriers to knowledge exchange strategies 2011-15 (% HEIF2011-15 strategies)



Source: HEIF2011-15 strategies, PACEC analysis

Uncertainty in HE landscape and adverse funding regime for KE

5.2.2 The introduction highlighted some major systemic shocks to the higher education and knowledge exchange landscape as well as some large reductions in funding to some HEIs for KE. Reflecting these changes, 68% of HEIF2011-15 strategies believed that this uncertainty over funding sources was an important constraining factor, while 48% believe that the changing economic landscape may hinder their KE activities. 32% cite the reductions in KE support while 10% think that the uncertainty in the HE sector will create barriers moving forward.

Uncertainty over demand for knowledge exchange

5.2.3 Almost two-thirds of HEIs are worried about the adverse economic conditions affecting their ability to meet their strategic objectives. 35% are specifically concerned that demand may not sufficiently materialise to meet the desired supply of KE over 2011-15. Given market uncertainties and the time it takes to cultivate new types of clients, HEIs will have to ensure that they are as flexible as possible to adapt to new opportunities and maintain KE performance over the short to medium term.

5.2.4 There is also a major question about the extent to which the absorptive capacity of innovators is constraining the engagement process and, if it is, at which points are their specific difficulties. Unless the absorptive capacity issues on the demand side are addressed, HEIs will always struggle to meet their growth and impact ambitions.

Lingering resistance to KE and other internal constraints

5.2.5 After a decade of investment in culture change amongst academics helping to raise participation in KE, HEIs have made substantial progress, with KE now perceived to be a legitimate activity for large parts of the academic population (PACEC/CBR, 2009). Indeed, some HEIs are now aiming for upwards of 90% of academics to be 'KE-engaged'. However, there is still some lingering resistance amongst a few academics. It is likely that many of the 'willing engagers' will now be participating, and converting the 'marginal' academic may become harder, though the incentives in play, notably the research impact agenda, may play a part here.

5.2.6 The conversion of these remaining academics will not be made any easier by the belief by some HEIs that both the REF and the introduction of student fees will divert attention of academics away from KE towards research and teaching activities. However, with the major changes to the REF, academics are going to have to think hard about how they can achieve impact with their research. There are also concerns that the introduction of student fees will mean that academics have to divert time away from potential KE engagement to enhance their teaching duties.

5.2.7 A small number of HEIs also cite other internal constraints including the continued need to improve internal structures (9% of HEIs) and the ability to recruit and retain appropriately experienced KE staff. The latter is particularly the case where funding cuts have led to redundancies with consequent implications on staff morale.

5.3 A Strategic Role for Knowledge Exchange

5.3.1 The scale, speed and depth of the challenges facing the system and the barriers that HEIs face in driving forward KE, have led to an urgent need for adaptation amongst HEIs. The HEIF2011-15 strategies demonstrate clearly that HEIs are not static institutions but rather, are dynamic and responsive organisations seeking to reconcile and balance the need for change to exploit the new opportunities afforded to them in the new system, with sustaining important core competencies and sources of competitive advantage built up over long periods of time.

Strategies are becoming more holistic, exploiting synergies between research, teaching and KE

5.3.2 The HEIF4 strategies of 2008-2011 found that 79% of HEIs were taking steps to integrate their KE strategies with their research and teaching missions. The HEIF2011-15 strategies take this one step further. It is clear that HEIs are taking a much more holistic approach to KE than in previous years, thinking strategically about how to best exploit the synergies with research and teaching. 58% of strategies seek to do so, while almost half have as a strategic aim to increase the impacts of research and teaching through KE. This cements the move of knowledge exchange from being seen as a 'bolt-on' activity to one which is core, closely integrated with, and enhancing, the research and teaching activities of an HEI, and increasing the overall impact of the institution.

5.3.3 Reflecting this development are the steps being taken by many HEIs (almost 60%) to integrate key support structures within HEIs to provide more streamlined support to academics, particularly combining research and KE support offices. These changes are being driven in part by the research impact agenda, as well as to exploit the synergies between KE and research. These requirements are also seeing new structures being put into place to systematically build impact assessment into the research proposal process (41% of strategies). In some HEIs, KE professionals are becoming closely involved with academics, providing their expertise on developing the pathways to impact requirement for research proposals and helping to prepare impact case studies. There are some claims that this has a positive spillover effect in helping to raise the profile and status of the KE professional amongst academics and build a significantly improved working relationship.

Integrating support for KE with research

"A key component of our KE Strategy … is a programme of activity to develop within the academic community a consciousness of the need fully to build pathways to impact into research proposals. This should not simply be a component bolted onto a grant application but integral to the whole programme. This requires development of multi-level links with business and community organisations that inform the content and framing of research proposals rather than looking to exploit outputs. Integration of the technology transfer and the business relationship management within the Business and Innovation Services unit has the objective of closing this cycle into a virtuous circle in which commercialisation of research outputs informs new proposals."

Durham University

5.3.4 Some HEIs are also exploiting the need to produce impact case studies to help identify, and market, opportunities for KE. These impact case studies can help identify routes to market that were successful, what the pitfalls were, understanding of key user groups and their needs, and how the activities of the HEI helped users to meet these needs. They can also be used to raise awareness amongst potential users of the benefits of engaging with HEIs.

5.3.5 HEIs also continue to work to raise the profile of KE amongst academics in attempts to increase the number engaging with users, not only to develop pathways to impact for their research, but also to strengthen their understanding of the needs of users in

order to inform, as appropriate, their research agenda. As mentioned earlier, there is still some lingering resistance and cultural aversion amongst some academics towards KE engagement. The requirements of the REF and RCUK pathways to impact may well provide the stronger incentives necessary to capture these academics, complementing the existing investments and changes to academic incentive for KE facilitated through HEIF.

The impact of the REF and Pathways to Impact on the KE debate

"The inclusion of impact within the REF and RCUK's Pathway to Impact continues to successfully raise the profile of impact across the university. Whilst the university has a long tradition of undertaking research with hugely relevant real world applications, the impact requirements have raised the level of debate and the bar, with substantial positive effects, including empowered and productive discussions between KE staff and researchers about useful applications of the research and potential commercialisation avenues."

University of Southampton

5.3.6 Just over a fifth of HEIs – including many large research intensive HEIs – are continuing to support or are expanding their 'KE Champions' initiatives – typically academics or researchers who have experience in KE – to help build academic participation and support continued culture change where resistance to KE still lingers. In many cases, the remits of these individuals is being expanded to become 'Impact Champions' supporting academics as they prepare research proposals as well as case studies for the upcoming REF.

5.3.7 There also appears to be much greater strategic thinking about how the KE activities and support infrastructure can be deployed to enhance the student experience and employability and enterprise skills (see discussion in previous chapter for details on how they are doing this).

Strategies are increasingly focusing on building user dialogue and relationships

5.3.8 Chapter 3 showed that more and more HEIs are moving towards developing strategic partnership and building long-term relationships rather than maximising single transactions. While this is still in its infancy for many HEIs, it does signal a critical, underlying shift compared to 2008 when just a few HEIs appeared to thinking in this way.

Working with industry to develop a holistic KE strategy

"We are moving to a model of co-investment or co-creation with industry where we share the costs of research and increasingly share IP, networks and know how. This holistic approach to KE, emphasizing the co-creation of knowledge and the various routes of knowledge exchange has been trialled during the latter years of HEIF 4. It has already proved successful in building long-term strategic partnerships with some industrial partners, evidenced by exchange of staff and students, open innovation platforms, company-owned infrastructure and resources in the University and extensive high level dialogue between university and industry management to align strategic objectives and deepen partnership for mutual benefit."

University of Exeter

5.4 Diversification and Internationalisation

5.4.1 The HEIF2011-15 strategies underline some fundamental shifts in the targeted users and markets for KE over the coming period compared with 2008-11. Firstly, there is a clear desire (by at least 53% of strategies covering HEIs of all types) to increase their efforts in developing KE with the private sector, partly reflecting signs that public sector markets have or will soon dwindle, as well as the larger economic growth agenda. A greater focus on reaching out to develop KE links with the private sector may well support a private sector, and innovation led recovery, with HEIs acting as more responsive and engaged innovation partners. Recessions can often lead to an initial retrenchment of private sector spending on innovation and R&D as they seek to cut costs and determine ways to reallocate resources to survive the turmoil. However, when the recovery begins, they may have lost the necessary capabilities and have to engage with external partners to meet their innovation requirements. Others may see the outsourcing as a method for sustaining their innovation activities even through the recession. Both of these trends provide opportunities for HEIs to build their private sector work. However, whether additional demand from the private sector will meet the scale of the desired increases in supply remains to be seen.

Economic uncertainty can drive demand for KE

"Continuing economic uncertainty is growing the demand for collaboration and precompetitive 'open-innovation', offering the prospect of increased investment in our strategic-level KE activities from the private sector."

Cranfield University

5.4.2 This trend is also driven by attempts of HEIs to reduce their reliance on public funding sources by focusing on other income generating activities such as CPD, contract and collaborative research and consultancy, as well as from technology transfer. Some are focusing their HEIF investments on those that have the potential to become financially self sustainable requiring some income generation to cover costs.

5.4.3 In a few cases, HEIs are taking advantage of the gaps caused by reductions in some public services and stepping in to provide, for example those support services previously provided by Business Link.

5.4.4 HEIs are also making greater efforts to internationalise their KE activities with key markets including the US, China, India and Brazil reflecting the key uncertainties surrounding the strength of likely demand for KE and the adverse economic conditions in the UK (as discussed earlier in this report).

Internationalisation of knowledge exchange

"Given the economic environment, it is now more important for the College to develop geographic diversity within its portfolio of industrial partnerships. … [W]e will extend our corporate partnership support by investing in a pilot international scheme with a view to furthering our understanding of the international market. Initially targeting the North American region, the aim is to establish a local presence, foster relationships with key corporate decision makers in high-value technology companies".

Imperial College London

5.4.5 Similarly, over a quarter of HEIs emphasise a desire to increase their efforts in securing greater European funding through the ongoing ERDF programmes as well as through the upcoming Horizon 2020 programme. Horizon 2020 is the European Union's new €80 billion programme for research and innovation running from 2014 – 2020. A key focus of the programme is to bridge the gap between research and the market. In response to the potential opportunities in Europe, there are efforts being made by some to improve the support provided to the application process and exploiting HEIF funding to act as match funding where necessary (particularly for the ERDF funds). HEIs are coming together – often reflecting the old regional boundaries – to access ERDF funds and provide support for regional businesses.

Alignment of knowledge exchange with national priorities

5.4.6 Another key development in the direction of HEIF2011-15 strategies is the effort of around 80% of HEIs to align themselves to the priorities of key national innovation funder agencies such as the Research Councils and the TSB in order to raise the likelihood of securing new streams of funding. 20% explicitly talk about the desire to align their activities to key TSB priorities.

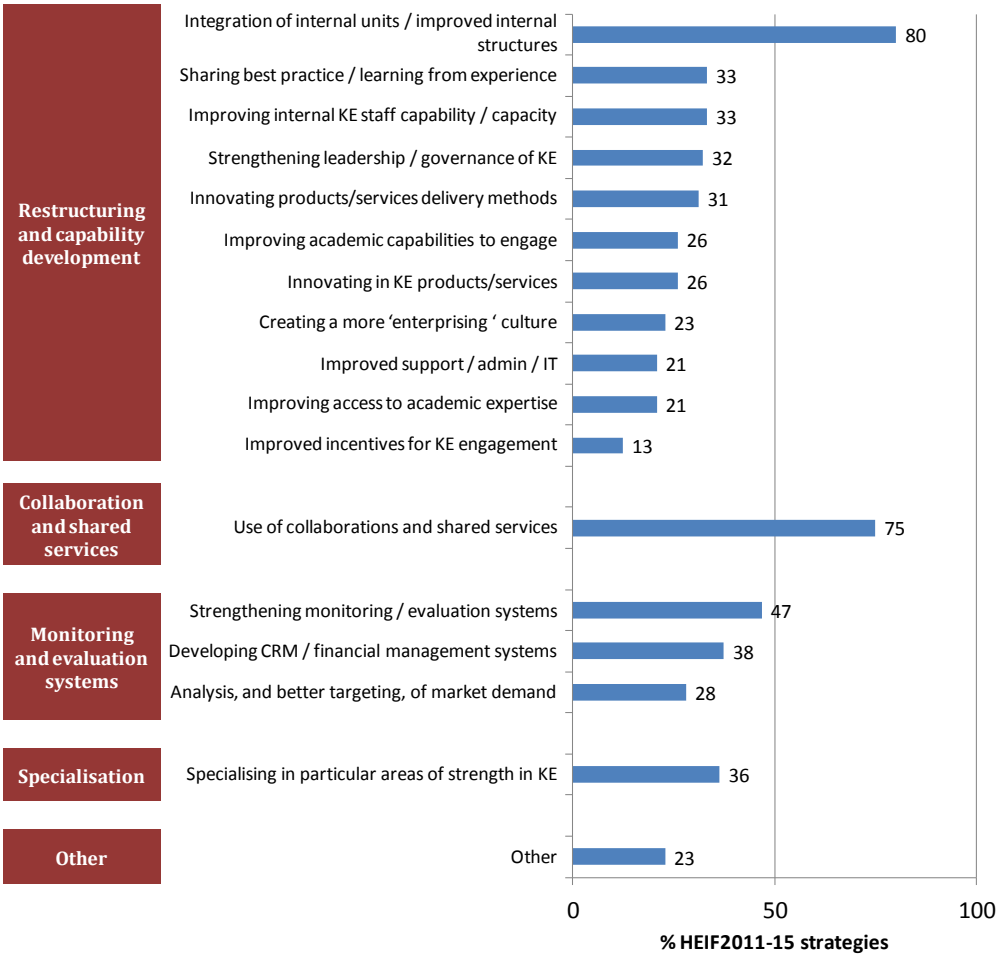
5.4.7 This alignment process is largely the result of the reaction of HEIs to the research funding made available within the key research themes set by these national bodies. Given the scale of funding channelled through the Research Councils, TSB and other major research funders, these bodies assume a hugely significant coordination role in innovation system. The way in which they distribute the funding (areas of research, types of programmes etc.) provide important signals to HEIs on the types of research expertise and KE capabilities that should be developed. They therefore help to mediate between current and future industrial and societal needs in the short, medium and long terms, and the existing and potential capabilities of the research base to meet these needs. A failure to do so will result in the reduction in the return on the research investments being made, and innovators will be forced to turn to overseas knowledge providers.

5.4.8 While this alignment will likely work well for some HEIs, it could potentially prove a risky strategy for others. Competition for funding will become more intense and there are signs that it will be increasingly concentrated in centres of excellence. Realistic assessments of internal capabilities, how they compare to key competitors, and hence the likelihood of securing the funding, will be therefore become critical to ensuring that this type of strategy succeeds.

5.5 Raising the Efficiency and Effectiveness of Knowledge Exchange

5.5.1 The changes in HEIF and RDA funding make improving the efficiency and effectiveness of KE (and other activities within the HEI) critically important to ensure value for money in the use of their investments.

Figure 5.12 Mechanisms for improving efficiency and effectiveness of KE



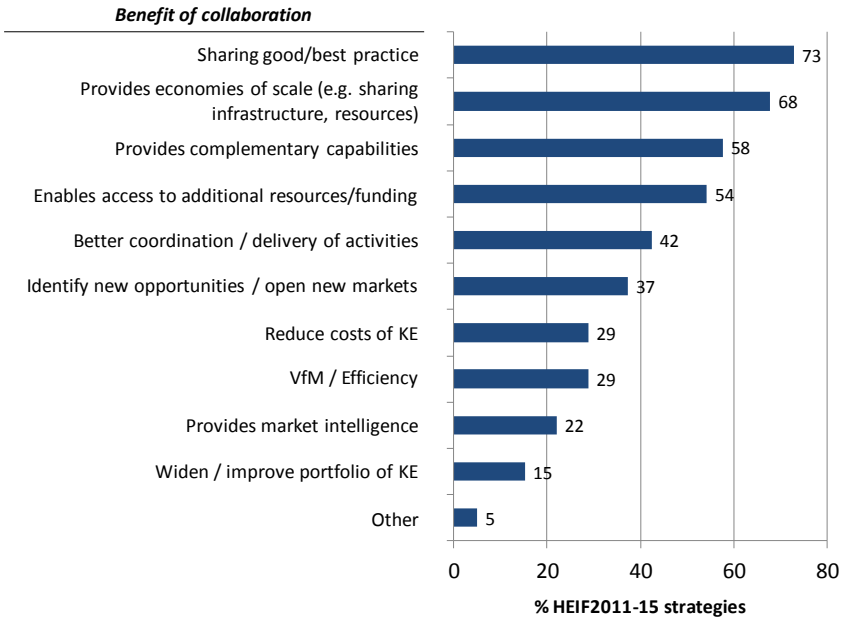
Source: PACEC

5.5.2 In part, as mentioned earlier, this is driving greater integration of the different activities of HEIs to exploit the synergies and the potential for streamlining and sharing support. As HEIs develop their strategic response, a number of types of measures to improve the efficiency and effectiveness have emerged (Figure 5.12).

Collaboration and shared services in an era of constrained budgets

5.5.3 English HEIs have a median of 13 collaborations with other UK-based HEIs to support the institutional or professional infrastructure for KE (i.e. not academic-based collaborations). This does not vary much by the different research intensity clusters of HEIs. Collaboration and sharing services was seen as an important method for improving efficiency and effectiveness by approximately three quarters of HEIs in receipt of HEIF2011-15 funding.

Figure 5.13 Perceived benefits of collaboration



Source: HEIF2011-15 strategies, PACEC analysis

5.5.4 The strategies also provided some insights into the types of benefits that collaborating and shared services bring (Figure 5.13). Most frequently cited was the sharing of good practice and experiences between the different partners. Just over two-thirds also believed that it provided important economies of scale through, for example, the sharing of infrastructure, management, or other resources. 58% believed it allowed HEIs to access complementary capabilities, helping to provide a more complete service to academics, students or external users, with 42% highlighting the coordination benefits allowing them to provide a more targeted set of local or regional infrastructure. 37% discussed the role of collaborations in helping to open new markets and identifying new opportunities for KE that they were previously either unaware of or unable to access.

5.5.5 The UK Government recently announced the planned introduction of the EU VAT cost-sharing exemption in the Finance Bill 2012 (BIS, 2012). VAT costs hitherto arose if universities (and other charities) wanted to work together to find efficiency savings through shared services. The removal of this barrier should provide aid the development of increased collaboration and shared services to support the KE process.

Changing motivations driving collaboration and shared services

5.5.6 The reading of the HEIF2011-15 strategies suggests a change in the motivation behind the formation of collaborations. In the earlier rounds of HEIF, and indeed through the RDAs, HEIs were incentivised to collaborate through the requirements of funding programmes (e.g. HEIF3 included both a formulaic allocation and the availability of funding for large scale collaborative projects). HEIs came together in order to access funding, providing, in some cases, joint services for KE such as student enterprise training, business support and joint investment funds. However,

the suggested increased movement towards share services in the current round of HEIF2011-15, particularly for HEIs facing larger budget squeezes, appears to be driven out of necessity to attempt to maintain support services in spite of often large budget cuts.

Partnering to provide local and regional KE services

5.5.7 Despite the turbulence at the sub-national level, key collaborations are continuing, and indeed strengthening, bringing together geographically focused partnerships of HEIs in similar geographic areas of the nation. Key examples are N8, a grouping of the eight research intensive universities in the North of England; SETSquared, a grouping of five research intensive universities stretching across the South of England; Westfocus, a clustering of London-based HEIs; and Yorkshire Universities.

Collaborating to provide innovation and business support

SETsquared Partnership

SETsquared is a collaboration between the Universities of Bath, Bristol, Exeter, Southampton and Surrey. It provides specific support services for high-tech, high-growth, early-stage companies, and works with other business support providers to provide a comprehensive business support programme throughout southern England. It delivers specific initiatives and common HEIF-funded services, shares best practice, pools resources and communicates its work collectively. SETsquared has also developed strong international linkages and has successfully attracted domestic and foreign early-stage funding to university spin-outs. The HEIs involved all list it as one of their leading collaborative knowledge exchange activities.

5.5.8 These major collaborations all act to provide KE-related support for innovation, business growth and economic development in their defined (albeit often large) areas. They often involve the sharing of services, expertise and capabilities, resources, and importantly, good practice and experiences to help improve the effectiveness of their activities. In addition, they can provide scale to help access funds such as ERDF and provide a single point of access to a large number of HEIs, making it easier for SMEs to access the knowledge base. The latter is, of course, dependent on the ability of the access point to route the enquiries appropriately.

Internal restructuring and improving capabilities

5.5.9 The strategies also revealed a variety of steps being taken by HEIs to improve their internal structures and KE support provided to the engagement process. These focus on integrating and better coordinating their support infrastructure; improving the commercialisation process; investing and disinvesting in areas of strength; improving capabilities and strengthening the leadership of KE; and developing the KE portfolio. While many of the changes may have been driven by reactions to the large external shocks to system requiring a response, a third of HEIs highlighted the role that sharing best practice and learning from experience has played in helping them to improve the efficiency and effectiveness of the KE engagement process.

Restructuring the system of support infrastructure

5.5.10 Many HEIs are seeking to restructure and integrate infrastructure to provide more streamlined services as well as seek efficiency savings. This is particularly evident with research support and KE support where 58% of HEIs receiving HEIF2011-15 funding are integrating their research and KE support offices and systems. This has been driven in no large part by the research impact agenda driving the need to realise the synergies between the activities that are targeted at addressing users' innovation needs through KE, with the underpinning research. In addition, almost a quarter of HEIs are also taking steps to improve the coordination of their internal structures to help streamline the research and KE support services to academics.

Integration of research and knowledge exchange support offices

"A key move in preparing for the Research Excellence Framework was to integrate our research grant, knowledge transfer and enterprise teams within a single Business Unit to provide end-to-end support. Research leaders now benefit from advice on impact planning from the knowledge exchange point of view at the initial proposal stage. Each project can then be nurtured through the pre-contract, post-contract and outcome stages by a single integrated support unit."

University of Liverpool

5.5.11 Much less frequently, some HEIs are seeking to integrate their careers services with employability and internship support units to recognising the important synergies and feedback loops between these two important functions of student support. Some are also bringing their volunteering units within these types of structures.

Improving the commercialisation process

5.5.12 The HEIF2011-15 strategies underline an increase trend towards shared services to exploit IP between groups of HEIs or the complete outsourcing of IP-related commercialisation services. In the latter, some HEIs are outsourcing their requirements to other universities. For example, both Cranfield University and Aston University have outsourced their IP exploitation process to other universities (Imperial Innovations and Isis Innovation of Oxford respectively) arguing that this has led to efficiency and value for money gains. Other HEIs are outsourcing their IP exploitation requirements to private sector firms.

5.5.13 HEIs are also seeking to make improvements to their internal processes and systems, often following external reviews of their performance. These included the steps outlined in Chapter 3 to improve the visibility of, and access to, IP.

5.5.14 A number of large research-intensive HEIs are also active in helping to develop and disseminate best practice in the commercialisation process. Universities such as Oxford, Cambridge, UCL and Manchester benefit from significantly higher deal flows than most HEIs giving them a wealth of experience that others simply cannot realise. This has helped them developed a better understanding of what works. The University of Oxford appears to be particularly active in working with other HEIs – both around the UK and abroad – to improve their commercialisation processes and strategies, and helping to develop their technology transfer capabilities.

Other internal developments to support improvements in efficiency and effectiveness

5.5.15 HEIs are also following a range of other interventions to help improve the efficiency and effectiveness of the KE process. 33% of HEIF2011-15 strategies discuss their efforts to strengthen internal KE staff capabilities through, for example professional training programmes, internal CPD and other staff development activities, with 32% seeking to improve the leadership and governance of KE within their institutions. 26% are creating new or improved KE products and services to offer to potential users while 31% are innovating in the ways these are delivered. A third also share best practice and seek to learn from experiences both through reviews as well as through engaging with other HEIs through personal and professional networks. As KE matures, so do these networks which should facilitate the further diffusion of knowledge of good practice around the sector. A small number of HEIs are also seeking professional standards accreditation for their project management processes highlighting attempts by some to continue to professionalise KE engagement.

5.5.16 Finally, as has been discussed, research in both the UK and the US has shown that there still appears to be no agreed best practice in knowledge exchange (PACEC/CBR, 2010). Increasing the efficiency and effectiveness of the process is often a reflection of what has worked or not within the specific HEI combined with any shared experience and learning gained through the networks of KE professionals. To support this internal development process, the University of Oxford for example, has created the 'Oxford Research and Development (ORD) Project. The project will "*pilot a scheme in two science departments to seek further efficiencies, optimal support structures and best practice for offering facilities services*". Pilot projects can be a very good method for helping to improve understanding of what works within the specific context of the HEI, and allow relatively low cost and low risk opportunities for experimentation of different potential solutions before roll-out more widely.

Strengthening monitoring and evaluation systems

5.5.17 The strategies highlighted the development of improved management systems and monitoring systems with 47% providing evidence on their efforts to strengthen their monitoring systems; 38% are seeking to improve and develop their customer relationship management (CRM) and financial systems; and 28% are looking to improve the analysis and targeting of market demand.

5.5.18 As KE matures and the HE sector adjusts to the new landscape, so do the systems to manage, monitor and evaluate the process. The strategic decision by many HEIs to develop and nurture strategic partnerships with key users requires improved management of the relationships which, in turn, requires improved systems. More sophisticated management systems combined with market research and intelligence are being developed by some to help better target KE services to areas of high demand as well as facilitate the improved cross-selling of activities and nurture longer term relationships with users.

5.5.19 Similarly, the research impact agenda is driving HEIs to improve their evaluation measurement and impact capture systems to support the demonstration of impact and improve the support provided to academics. A number of HEIs are also seeking to expand their management systems to include both their research and knowledge exchange activities (e.g. the University of York).

5.5.20 In addition, the decrease for many of overall funding for KE (not just HEIF) prompted a greater discussion in their strategies on the need for increasing the monitoring of their HEIF investments and ensuring that they are delivering the desired performance and delivering value for money. Some are also revisiting how they distribute their funding internally to ensure value for money.

5.5.21 However, as in the HEIF4 strategies, the systems to evaluate impact of KE still appear to be less well developed. Much effort is going into developing the ability to capture evidence for the impact case studies in preparation for the submission to the upcoming REF. This may well lead to improved capacity to undertake wider evaluations of KE and the hope would be that this evidence feeds into future strategies as well as organisational and performance improvements.

Specialisation

5.5.22 Over a third of HEIs are also seeking to specialise in areas of strength, as well as taking steps to disinvest in those areas in which they are underperforming. This partly reflects a response to the reductions in the overall funding for KE resulting in a greater targeting of resources to key areas of known strength where success is more likely to be achieved. It also reflects, in part, the recognition that HEIs often compete with each other as well as with alternative, non-HE, providers. If they cannot develop and sustain a competitive advantage, then they need to be willing to adapt and refocus their activities, or take action to build their competitive position.

5.6 A Dynamic Process of Learning and Adaptation

5.6.1 Over the past decade, HEIs have had the opportunity to experiment with different initiatives and organisational models for KE (PACEC/CBR, 2009). This experimentation has been very important for improving the efficiency and effectiveness of KE, given that best practice does not yet exist for KE, and no one-size-fits-all model of engagement is likely to emerge.

5.6.2 The speed of the changes to the landscape required rapid responses by HEIs in order to sustain their competitive positions within the new institutional and economic environment. In responding, most HEIs are drawing primarily on their internal learning from experience, adapting their strategies and infrastructure systems based on what worked or did not to the new landscape. 70% claim that their strategies are building on lessons learned through experience, while 61% said that they are building on their previous HEIF4 strategy. 43% undertook some form of formal internal consultation or review of their KE activities. Just 36% claim to have benchmarked

themselves against others while 16% undertook some form of external independent review of KE (which usually includes benchmarking 'competitor' analyses). Relatively few HEIs talked about exploiting good practice in KE (e.g. through networks, literature or conferences) in the development of their strategies[22]. However, there was significantly more discussion of the sharing of good practice elsewhere in the strategies through collaborations and networks, particularly as a mechanism for improving the efficiency and effectiveness of the KE engagement process.

5.6.3 Over a third of HEIs (35%) claim to have interacted with users or commissioned or exploited market research to shape their strategies, and it is thought that this has increased since 2008, reflecting the increased moves towards strategies partnerships outlined above.

Chaotic versus orderly adaptation to change

5.6.4 Where internal adjustments have been driven by the more rapid shocks to KE funding of some HEIs, there is evidence of a somewhat chaotic reorganisation in some HEIs. For example, some HEIs are making fairly dramatic wholesale changes to their internal infrastructure systems, often driven by large-scale losses of funding and reacting to what may not have worked effectively in the past. In addition a number of HEIs are having to refocus their KE strategy to new types of users and sectors, reacting to the loss of major public sector clients.

5.6.5 However, where the changes to the landscape have been (even slightly) slower in emerging, the responses by HEIs appear to reflect more strategic reorganisations. They have inevitably had more time to develop their strategic response and internal systems to improve efficiency and effectiveness

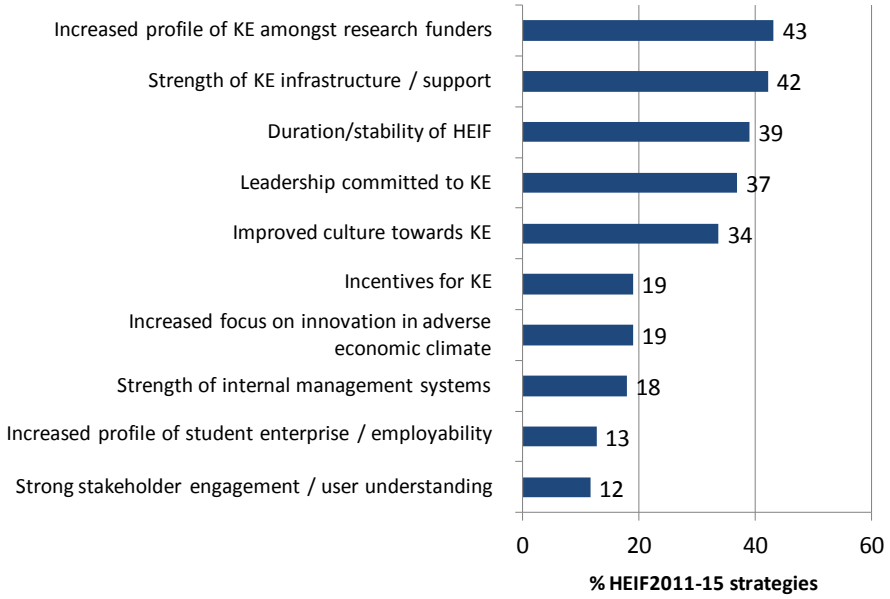
5.7 The Factors that will Facilitate Success

5.7.1 The changes to the overall incentive structure for HEIs governing research impacts and the student experience combined with the public sector changes for many HEIs are creating a unique set of conditions that could bring about a 'watershed' moment for KE as HEIs and academics are forced to demonstrate the impact of their research investments, deliver a greatly enhanced student experience and diversify their KE income. This confluence of conditions could result in a step-change in participation in KE amongst academics and the strategic positioning of KE to reinforce the research and teaching activities of HEIs and enable a much greater direct role for HEIs in supporting innovation in the economy and wider society. 43% of HEIF2011-15 strategies believed that the increased profile of KE amongst the research funders will be an important enabler of their KE strategies in the coming years (Figure 5.14).

[22] This echoes the findings of a survey undertaken by PACEC/CBR of 26 enterprise offices in 2010 that highlighted that much of the innovation in these offices was driven by internal learning, with the experiences of others exploited much less frequently. In part, this may reflects the importance of local contexts in shaping an effective strategy and the lack of widely accepted models of good practice.

5.7.2 Importantly, the ability for HEIs to realise this step-change has been critically enabled by the legacy of a decade-long, targeted investment programme in building the capacity and capability to engage with users through KE, including efforts to legitimise this type of activity. There has also been a significant maturing of our understanding of good practice in KE and the potential synergies with the other key activities of the HEI. Indeed, 42% argued that the strength of their KE infrastructure and support provided to academics will help them to meet their strategic objectives for KE. Much of this capacity and capability building has been enabled by HEIF funding and many HEIs see the duration and stability of the funding – in comparison to many other sources of funds – as an important enabling factor of success.

Figure 5.14 Top 10 enabling factors for the HEIF2011-15 strategies



Source: HEIF2011-15 strategies, PACEC analysis

5.7.3 HEIs also highlight a number of other key factors that will help drive the successful implementation of the HEIF2011-15 strategies. 37% believe that the commitments of their leadership to KE are important; and 34% believe that an improved culture towards KE is an important development that will help underpin success. Interestingly, despite the concerns that many HEIs have about whether demand will materialise, 19% believe that the adverse economic climate may well drive innovation activities that require external partners. HEIs should be, and many are, positioning themselves to respond to such opportunities.

5.8 Summary of Key Findings

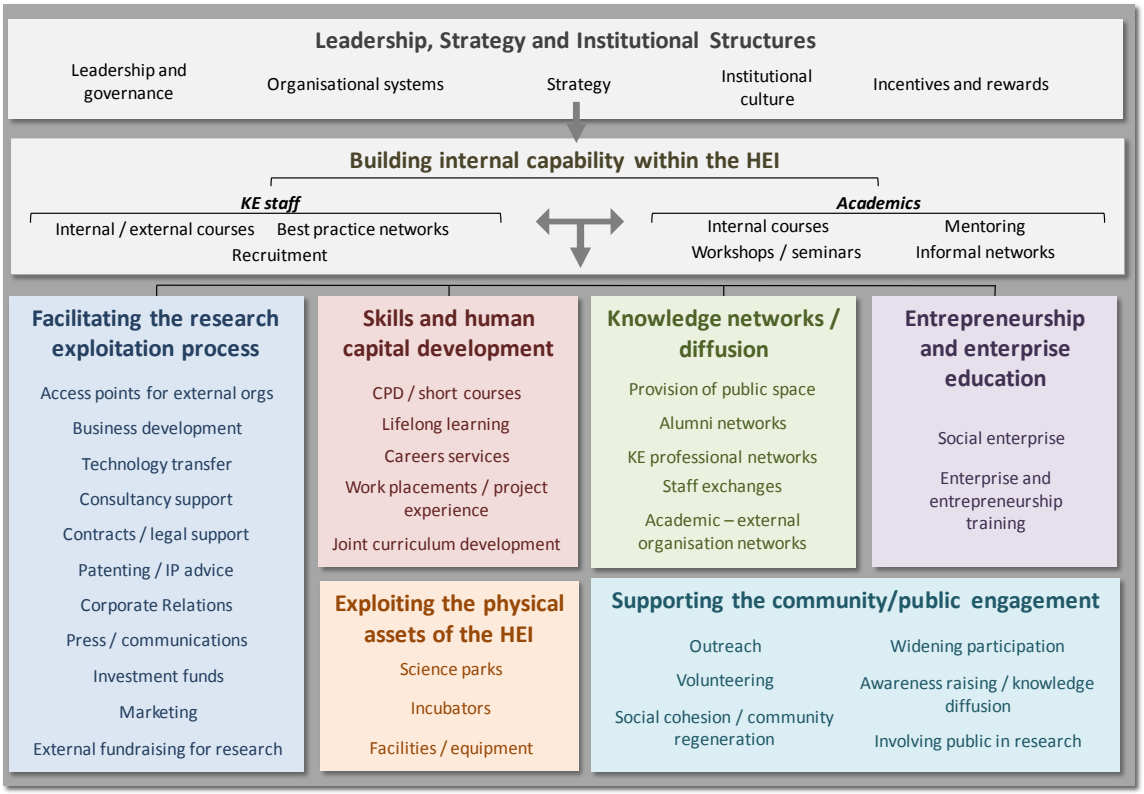
5.8.1 The sheer turbulence in the underlying landscape is requiring a response from HEIs to maintain their competitive position. The HEIF2011-15 strategies highlight the dynamic processes of learning and adaptation at play. Key strategic developments include:

- KE now finally looks to be permanently embedded within many HEIs and has become a strategic activity sitting alongside research and teaching. Over half of the HEIF2011-15 strategies are actively seeking to exploit the synergies that exist between the activities;
- The urgent requirement for academics to engage with the impact agenda, and the high profile, and often contentious, debate the surrounds it, is also helping to raise the profile of KE. HEIs are streamlining their research and KE related support and, in some cases are seeing an increased number of academics approaching KE staff to engage.
- Over half of HEIs are seeking to refocus their activities on the private sector, driven partly by the loss in demand for KE from other sectors of the economy as well as the economic growth agenda. However, there are some concerns over whether sufficient private sector demand will materialise to meet the desired supply of KE. HEIs will need to be flexible and adapt to new opportunities as they arise;
- Recognising this risk, HEIs are also taking steps to diversify overseas into key markets in the USA, China, and India;
- 80% also seeking to align themselves in some way with the priorities of the national research and innovation funding agencies such as the Research Councils and the TSB. This implies a critically important 'coordination' role for these organisations in identifying the key priority research areas, reacting both to current and likely future industrial and societal needs as well as fruitful areas of fundamental research. However, HEIs need to be realistic in their assessment of their capabilities as the growing competition for increasingly scarce funds may mean a concentration of funding in the HE sector;
- Most HEIs (80%) are making changes to their internal infrastructure in attempts to improve the efficiency and effectiveness of their KE investments.
- Three quarters of HEIs are moving towards greater collaboration and shared services to improve the efficiency and effectiveness of their support for KE. This is partly driven by a need by many to find ways to preserve the level of support for KE at significantly lower levels of funding;

6 Strengthening the Capability and Capacity to Engage

6.1.1 Research has shown that HEIs invest in a diverse range of infrastructure in support of the knowledge exchange process (PACEC/CBR, 2011). They have historically experimented with their infrastructure to develop their overall system of support for KE, the structure of which appears to be heavily dependent on their specific internal and contexts. Reflecting this, the research also found that there is no one-size-fits-all solution to developing KE infrastructure systems. The HEIF2011-15 strategies highlight the continued experimentation process as HEIs seek to adapt to the rapidly changing underlying KE landscape.

Figure 6.15 Types of KE infrastructure and support functions



Source: PACEC/CBR (2011) *Understanding the Knowledge Exchange Infrastructure in the English Higher Education Sector*, a working paper for HEFCE

6.1.2 Figure 6.15 provides a stylised KE infrastructure system (PACEC/CBR, 2011). The research found that the infrastructure can be usefully categorised into six key areas:

- **Facilitating the research exploitation process** through, for example, supporting the contract research process, consultancy activities and licensing/spin-outs through technology transfer.
- **Skills and human capital development** of academics, students and those external to the HEI through, for example, CPD, training for academics and students, providing entrepreneurship and employability training etc.
- **Entrepreneurship and enterprise education**, including social enterprise activities.

- **Knowledge networks / diffusion**, including the stimulation of interactions between those in the HEI and those in the economy and society through, for example, the development of networks, and holding events that bring academics and external organisations together to share ideas and knowledge.
- **Exploiting the physical assets of the HEI** through, for example, the development of science parks, incubators, design studios, hiring of specialist equipment, as well as museums, exhibition space and so forth.
- **Supporting the community/public engagement** through, for example, outreach and volunteering, widening participation programmes and so on.

6.1.3 In addition to the specific support provided to KE engagement process, HEIs have also been investing in raising the overall capabilities of their internal staff (both academics as well as the dedicated KE staff) to help improve the efficiency and effectiveness of the KE engagement process.

6.1.4 Further details can be found in Appendix A and in PACEC/CBR, 2009b and PACEC/CBR, 2011.

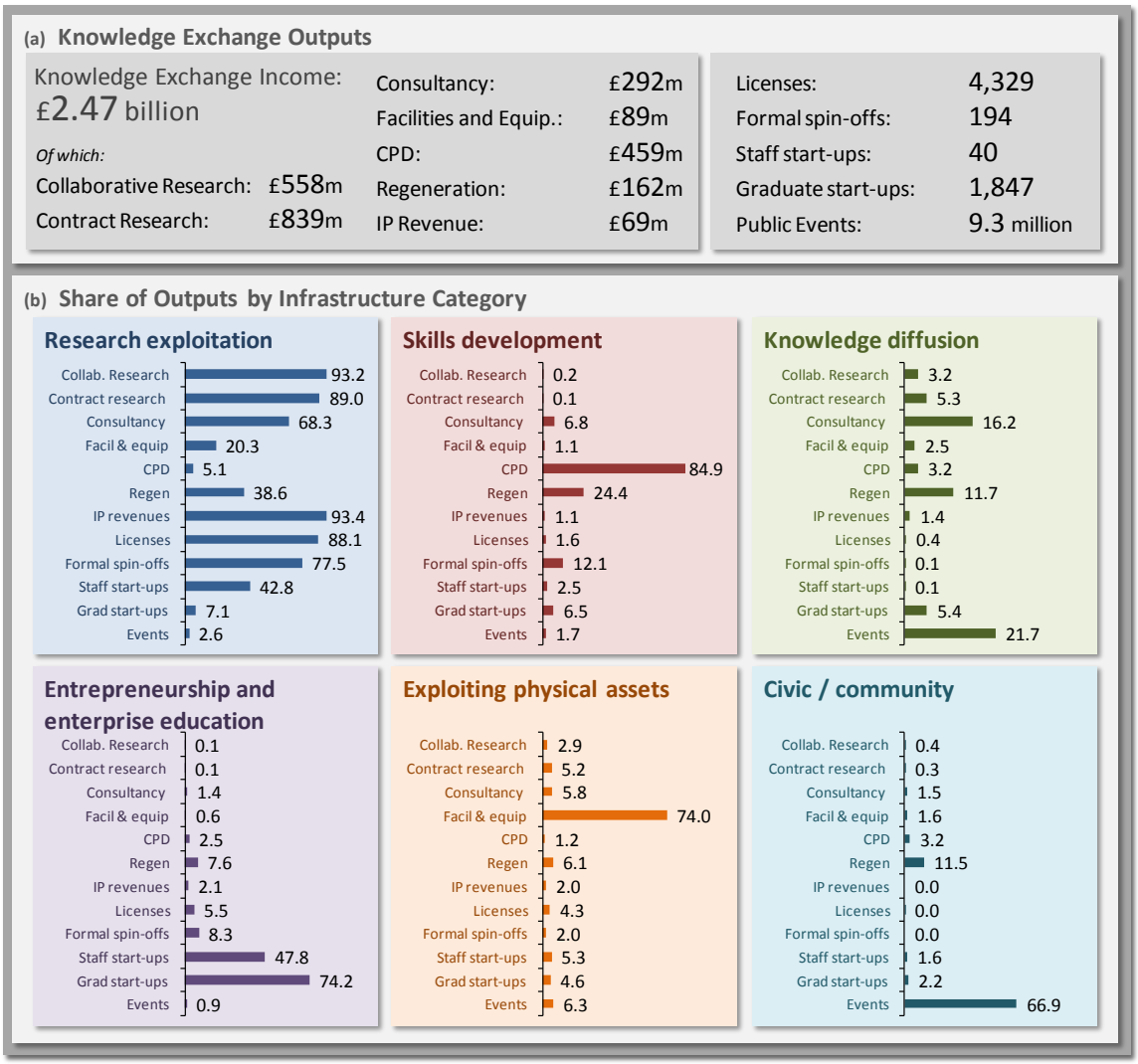
6.1.5 It must be recognised that HEIs invest in those support functions and infrastructure that they believe will meet their own internal and external needs and hence the scale of resources allocated to each function, if indeed any at all, can vary significantly between HEIs. There is no expectation that all HEIs will have all of the functions identified, nor would it be appropriate. The specific KE infrastructure system will depend critically on the internal capabilities and culture of the HEI, the nature and volume of external demand, legacies and the institutional mission moving forward.

6.2 Knowledge Exchange Outputs and the Support Infrastructure

6.2.1 The set of infrastructure outlined above helps to facilitate the production of a range of KE outputs from the HEI. Hitherto there has been insufficient data to link many KE outputs with different types of infrastructure. However, the HEIF2011-15 strategies help to close this data gap, providing us with a much better understanding of what KE outputs different types of infrastructure supports (Figure 6.16).

6.2.2 Panel (a) shows the aggregate of outputs recorded across English HEIs in receipt of HEIF2011-15 funding. In 2009/10 the KE activities of these HEIs generated approximately £2.47 billion in constant 2009/10 prices, with a large proportion arising from contract and collaborative research and the provision of courses. In addition, over 2,000 new businesses were established through spin-outs and start-ups from English HEIs, and public events attracted approximately 9.3 million attendees.

Figure 6.16 Key KE outputs in 2009/10 for HEIs in receipt of HEIF2011-15 (Panel (a)), and the distribution of these outputs by KE infrastructure category (Panel (b), (% of HEBCI outputs in 2009/10)



Source: HEIF2011-15 strategies, HEBCI survey 2009/10, PACEC analysis

6.2.3 Panel (b) of Figure 6.16 shows the degree to which HEIs attributed each of these KE outputs to the six infrastructure categories presented above. For example, HEIs attributed 93.2% of the collaborative research income to the KE infrastructure supporting research exploitation; 84.9% of the CPD income to the infrastructure supporting skills development; and 66.9% of the public events (measured by number of attendees) to the civic and community focused infrastructure with much or the remaining events attributable to the knowledge diffusion and networking-related infrastructure.

6.2.4 What is immediately clear from this evidence is that the infrastructure related to research exploitation is responsible for supporting many of the different HEBCI measured KE outputs, including: most of the contract and collaborative research income; two-thirds of the consultancy income; almost all of the IP revenues, licenses; and the vast majority of the formal spin-outs. The other infrastructure (with the

exception of the knowledge diffusion and networking related infrastructure) is often targeted at supporting more defined sets of KE outputs. However, it must be noted that this may also reflect a bias in the HEBCI output measures for KE towards income metrics and formal transactional measures. For example, it does not capture one of the key functions of the knowledge diffusion and networking infrastructure: the many interactions that may be formed through the support providing to create formal networks, as well as stimulate the more informal networking opportunities between academics and innovators (e.g. through exploiting the public space roles of HEIs).

6.2.5 In addition, Figure 6.16 also demonstrates that the support provided – much of which is through dedicated KE staff – for research exploitation related KE activities stretches well beyond the narrow confines of technology transfer through spin-outs and licensing.

6.2.6 However, we do also know that there are many important KE outputs that are not captured through HEBCI, particularly the outputs of non-transactional interactions. This is mainly due to the great difficulties in robustly capturing these types of outputs and being able to compare them across institutions. HEIs were asked in their strategies to suggest alternative outputs and metrics arising from the different categories of KE infrastructure, however many did not provide any, or very limited information and ideas. This reflects the wider challenges and limits in our current understanding on how to best capture the full range of these outputs.

6.3 The Complex Web of Funding

6.3.1 The funding regime for the infrastructure supporting the KE process is complex, with funding often interwoven from many different sources and combined with HEIF investments to support the overall system. While HEIF funding itself is highly flexible in how it can be used, many other external funding sources can have fairly restrictive conditions attached including on geographies of operation, discipline or technology focus or targeted sectors to be supported. In addition they will typically operate over different timescales, each with expected deliverables by their end-dates. HEIs must therefore piece together a complicated portfolio of funds in order to sustain their infrastructure and achieve their strategic objectives.

6.3.2 Table 6.4 shows the full list of funding sources, in addition to HEIF funding, that HEIs are accessing to support their system of KE infrastructure. Almost 90% of HEIs re-invested some amount of their previous KE income in supporting KE infrastructure. Beyond this, core HEFCE funding, as well as funding from the RDAs, research councils, EU and TSB were the most commonly used sources. However, the scale of this funding is not known, and so comment cannot be made on progress towards self-sufficiency of KE infrastructure. It is inevitable that some parts of the infrastructure will generate little, if any, income yet will nevertheless be an important part of the overall KE support system. We have to rely on the decisions of HEI management to make these decisions and put in place incentives to improve performance.

Table 6.4 Sources of funding used by HEIs to support knowledge exchange infrastructure in 2011 (% HEIF2011-15 strategies citing each source)

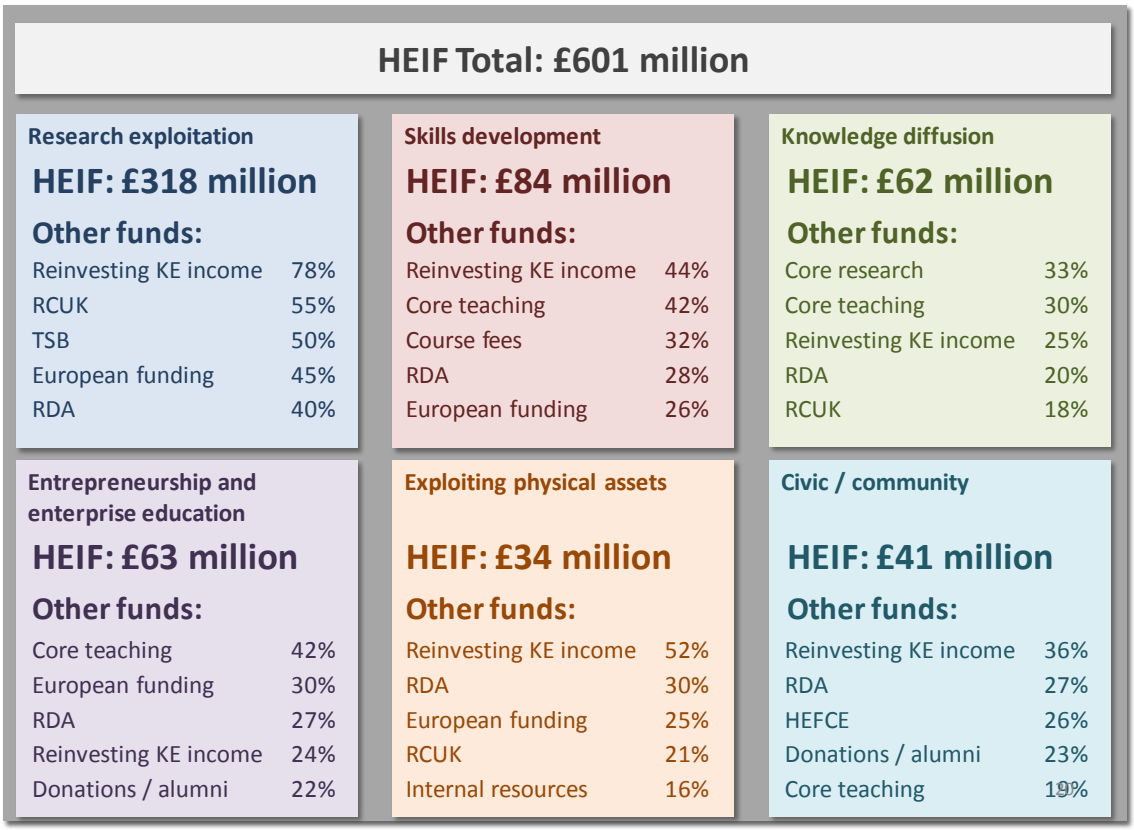
Funding source	% of HEIF strategies
Reinvesting KE income	88
HEFCE Core Funding	76
Regional Development Agencies	66
Research Councils	66
European Union	64
Technology Strategy Board	54
Course, employer and other KE fees	53
HEFCE: specific funds	39
Endowments / alumni / donations / sponsorship	35
Local Government	32
Government Departments	31
Internal University Resources	26
Trusts, Foundations and Charities	22
Non-Departmental Public Bodes / Executive Agencies	21
NHS / Health trusts	17
University collaborations	7
Venture capital / banks	7
Other	24
Total (%)	100
Total (number of strategies)	96

Source: HEIF2011-15 strategies, PACEC analysis

6.3.3 Figure 6.17 presents the proposed amounts of HEIF 2011-15 spending under each infrastructure category over the coming four years, as well as the top five most commonly cited funding sources used alongside HEIF in 2011. It shows that over half of the total £601 million of HEIF2011-15 funds will go to support infrastructure focused on supporting the research exploitation process (through a wide range of KE activities). £84 million has been allocated to skills development support infrastructure, dominated by the CPD and other short course activities of HEIs; £62 million has been allocated to supporting knowledge diffusion and networking; £63 million to entrepreneurship and enterprise education, including social enterprise support; £34 million has been allocated to exploiting the physical assets of HEIs, including the support for innovation centres and incubators; and £41 million has been allocated to supporting civic and community-related infrastructure.

6.3.4 The figure also shows that each category of KE infrastructure typically draws upon and combines a range of different sources of funding. Interestingly also is the relatively frequent use of donations and sponsorships from alumni and others to support both entrepreneurship and enterprise education and related activities as well as civic and community related KE and knowledge diffusion activities (this was the 6th most frequently cited other funding source for this category). The HEIF2011-15 strategies emphasised a desire to grow these sources as many of the other funding sources for KE dry up.

Figure 6.17 Allocation of HEIF funds by different types of KE infrastructure over the period 2011-15 (£ million, current prices) and the other sources of funding used to support the infrastructure in 2011 (% HEIF2011-15 strategies)



Source: HEIF2011-15 strategies, PACEC analysis

6.3.5 The pattern of funding sources currently used by HEIs to support KE outlined above leads to a number of key concerns over the ability to sustain such activity over the coming period, given the impacts of the changed economic climate and public funding changes, as well as upon the private sector. It is likely that many HEIs will undergo a difficult adjustment in seeking alternative funds. Note that RDA funding was allocated in some cases for long term projects and hence the loss of this funding may only be felt in a number of years' time due to the time lags involved.

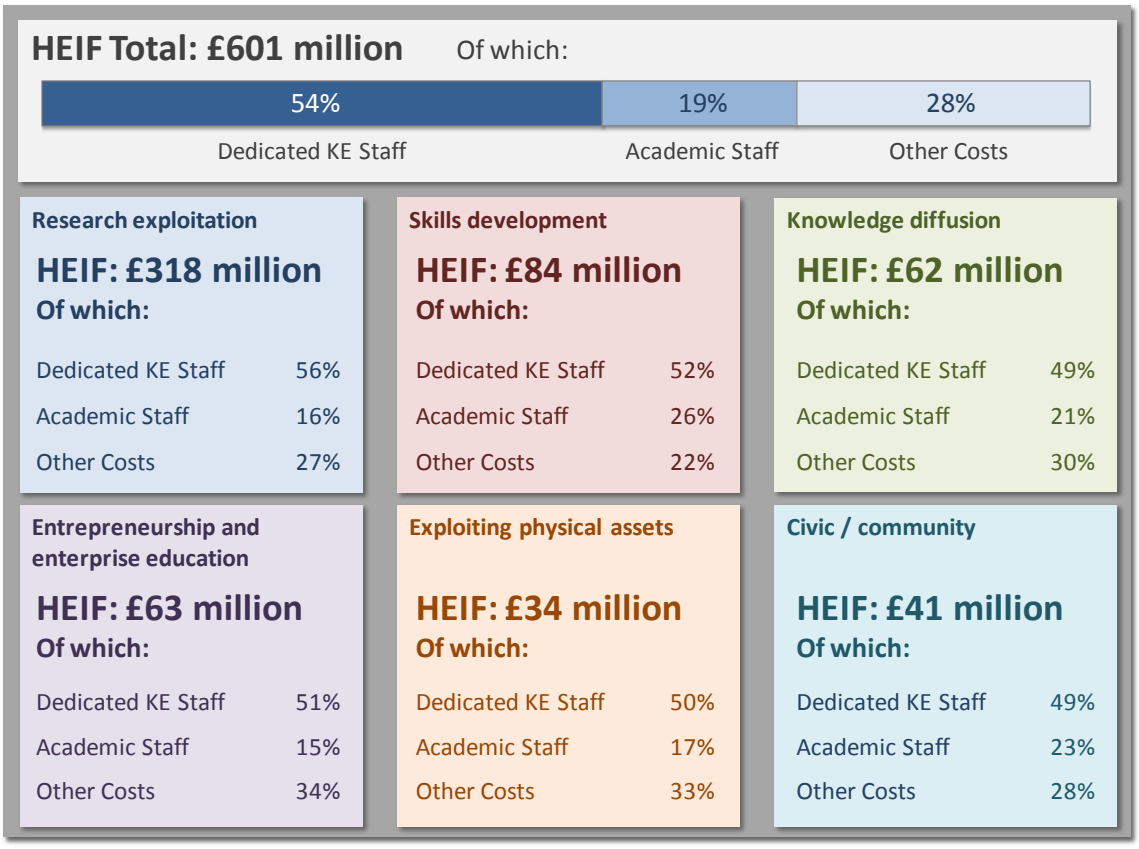
Planned HEIF expenditure by investment type across each infrastructure category

6.3.6 HEIF2011-15 funding support a range of different types of investments within HEIs, not least a cohort of dedicated KE staff that support the KE engagement process. The different types of expenditures explored in the strategies included:

- Dedicated KE staff: specialists employed solely for providing support for, and driving forward, KE. Examples include the staff in enterprise offices who support collaborative and contract research, and consultancy activities; and commercialisation and technology transfer related staff;
- Academic staff KE activity: this includes buying out of academic time to develop KE practice, as well as academic leadership and development activities in KE (e.g. training);

- Other costs and initiatives: this includes all forms of projects (such as proof of concept, seed-corn funding and pump-priming) as well as the costs of managing KE activities (such as marketing and evaluation).

Figure 6.18 HEIF2011-15 funding by staff type



Source: HEIF2011-15 strategies, PACEC analysis

6.3.7 Figure 6.18 breaks the HEIF2011-15 funding down by these types of expenditure for each type of infrastructure type. Of the £601 million, 54% is being allocated to fund the dedicated KE staff, emphasising the important human element in supporting the KE process. It also reflects a belief by HEIs that the specialisation of labour between academics and KE support staff is required to maximise the efficiency of their organisations. 19% has been allocated to support academic KE initiatives, while 28% is going to fund other costs and initiatives.

6.3.8 The amount of HEIF funding going to support dedicated KE staff in the coming period has increased only slightly since the HEIF4 allocations where 52.3% of funding was allocated to this type of expenditure.

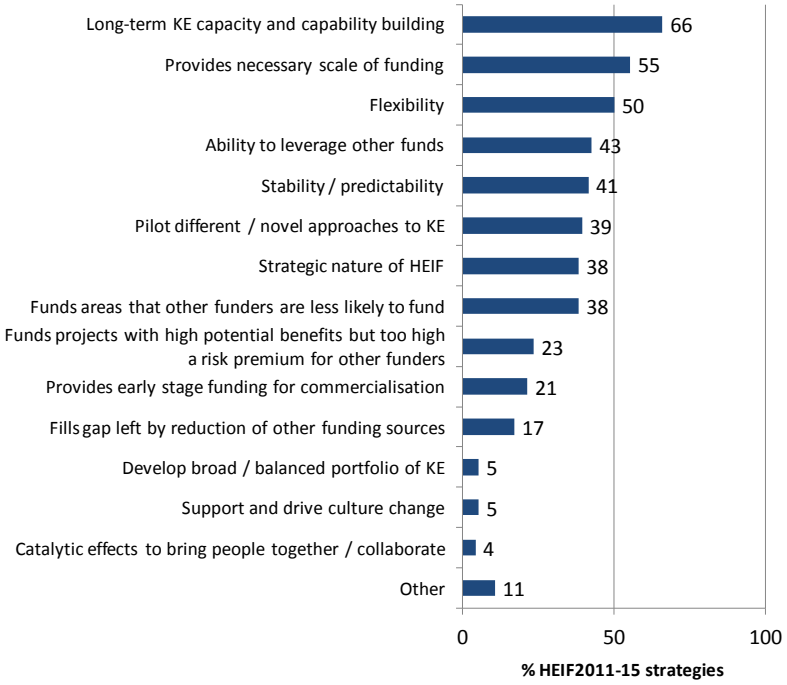
6.3.9 The distribution is fairly even across categories, although an above average proportion will be directed towards dedicated KE staff in the area of research exploitation, while the support infrastructure relating to skills development, knowledge diffusion and networking, and civic/community activities received an above average allocation in academic staff KE initiatives.

6.4 Importance and Distinctiveness of HEIF Funding

6.4.1 There was a strong belief amongst HEIs that the formulaic HEIF funding is a very important and distinctive component of the funding landscape for KE. It should be noted that funding programmes often have objectives, conditions and timescales attached to them which can have implications for how the funds are deployed. Different funds are often used to support different types of KE or different parts of the engagement process, with the less restrictive funds such as HEIF typically used in part to fund the long term underlying support infrastructure and capabilities from which individual initiatives can be built. As such many of the investments through HEIF should work to improve the productivity and effectiveness of other investments in KE.

6.4.2 The HEIF2011-15 strategies reveal that HEIF funding has a number of distinct benefits that act to complement the other funding sources available (Figure 6.19).

Figure 6.19 Distinctiveness of HEIF2011-15 funding compared to other funding sources for KE (% HEIF2011-15 strategies)



Source: HEIF2011-15 strategies, PACEC analysis

Ability to invest in long-term capacity and capability building for KE

6.4.3 Central to the distinctiveness of the funding is its stability and predictability in an otherwise turbulent KE landscape. It allows HEIs to make the long-term investments in the capability and capacity to engage in KE that many other sources of funding could not achieve, with the latter typically used to develop specific areas of KE or specific initiatives.

6.4.4 HEIs value the flexibility of the funding. It allows them to respond build capabilities that meet their specific needs, which is critical given the diversity of the HE sector. It also enables them to rapidly respond to KE opportunities and adapt to market conditions.

Enabling a flexible and rapid response to KE opportunities

"… HEIF is distinctive in its ability to be used very broadly across a complex span of activity to catalyse and engage in high impact KE activity that may have otherwise been missed. … it is the capability of deploying HEIF resources rapidly at an early stage to capture opportunities that is proving most beneficial. … In Surrey's view, no other form of funding offers that level of flexibility need to develop a culture of "engineered opportunism" so often lacking in the past within the majority of UK University's.

An excellent example of is the development of a relationship between the University and Marks and Spencer. A highly speculative visit from a single M&S manager to the University was coordinated by a HEIF Research Development Officer who worked to then arrange a day long visit by 13 senior M&S managers for a day long sand pit with senior Surrey academics. The result was a £300k in R&D contracts for high tech recyclable ceramics and nanotechnology decorative coatings for glassware."

University of Surrey

6.4.5 HEIF funding is also often used by some HEIs (largely with high existing performance) to fund areas for which other funding is scarce, such as KE engagement in the humanities, social sciences and the arts. This allows HEIs to build up a more comprehensive KE portfolio that stretches across the HEI, maximising the possibility for engagement.

Provides important scale of funding for KE

6.4.6 Over half of HEIs in receipt of HEIF2011-15 funding also believe that it provides the necessary scale of funding without which they would find it hard to engage in KE at the same scale or depth. In addition, 17% believe it helps to fill gaps left by the reduction or elimination of other funding sources.

6.4.7 The claim of an increasing reliance on HEIF funding also underscores the overall real reduction in funding available for KE being felt by many HEIs. More efficient and effective use of KE funds, and productivity increases will be required to maintain KE outputs. Targeting HEIF funding towards the best performers who deliver the greatest return on investment will also help to mitigate losses in KE output elsewhere in the sector.

6.4.8 One area where approximately a fifth of HEIs believe HEIF is important is in supporting the commercialisation process. They are not only using the funding to provide proof of concept funds for early stage commercialisation to help take the technologies a bit closer to market, but also to build stronger networks of business angels and other investors to support the commercialisation process.

Ability to leverage other sources of funding

6.4.9 Many funding sources – particularly large scale European Union funding through ERDF – often require match funding. However, the number of funds that allow this

are dwindling, particularly with the abolition of the RDA and with it their single pot funds. The ability to use HEIF funding as a leveraging tool to secure these additional funds for KE is seen by 43% of HEIs as an important distinctive feature. However, this ability to leverage has had a large downside for those HEIs that lost funding in the recent settlement.

Ability to experiment and innovate in the delivery of KE

6.4.10 Almost 40% of HEIs emphasise that HEIF funding enables them to experiment with new and innovative models of KE, testing out new delivery mechanisms or pilot new approaches to KE. In addition, 23% argue that it allows them fund projects where the potential benefits for the HEI may be high, but the risk premium may be too prohibitive for other sources of funds. They underling the importance of HEIF funding in pump-priming these new approaches to KE and acting to demonstrate the benefits to other funders who may invest at a later stage.

6.5 Estimating the Gross Additional Impacts of HEIF4 Funding

6.5.1 A central question in assessing the impact of any funding programme is the attribution of outputs to the inputs – i.e. the additionality of the funding. Gross additionality reflects the adjustment of impacts for the counterfactual of what would have happened anyway in the absence of the funding programme. Ideally, one would want to then move to the net additional benefits, accounting for any substitution or displacement effects. For a detailed discussion on the concepts of additionality in the context of HEIF funding, see for example, Hughes et al. (2011)[23].

6.5.2 The estimation of additionality is made extremely challenging in the case of innovation related funding, not least due to the fact that innovation activities often involve a wide range of inputs that interact and complement each other. Disentangling the precise impact on any one input is nigh-on-impossible. Nevertheless, it is possible to arrive at estimations that provide an indication of the level of additionality. The evaluation of the role and effectiveness of HEFCE KE funding programmes from HEROBC to HEIF3[24] did so through a range of methods to arrive at the view that HEFCE KE funding exhibited strong gross additionality, and that the impacts were also likely net additional, given the potential for displacement of private sector activity. It estimated, based on the subjective judgements of senior KE staff at 76 universities (based on a survey undertaken by Quotec in 2007) that the gross additionality of KE outputs to HEIF funding was in the region of 28% – 41%. This resulted in a ratio of cumulative gross attributable KE income over the period 2001-2007 to HEFCE KE funding over the same period of 5 – 7[25]. The evaluation

[23] Hughes, A., Moore, B. and Ulrichsen, T. (2011) "Evaluating Innovation Policies: A Case Study of the Impact of Third Stream Funding in the English Higher Education Sector", in eds (Colombo, M., Grilli, L., and Piscitello, L.) (2011) Science and Innovation Policy for the New Knowledge Economy, (PRIME Series on Research and Innovation Policy in Europe), Edward Elgar: Cheltenham
[24] PACEC/CBR (2009) *Evaluation of the effectiveness and role of HEFCE/OSI third stream funding*, Issues Paper 2009/15 for HEFCE
[25] The ranges in the estimates were due to uncertainties evident in the way the attribution estimates were made

also produced a cost-benefit-balance-sheet (CBBS) which summarised the range of benefits per £1 million of HEIF funding (see pg. 177 of the above evaluation).

Figure 6.20 Cost-benefit-balance-sheet summarising the quantifiable KE outputs and the extent of attribution to HEIF funding

HEFCE KE funding 2003-2010

£877 million

Other funding sources

Source	% HEIs
Reinvesting KE income	88
HEFCE core	76
RDA	66
RCUK	66
EU	64
TSB	54
Course / other fees	53
HEFCE specific	39
Endowments, alumni, donations	35

KE Outputs 2003-2010

		Total income (£m)	Gross additionality (%)*
Income metrics	Collaborative research	3,962	38
	Contract research	5,449	36
	Consultancy	1,848	39
	Facilities / equipment services	570	26
	CPD	2,913	21
	Regeneration / development	1,263	33
	IP revenues	445	39
	KE income	16,449	34

		Total number	Gross additionality (%)
Non-income metrics	Disclosures	22,401	41
	Patent applications	10,486	43
	Licenses	20,649	35
	HEI and formal spin-offs	1,120	43
	Staff start-ups	221	44
	Graduate start-ups	8,244	42
	Public events (attendance)	42,543,000	22

Gross Additional KE Income 03-10 per £ HEFCE KE funding 03-10*: 6

** Based on weighted average of HEI responses to HEIF2011-15 strategies excluding those estimating additionality based on the share of inputs formed by HEIF.*

Note: Total column and HEFCE KE funding is based on the total population. The estimation of gross additionality is based on the subset of HEIs excluding those where additionality was clearly estimated based on share of inputs from HEIF.
Source: HEIF2011-15 strategies, HEBCI surveys 2002/03 – 2009/10, PACEC analysis

6.5.3 The HEIF2011-15 strategies allow us to update these estimates of the impact of HEIF funding until 2009/10 on KE outputs, based on the views of the HEIs of the extent of attribution of these KE outputs to HEIF funding (Figure 6.20). The respondents were asked to make these estimates by type of KE infrastructure, and represent an informed best guess of the likely gross additionality of the funding. The estimates refer to the HEBCI KE outputs in 2009/10[26]. In estimating the new levels of gross additionality, we have excluded HEIs who formed their views based solely on the share of inputs supporting KE that HEIF forms.

6.5.4 The analysis suggests that 34% of KE outputs are attributable to HEIF funding, with technology transfer related outputs, consultancy, and collaborative and contract

[26] In estimating the new levels of gross additionality, we have excluded HEIs who formed their views based solely on the share of inputs supporting KE that HEIF forms. This assumes that £1 of HEIF funding is exactly the same as £1 of any other source, which we argued earlier, is likely to not be the case.

research outputs exhibiting the highest levels of gross additionality; and facilities and equipment services, CPD and public events the lowest levels. Applying this to the cumulative KE income over the period 2003-2010 gives us an estimate of the gross additional income over this period. Comparing this to the funding inputs of the same period, suggests that for every £1 of HEIF, £6 are generated in KE income. However, this likely represents an underestimate of the total benefits to the economy and society due to the potentially large impacts that are very hard to capture and the long term benefits arising from the positive behavioural and attitudinal changes it has had on academics towards knowledge exchange.

Table 6.5 Gross additonality and the ratio of cumulative gross additional KE income to HEFCE KE funding over the period 2003-10

	Total	Research intensity cluster				
		Top 6	High	Medium	Low	Arts
Gross additionality (%)	34	32	32	40	26	29
Gross additional KE income 03-10 per £ HEFCE KE funding 03-10	6	13	7	5	2	1

Sources: HEIF2011-15 strategies, HEBCI 2009/10 survey, PACEC analysis

6.5.5 If one undertakes the analysis by different types of HEIs – clustered primarily based on their research intensity – one finds a similar result to the evaluation of HEFCE KE funding (PACEC/CBR, 2009) that the ratio of gross additional KE income to KE funding provided by HEFCE increases as research intensity increases.

6.6 Summary of Key Findings

6.6.1 The range of KE infrastructure is funded through a complex web of funding sources, including, significantly, the £601 million invested through HEIF funding to help raise the economic and social impacts of HEIs through KE.

6.6.2 HEIF funding, however, is an important and distinctive funding source:

- Much of the distinctiveness stems from its stability and predictability, flexibility and discretion to use to support any forms of KE where many of the other funding sources are much more restrictive.
- It also allows them to innovate and experiment with new models of KE.
- Critically, it is one of a dwindling number of funds that can be used as leverage, to secure significant other sources of funds for KE. However, this also presents HEIs with a major risk: when they experience a loss in HEIF funding, the overall losses are magnified through the loss of the leveraged funding.

6.6.3 A crude estimation of the impact of the funding suggests that:

- For every £1 of HEIF invested, it returns £6 in gross additional KE income;
- This ratio increases for the more research intensive HEIs;
- However, it likely represents an underestimate of the total benefits to the economy and society with many impacts hard to capture and quantify.

7 Conclusions

7.1.1 The report has sought to bring to the fore the many diverse ways through which HEIs contribute to the innovation and development in the economy and society, both acting as direct partners in the innovation process, as well as their role in strengthening the underlying innovation conditions which can have important effects on the innovation performance of local economies. Drawing on the qualitative and quantitative evidence provided by HEIs in their HEIF2011-15 institutional strategies, it highlighted the key developments as HEIs seek to increase their local, national and global impacts.

7.1.2 The HEIF2011-15 strategies demonstrate a dynamic HE sector that is in the process of adapting to a significant amount of change in the underlying landscape for KE, not least due to the changing incentives associated with research impacts and student funding, as well as the uncertainties arising from the economic recession. Importantly, over the next period, many HEIs are planning on redoubling their efforts on driving their interactions with the private sector, driven in part by the changing patterns of demand and the wider economic growth agenda. Critically, there is clear evidence amongst an increasing number of HEIs of a switch away from maximising single transactions towards building longer-term relationships with businesses. However, there is some concern over whether sufficient demand will materialise from the private sector to meet the desired growth.

7.1.3 There are also key developments in the way HEIs support their local economies. Many of the larger HEIs are also active in supporting the development of their local Local Enterprise Partnerships (LEPs), and most are involved with local economic development bodies. While many are uncertain of the role that LEPs will play, others see an opportunity to place their HEIs at the heart of the local growth and innovation strategies. In addition, HEIs are often large providers of innovation infrastructure for their local economies. However, thought needs to be given to the design of both the hard and soft infrastructure and how it integrates with the wider HEI and local and national innovation systems. Importantly, a small, but growing number of HEIs are also deploying their capabilities and infrastructure to help drive exports and attract inward investment.

7.1.4 There is also a very large and growing emphasis on student employability and enterprise, with HEIs pursuing a range of initiatives in this area, not least a large expansion of the provision of opportunities for student work experience. Entrepreneurship and enterprise education are also becoming much more widespread.

7.1.5 In adapting to change, most HEIs are drawing on their prior experiences in KE, as well sharing experiences with others through both personal and professional networks and reviews. Collaborations and shared services between HEIs, as well as with organisations in the non-HE sector are being explored as ways to help increase the efficiency and effectiveness of the support provided by HEIs to their academics

and students engaging in KE, as well as providing a mechanism for sharing good practice.

7.1.6 The HEIF strategies also suggest that KE is now firmly embedded within most HEIs and has become a strategic, legitimate activity working alongside research and teaching, and seen increasingly seen as supporting and enhancing these activities. The combined effects of the prior investments in the capability and capacity to engage in KE (including efforts to institute culture change within HEIs), and the increased profile of KE amongst the research funders are seen as key enablers of the strategies moving forward.

7.1.7 Finally, HEIF funding has proven an important and distinctive funding source that helped HEIs develop the long-term capability and capacity to engage in KE, and the flexibility to respond and adapt to change. It also allows them to innovate and experiment with new models of KE. Critically, it is one of a dwindling number of funds that can be used as leverage, to secure significant other sources of funds for KE. However, this also presents HEIs with a major risk: when they experience a loss in HEIF funding, with the overall losses magnified through the loss of the leveraged funding. While the economic recession has created a large degree of uncertainty both over funding landscape and potential demand for KE, the developments and initiatives being enabled by the HEIF funding programme over the next period should provide a strong foundation for HEIs to strengthen their insertion into the innovation system and increase their overall impact on the economy and society.

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Appendix B Knowledge Exchange Infrastructure

The Development of the KE Infrastructure Categories

B1.1 The stylised KE infrastructure categories and functions were developed from a series of in-depth case studies, interviews and web-searchers undertaken in 2009-2010 as well as previous research undertaken by PACEC/CBR to evaluate HEFCE's KE funding (PACEC/CBR, 2009). The research identified 32 specific KE support functions and infrastructure provided by HEIs which are summarised in the KE infrastructure diagram (Figure 6.15).

B1.2 It became apparent from analysing these areas of KE support functions / infrastructure and how they were structured within different HEIs, that they could be grouped further into six key areas of support. These were based on an understanding of the major areas of HEI activity that ***underpin*** the KE engagement process (most notably the research and education activities of academics, but also the existence of physical infrastructure that can benefit external organisations and the wider community and the motivation of many academics and HEIs to engage with communities and the wider public to improve societal outcomes. The final categories are:

1 Facilitating the research exploitation process
2 Skills and human capital development;
3 Social enterprise and entrepreneurship;
4 Knowledge diffusion through the stimulation of interactions;
5 Exploiting the physical infrastructure of the HEI;
6 Community and public engagement.

B1.3 Each of these areas are now discussed in turn.

Facilitate the research exploitation process

B1.4 KE support functions / infrastructure have developed to provide support for academics as they seek to exploit their research outputs. Some of the mechanism most frequently focused upon in the knowledge exchange debate include: consultancy; contract and collaborative research; and the commercialisation of research through spin-outs and licensing. These activities (perhaps with the exception of consultancy which can frequently occur through private interactions between the academic and the external organisation without ever receiving any support from the HEI) are typically supported by a wide range of KE support functions from contract / legal support, to IP negotiations, to support for bid writing. Some HEIs also provide investment funds for academics to help prove their concept and bring it closer to market. Some have corporate relations functions to help build relationship with strategic partners (in all sectors, private, public and third sectors) and most have marketing and press/communications providing more indirect support to the KE process by raising the profile of the HEI as a place for external organisations to do business and the types of services/capabilities on offer. (*Note that corporate*

relations / marketing / press / communications / PR etc. functions operate across all types of KE engagement, not just the exploitation of research).

Skills and human capital development

B1.5 KE support functions / infrastructure exist to support the development of skills and human capital (external to the HEI as well as students). These functions – including the provision of support for CPD / short courses for external organisations in the private, public and third sectors, and lifelong learning for individuals in the local and wider communities – help the HEI exploit their teaching capabilities for the benefit of the non-student population. In addition, HEIs also provide support – through careers offices as well as through other units – to students helping them to find work placements. These are important conduits for external organisations to access the HEI as well as for the HEI to identify the knowledge-based needs of industry, the public sector and third sectors. Some HEIs are beginning to realise this and are attempting to create a more joined up system to allow these needs to feed back to academics for their research and teaching. This section initially included entrepreneurship and employability skills development. In consultation with HEFCE/BIS, this was separated out as a separate category. These support functions are becoming increasingly important for creating a competitive workforce.

Social enterprise and entrepreneurship

B1.6 Closely linked with the previous category, many HEIs are designing programmes and incentives to support the development of enterprise and entrepreneurship skills both amongst their undergraduate / postgraduate populations, but some are also making courses open to local professionals looking to increase their enterprise and entrepreneurship-related skills. A number of HEIs are also extending their support offering to provide specific support for the development of social enterprises (note that this could involve coordinated support from the other key categories as well).

Knowledge diffusion through the stimulation of interactions

B1.7 Most HEIs are stable, neutral environments, absent of any political or industrial agenda. They provide a venue in which individuals from different, potentially competitive or even confrontational, backgrounds can come together and exchange views and knowledge. KE support functions have developed in some HEIs to support the sharing and diffusion of knowledge through the stimulation of interactions between individuals and the exploitation of the public space of the HEI. They increasingly provide facilities and support to stimulate interactions between academics and those external to the HEI, such as hosting KE-related events, create and foster networks and in some cases host staff exchanges that bring external organisations onto campus. These, often informal, interactions can, among other things, facilitate the sharing of knowledge and ideas, as well as help create and nurture the development of networks that can reduce the search costs for the knowledge necessary for innovation. The interactions need not necessarily be

between academics and external organisations, but could also form between different external organisations. These public space activities have the potential to lead to further and deeper patterns of more formal activities between academia and external organisations for example through collaborative research, consultancy and teaching-based activities.

Exploiting the physical infrastructure of HEIs

B1.8 Those KE support functions / infrastructure that provide support for exploiting the physical assets of HEIs. HEIs possess many physical assets (buildings such as concert halls, galleries, theatres; equipment; labs etc.) that are underutilised. Such assets can be exploited a small opportunity costs for the HEI and can lead to overall economic efficiency gains as publicly funded assets have increased their utilisation for the benefit of innovation and competitiveness of the private, public and third sectors and the wider public. They also invest in physical infrastructure designed to support their innovation activities and business development (e.g. science parks; incubators; innovation centres etc.).

Community and public engagement

B1.9 The final category consists of the KE functions that provide support for community and public engagement. HEIs have developed significant, but often overlooked, capabilities in this area. Many have offices (including dedicated public engagement offices as well as through Student Unions), that provide support for a wide range of such activities, most notably for outreach into the local and wider communities (e.g. engaging with local schools), volunteering and the hosting of public/community events. Following government policy, most now have support functions for widening participation amongst those groups in society that are under-represented within higher education. Some academics – particularly in the social sciences and arts/humanities – also engage with local communities to support their research.