MAKING THE BEST BETTER

UK Research and Innovation
More efficient and effective for the global economy

Report for Department of
Business, Innovation and Skills

By Sarah Jackson
On secondment from the N8 Research Partnership

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The purpose of this report is to document and analyse evidence of the efficiencies within the higher education research base. The evidence has been collected from existing reports and data, combined with new case studies. Providing recommendations for future efficiency savings is explicitly outside the scope of this work.

Key highlights and conclusions

- The higher education sector is moving towards **a ten year track record** of delivering efficiencies, including headline savings of over £1.38bn over CSRs 2004 and 2007[1], and Research Councils delivering savings of £428m over the current CSR period.

- These efficiencies have been achieved **using two key drivers:**
  a. Increasing domestic and international competition
  b. Science ring fence, allowing reinvestment of savings to increase world class performance of universities.

- The evidence collected for this report shows a strong ten-year track record of institutions delivering both operational and productive efficiencies, which is improving research and teaching. This strong link between driving efficiencies and improving student experience and better research is increasing investment in skills, knowledge and human capital.

- Capital budgets are being utilised more effectively, primarily through creating clusters of excellence and sharing equipment. This is delivering state-of-the-art facilities, enabling new science and better equipment and expertise for business.

- The increased effectiveness of the system is delivering both greater outputs for science and research, and also greater impact in the global marketplace: generating new knowledge, leveraging private investment in R&D and increasing the quality of human capital. This pays a critical role in the industrial strategy, supporting innovation and growth in the economy.

- HE institutions have been delivering efficiencies for a number of years, but there is a significant weakness in the ability to tell the story: "Universities are good at telling people about their exciting research, but not about how much money has been saved"[2].

[1] Universities UK (2011) *Efficiency and effectiveness in higher education: A report by the Universities UK Efficiency and Modernisation Task Group* London: Universities UK. p.16.
http://www.universitiesuk.ac.uk/highereducation/Pages/EfficiencyinHigherEducation.aspx
[2] Professor Sir Ian Diamond, speaking at the 2nd Annual UUK Conference on Efficiency, 26 February 2013

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Introduction - Efficiency and world class performance

The efficiency and effectiveness agenda is critically important for any organisation; it increases competitiveness and creates new sources of value. By itself,
"Efficiency is not a measure of success in the marketplace"[3] (Mouzas, 2005).
In the context of the research base, efficiency needs to be considered alongside the quality of services provided for students, the quality of teaching and the quality of research The evidence collected for this report demonstrates that **it is the imperatives of effectiveness and increasing world class performance that are driving greater efficiencies across the sector.**

Definitions: When collecting case study data, the following definitions have been used[4]:
Operational Efficiency: Delivering the same output for reduced input
Productive Efficiency: achieving greater output (quality or volume) for the same, or proportionately less, input.

Structure: This report is split into 4 parts:

- **Section 1:** Building towards a ten year track record of efficiencies.
- **Section 2:** Operational efficiencies and how savings are being reinvested
- **Section 3:** Productive efficiencies: how the sector is delivering more, with proportionately less
- **Section 4:** "Surplus but not surplus to requirements"**-** financial management in HE

Scope: In view of limited time, and given the balance of funding[5], the report is focused mainly on efficiencies and effectiveness of the research base, and also includes a detailed case study on the Technology Strategy Board. *Providing recommendations for future efficiency savings is explicitly outside the scope of this work.*

Contributors: The list of contributors is detailed in Appendix 1. The case study material builds on the work undertaken by UUK in this area.

Author: I have completed this report whilst on a part time, 6 month secondment to BIS from the N8 Research Partnership - the collaboration of eight research intensive universities in the North of England.

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I would also like to thank all contributors to the report, who were hugely enthusiastic in telling their stories, and also Jamie Arrowsmith and Chris Hale at UUK.
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On part time secondment to BIS, October 2012-March 2013

[3] Mouzas, S (2005) Efficiency versus effectiveness in business networks Journal of Business Research, Volume 59, Issues 10–11, October 2006, Pages 1124–1132 (Lancaster University Management School)
[4] Definitions based on templates received from BIS central finance team, and subsequent helpful discussions with Rosa Fernandez, Economic Advisor, BIS
[5] For example, for FY 2012-13, the science and research budget was 5.3bn and the innovation budget £0.6bn (BIS, 2012-13)

Executive Summary

Efficiency in the HE sector - moving towards a ten-year track record.

1) The sector is moving towards a ten-year track record of delivering efficiencies. This has been achieved through headline savings of more than £1.38bn in England over CSR 04 and CSR 07, against a target of £1.23bn. This was at a time of record student numbers, increased activity on widening participation and the UK being ranked top within the G8 for publication productivity.

2) The savings targets in CSR 2011-2014 are largely based on the implementation of the Wakeham Review[6], which looked at the efficiency and sustainability of university research. Research Councils will deliver £428m of savings over this CSR period[7], mainly through reductions in indirect costs of research and pay restraint on grants and Institutes.

3) In addition, the decision to remove HEFCE QR funding from 2* research is generating a productive efficiency of £270.23m (against a target of £238m).

4) There has also been a substantial evidence base compiled by UUK, Research Councils and HEFCE to inform the "Diamond Review"[8] on efficiencies in university core business processes, for example procurement and estates.

5) As universities are autonomous institutions, it was not appropriate (or possible) for the Diamond review to mandate savings targets, but the work has placed both an increasing focus and prominence on the efficiency agenda, and built a platform to support longer term institutional change. The Wakeham and Diamond Reviews also demonstrate the importance of the dual support system in reinforcing efficiencies across the system.

6) This report builds on the Diamond Review by focusing on documenting evidence of the activity undertaken by HEIs themselves, which is a crucial, substantial and less well documented part of the efficiency agenda. Recommending future efficiency savings is outside of scope of this work.

7) The evidence collected for this report demonstrates that there are two key policy levers supporting the delivery of efficiencies over the last ten years
   a. Increasing domestic and international competition
   b. Science ring fence, and autonomy of institutions, allowing reinvestment of savings to increase world class performance of universities.

[6] RCUK & UUK (2010) **Financial Sustainability and Efficiency in Full Economic Costing of Research in UK Higher Education Institutions** http://www.rcuk.ac.uk/documents/reviews/fec/fECReviewReport.pdf
[7] http://www.rcuk.ac.uk/documents/publications/RCUK_Efficiency_Savings_interim_report_Nov2011.pdf
[8] UUK (2011), **Efficiency and effectiveness in higher education:** A report by the Universities UK Efficiency and Modernisation Task Group p. 6

Efficiencies delivered by Universities

Operational efficiencies

9) There is strong evidence of universities increasing their effectiveness by driving **operational efficiencies through procurement, estates and workforce change**. The savings are frequently being reinvested in front line student services and human capital. For example:

10) **Procurement**: Newcastle University has made savings of £1.7m a year through improvements in procurement, and is forecasting annual savings of £2.4m moving forward. The Advanced Procurement for Universities and Colleges in Scotland is saving £12-15m per annum on collaborative contracting, and £700k-£2.5m per annum on the College Services Team (depending on level of spend).

11) **Human Resource Management:** The University of West of England has reduced their salary costs by 14%; Lincoln University has implemented an absence management programme, leading to a 25% reduction in sickness absence, 50% reduction in overtime costs and £150k savings in agency staff; Swansea University has implemented a new performance review system supporting increased outputs from academic staff.

12) **Estates**: The University of Leeds is saving almost £1m a year on energy costs through a combined heat and power plant joint with Leeds Teaching Hospitals NHS Trust, and £200k savings a year on carbon tax through using steam and hot water; Aston University has relocated their chemistry department from a 7,000 to a 4,000 square metre space, providing savings in real estate, and energy efficiencies with lighting, heating and ventilation. Furthermore, carbon emissions are reducing across the sector – the collective impact of institutional targets is forecast at a 38% reduction between 2005 and 2020[9].

13) **Financial Management**: Imperial College has held pay costs and staff numbers in central support functions since 2009, maintaining a flat cost base at around £57k per staff FTE, absorbing the impact of inflation.

14) The autonomy of institutions facilitates and incentivises greater efficiencies as these operational savings can be reinvested to improve research and teaching. The strong link between driving efficiencies and improving student experience and better research is increasing investment in skills, knowledge and human capital in the economy.

15) The case studies on operational efficiencies clearly demonstrate three common factors where significant cash savings are delivered: i) strong and skilled leadership; ii) support for the costs of change over a fixed period (typically 12-18 months); and iii) allowing adequate time for change to embed within the organisation (full benefits realisation is typically 2-3 years onwards).

Productive efficiencies

16) **Productive efficiencies** are defined as achieving greater output (quality or volume) for the same, or proportionately less, input. There are some very interesting examples of productive efficiencies in universities, for example;

17) **Student Services**: University of Oxford has refocused the careers service over the last 4 years and is now serving 70% of the student population (up from 40%) from the same baseline budget. The University has also delivered efficiency savings of £400k on outsourcing and redesign of services, grown the number of job vacancies

[9] http://www.hefce.ac.uk/whatwedo/lgm/sd/carbon/

advertised by 20% a year, grown the Internship Office from 4 places advertised in 2008 to 280 in 2012, all delivered from the same baseline budget.

18) **Teaching and student experience:** The University of Manchester has implemented a lecture capture and distribution system (via i-Tunes) costing £460k in total. Pilot studies for two modules have demonstrated both increased student satisfaction (88% indicated it increased their learning experience) and student attainment (53% achieved 60% or above pass rate, compared with 34% in 2008).

19) **Sharing of research equipment and capital:** there has been significant progress in this area in the last 18 months. EPSRC funding has accelerated progress on compiling asset databases with shared registers of research equipment, for example in the N8[10] , M5[11], SE5[12] and GW4[13] universities. Over 10,000 items of research equipment have been catalogued on asset registers through the work of these cluster groups, and these registers provide a significant resource to support national capital investment planning and business access to publically funded research facilities.

20) **Collaborating within institutions:** there is evidence of actors in the system changing their behaviour in light of restrictions on capital funding –for example Aberdeen Life and Medical Scientists collaborating to purchase one gene sequencer, rather than two, which enables new research combinations and achieved a capital saving of over £0.5m; University of Birmingham has developed Central Equipment Hubs in Mass Spectrometry, High-throughput Sequencing and Microscopy to provide improved services with greater scale, leading to increased utilisation rates and reduced duplication.

21) **Collaborating across institutions**: Progress is particularly evident where institutions are collaborating to purchase the highest specification of kit that would be neither affordable nor fully utilised by one institution alone. Examples include:
- High Performance Computing facility shared across the N8 universities
- The London Centre for Nanotechnology which has developed equipment specialisms at Imperial and UCL

Both are attracting significant industry interest, e.g. National Grid and BAE Systems through access to state-of-the art equipment and a cluster of research and technical expertise.

22) The sector is changing: these clusters of research intensive universities have formed organically to share equipment and "sweat the assets", in order to remain at the leading edge of scientific excellence.

23) These clustering arrangements enable new science, and bigger and better outcomes. It allows researchers to tackle new research challenges not possible on smaller facilities. Significantly it also provides leading edge facilities for business, many in key sectors of the industrial strategy.

24) Sharing can involve substantial transaction costs and is best utilised for larger equipment items. Increased costs can include consumables, maintenance, travel and an additional VAT charge on sharing if the appropriate financial arrangements are not put in place.

25) Although progress has been made, further long term cultural changes are needed in the sector and there are further opportunities for policy reform to remove barriers and

[10] The N8 universities are Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield and York
[11] The M5 universities are Aston, Birmingham, Leicester, Loughborough, Nottingham and Warwick
[12] The SE5 universities are Cambridge, Imperial, Oxford, Southampton and UCL
[13] The GW4 universities are Bath, Bristol, Cardiff and Exeter

encourage greater asset sharing. The Research Councils continue to play a significant role in progressing this agenda. The long term commitment of Government funding for research capital will also enable greater strategic planning and joint investments, supporting greater efficiency and effectiveness of public spending.

"Surplus but not surplus to requirements"[14]

26) The surplus or "margin for sustainability" of each university is based on prudent financial management that enables:
    a. Risk management to mitigate the increased volatility in the teaching system
    b. Capital investments –HEI capital funding has been cut to 53% of previous levels.
    c. Agility – to fund new projects with business and leverage private sector funding (e.g. RPIF and ERDF projects)
    d. Overseas student numbers – the long term pattern of this significant funding stream is uncertain
    e. Increased spending in new areas – e.g. Widening Participation spending at one Russell Group institution is doubling from £8-£16m in the next 3 years

27) There is a significant range in the level of surplus across the sector (-5% to 22%).

28) It is also important to take into account the net cash or debt position in addition to the annual surplus position. The sector's current liquid position is £8.1bn, representing 3.9 months of expenditure. However, the sector's borrowings stand at £6.1bn, equivalent to 21.8% of income, so the net cash position of the sector is around £2bn, less than one month's expenditure, a much smaller cushion[15].

29) **Capital Investments** Institutions need to increase both operational and productive efficiencies to fund large scale capital developments. For example Cambridge, Manchester, Oxford and Sheffield are all investing in new teaching and research facilities, and some schemes are supported by borrowings leveraged from healthy balance sheets. The willingness of financial markets to lend to institutions is contingent on demonstrating a recurrent surplus as evidence of the ability to service the debt. Developments like these are needed to ensure that the sector does not become under-capitalised, and productivity is maintained.

Conclusions

30) Significant progress is being made across the system, at a significant time of change. To continue with this, and to embed long term reform, progress should be encouraged, rather than mandated. The science ring-fence and increased competition are the main policy levers in enabling further efficiencies, and are embedded in the system.

31) In supporting HEIs to deliver increased efficiencies, consistent and reinforcing signals from the sector, particularly funding bodies, can accelerate the pace of change in the short term, and cultural change in the long term.

32) Where further policy reviews are undertaken on research efficiencies, policy reforms to reduce barriers for equipment sharing should be addressed, including mechanisms for accounting for REF and RCUK income credits to reflect the usage of the asset.

33) The sector needs to become much more effective at communicating the progress that has been made.

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[14] Professor Sir Keith Burnett, Vice-Chancellor, University of Sheffield

[15] Letter from Andrew McConnell, Chair of BUFDG, published in THES, 21 March 2013, http://www.timeshighereducation.co.uk/comment/letters/no-room-on-this-cushion/2002686.article

Section 1: Building towards a ten year track record

There is a strong track record of effectiveness and efficiencies within HEIs. There are two main drivers:

- Competition: increasing pressures of domestic and global competition.
- The science ring-fence: this incentivises efficiencies, as savings can be reinvested to support improvements in teaching and research.

The existence of these drivers pre-dates the current period of austerity and the introduction of tuition fees. HE institutions have been delivering efficiencies for a number of years, but there is a significant weakness in the ability to tell the story: "Universities are good at telling people about their exciting research, but not about how much money has been saved"[16]

1.1 Operational and Productive Efficiencies

Efficiencies delivered over a sustained period (since 2004)
There is strong evidence, already published, to highlight that the sector has become more strategic and efficient across the portfolio of research, teaching and administration activities[17]

Efficiencies achieved since 2004: Building towards a ten year track record

- Headline savings in England over CSR04 and CSR07 periods of more than £1.38bn in response to mandated targets of £1.23bn (either in-year cuts or managed efficiencies)

Reporting period	Target (£m)	Delivered (£m)
2005/06	151	134
2006/07	150	150
2007/08	198	202
2008/09	126	159
2009/10	241	275
2010/11	363	462

- These savings were implemented during a time of
  - Record student numbers
  - Increasing activity on widening participation
  - Increased research performance: "UK ranked first out of the G8 nations in terms of publication productivity, and generally having greater outputs per researcher and per unit of investment than similar sectors" (UUK, 2010, p.14)

(UUK Efficiency and Modernisation Task Group "Diamond" Report p. 14, 16 and 17. Figures compiled from HEFCE Board papers: B61/07e; B78/08; B75/09; B75/10; B11/67)

Productive Efficiencies
Greater output (number or quality) for same, or proportionately less, input.

[16] Professor Sir Ian Diamond, speaking at the 2nd Annual UUK Conference on Efficiency, 26 February 2013
[17] UUK (2011), **Efficiency and effectiveness in higher education:** A report by the Universities UK Efficiency and Modernisation Task Group p. 6

The sector has also demonstrated its ability to achieve greater productive efficiencies, for example through the Science Research Investment Fund Round 2 (SRIF2), where £1bn was allocated across the UK in 2004/05 and 2005/06. This was used to support long term institutional strategies (e.g. Life Sciences Centre at the University of Dundee); collaborations across HE (e.g. the London Centre for Nanotechnology) and collaborations between HEIs and business (e.g. Cambridge University and Alps Electric, Dow Corning and Marconi on electrical engineering)[18]

The Technopolis evaluation of the fund in 2009 highlighted the four most valuable investments from this fund were:

- Increases in research productivity
- Ability to perform new types of research
- Ability to perform research in new areas
- Improved ability to attract research funding

The report highlights that SRIF enabled "a large number of small but critical investments in new equipment and facilities, often a pre-requisite to participating in frontier research and becoming ever more so as large swathes of science become more complex and capital intensive" (page 4). This theme will be returned to in sections three and four, looking at new approaches to capital investment and equipment sharing following changes to funding in CSR 2010.

Research Pooling in Scotland

The Research Pooling exercise adopted by the Scottish Funding Council (SFC) in 2003 (then Scottish Higher Education Funding Council) is often cited as an example of productive efficiencies in the research base. The SFC highlight that the aims of research pooling are the maintenance and further development of a sustainable world-leading research base across areas of strength in Scotland's universities[19]. A total investment of over £500m (as at March 2011, including £150m from SFC and £350m from HEIs) was utilised to build virtual critical mass in key areas of the research base, including physics, chemistry and engineering. The funding was largely invested in recruiting new and high quality staff, new studentships and some limited capital equipment contributions[20].

The evaluations of research pooling point to some important benefits from this exercise. For example:

- For the Scottish Universities Physics Alliance (SUPA) benefits include the new Graduate School and the sharing of resources and expertise between HEIs, significant inputs into RAE submissions which are believed to have improved the quality of submissions, critical mass and associated networks of SUPA, and raising the profile of Physics in Scotland[21].
- In the case of chemistry, it is estimated that the pooling exercise enabled the institutions to secure £42m of addition competitive research funding between 2005/06 and 2009/10, "this implies that each £1 of SFC and OST investment generated £3.05 in additional competitive research funding" [22] (p. 7).

Neither the SQW nor BiGGAR Economics evaluations mention efficiency as a key driver for the intervention or as an output / benefit achieved thus far, although both highlight the longer term benefits of collaboration and cultural change. Indeed, the Chief Executive of

[18] Technopolis (2009) Science Research Investment fund: a review of Round 2 and wider benefits

[19] Letter from M Batho, Chief Executive, SFC to Graeme Reid, Director of Research Base, BIS; 25 March 2011

[20] Letter from M Batho, Chief Executive, SFC to Graeme Reid, Director of Research Base, BIS; 25 March 2011

[21] SQW Consulting (2009), Formative evaluation of research pooling- focused on Scottish University Physics Alliance, Final report to SFC, Part One

[22] BiGGAR Economics (2010), Evaluation of Chemistry Research Pooling, A report to the Scottish Funding Council

SFC has highlighted that research pooling has "the characteristics of a policy default for reasons of scale, efficiency and quality"[23].

What policy levers are being utilised to deliver efficiencies and what more can be done?
The sector has explored and is exploiting a number ways to lever efficiencies. The focus of activity is highlighted in two major reviews.

1.2 The Wakeham Review: Efficiencies and Sustainability of Research

The Wakeham Review[24] (2010): UUK / RCUK Task Group looked at the financial sustainability, efficiency and effectiveness of research undertaken in universities, and RCUK subsequently produced a delivery plan on the implementation of the findings[25].

Implementation of Wakeham: Efficiencies delivered in Spending Review 2011
The principles of the Wakeham Review have been applied "across the spectrum of research funding as the core driver for efficiency savings in SR10"[26], and progress is as follows:

- Efficiencies totalling £324m in 2014/15 were agreed in SR10 (7% of the £4.6bn resource budget for science & research).
- This is being delivered mainly through reduction to the indirect costs of research and pay restraint on grants and Institutes.
- Implementation of the Wakeham Review means Research Councils will deliver savings of £428m over the CSR period.
- The decision to cut HEFCE QR funds from 2* research and to reinvest in higher quality research in the last SR means higher quality research is being delivered for the same level of funding.
- This is delivering a productive efficiency of £270.23m across the CSR period against a target of £238m.

1.3 The Diamond Report

Efficiencies being progressed by the sector– the Diamond Report
UUK established a task group in 2010, led by Professor Ian Diamond, focusing on university core operational functions, for example ICT, finance, estates, procurement and human resources. The review[27] made 17 recommendations across a number of areas including development of shared services, outsourcing and procurement. Many of the efficiency improvements can only be realised at institutional level, and cannot be mandated.

As such UUK is currently working on areas where sector-wide approaches to efficiency will be required in order to overcome duplication or fragmentation. There is a programme of work with four strands; 1) Leadership, implementation and monitoring, 2) Data, benchmarking and costs, 3) Regulation and 4) Procurement.

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[23] Letter from M Batho, Chief Executive, SFC to Graeme Reid, Director of Research Base, BIS; 25 March 2011
[24] RCUK & UUK (2010) Financial Sustainability and Efficiency in Full Economic Costing of Research in UK Higher Education Institutions http://www.rcuk.ac.uk/documents/reviews/fec/fECReviewReport.pdf
[25] RCUK (2011) Efficiency 2011-15: Ensuring Excellence with Impact http://www.rcuk.ac.uk/documents/documents/EfficiencyEnsuringExcellencewithImpact.pdf

[26] BIS (2010), The Allocation of Science and Research Funding, 2011/12 to 2014/15, p. 15
[27] UUK (2011), **Efficiency and effectiveness in higher education:** A report by the Universities UK Efficiency and Modernisation Task Group p. 6

Implementation of the Diamond Report
Activities like data and benchmarking are highlighted in the Diamond Report as crucial supporting infrastructure to provide tools for the sector to support long term institutional change. UUK have stated the commitment to monitor, evaluate and report on progress, but clearly **it is the responsibility of institutional leaders to address efficiency within their own institutional framework**. As detailed in sections 2 and 3, this report finds significant progress is being made by institutions.

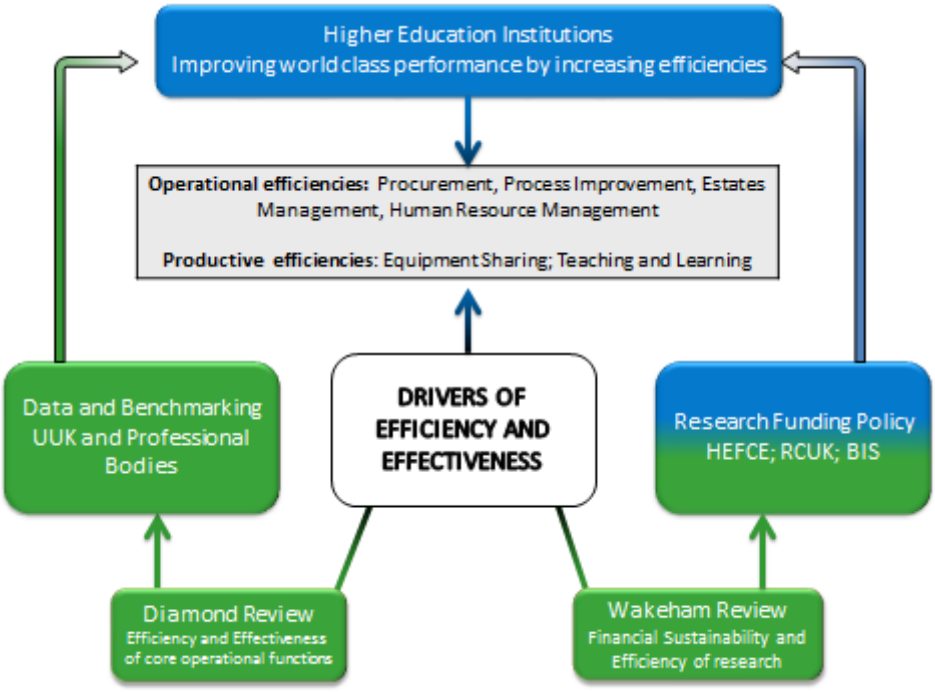
Following a joint BIS / UUK workshop in November 2012, colleagues in BIS have worked with UUK to steer the work. UUK have appointed researchers to collate quantitative evidence provided by institutions in value for money submissions to HEFCE. This will deliver a single number of efficiency savings delivered following the Diamond Report.

1.4 How the system works and where the efficiencies are realised

It is important to be clear about how efficiencies across the sector can be delivered and where the efficiencies are realised:

The Wakeham and Diamond Reviews demonstrate the role and complexity of the research system, the importance of the dual support system and how incentives and drivers work to generate efficiencies. This is highlighted in Diagram 1

Diagram 1: Drivers of Effectiveness and Efficiency in the HE system



Green: indicates work undertaken nationally and by the sector as a whole; blue indicates work done within individual institutions

These Reviews point to the different role of all actors in the sector (BIS, HEFCE, RCUK, UUK Institutions, and Professional Bodies) and highlights:

a) The importance of the dual funding system[28] in supporting efficiency across all levels in the sector
b) The range of levels where mutually reinforcing policies and actions are required to support long term change
c) That while HEIs are responsible for delivering increased effectiveness and efficiencies, **consistent and reinforcing signals from BIS and RCUK can accelerate the pace of change.** These can be as simple as including relevant examples in Ministerial speeches, or RCUK policy changes to further incentivise collaborations and sharing across the sector. Both examples are at no cost.

1.5 Building an evidence base of efficiencies within HEIs

The case studies are focused on documenting and analysing evidence of the activity undertaken specifically by universities; this is a crucial, substantial and less understood part of the picture on effectiveness and world class performance of the research base.

The work within universities is complementing the extensive work undertaken at national level, described in section 1, by UUK, HEFCE and Research Councils, as part of, and following, the Wakeham and Diamond recommendations. This report builds on the case study evidence collected by colleagues at Universities UK.

Providing a commentary on, or recommendations for, future efficiency savings is explicitly outside the scope of this work.

1.6 Efficiency taxonomy

An outline taxonomy has been developed (see Table 1) to classify efficiency case studies and the types of activity that are possible.

Table 1: Efficiency Taxonomy

<table>
<tr><td colspan="4">Operational Efficiencies[29]
An operational efficiency decreases the resource input to deliver the same level of activity</td></tr>
<tr><td>Process Improvement</td><td>Procurement</td><td>Human Resource Management</td><td>Estates Management</td></tr>
<tr><td>Optimising business processes to reduce time and cost and improve quality</td><td>Delivering maximum value from resources spent through increased internal capability and collaborative procurement solutions</td><td>Management of human capital to improve organisational performance</td><td>Optimising the development, management and maintenance of the University estate</td></tr>
<tr><td colspan="4">Productive Efficiencies:
Continuous relationship between production function
Greater output (number or quality) for same, or proportionately less input</td></tr>
<tr><td colspan="2">Equipment Sharing
Increasing utilisation rates of existing equipment and collaborative purchasing and utilisation of new assets</td><td colspan="2">Teaching & Learning
Managing the teaching and learning process to improve quality, learning outputs and reduce cost</td></tr>
</table>

[28] Where the distribution of QR income through the Research Excellence Framework is complemented by the more directed programme based research funding of the Research Councils, charities and EU.

[29] Definitions based on templates received from BIS central finance team, and subsequent helpful discussions with Rosa Fernandez, Economic Advisor, BIS

Section 2: Operational Efficiencies - Cash Savings reinvested for students and research

2.1 Procurement

Procurement efficiencies can be delivered at two levels – within an organisation or across organisations through collaborative procurement arrangements.

Procurement in universities

There are a number of strong examples across the sector where single institutions have worked to improve their procurement capabilities to reduce process and purchasing costs. For example:

- **Newcastle University** has recently undertaken an 18 month project, supported by £1m investment in the HEFCE Modernisation Fund, to rationalise and improve their procurement function. This has;
- Saved £1.7m in year one
- Projected to save £2.4m per year in future years
- The University is also looking at local collaborative procurement opportunities, for example joint estates contracts with the City Council.

Collaborative procurement

There have been a number of areas of good practice where purchasing consortia are achieving increased efficiencies and more for less:

- **Southern Universities Purchasing Consortia** –£31m quantifiable savings (including £14m cashable[30]) on £250m collaborative spend by SUPC members in 2011/12[31]
- **London Universities Purchasing Consortia** - £26m savings (including £15.5m cashable) on £159m collaborative spend[32]
- **The Advanced Procurement for Universities and Colleges (APUC**) is the procurement Centre of Expertise (CoE) for Scotland's 55 universities and colleges; it has achieved savings as follows:
    - Collaborative contracting: £12-15m[33] a year, approx. (circa 9% of relevant spend)
    - eSolutions shared service – 700k a year
    - College Services team-capital projects (700k-£2.5m a year). depending on level of spend)

Future work

The Diamond Report (2011) recommended that British Universities Finance Directors Group (BUFDG) establish a Procurement Academy to raise national capabilities and promote procurement as a strategic asset. The work thus far has been scoping and planning for the Academy, and this is aimed at all staff in HEIs who are involved in purchasing goods and services. The Academy will be building good practice guides, packages of programmes on skills training, qualifications and a Leadership Development Programme (in conjunction with the Leadership Foundation).

Institutions are also undertaking further work around Procurement Maturity Assessments, to provide a ranking and benchmark on procurement performance. Improvements in the

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[30] Direct Price Based (Cashable) savings relate to the cashable savings delivered by the consortia, while price v market savings are non-cash savings from equivalent to what a HEI would have had to spend if they were not dealing through the consortia

[31] Southern Universities Purchasing Consortium report 2010/11 http://www.supc.ac.uk/aboutsupc/annual-reports

[32] http://www.lupc.ac.uk/resources/annual-report.aspx

[33] Methodology for calculating savings is on very demanding criteria; based on previous price paid
Other common used methodology is savings against market price. If this methodology used, savings projection potentially approx. £30m per year

maturity of the procurement function should bring tangible benefits to institutions. Early indications are that raising the level of performance could deliver recurrent savings of around 1%, though more work needs to be done to confirm this.

Finally, Procurement UK has been established as a UUK sub group to define the future landscape and strategic direction of procurement in the UK at the highest level. This is chaired by Professor Nick Petford, Vice Chancellor of Northampton University.

Process Improvement
Universities undertake a range of business processes associated with a complex array of core business functions, and the Diamond Report contained three clear recommendations with regard to efficiencies delivered through process improvement[34]:

1) Institutional leaders continue to prioritise streamlining and standardising internal administrative and operational processes.
2) Maintaining a longer term view on efficiency initiatives should always be seen in the context of maintaining the effectiveness and quality of UK higher education.
3) Decisions on efficiency initiatives are based on costed and robust business proposals so that the benefits can be clearly evidenced.

A case study from the University of the West of England exemplifies all three of these recommendations in a review that encompassed 460 members of staff. The "One University Administration" project was seeking to reduce service delivery costs by 25% and led to:

a) Reduction in administration tasks through economies of scale; lean management reviews, process automation and standardisation, stopping some tasks (e.g. local marketing). As a result: staffing complements within the new structures reduced from 460FTE to 360FTE
b) An annual pay bill saving of £2.1m per annum (14% of budget) - against investment of £1.8m in direct costs (predominantly severance payments) and £1m indirect costs (predominantly managerial opportunity costs through time of secondments and senior managers)
c) Savings have been utilised to reduce financial deficits and place institution on sound financial footing

The reconfiguration of services has also led to improved service delivery to students, for example centralised response handling for student phone and email enquiries, generating economies of scale which enabled longer "opening times" to deal with student queries.

2.2 Human Resource Management

The staff costs of the HE sector account for 52.6% of total income, the largest expenditure item[35]. In terms of the national picture it is important to note:

- Pay costs have been reduced from 57% of income to 52.7% of income over the past 5 years
- This has been achieved through:
  - Four years of pay rise restraint to 1% or less
  - Amending the pension schemes (both USS and local Self-Administered Trusts) – one of the first areas of the public sector to do so
  - Voluntary severance programmes at several institutions

[34] Diamond Review, ibid, p.10
[35] HEFCE, (2013), Financial Health of the Higher Education Sector, http://www.hefce.ac.uk/media/hefce/content/pubs/2013/201304/2013-04.pdf

Universities Human Resources is a sector professional organisation which disseminates and showcases good practice around human resource management. They have highlighted a number of ambitious, successful case studies where significant change and benefits have been achieved.

These include:

- **Swansea University** focused on increasing the quality of the output of current academic staff; "supporting good people to do even better"
  - Communications and negotiations with the Trade Unions involved 180 meetings, with 940 staff attending the consultations about improving the performance of staff around a new suite of academic KPIs
  - The project resulted in a 79% completion rate of PDRs in year one, and 90% in year 2, against 25% in previous years
  - Swansea has risen 38 places in the National Student Survey (42nd out of 136) and up 12 places to 45th in the Sunday Times University Guide

- **University of Lincoln** focused on new absence management strategies and a reward strategy and well-being programme
  - This includes a new absence management system which has led to a 25% reduction in sickness absence and 50% reduction in overtime costs
  - New e-recruitment system saving 1,500 staff hours per year
  - Time has also been spent on working on positive relationships with the Trade Unions, which although time consuming, offers significant benefits

2.3 Challenges in managing workforce change – why these need to planned not mandated

These case studies demonstrate the significant savings and benefits that can be achieved through human resource management and organisational change. It is equally important to note that these transitions are bedevilled by complexities including:

- Strength of Trade Unions and engaging in dialogue around the need for change
- Level of opposition from staff – this may be increasingly heightened in the academic sector founded on the values of academic freedom and independent thinking
- Propensity and energy for change which is best driven by an academic case rather than financial or market drivers

This makes organisational change and efficiencies in HE both costly and complex to achieve.

Finally, although efficiencies through reducing staff numbers is often the short term objective of workforce change projects, it is also the long term cultural change which is ***critical to move from a system of allocation of undergraduate numbers, to a market and competition for students*****,** requiring a more flexible staff resource.

Case Study: challenges in managing workforce change:
Why these need to be planned rather than mandated to deliver efficiencies

- Implementing measures to reduce headcount and pay costs can deliver significant cash savings but this can often lead to significant reduction in capability in the research base.
- *The University of Case Study** implemented a short term voluntary severance scheme that secured the future of the institution
- But the reduction in staff has huge implications for the business going forward including
    - Loss of some of the best people (those who are able to secure jobs elsewhere are often the ones who volunteer to leave)
    - Huge gaps in service delivery in key compliance tasks (e.g. statistical data returns)
    - Loss of organisation memory
    - Survivor syndrome – staff disempowered and vulnerable following reductions in large numbers of staff

Regaining organisational confidence

- There was then a two year process to address the gaps in service delivery and rebuild individual and organisational confidence
- There was a twin track process
- Short Term
    - Fire fighting: sorting the basics (new HR policies and payroll; building confidence of HR team – "train the trainers")
    - Where staff were recruited this was done very carefully to secure quality people who can punch above weight and to make sure new people would drive change in a collaborative way
- Longer term
    - Building academic capability for teaching – modernise from "talk and chalk" to new methods of delivery – look up and outwards, raising aspirations to modernise and be truly academic on scholarly activities.
    - People previously embarrassed to work at the institution – move to being proud through, for example, new staff awards scheme to celebrate success.

*The institution wishes to remain anonymous.

The case study highlights that in order to deliver increased effectiveness, these changes needed to be planned and delivered at the appropriate pace, **rather than universities being mandated to deliver efficiencies.** The case studies highlight three critical success factors in delivering organisational change;

1) **Trade Union relationships**: Base on trust and sharing information – soft influencing, working collaboratively but being tough at the right times.
2) **Mandate from the top to deliver with pace:** where HR Director is a Board level executive – provides the mandate to deliver change.
3) **Performance management** – issues with poor performers or antagonistic individuals are dealt with in conjunction with the Trade Unions

2.4 Estates

Maximising the overall use of space within a University estate and lowering the operating cost of that space are key efficiency drivers of universities. Depending on the nature of the intervention, these measures can be classified as either productive or operational efficiencies, whilst some schemes will be a combination of both (for example, some space may be taken out of use, while adjacent buildings may be upgraded).

It is encouraging to note three important trends across the sector:

1) Teaching space utilisation (based on student numbers) has improved by 10% in 4 years[36]
2) Research space utilisation (based on research staff numbers) has improved by 11% in 4 years[37]
3) Carbon emissions are reducing – the collective impact of institutional targets is a 38 per cent reduction between 2005 and 2020[38]

The Lean Laboratory

Work led by Peter James at the University of Bradford, funded by HEFCE, highlights and exemplifies the work that is being done across university laboratories to increase efficiencies. The changes to laboratories parallel the work done to increase the efficiency of data centres which are now 40-50% more energy efficient than 4-5 years ago. The key drivers for the increasing efficiencies in laboratories are highlighted by James[39] as:

- Increased student expectations
- Regulatory / stakeholder demands
- International competition – are UK labs efficient and competitive? Can routinised processes be outsourced to be cheaper e.g. gene sampling?
- Evident inefficiencies, and the need to utilise resource and knowledge of technical staff

James[40] highlights the key goal of the lean laboratory as deriving more value from less resource use and activity, to improve research and teaching performance. This can be achieved through:

- Improving flows
- Reducing waste
- Better use of space: the costs of building laboratory space are typically £2-3k per sq. metres to build and £300+ per sq. metres to operate
- Improving resource efficiency – laboratories often consume 3 to 4 times more energy than offices on a sq. metres basis[41]
- Improve utilisation of equipment and related services (e.g. cold storage)

Some examples of recent efficiencies and best practice in laboratory management are:

- **Imperial College**: changes to air handling services cut Flowers Building costs by almost £50k per year, cut carbon emissions by 315 tonnes, with a payback within 12 months
- **Warwick University** – Undergraduate Chemistry Laboratories: saving of 370 carbon tonnes and over £50k per annum

[36] Net Internal Area (Teaching Total) in Metres² per Teaching Student FTE – *EMS Data Collection*
[37] Net Internal Area (Research Total) in Metres² per Research Staff FTE – *EMS Data Collection*
[38] http://www.hefce.ac.uk/whatwedo/lgm/sd/carbon/
[39] James, P (2013) Presentation to UUK Efficiency Conference, 26 February, Woburn House, London
[40] James, P (2012) "The Effective Laboratory: Safe, Successful and Sustainable" http://www.goodcampus.org/files/files/88-117899_The_Effective_Laboratory_2012_Report_72dpi.pdf
[41] James, P et al (2011) "Energy Consumption of University Laboratories: Detailed Results from S-Lab Audits" http://www.goodcampus.org/files/files/60-S-Lab_Energy_Audits_of_HE_Labs_final_v15_4_7_11.pdf

Other examples of estates efficiencies collected for this report include:

- **Reducing campus energy costs through shared services with local partners:** the University of Leeds is saving almost £1m a year on energy costs through a combined heat and power plant joint with Leeds Teaching Hospitals NHS Trust, and annual savings of £200k on carbon tax through using steam and hot water;
- **Disposal of ageing building and upgrade to modern facilities:** Aston University has relocated its chemistry department from a 7,000 square metre to a 4,000 square metre space, providing savings in real estate, and energy efficiencies with lighting, heating and ventilation.

2.5 Shared Services

There are a number of different shared service arrangements operating across the research base. These include

- **Student Services** e.g. the Careers Group – the careers service run by the University of London for 50 institutions
- **Administrative functions** e.g. University of London Computing Centre – has 300 institutional customers, including Further Education Colleges
- **Cross sector provision** e.g. UCAS (the UK university admissions service) and JANET (the UK academic computing network)
- **Cross organisation provision** e.g. RCUK Shared Services Centre which provides services for 7 Research Councils and now administers payroll and transactional finance, HR and payroll services to BIS.

There has been a significant level of information collected on Shared Services[42], highlighting the positive benefits that can be delivered from these arrangements, including cost savings, and unity and integration of a range of services. There are also a number of challenges including management and governance arrangements, and how to manage the increased competition within the sector alongside efforts to collaborate. There is evidence of significant savings already being delivered. For example through the work of JISC[43]:

- For each £1 spent by JISC on the provision of e-resources, the return to the community in value of time saved in information gathering is at least £18
- For every £1 of the JISC services budget, the education and research community receives £9 of demonstrable value
- For every £1 JISC spent on securing national agreements for e-resources, the saving to the community was more than £26.

It is likely that there will be increased consideration of shared services over the coming months, particularly with the VAT exemption now in place[44]. The complexities and challenges should not be underestimated, as highlighted by the recent failure of two proposed schemes based at Warwick and London Metropolitan Universities.[45]

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[42] For example, JISC commissioned 3 reports on the current position and further potential for shared services: http://www.jisc.ac.uk/media/documents/programmes/jos/sharedservicesreport1.pdf

[43] Statistics from Cooke, R The Value of Joint Information Systems Committee to Further and Higher Education", reported in UUK, Efficiency and Effectiveness in HE (the Diamond Report) p. 44

[44] In Autumn 2012 HMRC introduced the VAT exemption, enacting a piece of European VAT legislation which has been in place since 1978. It allows, under certain circumstances, supplies of services made by an organisation owned by members to its members to be VAT exempt, rather than subject to standard rate VAT. If the terms of the cost sharing exemption are not met then organisations are required to add 20% VAT to the value of the services in all but a few specific cases.

[45] Times Higher Education Supplement, 13 December 2012, "State pulled out the VAT stops, so why haven't you learned to share?" http://www.timeshighereducation.co.uk/422077.article

Section 3: Productive Efficiencies

3.1 Teaching and Student Service Delivery

There are a range of innovations being implemented in the delivery of teaching and student services, which are adding significant value for minimal additional cost. For example:

University of Oxford has redesigned their careers service through a process of continuous improvement over last 5 years, where the numbers of staff have remained constant but the department now serves 70% of the student population (up from 40%). University of Oxford careers service has also

- grown the number of job vacancies advertised by 20% a year
- grown the number of internships advertised from 4 in 2008 to 280 in 2012.

These improvements have been delivered through changes in the way the overall service is delivered (fewer 1:1 appointments and with a focus on a breadth of products) and outsourcing of IT systems, which cost significantly less than the corresponding staff posts.

The careers guide is now produced in-house rather than delivered by a 3rd party supplier, increasing the quality of the product and earning advertising revenues shared jointly with the Student Union.

The University of Manchester have implemented a sophisticated lecture capture and distribution system, resulting in 164,000 podcast downloads in the pilot year. Research has been undertaken on benefits and disincentives to broadcasting lectures where 88% indicate it has increased satisfaction and student attainment rates have been increased[46].

Following the pilot of 10 lecture theatres this is being rolled out to 100 lecture theatres for completion by September 2013, with a total project cost of £600k. There is also potential to multi-purpose the lecture material, for example for Massive Online Open Courses (Moocs), and notably there has been no impact on attendance rates, even for lectures scheduled at the beginning and end of the day!

Due to time constraints, only two case studies have been collected on teaching efficiencies but there is huge scope to collect additional material in this area.

3.2 Science Assets and Equipment – higher cost, higher productivity, efficiency and sharing

Why is equipment important and why does it cost so much?
Access to leading edge research equipment supports increased productivity and excellence across the science base. The increasing cost of maintaining the science infrastructure was originally acknowledged by Government economists in the 1960s who found real-price growth rates per scientists for major equipment of up to 20 per cent per annum in some laboratories[47]. While innovation in instrumentation and the way it is used has caused the price for a given effect or throughput to decrease dramatically, international competition to

[46] Research paper available at http://www.ucisa.ac.uk/~/media/Files/members/awards/excellence/2011/Manchester
[47] The Sophistication Factor in Science Expenditure, HMSO 1967 quoted in Georghiou, P & Halfpenny, P (1996), Equipping Researchers for the Future, Nature, 383, October 1996,

be at the leading edge of discovery and exploitation of results has tended to outweigh this. This cost of staying at the leading edge was termed the "Sophistication Factor".

Examples of the kind of dynamics affecting instrumentation include[48]:

1) **Increased performance e.g. – power, resolution, accuracy and throughput of samples**
   For example the productivity of DNA sequencing technologies has increased more than 500-fold (1997-2007)[49] and continues to increase.

2) **New families or classes of equipment**
   New equipment has emerged offering novel capabilities and enabling new science not previously possible. These new classes of equipment only partially replace facilities that are currently utilised.

3) **Increased equipment intensity in a wider range of disciplines**
   Physics and Chemistry and associated areas of engineering were traditionally far more capital-intensive than other fields but increasingly the life-sciences have been catching up. In areas such as imaging there has been a strong convergence in equipment requirements. This is in itself a source of new interdisciplinary interactions and benefits.

The increasing cost of equipment and desire of the UK to maintain a leading edge science infrastructure has implications for public funding mechanisms. This is a well-rehearsed debate of the last twenty years: "equipment required to remain competitive in the field is becoming relatively more expensive, and unless new funding is found, existing allocation and management systems will have to change" (ibid, 1996, p. 664).

Supporting transition and cultural change following changes to capital funding
The recent reductions in capital funding have required significant changes incurring transaction costs, in order to achieve efficiency gains. These costs will reduce over time as organisations progress and move up a steep learning curve. The initial support to meet these costs is critical so that the sector can maintain and improve effectiveness as well as enhance efficiencies.

The availability of transitioning funds by EPSRC has supported significant change and progress in the area of equipment sharing. It is important to note that the transition is about initiating two things:

1) **New systems:** putting in place the practical infrastructure to support equipment sharing
2) **Cultural change**: enabling the long term behavioural changes required to support use of research infrastructure in different ways

Asset Registers and formation of University clusters
Following the reduction in capital budgets in 2010/2011 and the 50% reduction to capital funding, Research Councils implemented new processes for handling equipment requests. EPSRC also supported Framework Institutions in transitioning to these new arrangements by allocating approximately £150-200k per institution towards equipment sharing initiatives.

[48] Georghiou, P & Halfpenny, P (1996), Equipping Researchers for the Future, Nature, 383, October 1996
[49] *Genome Synthesis and Design Futures; Implications for the US Economy, BioEconomic Research Associates, 2007*

This funding was important for a number of reasons:

1) It allowed institutions to make a quick and direct response to changes in capital funding
2) Institutions were able to focus this funding on areas where it was most needed within their own organisation
3) Many universities chose to focus on developing equipment and asset registers, categorising all pieces of research kit, over a certain level (typically around 15k)
4) Due to the imperatives of sharing, this has stimulated further coalescing of clusters of research intensive universities; firstly the N8, and followed by the M5, GW4 and most recently the SE5.
5) These collaborations have emerged organically, and have provided an important platform for research infrastructure planning and future investments.

Table 2: Asset registers and formation of university clusters

Partnership	**Numbers of kit registered on database**	**Next steps**
GW4 (Great Western Four) Formed in 2013 Bath, Bristol, Cardiff, Exeter	2,200 (in progress)	Database to be launched; exploring the potential for research collaboration, joint bids and joint procurement, evaluating multiple taxonomies that could help make the database more useful to other stakeholders, and ensuring the administrative burdens associated with sharing equipment is minimised.
M5 (Midlands 6) Formed in 2011 Aston, Nottingham, Birmingham, Leicester, Loughborough and Warwick	600 suitable for sharing across institutions. Each University has several hundred other items on their internal catalogues	Strategic Equipment planning in selected areas http://www.m5universities.ac.uk/facilities/ Kit-Catalogue (developed at Loughborough and adopted across the M5) has resulted in savings on asset software and registers
N8 (Northern 8) Formed in 2006 Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield, York	4,000	Strategic Equipment planning in selected areas Both large scale new capital and coordinated refreshing of lower grade facilities http://www.n8equipment.org.uk/
SE5 – Science and Engineering 5 Formed in 2013 Cambridge, Imperial, Oxford, Southampton UCL	2,700 in phase one, progressing to 3,400 by Summer 2013	Group is taking a pragmatic approach to beginning the process of sharing facilities and equipment. Focus is on items of equipment regarded as being "managed", with procedures and processes in place to facilitate external usage.

Why does proximity matter?

The emergence of regional clusters of research-intensive universities is due to the importance of proximity in equipment sharing. For many types of capital assets, this is a key factor underpinning the economics of equipment sharing, taking into account travel time, depending upon the likely frequency, intensity and duration of use.

Supporting the transition through short term incentives
There has been greatest progress in the EPSRC "Framework Institutions" who were provided small sums of money through a formula allocation. Importantly, this Illustrates the benefit of supporting institutions with "costs of change" which can accelerate the pace and quality of the organisational transition required across the sector.

Planning for the long term transition - sharing for excellence and growth
Funding provided by the EPSRC also supported a report by the N8 Universities[50], looking at how to support long term strategic, organisational and financial changes to support greater equipment sharing as a key policy response to reduced funding for capital equipment.

The report looked at three main challenges:
1) **Equipment for sharing:** when to share, benefits, barriers and cultural factors
2) **Knowing what is available to share**: developing asset registers
3) **How to pay for sharing:** business models and costings

Sharing for Excellence and Growth: Professor Luke Georghiou, for the N8 Universities, funded by the EPSRC (2012)

There are positive benefits of sharing equipment, of 3 main types
- Creating concentrations of research activity where collaboration between and within universities and with industry can drive excellence and impact in research
- Increased efficiency by reducing the number of items that need to be purchased and obtaining higher load factors on existing items; and
- Allowing capital items too large for a single institution to be acquired and hence solving the problem of indivisibility of assets

These benefits can only be obtained if certain pre-conditions are satisfied:
- Trust is built between the holders and users of equipment through common objectives and assurances about treatment of samples and equipment;
- Potential users need to be able to locate the equipment they need and that equipment must have available capacity in the desired period; and
- A governance and management framework needs to be in place to ensure that the additional costs associated with sharing are adequately covered and allocated, service levels clarified, and that intellectual property, health and safety, liability and training issues are organised; and
- Proximity and travel time are factored into the calculation, depending upon the likely frequency, intensity and duration of use.

In view of these conditions, a pragmatic approach to the sharing agenda is critical.
- "Even with highly efficient arrangements in place, sharing can only succeed if the circumstances are right: Sharing inevitably involves substantial transaction costs which are only in part sensitive to the scale of equipment investment under consideration – for example, access arrangements and the provision of technicians for longer hours to create availability are both largely fixed costs irrespective of the size of equipment under consideration"
- "Sharing is far more likely to be an economic proposition when larger items are under consideration. There is no fixed cut-off as maintenance and other requirements vary but it is unlikely that equipment below a threshold of between £200-500k will be viable for anything beyond casual opportunities" (page 1)

[50] Georghiou, L (2012), on behalf of the N8 Research Partnership "Sharing for Excellence and Growth" http://www.n8research.org.uk/assets/14137%20N8%20Sharing%20for%20Excellence%20and%20Growth%20Report_WEB.pdf

Removing policy barriers and increasing incentives
Given the changes to the levels of capital funding for research, it is important to ensure that, where appropriate, research policies are incentivising the sharing of kit and that barriers to sharing are removed. Some ideas for no-cost policy reforms in this area include:

1) Opportunities to change the mechanism for the credit distribution that would apply for REF and Research Council accounting purposes.
2) Opportunities to change the mechanism for allocation of carbon credits associated with a shared piece of kit, to reflect the usage by a consortium of institutions.
3) Where appropriate, funding bids to include mechanisms for sharing as a key criteria.

New strategic approaches to funding of equipment (EPSRC)
As resources are limited, there is an increased imperative to be more transparent and more strategic with investment, and to maximise national resources and capability. The development of asset registers is a new resource which can be used for infrastructure investment planning and national equipment strategies.

A good example is in the area of NMR, where on behalf of the EPSRC, Professor Mark Smith has recently developed a strategic overview of equipment needs in the physical sciences area, following a survey of the research base. The report now acts as an important resource and roadmap to:
- Enable peer reviewers to prioritise investments in NMR
- Support RCUK to strategically plan investment to address weaknesses in the system in comparison with overseas competitors

Why is NMR important?
Maintaining leading edge NMR capability is critical as this is a core underpinning technology across physical sciences including chemistry, civil and chemical engineering, materials science, chemical biology.

NMR plays a key underpinning role in the majority of the focus areas for the industrial strategy, but most specifically in:

- **Nuclear and Renewables**
  - Especially where NMR is a key technique in development hydrogen storage materials, batteries etc.
  - The UK is probably world-leading in applying NMR to these applications,

- **Life Sciences**: in pharmaceuticals and in implant materials for healthcare,

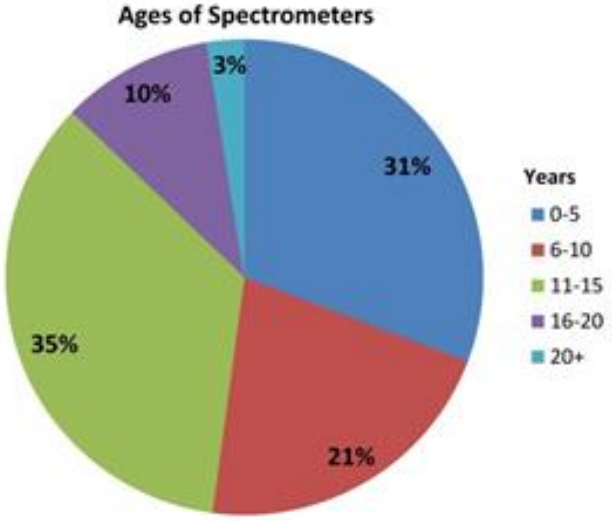
- **Construction**: understanding things like cement hydration

Understanding the current portfolio and resourcing implications of NMR infrastructure underpinning world class physical sciences. Professor Mark Smith, EPSRC

"Aged equipment becomes physically worn out requiring more repairs and is of lower inherent sensitivity. However what becomes more of a limitation in enabling internationally competitive research is the range and sophistication of experiments that can be performed on older instruments"

The report highlights that a lifespan of ten years is probably the best guideline for when NMR equipment is considered both last generation and becomes physically unreliable. "There is then a double loss of efficiency with older "last" generation in that adequate but less informative experiments performed"

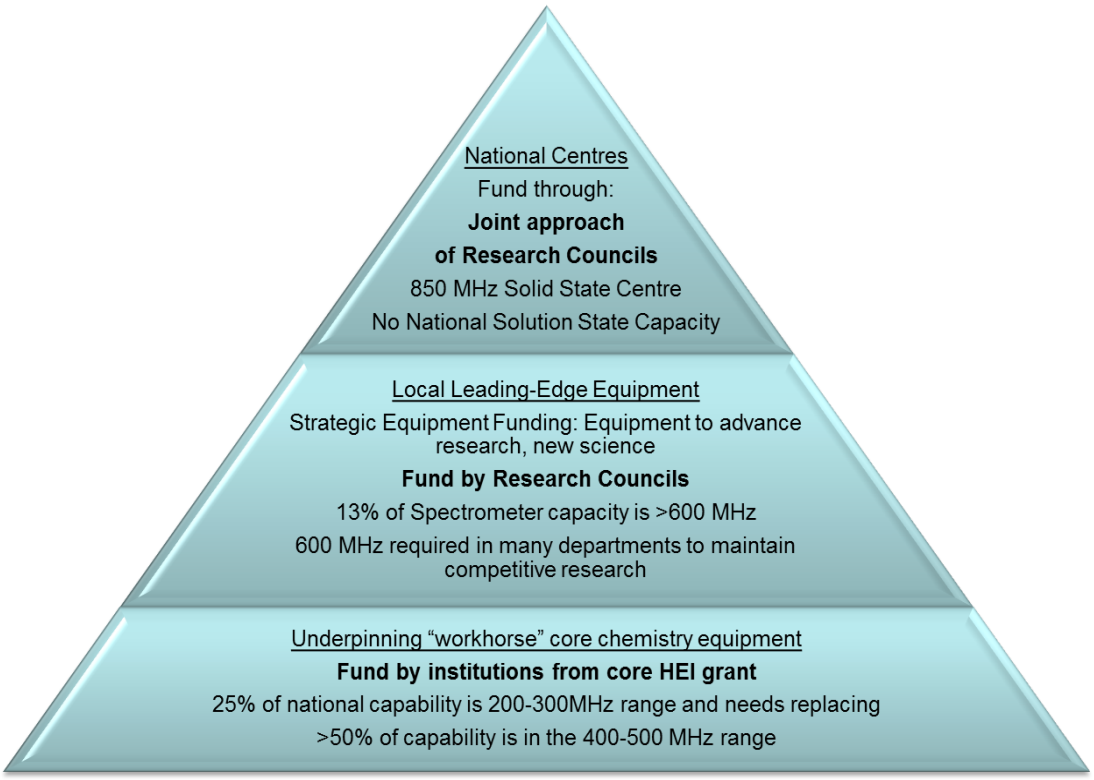
The age profile of NMR spectrometer consoles being used within the physical sciences



"The age profile of the consoles shows around 40% could be regarded as roughly current generation, which is positive. On the downside over 50% of the portfolio is 11 or more years old which in an ideal world would be replaced and is therefore a big capital liability for the sector" (all quotations page 4)

The report then highlights that in order to retain leading capability; the sector needs to be clear about the use of specific funding streams. An approach is suggested in the pyramid diagram which has been recommended by Professor Smith in his report

Suggested new approach to funding NMR for physical sciences



This demonstrates a planned, tiered system of equipment funding for NMR, which would allow the research community to make the best use of funding available. The suggested approach is for HEI monies to be used for lower level equipment; Research Council funding for strategic new research equipment, and a joint approach of Research Councils to support cross discipline, large scale research centres.

In an environment of reduce public resource, increased planning and prioritisation of this type is crucial to maintaining a competitive position in key equipment categories.

The report was presented to the research community by Professor Mark Smith and EPSRC on 21 March 2013. The report was well received including the need for an eco-system of spectrometers at varying levels of field strength, although there was some indication of reluctance to invest at a university level in expensive technologies such as cryo-probes; despite the step-change in experimental sensitivity they provide
There was an important discussion about the associated running costs associated with new capital, and how the recurrent responsibilities associated with capital equipment could be funded.

This was a unique exercise for the community to undertake but one that has significant policy relevance for other large equipment areas, for example electron microscopy (led by Professor Peter Nellist, University of Oxford), with consideration being given to a similar exercise for mass spectrometry.

Responses from the community: sharing within Institutions
As well as sharing equipment, underpinning capability and expertise can also be shared, for example in statistics, high performance computing and data management, providing an environment for increased collaborative research across disciplines. Sharing can therefore drive greater world class excellence and impact of research. Specific examples include:

- **New Centre for Genome Enabled Biology and Medicine at Aberdeen University** – instead of purchasing two machines, one superior machine is being installed within a new Centre which will
  - Ensure high occupancy rates of around 75% once fully operational (around the maximum for a machine of this nature)
  - Reduce costs per sample by 30-40% through pooling samples in a single run
  - Create new UK-led scientific advances – for example through biologists bringing in ecologists to use genomics, which researchers report is revolutionising the discipline

- **University of Birmingham: Central Equipment Hubs in Mass Spectrometry, High-throughput sequencing and Microscopy** – programme of work to understand and manage equipment categories across institutions
  - Creating hubs of facilities – an integrated suite of facilities (for example functional genomics equipment) co-located to provide bigger and better services, increase utilisation rates and reduce duplication
  - Create pathway for decision making on updating kit: when refresh is needed academics referred to most appropriate piece of equipment– reduces demand on research councils and increases utilisation of existing estate
  - Pools of technicians are trained to increase skill levels, create a pool of expertise and provide better coverage for researchers across the institutions
  - Programme of apprenticeships on Advanced Instrumentation training with local FE college

- **University of Oxford** has used EPSRC funding to provide small grants (normally up to £10k) which have:
  - Increased effectiveness (machines available at higher capacity; new science through collaborations across disciplines)
  - Increased efficiency (e.g. machines operational for extended periods, e.g. an NMR machine has been upgraded to increase overnight sample throughput and e.g. usage time for a small laser fabrication facility is now up from 60% to 80%
  - Stimulated new approaches to sharing equipment, which will have benefits in the longer term

Responses from the community: sharing between institutions and in partnership with industry
In addition to sharing equipment within the research base, there is strong evidence of universities working together to collectively purchase equipment, reducing the burden on the public purse and supporting greater world class research. These new approaches are ensuring access to:

- **Better kit**: more powerful and latest state of the art machines that would be neither affordable, nor utilised by one university alone
- **Better science:** Supporting increased productivity and excellence across the research base.
- **Better for business:** Proving a state of the art research infrastructure is a key element of the offer to large multi-national companies, supporting increased stickiness of firms, and links to SMEs through the value chain

There are a range of examples in this area, including a range of new investments catalysed under the recent UK Research Partnership Investment Fund, such as the High Temperature Research Centre between Rolls-Royce and University of Birmingham. Other examples of new, innovative and efficient good practice are:

High Performance Computing Facility – N8
The new High Performance Computing (HPC) facility shared by the N8 universities provides capability to tackle research challenges not possible on existing facilities.

1. By sharing the resource, all 8 universities have access to a larger and higher specification machine that would not be affordable or fully utilised by one institution.
2. This enables new science, and bigger and better outcomes. It allows researchers to tackle new research challenges not possible on smaller facilities.
3. This is a world-leading facility supporting business to be internationally competitive across a range of sectors in the industrial strategy. It has attracted enquiries from 25 companies, including Unilever, Rolls-Royce and Syngenta within the first quarter of service.
4. Creating one larger facility supports better multidisciplinary research, pushing the boundaries of knowledge, for example in materials science

Productive efficiencies delivered through a shared facility: There is a marginal cost saving of capital (£735k on an asset with 5 year lifespan), plus a total revenue saving of £1.2m (equating to £30k per institution, per year). It is important to note although the two cases are broadly similar in cost, **the resulting scenarios are not comparable in terms of capability**.

London Centre for Nanotechnology –UCL and Imperial College

- The field of nanotechnology research is highly dependent on high value capital equipment, and UCL and Imperial College have developed fields of specialism
- For example, there are world-leading Electron Microscopes (£2-3m capital item) at Imperial College which can be accessed by UCL researchers
- UCL has ion beam microscopes which are available to all Imperial researchers
- Each facility has technical expertise to support operations, and collaborators can also access modelling and simulation expertise.
- Facilities are utilised by world leading companies such as Nokia, BAE Systems and 30 SMEs
- Kings College is also collaborating with UCL and Imperial College, through a shared Ion Beam Microscope – the first in Europe

M5 Universities

- The M5 Universities have a range of equipment sharing initiatives underdevelopment including:
  - Core Chemistry equipment: Nottingham and Birmingham
  - Optical Microscopy - Nottingham, Warwick and Birmingham
- These collaborations are building on the strengths of institutions and ensuring the availability of advanced cutting edge equipment of a scale that is greater than one institution could procure alone

University College London and BBC – Advancing the Future of Digital Content

- UCL and the BBC are investing in a 4 year R&D programme where expertise, equipment and knowledge will be shared in a new facility with 40 researchers from each organisation
- The costs of the new facility are being shared by the partners, with open access to resources (e.g. listening rooms and virtual studio facilities – BBC) and workshops, visualisation facilities and virtual reality studios (UCL)

Training and Technical Support for Equipment – M5

- Technical expertise to operate equipment is a highly skilled area and vital to maximise the benefits and utilise of high specification kit
- The M5 universities are working collectively to develop professional, technical expertise for sharing equipment
- Technicians from across the 6 universities have been brought together to discuss how career pathways can be developed, share training programmes and develop new networks of knowledge
- This enhances skills levels, career prospects and the retention and development of specialist skills within the sector

Joint Procurement Initiatives enabled through Equipment Sharing

Equipment Sharing initiatives also facilitate opportunities for joint procurement, through both purchasing of kit and also longer term maintenance and service contracts.

N8 universities: joint procurement for EPSRC Core Chemistry Call

Background

1) University of Leeds recently coordinated joint procurement for a range of core chemistry equipment awarded to Durham, Leeds, Liverpool, Manchester and York by the EPSRC.
2) The total value of the tender was approximately £5m
3) The institutions collaborated due to potential benefits from greater purchasing power
4) Companies were requested to submit additional discounts if awarded over a certain threshold.

Benefits

- **Payment terms and conditions**- 1.5% finance charges reduced to 0.7% due to higher purchasing power – saving = £24k
- **Additional service contracts** on each of the instruments (£200k offered: 2-3% on service costs
- Driving best value - prices consistent across research base

Although the savings are relatively modest in this example, this was all achieved through a collaborative procurement exercise taking four weeks in total. **It demonstrates the principle and potential for what is possible through organic collaborations driven by the sector.** This requires a strong relationship across the procurement professionals and academic colleagues to facilitate this.

Long term funding of capital

Finally it is also important to note that whilst additional capital sums are hugely important to maintain the competitiveness of the research base, where these are issued at short notice this can produce inefficient responses and allocations. A long term commitment to capital can

- Increase the ability of universities to plan capital investment more strategically
- Increase the ability of the research councils to support an equipment base that is world leading[51]
- Encourage strategic planning and shared investments across research partnerships and clusters to increase the efficiency and effectiveness of public funding.

[51] See, for example, "understanding the current portfolio and resourcing implications of NMR infrastructure underpinning world class physical sciences". Professor Mark Smith, EPSRC – quoted on page 24 of this report

Furthermore, university asset registers, and integration of these registers under the Uniquip project and the more detailed regional databases, provides a new resource for institutions to track equipment, depreciation, renewals and identify opportunities to share investment and world-leading facilities. This coupled with a certainty of long-term capital will enable individual universities, institutes or groups of universities to put in place arrangements to develop integrated suite of facilities, including replacing existing multiple versions of lower specification equipment with the state of the art shared capital and equipment needed to stay at the leading edge of science and to meet business needs. Examples of this emerging good practice are demonstrated in the case studies from universities of Oxford, Aberdeen and the N8. Research Councils have a critical role to play in incentivising and highlighting good practice on equipment sharing.

Finally, new capital investments also require recurrent funding, for example staff to operate the equipment, consumables and maintenance, to ensure that kit can be operated at optimal levels to derive maximum benefit from the investment.

3.3 Innovation Funding – Technology Strategy Board

The Technology Strategy Board (TSB) promotes and supports technology-enabled innovation in the UK. It works with over 4,000 businesses, in a highly specialised area.

1) International Comparators:
The TSB has a 2011/12 budget of £370m, delivered by 160 staff – this is £2.31m per FTE. The comparator figures for Tekes (Finland) and VINNOVA (Sweden) are £1.26m per FTE and £1.05m per FTE respectively, suggesting the TSB is more efficient than its peers.

2) TSB progress on efficiencies
The full TSB case study (page74), completed with TSB and BIS colleagues, highlights a number of

- Operational efficiencies (for example savings in the delivery of SMART awards and Knowledge Transfer Partnerships), and
- Productive efficiencies (for example delivering innovation schemes for LEPs and Government departments, utilising TSB expertise and programme management systems).

3) TSB enhancing productive efficiencies across the public sector
The TSB is playing a dual role, both as an innovation agency *and* providing intelligent delivery capability across other areas of Government, including for LEPs and other Government Departments, e.g. DEFRA

This mode of delivery supports both

- **Productive efficiencies**: delivering additional spend through TSB with augmented delivery capacity rather than duplicating structures, systems and knowledge
- **Alignment between national programmes**, maximising impact of publically funded schemes and supporting better services for business

Where new schemes may emerge from the Industrial Strategy, the productive efficiencies of the TSB, and Government more generally, could be increased by routing appropriate projects through the TSB to maximise the efficient use of existing delivery capability.

In 2011/12 TSB's 160 staff managed 70 competitions. This provides a crude measure of efficiency which would indicate ***at least*** an additional 2 staff per additional competition (note not all staff will not be directly involved in competition delivery, so this may change depending on overlap with existing competitions and economies of scale).

Section 4: Financial Management

The question of efficiency links to the nature of financial management within the sector. A clear theme emerging from this project is that efficiency savings are being reinvested in many areas of core business, including improving student experience, widening participation and new research and teaching facilities.

4.1 Awash with Cash - the case against: "Surplus, but not surplus to requirements"[52]

There is a perception that, following the changes in university funding, institutions in certain parts of the sector are "awash with cash". Prudent financial management across the sector is clearly important, and institutional surpluses play an important role in a number of ways:

1) **Management of Risk:** secure income streams of HEFCE teaching grants have been replaced by new market-driven student fee. Higher levels of surplus are needed to mitigate against increased volatility in the system

2) **Agility**: reserves are need to fund joint projects with business and leverage private sector funding (for example RPIF and ERDF funded projects) and to make new investments in new activities or subjects, or divestments when needed.

3) **Overseas student numbers:** Government policy on migration and perceptions about the ease of entry to the UK present significant risks to universities overseas student numbers and financial projections The long term pattern of this income stream is uncertain and these students also require an increased level of resource to support them.

4) **Capital investments:** SR2010 saw universities capital funding cut to 53% of its previous level and universities need to build reserves in order to fund capital projects that were previously funded directly by Government. The graph on page 33 from a Russell Group university demonstrates the levels and source of capital spending over the next 3 years, indicating the primary source for this spending is derived from the institutions' own balances. Rather than being awash with cash, institutions are being prudent, efficient and reinvesting funding to enhance world class research and teaching facilities.

Links between funding streams for teaching and research

In addition to the drivers of the science-ring fence and increased international competition, the teaching funding reforms and increased domestic competition for students have also been major drivers of efficiency. The need to hold larger cash balances and respond to the capital cuts has driven efficiency improvements at universities. It was the ability and agility of higher education institutions to scenario plan and take pre-emptive action that has resulted in some of the prudent management practices in the case studies, for example Imperial College (p.54). Governors and Council members of higher education institutions are in the role of charity trustees and are under a legal duty to act prudently; increasing cash balances was a natural and legally required response to the increased risk that was introduced into the system.

Finally, it is important to note the interconnectivity of the institution's income streams - the health of teaching and other business streams is essential to the health and vitality of research.

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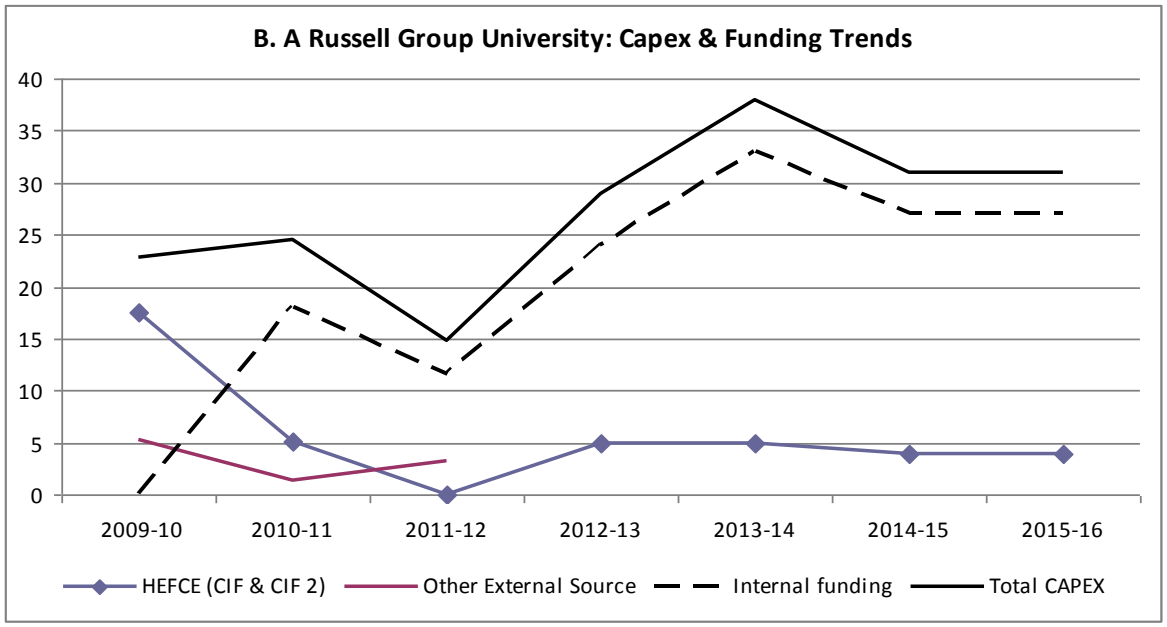
[52] Professor Sir Keith Burnett, Vice Chancellor, University of Sheffield



4.2 Developing new teaching and research facilities: leveraging resources from financial markets

- HEI capital funding has been cut to 53% of previous levels in SR 2010
- If new investment is not planned and made, there is a risk that universities become under-capitalised, reducing productivity
- Due to the age of some facilities, it may often cost an amount equivalent to new investments to undertake a plan of long term maintenance and upgrade (for example University of Manchester's recent appraisals for new teaching and research facilities in engineering, which are part of a £1bn capital development)
- Between 2009-10 and 2010-11, while the level of capital expenditure by English HEIs was stable, the amount funded by internal cash resources increased four-fold (Professor Ian Diamond speech to UUK Conference, 26 February 2013)
- In 2012-13, forecasts show that the sector requires £1,499 million from its own cash reserves, equivalent to 6 per cent of total income, to help fund the capital investment planned for that year[53]
- New capital projects often require a mix of accumulation of cash surplus from institutions plus borrowing from capital markets.
- This is reducing the burden on the public purse
- For example University of Cambridge has an AAA rating from Moody's, praising "outstanding market position, significant amount of liquid assets and strong governance structure".
- This is supporting a 40-year £350m bond, the first debt sold by Cambridge, which will fund investments in research facilities and accommodation and other projects
- Other universities who have issued bonds include De Montfort University (£110m)
- The ability to borrow is contingent on demonstrating a recurrent surplus as evidence of ability to service the debt.

[53]HEFCE, 2013 "Financial health of the sector 2011-12 financial results and 2012-13 forecasts" http://www.hefce.ac.uk/media/hefce/content/pubs/2013/201304/2013-04.pdf

Durham University – programme of capital investment

Durham University is funding new capital investment, not only from existing cash (reserves and generated year-on-year), but also a commercial loan of £45m. The major capital projects, completed or planned, include

- A major development to expand and refurbish Durham Business School costing £17 million which will be formally reopened in spring 2014.

- Redevelopment of a site on Durham's World Heritage Site released through energy efficiency measures at a cost of £10M to house a new Research Institute and accommodate postgraduate students.

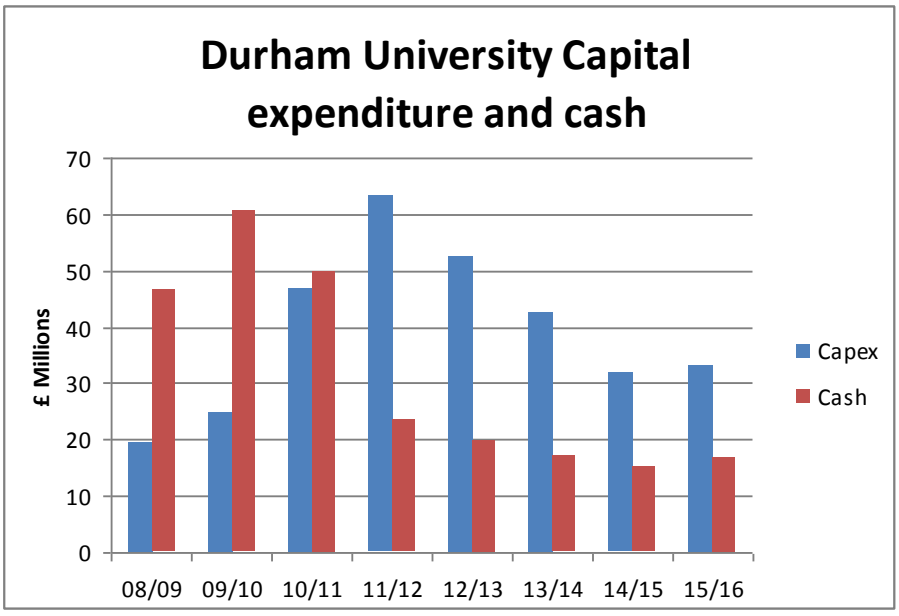
- A new Physics building to house the UK Institute for Particle Physics Phenomenology and Institute for Computational Cosmology at a cost of £9M

- Refurbishment of the historic Palace Green Library (£13m), as part of regenerating our World Heritage Site

- £56 million invested in a major programme nearly doubling the size of the main Bill Bryson Library, developing a state of the art law School and a new student services building which also incorporates University headquarters.

- A new interdisciplinary research institute is planned costing £12.5M with significant industry and business input.

- Renewal of Dunelm House, an iconic 1963 concrete building designed by Arup which is the home of the student union and academic and social facilities for arts and humanities, at a cost of £14M.



This graph highlights the profile of actual and planned expenditure. It is clear any annual cash balances / surplus are needed for this extensive reinvestment programme- rather than being "awash with cash" the institution is investing in a broad range of teaching, research facilities with historical and cultural significance.

4.3 Net cash or debt position

When considering the financial position of institutions it is important to consider either the net cash or debt position (cash minus debt), in addition to the annual surplus or deficit position. An institution may appear "awash with cash" based on a short term or annual position, but it may be highly leveraged in terms of debt.

Across the sector, the current liquid position is £8.1bn, representing 3.9 months of expenditure. However, the sector's borrowings stand at £6.1bn, equivalent to 21.8% of income, so the net cash position of the sector is around £2bn, less than one month's expenditure, a much smaller cushion[54].

The debt may be planned, and incurred for sound investment reasons, for example to support big strategic research opportunities or provide new accommodation for students. There are a range of views across the sector: some HEIs are willing to take on more risk and move to a highly leveraged position, while others take a more prudent approach and have not taken on high levels of debt.

But it is the **net** cash or debt position which gives a better indication of the financial exposure of HEIs, rather than solely looking at the annual surplus or deficit figure.

Time of change

The next few years are a transition period where a core revenue stream is being radically changed, combined with significant reductions in capital funding. There are 3 important things to note

1) Institutions will respond to funding changes in different ways and at a different pace (some, for example, instigated savings programmes in advance of CSR 2010 and funding changes, whilst others may have some pain to come in terms of reducing operating costs.)

2) Levels of surplus may look reasonably healthy in some parts of the sector, but spending projections in areas such as academic staff, outreach activities and access agreements will increase as the transition to the new regime is complete. For example
   a. one Russell Group university is projecting a doubling in spend from £8m to £16m in next 3 years, as the new fees regime beds in)
   b. Spending on Access Agreements from another Russell Group institution will be in the region of £12-14m higher in 2015/16 than in 2008/09

3) Following year 1 of the new student fee regime, there is a limited amount of market information available to predict future demand at an institutional level. The wide levels of variation in year 1 increases the imperative to retain higher levels of surplus at this stage (for example of the 20 English members of the Russell Group, the intake at 10 has declined Southampton down 13%, while Bristol were up 27.9%)

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[54]Letter from Andrew McConnell, Chair of BUFDG, published in THES, 21 March 2013, http://www.timeshighereducation.co.uk/comment/letters/no-room-on-this-cushion/2002686.article

Section 5: Conclusions

1) Significant progress is being made across the system, at a significant time of change. To continue with this, and to embed long term reform, progress should be encouraged, rather than mandated. The science ring-fence and increased competition are the main policy levers in enabling further efficiencies, and are embedded in the system.

2) In supporting HEIs to deliver increased efficiencies, consistent and reinforcing signals from the sector, particularly funding bodies, can accelerate the pace of change in the short term, and cultural change in the long term.

3) Where further policy reviews are undertaken on research efficiencies, policy reforms to reduce barriers for equipment sharing should be addressed, including mechanisms for accounting for REF and RCUK income credits to reflect the usage of the asset.

4) The sector needs to become much more effective at communicating the progress that has been made.

Appendix 1: List of Contributors

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Appendix 2: Case Studies

Contents

Procure to Pay:
Newcastle University

Focus Area: Increasing efficiency through strategic procurement
Brief description:

- The project was focused on identifying and implementing improvements in buying goods and services at Newcastle University.
- The project lasted 18 months and was overseen by a multi-functional team. A key feature was a dedicated change management and communication team, providing critical expertise to realise benefits from process change.

Critical Success Factors:

1. **Blueprint** - the target business processes were well defined and agreed at the outset, there was no scope creep.
2. **Finance -** the support of HEFCE modernisation funds (£1m) – dedicated funds from HEFCE - allowed progress to be accelerated and specialists recruited. (£1.2m total project).
3. **Time for project preparation and planning** - this included investigation and research into relevant technologies and best practice; this absorbed double the resource that was predicted but was a sound investment.
4. **Time for consultation and roll out** – including business process discovery workshops – understanding how people currently do the work, which allowed pre-purchase customisation and minimised costs later on.
5. A **dedicated change management function** - dealing with human consequences: confronting bad behaviour, bespoke training, changes to jobs, follow up training supporting stickiness of new processes.

Key outputs and direct benefits:

- Delivered **procurement savings** - in Year One of £1.46m, future savings per year predicted to be £2.4m p.a. (based on benchmark estimates against organisations of similar size (£100m total non-pay spend).
- **Reduction volume of work**, through greater use of purchasing cards, consolidated electronic supplier billing and improved workflow management tools. The business case estimated this to be £0.2m p.a. net (circa 8 FTE) – using GPS benchmarks which is the Government endorsed framework, this would quantify as £1.07m.
- Measured by transaction times on previous system V new business process.
- **Centralise processing activity** - improved productivity, increased use of IT tools and improved supplier experience.

Other efficiencies delivered at Newcastle:

- Electricity usage constant with additional 30,000 square metres of space, supported by replacing large numbers of old light units; replacing old motors on air handling units and behaviour change – supported by a combination of University and Salix funding.
- Smart working –saving £1.4m capital expenditure on new Estates Service refurbishment through new ways of working – 60 desks provided for 80 people – space saving of 25%.

Procure to Pay – Newcastle University

Policy Area and how links to Growth	**Efficiencies through strategic procurement**
Savings: Operational Efficiency: Same output for reduced input	Use of e-marketplace software supported reduction in costs of £1.2m per annum on consumables Use of purchasing cards saving £260k pa Reduction in volume of work: 8 FTE redeployed to front line functions saving: 200k per yr. **Total savings Year 1: £1.7m (figures above)** **Future savings £2.4m pa**
Current Progress (including numbers on realised savings where possible)	Total savings Year 1: £1.46m + staff figure above
Cost of Change – cost of managing / implementing changes	HEFCE Modernisation Fund Project = **£1m** Plus institutional contribution to implementation = **200k** Recurrent costs per yr. = **100k**
Time taken to realise benefits – (short term and long term issues)	Project duration: 2 years Long term benefits to be realised over a number of years and include better category and supplier coverage and management, leading to savings and efficiencies in a wide range of areas.
Unanticipated consequences – good and bad	**Good** Greater expertise across institution and better compliance: e.g. 85% awareness of EU laws Ensuring most beneficial terms and conditions available to all, not just to one School or Institute Supplier gets paid quicker in return - more strategic relationships; best supplier awards Wider net of suppliers willing to bid for university business – will decrease prices (e.g. Travel companies) Consistency of suppliers and supplier pricing leverages opportunities for collaborative procurement **Bad** –underestimated time on project planning
Future plans	Strategic relationships and building community of suppliers for future pilots e.g. reducing number of deliveries in campus to reduce costs, carbon emissions and may reduce costs for suppliers Joint procurement with City Council on strategic areas (centralised window cleaning pilot has saved University 50k per annum and City Council 500k pa)
Potential for application across R&I base	Supplier Catalogues: potential for greater involvement with other Universities – collaborative catalogues can be shared Newcastle have now added items relating to Medical Schools Possible synergies for using same supplier base – no set up costs.

Public Procurement for Universities and Colleges:
Advanced Procurement for Universities and Colleges (APUC)

Focus Area: Increasing efficiency through strategic procurement

- APUC (Advanced Procurement for Universities and Colleges) is the procurement Centre of Expertise (CoE) for Scotland's 55 universities and colleges. (was 62 before mergers)
- It is a private limited company, owned by its client institutions and established in response to the McClelland Report: 'Review of Public Procurement in Scotland', which made recommendations for public procurement reform.
- AUPC has four main activity areas: collaborative procurement; disseminating best practice & training (including managing a sectoral procurement capability assessment programme); managing college support services; and eSolutions.

Critical Success Factors:

1) **Human Capital**– CEO has extensive experience of cross sector strategic procurement; both HE sector (10 years) plus commercial background (15+ years in blue chip multi-national) with relationship management skills for organisational leadership. Core Centre of Expertise of 28 high quality FTEs, with additional skilled staff on shared service arrangements within institutions and also through "flexible experts work bank" to cover peak demands in workload.
2) **Stakeholder engagement** –first year visits to all 62 client institutions by new CEO prior to restructure of AUPC.
3) **Client Account management model** HE/FE sector made up of different sized and shaped institutions. Changed the "one size fits all approach" to a flexible model – each client (university or college) has a direct account manager for communication and advice based on their particular needs
    - Model is a key enabler in supporting capability improvement and contract uptake for all institutions, but critical for smaller colleges who could not justify or afford to employ professional procurement resource
    - Increase in collaborative procurement levels across institutions from below 10% in 2009 to 20 % in 2010/11, estimated circa 25% 2011/12, target for 2012/13 is to move towards 35%
    - Joint working not only delivers the benefits from combined purchasing power, it is also the most efficient way to manage expensive professional procurement resource and share best practice / develop capability
4) **Business model:** developed in conjunction with Client partners –simple solution, company limited by guarantee, own jointly by all institutional members (Clients), funded at Client request via Scottish Funding Council through top slicing institutional teaching grants – allows flexible application of resources to suit variable needs.
5) **Continuous improvement model** and management information tool – HUNTER – developed in house, being rolled out collaboratively across partner English regional consortia (UKUPC) without charge to UKUPC consortia – significant savings to the sector versus buying off-the shelf but with the benefits of it being aligned to collaborative procurement activity needs.

Advanced Procurement for Universities and Colleges (APUC)

Policy Area and how links to Growth	Increasing efficiency through strategic procurement
Savings / Benefits: Price Savings & Operational Efficiency: Same output for reduced input	• Collaborative contracting: **£12-15m[55] per yr.,** approx. (circa 9% of relevant spend) • eSolutions shared service – **700k per yr.** • College Services team (**700k-£2.5m per yr**. depending on level of spend, particularly capital)
Current Progress	• circa 500 suppliers managed • Savings delivered year on year • e-procurement systems rolled out and supported to / for over 50 institutions (down to 48 now due to mergers).
Cost of Change – cost of managing / implementing changes	• Originally funded by SFC and Scottish Government –covers FE and HE • In early 2009, 28 core members then up to full sectoral membership (62) by mid-2010 • Rich diversity of size and nature of institutions • Since 2009, APUC has reduced operating costs by 60%, core staff FTE reduced by 50% and outputs increased by over 300% • Operating budget circa £1.8m
Time taken to realise benefits – (short term and long term issues)	• AUPC established in 2007, by 2009 sector felt it to be inefficient and costly. • New CEO undertook review and restructure – this has resulted in much more lean and effective operation. It took approx. 3 years (1 year from re-structure) since set up to realise and deliver full recurring benefits
Unanticipated consequences – good and bad	• Development of professional expertise – now running institutional level procurement resources on a shared service basis for 16 institutions (3 HEI and 13 FE – including what is thought to be the biggest FE in Europe) – charged full cost plus overhead (no margin so compliant with HMRC cost sharing exemption) - Support recruitment and progression, professional development - Increases knowledge and integration of e-procurement systems in each institution • core enabler as smaller institutions would not be able to afford to recruit one person
Future plans	• New major review of Sustainable Supply Chain approach, jointly done with institutional management and student bodies. To include social, ethical, environmental and economic impacts (SMEs/3rd sector). • Significant focus on increasing collaborative spend as well as collaborative roll out on new shared procurement related system.
Potential for application across R&I base	• Hunter enterprise management database now being used across UK regional purchasing consortia - also being utilised

[55] Methodology for calculating savings is on very demanding criteria; based on previous price paid
Other common used methodology is savings against market price. If this methodology used, savings projection potentially approx. £30m per year

	for joint procurement for Fire in Scotland and offered to other sectors. • Several tools being shared across UK HE and in particular UK Universities Purchasing Consortia (UKUPC) • APUC work in partnership with UKUPC to share tools and resources / contracting plans to avoid duplication of effort and to maximise UK HE sector leverage • APUC work with Scottish Government and other publicly funded sectors on Scottish procurement activity where there are cross-sector synergies • New Benefits Reporting methodology agreed across all publicly funded sectors in Scotland (HE/FE, NHS, LAs, Central Government, NDPBs, Fire and Police) – process led by APUC, could be applied on a UK basis. • New Sustainable Supply Chain approach could be shared on UK basis

Performance Enabling; Engagement and Culture Change:
Swansea University

Focus Area: Human Resource Management
Brief description:

- The project was focused on improving performance of staff, with the objective to be a top 30 institution by 2017
- The focus was increasing the quality of output of current academic staff

Critical Success Factors:

1) **Communications strategy and intense process of engagement**
   - Conducted 180 sessions with trade unions, management & staff and this informed the plan and engagement strategy
   - Initially trade unions and staff were suspicious of the programme, particularly the use of individual KPIs
   - Internal engagement changed this, were asked the question "what should replace the appraisal?" Was very effective way of challenging and working with the Unions
   - Resulted in cross institutional ownership of HR by non HR Leaders, and allowed a more radical approach
   - 940 staff attended consultations in colleges /departments as part of the implementation to assist culture change

2) **Supporting process of change in institution**
   - Many academics have worked in one organisation for a long time
   - Process of engagement built relationships that would enable the process of change
   - Strong relationship between Director of HR and Head of Trade Union
   - Holistic approach supported change: is about every single member of staff and helping them improve performance
   - After year 1: consulted on what gone well, what needs to be stopped, what needs to be improved – staff involved in shaping journey

3) **IT and database on KPIs:**
   - Simple system for academics to amend and correct own data
   - Technical solution was complex – 5 systems contributing to one front end system holding PDR report
   - Led to improvements in the quality of data – supported delivery for the REF and other areas of business

4) **Focus on academic staff**
   - Key driver of the local economy and university
   - Culturally this is the first time data has been available for performance review – provided an objective view of performance; and benchmarks to make the good even better

5) **Introduction of a suite of Academic KPIs:** Publications, Grant Applications, PhD Students, Student retention, Student Outcomes, Student Feedback
   Can now truly measure what each individual is contributing to performance of institution

6) **Leadership**: led by Director of HR and Deputy Director of HR who has successfully implemented cultural change in the private sector. Programme incorporated best practice elements from other institutions

Key outputs

- Every individual's contribution to the REF preparation exercises measured and directly linked to their PDR.
- KPIs introduced & refined for Academic members of staff.

- 98% of senior line managers trained on the legal aspect of performance
- 70% of reviewers trained in a coaching approach to assist effective discussion
- 79% of PDRs were completed in the first year and 90% in year 2 against around 25% previously
- Systematic evaluation of perceived impact - 89% believed the quality of the Review had improved in year 2.

Policy Area and how links to Growth	**Delivering efficient and effective human capital base in UK universities**
Savings: Operational Efficiency Greater output for the same input	**Improved performance from same staff resource:** League Table position based on student surveys improved. NSS results: Swansea's score for "overall satisfaction" is 87%, up from 82% last year, , 42nd out of 136, up 38 places Swansea rose 12 places to 45th in the Sunday Times Guide No grievances, action or formal complaints were made as result of implementation
Progress	**Outcomes** • **Completion rates of PDRs have risen** - 90% in year 2 against around 25% previously • **Improved management information and data** 1,129 publications on the database since July • **Improved PDR discussion** using KPI data and training for managers in coaching techniques **Planned progress for Medium and Longer term** • Maximise Submission to REF – numbers of academic staff not submitted reduced by 50% • Year on year improvement in student satisfaction to 2017 • Year on year improvement in student attainment outcomes to 2017 • Year on year improvement in student non-completion rates to 2017 • Year on year rise in research income. **Long Term:** Impact on league tables so that Swansea will be in the top 30 institutions by 2017
Cost of Change – cost of managing / implementing changes	0.87 FTE (Deputy Director of HE); 0.5 FTE + 0.3 FTE IT support Total cost per year = £74,726 Contributions from a range of staff in a number of departments and HR team
Time taken to realise benefits – (short term and long term issues)	Two years into process – 25% to 90% completion rates on PDRs. Aim is to improve REF performance, be a top 30 institution by 2017
Unanticipated consequences – good and bad	**Challenges**: **Lack of resource** Resourced through a matrix structure; IT colleagues; analysts working on KPIs; Research team looking at research data. Relying on goodwill for people to do this as part of the day job as no resource / funding for a project team. A consequence of lack of resource: project was focused. But did mean some areas were not covered until later (e.g. reward management) and programme could have been accelerated. **Line Management:** needed to be clarified who these people were, then provide training (the "how") **Feedback from staff:** 30% of staff not challenged on things they expected to be challenged on

	Benefits: Improving quality of data **Changed status of HR within the university** Award from UHR: HR function is now seen as vital for business, can help colleagues deliver
Future plans	The Programme will drive cultural change over a 5 year period
Potential for application across R&I base	HR professionals at Swansea believe that the approach could be applied at other Universities and enhance work relating to performance that is being undertaken in other UK HEIs. We would be happy to disseminate the scheme more widely via UHR or other opportunities. HR professionals from other HEIs have visited us to learn from best practice.

Human Resource Management
University of Lincoln

Background:

- Delivering change within a limited budget has been an important requirement at Lincoln– the organisation has developed a capability and appetite to support organisational change and to do so with pace
- During different phases Lincoln has needed to evolve e.g. introducing new subject areas and rationalising the estate
- The Lincoln HR Team has achieved regular external recognition– both from HE and outside the sector in areas such as reward and engagement
- The University has risen over 50 places in league tables over the last ten years
- The student voice very much shapes the development agenda at the University with students being actively encouraged to engage and jointly produce with staff

Critical Success Factors in Driving Effective Performance

1) An open style of leadership - communicative, enabling and empowering – "no them and us", future of institution rests with all colleagues
2) Opportunity to access additional funds to deliver business improvements with sound business case
3) Developing leadership as an organisational competency – requiring people to take responsibility for their performance and for managing personal development
4) Openness to feedback and supporting a listening culture – for example students are members of key committees including the Executive Board, all UCAS applicants asked for feedback on their experience throughout the process.

Key achievements

- **Innovative reward strategy and well-being programme** including creating partnerships with businesses such as Halfords to support wellbeing initiatives like healthy campus week, developing on line reward statements with a local technology company and offering all staff the opportunity to volunteer to support a charity through a give-back scheme
- **The management of absence** has been reviewed with the introduction of a new policy which includes clear trigger points and the development of an on-line absence reporting system. Coupled with a focus on wellbeing these actions **resulted in a £300k reduction in sickness absence costs in year one.**
- **The physical estate has been rationalised** which has resulted in the complete closure of a satellite campus 50 miles away from Lincoln, the TUPE of 100 FE staff and the creation of a science park.
- **Creating a leadership framework** which delivers a clear understanding of the skills, attitudes and behaviours expected, this has been supported by the opportunity for leaders to network and collaborate to deliver the KPIs
- **Partnership with the Students:** This is the most important partnership. The SU president is a member of the Board of Governors. Key decisions such as innovations in teaching and learning, enhancements in technology, the enhancement of key services such as the library, student services [including support for international students] are discussed and decided with the students. Students are able to access some of the staff on line support packages such as wellbeing and flexible benefits

Organisational Transformation
University of Lincoln

Policy Area and how links to Growth	**Improving quality of teaching and research through improving performance of staff**
Savings: Operational Efficiency: Same output for reduced input	Improving technology has reduced costs e.g. **25% reduction in sickness absence**, **50% reduction in overtime costs and 150k saving in agency staff** Procurement for services such as employee assistance and occupational health services have been tendered jointly with the local FE college to achieve more competitive rates
Savings: Programme Efficiency Greater output (number or quality) for same input	Absence Management system 1st year: **£300k** savings for 30k one off investment Year 2 **£80k** saving Well-being initiatives E-Recruitment system: **one off cost of £50k** and has led to **staff time savings of 1,500 hours** per year enabling more value added service benefits to be delivered
Cost of Change – cost of managing / implementing changes	There are a number of investment funds available for refreshing the workforce, require a business case with clear costed benefits Cost of absence management and e-recruitment systems: **80k total**
Time taken to realise benefits – (short term and long term issues)	The impact of the changes put in place is starting to build a momentum over the last 2 years. Employees are familiar with the concept of change and are beginning to recognise the benefits of engaging and shaping developments
Unanticipated consequences – good and bad	Some change has been difficult and required vision and courage from HR and leaders. Working to create positive relationships with recognised unions has been time consuming and at times frustrating however it offers significant benefits
Future plans	Continuing the evolution towards a top 25 University which means further developing staff skills and attitudes and continuing to improve service and technology

Organisational Efficiency:
The University of the West of England (UWE) One University Administration (OUA) project.

The OUA project was the biggest organisational development project ever undertaken at UWE; the project was initiated in late 2010, and completed in December 2011.

The aims of the OUA project were to:
a) create more coherent, efficient system and organisational structures;
b) simplify business processes to enhance their utility and reduce duplication;
c) reduce service delivery costs by 25% over a three year period.

Scope
- Services delivered by faculties and services under the headings of student services, academic registry, marketing, admissions, international recruitment, research and business innovation, business support, finance and HR.
- A total of 460FTE (full time equivalent) staff came within the remit of the project; 150 were located in service departments, and 310 were located in UWE's four faculties.

Critical Success Factors
1) Identification of the aims of the project and clearly identified objectives
2) Support from senior management; Assistant Vice Chancellor led the programme
3) Clear project plan and planning process
4) Resources dedicated to the team – secondments and Programme Management expertise

Project outcomes
The OUA project was completed in December 2011. The key outcomes were:

- New, integrated professional service structures introduced in January 2012 to deliver all of the student facing services and other services covered by the scope of the project.
- Reduction in admin tasks through economies of scale; lean management reviews, process automation and standardisation, stopping some tasks (e.g. local marketing). As a result: staffing complements within the **new structures reduced from 460FTE to 360FTE**
- An annual pay bill saving of £2.1m per annum (14% of budget) - against investment of £1.8m in direct costs (predominantly severance payments) and £1m indirect costs (predominantly managerial opportunity costs through time of secondments and senior managers)
- Savings have been utilised to reduce financial deficits and place the institution on a sound financial footing
- Improved service delivery to students including better advice and information provision; for example: (i) "one stop shop" counters installed so that students no longer have to visit different locations to access information and advice; (ii) response handling for student phone and email enquiries was centralised, generating economies of scale which enabled longer "opening times" to deal with student queries; and (iii) pooling expertise in one place to support better service provision to students and increase opportunities for innovation

The OUA project also enabled partial reinvestment of savings to improve the student experience. As a result, resources have been invested to build on student employability and enterprise schemes:

- Improved careers advisory service for graduates including:

    i. Career Coaching Services – providing 1-1 and group workshops with students aimed at building their skills and knowledge in order to secure a placement/job/internship

    ii. Recruiter Partnership Services – building relationships and securing vacancies

- Key targets include 30% - 50% increase in the cost efficiency of staff delivering placements, delivering minimum of 300 extra placements/internships in Year 1 (2000 extra by Year 3)
- Funding a pilot graduate internship scheme at the University – 16 internships with training
- Launching UWE InnovEntors- a student innovation and enterprise society to foster networking with entrepreneurs, engaging with enterprise competitions and providing a sound-boarding for ideas

Organisational Efficiency:
The University of the West of England (UWE) One University Administration (OUA).

Policy Area and how links to Growth	**Delivering efficient and effective human capital base in UK universities**
Savings: Operational Efficiency: Same output for reduced input	Staff numbers reduced from 460FTE to 360FTE as part of the transfer process. Staff costs reduced by £2.1m per annum
Current Progress (including numbers on realised savings where possible)	a) Staff costs reduced by £2.1m per annum b) All major processes reviewed and new, leaner customer orientated processes have been implemented c) All staff trained in their new roles in advance of January 2012 launch date.
Cost of Change – cost of managing / implementing changes	12 month project. One off implementation direct costs of £1.8m (including severance and relocation costs) and £1m in opportunity costs and management time
Time taken to realise benefits – (short term and long term issues)	Cost reductions – within 12 months Longer term transition of moving towards a service commissioning based model; Faculties commissioning services from central administration. This requires a huge cultural change that will take longer term to realise
Unanticipated consequences – good and bad	Process and impact on management to deal with change of this scale has been huge. Ensure adequate support provided, especially local managers who may be experiencing this level of change for the first time
Future plans	Focus on lean processing – now have the critical mass of teams and centralised processes to undertake this. This project is financed from project savings. It is expected that the outcomes from the process reviews will deliver the remaining savings needed to meet our 25% target over next 18-24 months

Efficiency and Shared Services:
The University of Leeds

Unipol Student Homes
Unipol is an independent Charity and not for profit company formed by the University of Leeds and Leeds Metropolitan University to manage a residential accommodation bureau for students in Leeds seeking private sector accommodation. The bureau provides a professional service for students and through their operation of local and national codes of standards helps to ensure students rent accommodation which is safe, secure and well managed.

- Unipol has developed its services and now effectively provide services for all students in Leeds (not just the two main universities) and also provides services in Bradford and in Nottingham.
- Unipol provides training nationally to improve professionalism in managing student accommodation and administers a national code of standards for large student housing developments.
- Partner institutions pay an annual fee to support the operation of the accommodation bureau and the cost of administering the code of standards, however, this is much less than the cost of providing these same services in-house and on an institution by institution basis. For example, The University of Leeds has estimated that the annual saving by providing these services through Unipol rather than in-house is approximately £90k.
- In addition to the savings, the service provided by Unipol is more professional and more extensive because of the critical mass achieved by providing services for several institutions.

Generating Station Complex (GSC)
The University of Leeds and Leeds Teaching Hospitals Trust have joined forces to build a combined heat and power plant (CHP) which provides the majority of electricity and heat for the University and the Hospital. Heating is provided across campus in the form of steam and low pressure hot water which are by products of electricity generation in the complex.

- The complex is managed by a third party on behalf of the University and the Trust.
- Estimated CRC (Carbon Tax) savings for the University are approximately £200k p.a. associated with the use of steam and low temperature hot water.
- Direct savings are difficult to quantify because of the many variables over the life of the agreement, however, based on the University's total electricity and gas costs associated with the GSC of £9.6M we estimate that our annual savings are approximately £960k. This estimate is based on the lowest figure in our range of savings (10%) compared to buying electricity directly from the grid and generating heat via on-site boilers.

HE Shared Services Steering Group
In 2010 the University of Leeds formed a Shared Services Steering Group to explore how partners in HE and FE in Leeds could share services or collaborate to reduce costs, improve service levels and improve efficiency.

Partners included The University of Leeds, Leeds Metropolitan University, Leeds Trinity University and Leeds City College. The group meet termly to discuss developments in shared services and to explore specific opportunities in the following key areas:

- Procurement
- IT
- Facilities Management
- Back office functions (HR, Payroll, Finance etc.)

Working groups have been established for each of these key areas and working group leads report progress to the steering group. Establishing the steering group has helped to link together key contacts from each HEI/FEI and develop closer working relationships and is now starting to realise benefits thorough joint procurement activity, for example by negotiating better rates for outsourced maintenance contracts.

The group has also now been in contact with Leeds City Council to explore various, specific, shared service opportunities

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Efficiencies and added value through modernising the Estate:
Aston University

- Small to medium sized institution: 9,000 students (7,500 undergraduates and 1,500 postgraduates)
- Campus is 40% bigger than recommended size from LSE estates model.
- Need to improve efficiency and added value via University estates improvements.
- One specific project: disposal of 1970s building housing chemical engineering and applied chemistry facilities.
- Replaced with modern teaching and research facilities placed efficiently inside an existing building and new building dedicated to bio energy research.

Critical Success Factors

1) **Clear vision:**
    a. To provide a modern research facility and full sized energy demonstrator plant
    b. Reunite undergraduate students and researchers into main building to provide an integrated capability to School of Engineering and Applied Science.
2) **Intelligent consumption**: external project management support managed by in-house professionals. Allows internal staff to focus on critical tasks; and a project team dedicated to "single objective".
3) **Attention to detail** and delegation ensured building specifications and delivery fit for purpose.

Two projects

1) **EBRI – European Bio-Energy Research Institute**
   Funded 50% by institution, 50% ERDF funds.
   6 labs and academic offices
   Demonstrator Plant (Gasifier; CHP Engine) will generate heat and power from biomass, including sewage sludge, wood, algae and agricultural waste.
   CHP plant powers entire building

2) **SEAS – Phase 2 & 3**
   Teaching Labs and Research Labs into the University Main Building - core physical part of the university.
   Some of the space previously was under underutilised for estates storage.
   Funded 50% by university and 50% HEFCE Research and Infrastructure Fund.
   Research labs completed autumn 2012, teaching labs completed autumn 2011.

Efficiencies and added value through modernising the Estate:
Aston University

Policy Area and how links to Growth	**Research and innovation supported through efficient estates management.**
Savings: Operational Efficiency: Same output for reduced input	Previous space utilisation for the chemistry department: 7,000 sq. metres - Now 4,000 sq. metres. Significant saving in real estate, plus energy efficiencies – modern lights, heating and ventilation.
Savings: Programme Efficiency Greater output (number or quality) for same input	Research income should rise by 6.5% per sq. mt
Current Progress (including numbers on realised savings where possible)	Disposal of 1970s building has allowed new investments in library; social learning space; teaching space; sports facilities, spaces for non-residential students.
Cost of Change – cost of managing / implementing changes	EBRI - £16.0m (£7.0m from ERDF) SEAS - £8.0m (£4.0m from HEFCE)
Time taken to realise benefits – (short term and long term issues)	Short term income from sale available July 2011. Enhanced student experience October 2011 as all engineer/science teaching in main building; students being taught in modern labs. Medium term – Cost savings to Estate benefit from January 2013 onwards. EBRI enhancing research capability and reputation of Aston. Students benefiting from working with leading researchers in the bio energy field.
Unanticipated consequences – good and bad	Quality of building has raised expectations and motivations of research staff Supporting better multi-disciplinary work between chemical engineers; mechanical engineers; mathematicians
Future plans	Potential for energy demonstrator to be connected to rest of campus (and potentially the grid if upgrades are made for the connection to be economic).

Imperial College, Approach to achieving financial sustainability

Imperial College London is a world class university, ranked 3rd in Europe and 8th in the world. The drive to deliver world-leading education and research is underpinned by strong strategic financial and operational management.

A specific priority is to generate the required margin for sustainability (approximately £100m a year) to support new investments needed to remain globally competitive.

The approach has been as follows

- **Priority to achieve a stable financial position in times of austerity** through a drive for flat cash budgeting in central support areas (this excludes research costs and other exceptional items).
- This has been achieved in many cost areas since 2009 by holding pay costs and staff numbers. The cost base remained flat at around £57k per staff FTE, with the impact of inflation being absorbed.
- **The institution has moved away from national pay bargaining –** this allows for more flexible financial management, tailored to the specific to circumstances of the institution.
- **The operating surplus is healthy, but smaller than needed for financial sustainability.** To remain globally competitive approximately £100m of cash is needed for new investments; the current annual surplus is short of that and either needs to grow or additional sources of external income need to be secured. An example of the reduction in public capital funding is the decline in the College's capital funding from HEFCE from £46m in 2007-08 to £14m in 2011-12.
- Imperial College has a diverse income base, including UK public, industrial and EU funding. The focus is on **growing core areas of research income** to support high quality research, growing endowments and donations and reducing the dependency on public income streams.
- Future areas of focus for efficient financial management include
    - Benchmarking new capital programmes to provide better understanding of value for money
    - Reviewing processes and tendering arrangements for capital purchases
    - Better use of permanent staff and contractor arrangements, including in Information Technology

Equipment Sharing within Imperial College

- The College has been working to support a culture of equipment sharing and has appointed an academic champion to promote this.
- One of the major outcomes is the Research Facilities Database, which lists over 800 College facilities that can be booked online and was launched in June 2012 with a showcase event where the managers of the major research facilities presented posters
- The new database both increases the visibility of the College's research facilities – meaning that academics are less likely to put pieces of equipment already owned by the College on grant applications – and it makes it easier to book these facilities
- The online booking system automatically matches each booking with the code to which it should be charged.
- This system has also resulted in increased efficiency because it has freed up time for the facilities managers, who no longer have to deal with bookings manually, and for the finance officers, who no longer have to spend a lot of time authenticating users and organising recharges.

Equipment sharing within SE5

- The College is part of Science and Engineering 5(SE5)

- This comprises the University of Southampton, the University of Oxford, the University of Cambridge, University College London,
- The initial focus has been on the development of searchable and inter-institutionally shareable equipment databases.
- Imperial have also developed “CORE”, an alliance with the University of Cambridge to make joint facilities and expertise in hardware, software and know-how for high performance computing and data management available to UK companies of all sizes, including Xyratex, Audio Analytic, Atomic Arts, Rolls-Royce and the Caterham F1 Team.

Increasing student experience and satisfaction through information technology:
The University of Manchester

Brief description:

- The project produced a sophisticated lecture capture and distribution system, where lectures can be viewed after 60 minutes on mobiles and desktop devices
- The project resulted in 164,000 podcast downloads during the pilot year
- This has increased student satisfaction, completion and performance rates, and is supporting students to achieve maximum academic potential
- The total cost of the project and fit out of 100 lecture rooms and teaching spaces will be £460k

Critical Success Factors

1) **Senior Management support**: Associate Vice President for Teaching was a member of the Project Team, which included colleagues with expertise from range of functions (academic teaching, student experience, media services and e-learning)
2) **Lecture capture system is automated (based on timing) and requires no training to use:** This is critical as high failure rate when using a manual system (often only capturing approx. 20% of lectures, success rate is now above 95%). Deploying a system that requires no training or micromanagement on the part of academics allows the use of podcasting without needing technical experience.
3) **Building evidence base:** was crucial to demonstrate to staff that lecture capture increased student satisfaction attainment levels and did not adversely affect student attendance at lectures.
4) **Finance**: project cost is affordable, and represents strong value for money given the numbers of students who could benefit – total cost for new equipment for 100 rooms under £500k.

Key outputs

- Fit out of over 100 lecture theatres and teaching rooms for lecture capture, at a total cost of £460,000
- Delivered increased student satisfaction: 89% rate as beneficial to their education; 88% indicated it increased satisfaction; 94% of users indicated they wanted podcasts of other course units.
- Increased student attainment (based on one course unit, sample size ~200 students per year):
  Year 1 (2009):
  - 52% of students achieved over 60% pass rate (compared with 34% in 2008)
  - Failure rate more than halved - 7.5% (compared with 19% in 2008)
- Full research paper available
  http://www.ucisa.ac.uk/~/media/Files/members/awards/excellence/2011/Manchester

Increasing student experience and satisfaction through information technology; The University of Manchester

Policy Area and how links to Growth	**Improving student experience and satisfaction rates through use of IT**
Savings: Programme Efficiency Greater output for the same input	Students surveyed in initial pilot study (45,000 downloads in a single semester) - 88% indicated it increased satisfaction - 52% of students achieved over 60% pass rate (compared with 34% in 2008) - Failure rate more than halved - 7.5% (compared with 19% in 2008)
Current Progress (including numbers on realised savings where possible)	10 locations have been completed, 20 by January 2013 >200,000 podcasts downloaded
Cost of Change – cost of managing / implementing changes	Cost per lecture theatre (based on pilot of 10) = **£14,000** This includes associated staff costs, theatre hardware and back-end hardware) – utilised existing equipment from small-scale pilot. **Total cost for pilot= £140,000** Full roll out across all lecture theatres and small teaching spaces **£460,000**, includes new capital purchase of back end system **Total project costs: £600,000**
Time taken to realise benefits – (short term and long term issues)	Project pilot duration (10 lecture theatres): 1 year Roll out to 100 lecture theatres – to be completed by September 2013 Total project duration: 2 years
Unanticipated consequences – good and bad	Good: Multi-purposing of material; - Additional support for disabled students - Extra value resource for students learning in a second language - Taster sessions for students before they sign up to courses - Provides potential material for Massive Online Open Course (Moocs) and other online possibilities - Used to promote best practice teaching across the University No impact on attendance rates - This remains case even with lectures scheduled in less desirable parts of the timetable: (e.g. Monday at 9am, Thursday 5pm!) - Attending lectures provides full and richer learning experience, and interactions not possible through pod cast material Unforeseen: Content which is openly viewable across faculty / school members may lead to changes in teaching style / review methods. Uptake by staff is very difficult to predict, making the impact on storage and network solutions hard to estimate accurately.
Future plans	Large-scale deployment across all lecture theatres and

	small teaching spaces – by September 2013
Potential for application across R&I base	Increasing take up across the sectors Manchester system –captures voice and screen (slides) only; no video recordings Range of other solutions based on multimedia approach Large number institutions collaborating on development of open source system for back-end hardware. Other institutions can benefit from the same software without the need for costly licencing deals. It is currently used across many HE institutions outside the UK (Stanford, UC Berkeley, ETH Zurich, Osnabruck) with national level pilot across universities in Norway orchestrated by UNINETT. Manchester is keen to work with organisations such as UCISA and attending JISC funded group events such as the Steeple Community (supporting University podcasting efforts) to share experiences and knowledge gained through deploying this new and innovative technology.

Efficiencies and added value through improvements to Careers Service: University of Oxford

Background

- 2008: careers service only utilised by 20% of student population (mainly through 1:1 sessions with career advisers)
- Although they can be an effective intervention, they are expensive, were over-serving a small proportion of students, needed to be refocused and complemented with other services
- No benchmarking or client survey data used to assess effectiveness, efficiency or quality
- There has been a continuous process of improvement over last 5 years
- Numbers of staff: remained at 30-32, although dropped to 24 in interim during reorganisation of services
- Although the total number has remained constant, there are more working in client facing roles than in prior years

Key service improvements

1. Change in delivery of existing services

- Outsourcing of IT systems: events/vacancy database, website design and delivery, and DLHE support system
- **Vacancy System**: purchased US system (Interfase from CSO): costs significantly less than one FTE –fast to implement (3 months), is totally reliable, scalable, and almost completely customisable
- When system installed, typically had 350 live vacancies at any time, now is 1,200+
- In 2009 3,500 vacancies posted; it was 6,500 in 2012
- This growth rate was partly driven by the ease for all employers of posting vacancies
- **DLHE annual careers destination survey** – previously conducted in-house, but now run by 3rd party – fee is less than 1 FTE plus far less bureaucracy
    - Results now published in a searchable and sortable database –the first university to do this

2. Providing new services with redeployment of existing resources

The Internship Office

- Started with 4 internships in 2008 provided by alumni, 30 in 2009, reaching 280 in 2012 –anticipate over 300 in 2013
- Open to all undergraduate and postgraduate students; demand is increasing (e.g., 2012 100 students had clicked through an internship with the World Food Fund, in 2013 it is over 800)
- Aspiration to grow to offering 1,000 internships within the next few years; redeployed vacant back-office posts to build the Internship Office
- Vacancies are now posted by alumni/employers themselves rather than Careers Service, system can absorb increase in volume at no extra cost

3. In house production of careers guide

- Guide now published in house by Careers Service and Students Union
- Better quality product and jointly earn £70k in revenues, shared 50:50 with Student Union, and reinvested in student services
- Part of a drive to increase revenues from outside the University
- In 2012/13: approx. 33% of funding from external sources

4. The Student Consultancy (also HEIF 5 supported)

- Student idea; Pilot of 40 students, growing to about 70/term
- HEIF5 funds used to expand original scheme to 108 students a term
- Students work in teams of 4 to address a strategic issue or business problem affecting a local organisation
- Cross year and cross discipline (e.g., 1st year English undergrad with 3rd year undergrad Physiology, with DPhil in Biochemistry and 2nd year PPE)
- Type of problems vary e.g., business plans for new catering facility in Community Action Group; understanding views on changes to bin collection in Oxford; bar coding 2 million books in the Bodleian; and usage by students of the Playhouse bar
- 90% repeat business from the client organisations

Critical Success Factors

1) Leadership

- Service led by Director with international, large corporate, SME expertise
- Careers Advisors recruited with professional experience (private, 3rd sector, public sectors) and entrepreneurial attitude
- Emphasis to all staff on the importance and welcome for innovation

2) Strong relationship management

- Service depends on building open and strong relationships with recruiters, Colleges, Students Union and suppliers to provide services to all stakeholders
- Regular surveys are used to provide evidence of improvement against targets and uncover opportunities for improvement
- Pervasive policy of being very responsive on email, media and data requests

3) Innovative and supportive atmosphere

- University environment allows entrepreneurial activity; senior management is very supportive and trusting
- Service is given fairly free rein to innovate to drive up service levels, and to raise further external funds

Efficiencies and added value through improvements to Careers Service: University of Oxford

Policy Area and how links to Growth	**Maximising development of human capital and improving student experience in Higher Education**
Savings: Operational Efficiency: Same output for reduced input	Outsourcing of IT systems for Events & Vacancy System, Website, and DLHE collection has saved approx. **£90K per year.** Reduction in 1:1 sessions for students from 45 to 15 minutes has saved 2FTEs of Careers Adviser time, still offering 5,500 1:1 sessions a year, but more effectively.
Savings: Programme Efficiency Greater output (number or quality) for same input	1. Over the last 4 years (from 2010-13), now serving 70% of the UG and PG population, up from ~40%, from the same baseline budget; equivalent to **6,000** extra students being served in 2013 compared with 2010 – excluding HEIF5 for specific projects 2. **Additional projects being delivered from savings in resources:**

	- Internship Office – from 30 to 300 internships in 4 years - Insight into Teaching – 40 placements this term - The Student Consultancy (supplemented by HEIF 5) – for 108 students a term - Springboard development programme for undergraduate women – first in the UK – 100 students a year - The Shed – new incubator and innovation centre (supported by HEIF5+)
Current Progress	• Over 5 years income up 4% a year (Compound annual growth rate, CAGR), and operational costs at 1% CAGR a year. Savings (or cost avoidance) on **outsourcing and redesign of services equal to at least £400K** (i.e. 5 years at £80K/year) • Grown the vacancies by 20% a year (CAGR), doubled the number of employers. • Additional numbers of students each year benefiting from service over 5 years: **6,000 (data pre 2010 are unreliable)**
Cost of Change – cost of managing / implementing changes	Costs to refocus include central funding of the university's early retirement scheme in 2010 that enabled 5 staff to move, rest of the changes came from natural wastage. Retraining on IT was managed internally at no cash cost. Funding of the events system is a fixed annual fee that includes initial configuration.
Time taken to realise benefits – (short term and long term issues)	Short term: growth in student engagement has been fast, from 40% to 60% engagement in one year, Medium term: engagement with colleges and departments: networks approx. 50% complete
Unanticipated consequences – good and bad	Demand from alumni is growing and might overwhelm our resources Good consequences are the engagement levels are higher than the initial targets I set; I had assumed that with 1/3 of UG going to further study, they would not need as much help and overall UG target would be 65% - passed last year
Future plans	Continue the model of gathering evidence from clients and providing products and services to support their demands. Identify future sources of business or grant income to support new activities that are in demand by students *De facto*, become the go to place for all career and work opportunities and information

Maximising use of research equipment to support excellence and growth: University of Leeds

Background

The University of Leeds has developed an asset register system to classify research equipment and facilities according to primary function. This has been built into a web interface for academic and business users to search for, and request access to, publicly funded research equipment across Leeds.

Objectives of the project

- Develop consensus across Leeds, and subsequently the seven other universities in the N8, to an agreed system for classifying research equipment and facilities.
- Define and explore the barriers to sharing research equipment
- Build upon the database development work at Leeds to define the scope for a web based system to allow academic and industry users to search across the N8 for research equipment, to increase equipment utilisation and sharing of assets

Direct Benefits

- A common taxonomy developed by Leeds and agreed across the N8 that can classify research equipment according to primary function in a way that is intuitive to the end user.
- Agreement and transfer of system to 7 universities saved approximately £315k (cost of development at Leeds= 45k x 7 HEIs)
- Classification of 5,000 items of kit across the N8 universities
- Equipment with a value of >£25k within the University of Leeds can be accessed externally through a web-based search engine (https://esms.leeds.ac.uk/).

Indirect benefits

- Development of new research ideas and knowledge sharing across researchers using a particular type of equipment
- Sharing engagement across the research base: an RCUK-funded project (UNIQUIP) has been initiated between N8, S5, SET^2, and M5 to maximise use of equipment assets across the UK.
- Contributed to the development of the proposed national research equipment portal 'equipment.data.ac.uk'

Next Steps

- The development of a fully searchable online database across which can be used to locate and request access to research equipment and facilities across the N8 University partnership. This will be launched in March, initially with data from Leeds, Manchester and Sheffield Working with other national partners to define national standards for equipment classification and sharing.
- Strategic asset planning: allowing evaluation of the investment required to maintain the research equipment base at its current level
- Identification of opportunities to collaborate in the development of new research facilities across the N8
- Open days to promote and encourage use of equipment within equipment clusters, both for industry and academia.
- The potential for cross-faculty technical support, and collective negotiation of service contracts.
- Ensuring provision of the necessary technical staff to support equipment, together with appropriate levels of funding for equipment maintenance, to allow equipment to be run continuously with state-of-the-art performance.

Kit-Catalogue® Case Study:
Loughborough University

Kit-Catalogue™ - Loughborough University's open source equipment database system – demonstrates the intelligent use of ICT to make cost and energy savings allowing transformation towards a more sustainable future. The system is innovative and strategic, maximising the use of equipment and enabling new models of sharing with far-reaching benefits for research, teaching and learning.

Summary of Project

In 2008, the Materials Research School and the Centre for Engineering and Design Education at Loughborough University created an 'Equipment Database', an online catalogue of laboratory equipment, workshop machines and specialist tools from across the University. This catalogue, which now contains several thousand items, enabled staff and students to search for a particular item to borrow, book out or hire for research or teaching use.

In March 2011, the JISC funded developments to the equipment database in order to exploit the intelligent use of ICT to make cost and energy savings, allowing transformation towards a more sustainable future. The project made significant enhancements with the intention of providing public views of the website (http://equipment.lboro.ac.uk) as well as open linked data for other web services to exploit. The project enhanced the cataloguing effort, improved system functionality and integrated it within procurement and policy workflows: embedding and encouraged greater use across the institution.

The enhanced application, Kit-catalogue, has been available as open source software (http://www.kitcatalogue.com) since December 2011. From then, Loughborough has continued to develop the software, further populate its own catalogue, establish a user group from adopters of Kit-Catalogue, become a partner in the national UNIQUIP project to standardise equipment taxonomies to facilitate national equipment sharing, and use Kit-Catalogue as the M5 Universities regional equipment database. The project won an S-Lab Award for Laboratory Equipment and Services in June 2012, and was a finalist for the Outstanding ICT Project of the Year at the Times Higher Awards in November 2012.

Benefits of Kit-Catalogue®

- Loughborough's Kit-Catalogue is populated with 2,048 laboratory items. By making all of the equipment available in one place, researchers become more aware of what is actually available on-site, potentially reducing the need and cost to travel far afield to carry out certain research experiments.
- Due to the high level of detail ascribed to each item listing, more effective judgements can be made in deciding exactly which item will be ideal for each individual laboratory operation. By offering the ability to include a full description, specifications, photographs, user manuals, case studies and other application details for each item listing, Kit-Catalogue has another benefit as an educational resource, allowing students to increase their knowledge of certain items, cover new applications of items, and possibly even introduce types of items otherwise unknown to the user.
- By encouraging the sharing of equipment between differently disciplined departments across campus, a greater potential for collaborative research arises, in turn, enabling a greater possibility for new areas of research which would have otherwise been difficult to pursue without this pooling of knowledge and skills.
- Kit-Catalogue prevents the unnecessary and costly double purchasing of items. At Loughborough, Kit-Catalogue is linked to the procurement process and a notification is sent to the Kit-Catalogue administrators when any equipment above a certain amount is submitted for purchase, for which duplicate or similar items will be checked against. This has recently occurred when one School proposed the purchasing of an item which, when checked, was

already present and available elsewhere on campus. The item was subsequently not purchased, saving the university over £25,000, and also stimulated new collaboration between the researchers involved. Not to mention that duplicating equipment requires more technical and academic support. Immediately, the real savings made by the implementation of Kit-Catalogue could outweigh the cost of the project!

- With the prevention of the costly double purchasing of equipment comes the reduced need for heating and occupation of additional space within buildings for duplicated equipment. This kind of energy saving contributes towards the Green Impact Scheme for sustainability at Loughborough University.
- By allowing all custodians to control the availability, access and visibility restrictions for each of their items, hindrances to normal teaching schedules and research projects are prevented.
- In providing the capability of listing detailed information in the back-end of the catalogue, Kit-Catalogue enables equipment managers to effectively monitor and maintain equipment by generating simple reports with information such as calibration status, PAT test due dates, upgrades, financial information and a whole host of other information.
- With Kit-Catalogue there is a potential to promote equipment use externally to regional HEIs, industry and Small to Medium Enterprises (SMEs) as Kit-Catalogue provides the option to make any item publically visible and available for external hire. This potential for commercial hiring or equipment provides a potential to generate money for the laboratories, and enhance possibilities for collaborative research and development.
- By enabling public visibility for a host of items, Kit-Catalogue could also attract prospective researchers and students to join the institution, based on the level of high-quality equipment already provided.
- The open source license means that Kit-Catalogue is easily adoptable and customisable to other institutions. There are currently 16 institutions using either their own full installation of Kit-Catalogue or a hosted trial version; and Kit-Catalogue also powers the M5 Universities Equipment Database - the first regional equipment database in the UK.

Increasing the intensity of research equipment and facilities use, reducing costs and sharing scarce resources.
University of Oxford

The University of Oxford invited proposals to increase the use of research equipment and facilities, to reduce costs and share resources. These proposals leveraged EPSRC Block Grant (Delivery Plan) funding with University cash or in-kind, and were about stimulating new approaches to support new science and greater utilisation of facilities across the world class research base.

The Oxford EPSRC Block Grant Committee funded 17 initiatives, with grants (normally up to £10k) matched by local cash and or in-kind support.

These small allocations of funding have
- increased effectiveness (machines available at higher capacity; new science through collaborations across disciplines)
- increased efficiency (e.g. machines operational for extended periods, remote access)
- stimulated new approaches to sharing equipment, which will have benefits in the longer term

Case Studies
1) Small laser fabrication facility

- Relocation of £300,000 worth of laser fabrication equipment to a larger laboratory providing access for several research groups.
- This is being set up as a small research facility (SRF) and will enable the number of supported experimental projects and user base to be expanded.
- Previously, the system was based in a small laboratory and was capable of supporting only one project.
- The relocation has increased the capacity of this system so that it can now support several lines of research.
- Higher capacity is achieved by the running of systems simultaneously through separate beam lines.
- The extra space also permitted more flexible system design that facilitates rapid changeover between applications.

Outcomes and Benefits

- The relocated equipment is central to several research streams that will enable scientific and technological advances through projects within the University and with external collaborators.
- Current applied research projects involve researchers from 4 departments alongside Engineering (Chemistry; Materials; Atomic Laser Physics, Astrophysics)
- Estimated use time per month is now up from 60% to 80%
- The system also supports its original role in the development of new optical methods for laser machining. The new arrangements permit the parallel development of applications and methods with reduced downtime.

2) Extending the operational capacity of an NMR spectrometer to allow multiple-sample data collection overnight

- New design of automated sample changer has been added to a NMR spectrometer that previously had no robotic capabilities.
- Allows multiple samples to be queued and analysed under automation without user intervention after initial system configuration.
- This means the instrument can be used during periods when it would otherwise be unattended, most notably overnight.
- The sample changer can accommodate up to sixteen samples and thus significantly enhances the operational hours of the spectrometer and increases its overall sample throughput.

Benefits

- The changer will allow the SRF staff to collect data on multiple samples during overnight periods and thus improve the efficiency of the analytical services provided across its existing user base.
- The higher sample throughput this allows will mean service time saved on the instrument can be made available to suitably trained research chemists, thus further promoting their research activities.

Outputs across the whole project

EPSRC funding has helped to

- Enhance capacity and sensitivity (Physics SQUID-based magnetometer)
- Train new users (Materials; JEOL instrument)
- Set up internet booking (Biochem, BMG-PherastarFS platereader)
- reactivate Differential Scanning Calorimeter (DSC) and thermogravimetric analysis (TGA) systems and incorporate them into the X-ray Crystallography SRF;
- Enable material researchers to study high temperature structural phenomena ("Supernova" single-crystal diffractometer SRF)
- Establish new collaborations between Engineering Science, DPAG, Oncology and NDORMS (multiphoton microscope, Eng Sci) make undergraduate lab instruments open to researchers

A qualitative and quantitative assessment of cost and benefits of asset sharing: N8 High Performance Computing Facility

Summary – Better kit, New Science, Better for Business
The new High Performance Computing (HPC) facility shared by the N8 universities provides capability to tackle research challenges not possible on existing facilities.

a. By sharing the resource, all 8 universities have access to a larger and higher specification machine that would not be affordable or fully utilised by one institution.
b. This enables new science, and bigger and better outcomes. It allows researchers to tackle new research challenges not possible on smaller facilities.
c. This is a world-leading facility supporting business to be internationally competitive across a range of sectors in the industrial strategy. It has attracted enquiries from 25 companies, including Unilever, Rolls-Royce and Syngenta within the first quarter of service.
d. Creating one larger facility supports better multidisciplinary research, pushing the boundaries of knowledge, for example in materials science

There is a marginal cost saving of capital (£735k on an asset with 5 year lifespan), plus a total revenue saving of £1.2m (equating to £30k per institution, per year).
It is important to note although the two cases are broadly similar in cost, **the resulting scenarios are not comparable in terms of capability**.

Benefits from higher specification, N8 HPC facility

1) **Effective engagement with business:** This is a world-leading facility supporting business to be internationally competitive across a range of sectors in the industrial strategy, including aerospace, nuclear, automotive, info-economy and renewables. It enables new science in technology areas with cross sector application, for example power electronics.
2) **Clustering of multidiscipline research teams around themes and techniques**, including atmospheric modelling, materials modelling and financial modelling. The critical mass of researchers using N8 HPC will also enable knowledge exchange and development of methods and techniques common to many disciplines such as multi-scale modelling, use of next generation architectures and modelling in extreme conditions. This allows for strengths in individual institutions to be applied more broadly across N8. The NCAS and Material Science use cases are provided to illustrate a number of key points [1&2].
3) **Flexibility to tackle urgent research problems:** Facility can operate flexibly and facilitate urgent computing, for example flooding/ environmental modelling and disease contagion/spread modelling.
4) **More effective provision for SMEs:** The service supports modelling and analysis on lower - level facilities and the transition to high capability HPC, of particular interest to SMEs, who would not have awareness or know how of the possibilities of these facilities
5) **Skills development in use of e-Infrastructure**: Development of skills in the use of e-Infrastructure and training of academics and industry partners to use HPC. This will embed the use of computational science in doctoral programmes
6) **Training and career development**: Tier 2 centres of excellence crucially provide a career path for specialists in HPC who are necessary to support research and industry that would otherwise be lost to other sectors. They need to be embedded close to the research they are supporting.

Benefit for industry and research partners

1. Application of HPC to Power Electronics Modelling

The UK is a world-leader in power electronics, and is crucially important for industrial companies including Rolls Royce, Siemens and a host of others due to the crucial role it plays in aerospace, energy, automotive and renewable sectors.

At present, the leading power electronic groups in the UK (principally Nottingham, Newcastle, Sheffield, Warwick, Bristol, Cambridge, Strathclyde Universities) are limited in their ability to simulate power electronic modules due to the computational time taken for realistic time-dependant calculations. Porting engineering packages capable of power electronic simulations to the new N8 HPC facility will give the UK a unique international advantage in this field.

Benefits include:

- Enabling for the first time the realistic simulation of the new generation of fast switching high efficiency power modules.
- Designing new, more efficient power modules - (predicting change in efficiency from 95%-98%)
- Over 90% of electrical power produced in the UK goes through a power module – so the overall energy saving potential in the UK would equate to a national saving of approx. 2 power stations
- Higher frequency of operation produces smaller and lighter modules that are in high demand for advanced aeroplanes and other high margin markets.

This will give UK industry a unique advantage that should create opportunities for improved products and economic growth, particularly in energy, aerospace and automotive sectors.

2. BBC R&D High Throughput Data Analytics

BBC R&D approached the University of Manchester after hearing about N8 HPC. They had a unique computational intensive data analysis problem that required the analysis of hundreds of thousands of audio files.

The BBC commercially releases many programmes that utilise licensed music as a bed to the production. In regions where this creates licensing problems another musical piece is used, that matches the ‘feel’ of the original. This can be done manually but BBC R&D has developed an automated process but it is still computationally intensive, even on a high-powered workstation. When multiplied across the whole BBC library this problem became intractable.

The specialist support staff in Manchester ported the code to N8 HPC and scripted the workflow to allow the 128,000 calculations, which ordinarily would have taken over a year, to be performed in 12 hours.
By providing specialist support, in addition to the tier 2 capability, N8 HPC were able to introduce the BBC R&D team to HPC and demonstrated how this could be integrated into their normal workflow.

"We approached the University of Manchester with 175 days’ worth of music which we needed to process using 53 different algorithms. The entire dataset was processed in only 12 hours, creating the world's largest time-varying musical feature database. Their combination of cutting-edge facilities and outstanding support was of huge benefit in getting the project completed and we look forward to working with them again." - Chris Baume, BBC R&D

Cost comparison

		N8 HPC	Business as Usual	Difference
	Capital Costs	£2,600,000	£3,500,000	-£900,000
	Staff Setup Costs	£165,000	£400,000	-£235,000
	Accommodation /Facilities	£800,000	£400,000	£400,000
TOTAL SETUP COSTS		***£3,565,000***	***£4,300,000***	***-£735,000***
Staff	for 1 year	£260,000	£420,000	
Energy	for 1 year	£180,000	£260,000	
Staff	for 5 years	£1,300,000	£2,100,000	-£800,000
Energy	for 5 years	£900,000	£1,300,000	-£400,000
RECURRING COSTS TO YEAR 5		***£2,200,000***	***£3,400,000***	***-£1,200,000***

The saving of £735k is primarily capital. £1.2m is saved in running costs over 5 years, this equates to £30k per institution per year

Appendix 1: Notes on the models
Notes on modelling

- The baseline is reflection of how much resource would need to be invested to provide a similar overall capacity, in a distributed model
- To provide the computing ***capability (size of jobs)*** of 5300 CPU cores in each institution then each institution would need a 5300 CPU core facility
- Reducing this duplication is the key benefit of the approach we have taken; it is **capability (*size of jobs***) that drives the research outcome not the **full capacity *(number of jobs as production throughput***).
- So although the two cases are broadly similar in cost, the resulting systems are not comparable in terms of capability.

Base Case – Business as usual

- Each N8 partner invests the EPSRC funding in a cluster of around 650 CPU cores (i.e. the totalling a similar ***capacity*** to the current N8 HPC shared facility).
- This requires staff time for administration and user facing support.
- For each site this is the equivalent of 1 FTE (admin + back up admin time) + 1 FTE user support. The degree that this exists in each institution varies, so this is an averaged cost.

Shared case – High Performance Computing facility

- This is what has been implemented as N8 HPC.
- Purchase of larger scale machine only made possible by EPSRC funding
- Requires staff time associated with commissioning, purchase and installing this investment, and increased costs in the facilitation of the networks of people critical to maximise the usage of the facility
- The shared N8 HPC provides the opportunity for much more that the base case.

Developing a Strategic Overview of NMR Equipment Needs to Underpin World Class Physical Sciences
Led by Prof Mark Smith, Vice-Chancellor, Lancaster University

Summary – key highlights

- With improvements in research equipment databases, the sector is better able to progress towards sustainability, plan and prioritise strategic capital investment.
- The strategic overview of NMR facilitates is a tool for targeting reduced levels of investment to enable new science, better research outcomes and multi-sectoral access
- It means funding can be targeted, supporting better decisions over difficult investment choices to ensure UK can stay at leading edge through maximising strengths, and proactively identifying any shortcomings
- This pilot exercise in NMR has huge potential for other strategic, high capital investment areas, both in Physical Sciences and other disciplines across the research base

Key findings from the review

1) As resources are limited, we need to be more transparent and more strategic with investment, and maximise national resources and capability.

2) The report recommends an approach through a continuum of how equipment should be funded

a. Underpinning equipment / lower spec of kit: **fund by institutions** using QR and other university income streams. These requests will be high in number, lower in cost per item
b. Kit to advance research, new science – **fund by Research Councils**, use specific set of criteria for a category of equipment
c. National leading centres – fund through **joint approach of RCs**

3) NMR base in physical sciences is well used. Usage figures are in excess of 80% - very encouraging

4) On an international basis, there are some shortcomings in our equipment base- specific targeted funding calls are recommended to plug gaps and support efficient use of limited public funds to maintain competitive position

5) As a community, the universities and research councils can undertake strategic reinvestment plans. The rapid progress on the development of asset registers in the last 12 months (using EPSRC funding) means institutions now have the ability to provide this management information, which Research Councils can collate to provide a strategic picture across the whole of the sector

6) Collaborations of institutions are increasing, and institutions are coalescing around capital equipment – seen as necessary to prosecute world class research and meet changing financial circumstance

7) In view of all the benefits of this information, the data collection and analysis should be undertaken for at least 3 other techniques in the physical sciences Mass Spec, Electron Microscopy, and Diffraction

8) Research Councils should use all levers at their disposal to encourage universities to work together in the relevant circumstances. This could include providing incentives in funding calls for institutions to work together and reviewing mechanism for apportionment

Why develop a strategic overview of NMR?

1) To provide context and an evidence base to support EPSRC funding decisions for equipment over £173k, following changes to capital funding in early 2012. (primary driver)

2) Understand the level of investment necessary to maintain equipment base for NMR (EPSRC is one of a number of funders in this space) What is scale of replacement that EPSRC will be faced with?

3) Recommend ways of maximising coherence between range of capital funding streams (QR, CIF, RCUK) to support world leading equipment base

4) Understand how current changes to capital funding have changed behaviour and how has collaboration changed in the sector.
5) Understand how we can maximise usage of existing equipment

Other information

1) Background

- EPSRC Strategic Equipment Panel – established as a new approach following changes to capital funding
- Applications for kit over the OJEU threshold (£173k) are evaluated by this panel (rather than by peer review process)
- Panel has a broad range of expertise and has been operating for 18 months
- In the early stages of this new system, there were limited number of applications, and few difficult choices to make – little business, no big issues
- Middle of 2012 – applications started to increase, across a whole variety of cases.
- Range of different types of equipment, each playing a different role
    - Fairly standard equipment
    - Equipment enabling new science
    - New national facilities
- Difficult for panel to make a judgement on how strategically important the equipment was
- Panel members drawn from a broad range of disciplines-need contextual document to understand where equipment sits in landscape, and the scale and importance of the funding request; is it core/underpinning equipment, or will drive new science or a national level facility?

2) Methodology

- The approach was to undertake a survey and ask community (all EPSRC framework and managed universities)
    - What is the current capability?
    - How and when will it be replaced?
    - What role does it play – underpinning infrastructure or leading edge?
- Professor Mark Smith analysed the responses and wrote a report; providing a commentary of what we have learnt, key points and recommendations
- Report is for EPSRC and was publicised and discussed with the community at a recent Town Hall meeting with EPSRC

Benefits of Subject-Specific Regional Alliances:
The Midlands Physics Alliance

Summary
The Midlands Physics Alliance (MPA) is a strategic alliance of the Physics and Astronomy Departments at the Universities of Birmingham, Nottingham and Warwick. It was formed in 2006, with the aim of establishing a co-ordinated research grouping and a joint Graduate School with the critical mass to compete with top US and EU Universities The MPA comprises three similar-sized partners, each with around 40-50 academic staff and 100-150 PhD students.

The MPA works with industrial partners including ARKeX, Astrium, e2v, IBM, NKT Photonics, Shell, TOPTICA and national standards laboratories including National Physical Laboratory (UK), PTB (Germany), SYRTE (France), and DFM (Denmark)

Collaborative Research in the Midlands Physics Alliance

- Twelve new academic staff were appointed through headhunting the best international talent that aligned with targeted research themes in the three partner institutions.
- Midlands Ultracold Atom Research Centre established for £9M (£5M from EPSRC/HEFCE and £4M from the two Universities)
- MidPlus state-of-the–art high-performance £3.5M computing centre enables the rapid realisation of modern computational research methods for business and industry
- The collaborative framework created by the MPA led to a coordinated approach to equipment procurement and maximization of its usage.

Outputs
More than 40 joint publications in leading academic journals have arisen from research collaboration across the MPA and the alliance has underpinned joint grant funding in excess of £20M. It has catalysed engagement with national facilities, such as the National Physical Laboratory, and with major UK/EU-based companies including e2v (Knowledge Transfer Partnership), ARKeX, IBM, NKT Photonics and Toptica.

Graduate Training

- Enabled by two tranches of Strategic Development Funding from HEFCE.
- Initial focus (2007) on graduate teaching in EPSRC-funded areas of physics
- Broadened to include Astronomy and Particle Physics in 2011.
- Four additional Midlands-based Universities (Keele, Leicester, Loughborough and Nottingham Trent University) joined MPAGS in 2012.

The collaboration provides:

- Met a national need for high quality interdisciplinary physical scientists by training around 100 post-graduate students per year since 2007
- High quality taught modules: 40 are now delivered annually through MPAGS, from a total portfolio of more than 60 modules.
- Industrial placements enable students to spend up to three months gaining experience of working in a company as part of their PhD training period.
- 1,000 postgraduate students have benefited from MPAGS modules and training since 2007.
- Lectures are provided via the Access Grid, complemented by bringing students together for thematic workshops and summer schools.

Case Study– London Centre for Nanotechnology (LCN)

- Collaboration between UCL and Imperial to provide critical mass of expertise not present within one single institution
- This field of research is dependent on high value capital equipment items
- In order to develop new advances and push the boundaries of knowledge, leading edge research kit is required.
- The Centre comprises over 130 academic staff based at two sites

Sharing of Equipment

- The LCN provides open access to facilities, including clean rooms with capability for design, fabrication and characterization of devices, and cutting edge scientific equipment.
- To ensure the UK remains at the leading edge, UCL and Imperial have developed specialisations of equipment
    - For example, Imperial have world leading transmission electron microscope (£2-3m capital item) which can be accessed by all LCN researchers
    - Focused ion beam microscope is based at UCL (£1m capital item) which can be accessed by all LCN researchers
- The ion beam and transmission electron microscopes provide a suite of facilities, allowing a continuum and progression of research through sharing of equipment.
- Each facility has specialist technical expertise to support operations
- New research collaborations and high impact science enabled through equipment sharing
- Collaborators from around a dozen UK universities plus NPL, Rutherford Appleton laboratories at Harwell; EU collaborators
- Working with the Thomas Young Centre for Materials Modelling, based at the LCN, industrial collaborators can also access modelling and simulation expertise to complement experimental research.

New facilities

- Europe's first neon Ion Beam Microscope: £1.7m EPSRC funded– to be shared by UCL, Imperial and Kings
- Kings key collaborator as Neon Focused Ion Beam will be a key tool for nanophotonics research –significant expertise in this area at Kings

Industrial Collaborations

- Work with business from a wide range of sectors from healthcare and diagnostics, to energy, natural resources and mining, information technology and computing.
- Industrial collaborations with over 80 companies – one third of these are SMEs.
- Larger companies: Lockheed Martin, Nokia, AkzoNobel, BAE Systems, Carl Zeiss, Oxford Instruments
- Equipment: utilised by NPL; SMEs developing new innovations in biophysics field
- The LCN has industrial collaborations with over 80 companies, just over a third of which are SMEs.

Advancing the Future of Digital Content
University College London and BBC

Focus Area: new innovations in advanced communications technologies
Brief description:

- University College London (UCL) and BBC have agreed a four-year research and development (R&D) programme to investigate the future of digital content.
- As part of this UCL and BBC are sharing expertise, knowledge and equipment in a brand new facility for the co-location of 40 researchers from each organisation

Background to the collaboration

- BBC and UCL have previously worked on a range of collaborative research projects and joint studentships
- Core shared areas of expertise include networks, distribution, content production, intelligent systems and user experience
- This work has been scaled-up within a strategic partnership to develop new world leading research and technology, and support new innovations in digital communications
- UCL Engineering collaborates with hundreds of companies, and is developing more strategic relationships with a small number of these to leverage greater impact from research collaborations. These include Arup, Cisco, IBM, Intel and Microsoft

BBC and UCL: resource sharing

- Major resource input: new facility at 1 Euston Square to co-locate 80 people (40 UCL and 40 BBC), with flexible space for other universities and partners
- Approximate cost of new facility: £5-10M shared by the partners[56]
- Laboratory space: flexible to allow user-based experiments, with mini technical studio for filming and building production systems
- Researchers from each organisation: access to resources that each partner brings. For example listening rooms and virtual studio facilities (BBC); workshops, visualisation facilities and virtual reality (UCL).
- The state-of-the-art expertise in running and utilising facilities – **enables new possibilities to advance research and technology.**
- **This is the key driver for the collaboration:** sharing expertise and equipment to enable new approaches and ideas for what is possible
- Efficiencies are also achieved through sweating the assets and increased utilisation of equipment: total approximate cost of pooled equipment £5-10M.
- New facility has space for new assemblies of equipment and access to well established facilities.

Impact of the collaboration

- New partnership is targeting innovations in production, delivery and experience of next generation content, for example
    - Production of content in new ways: better uses of archives, distributing access to production tools and enabling SMEs to produce content
    - Mechanisms for delivery of new forms of content to users: both to UK and global markets
- The partners are working with SMEs to get new providers into the content chain.
- This partnership will contribute to Government's Industrial Strategy and supporting growth in the info-economy

[56] Precise figures are commercially sensitive and partners were unwilling to share due to current negotiations

Centre for Genome Enabled Biology and Medicine:
University of Aberdeen, College of Life Sciences and Medicine

Summary

- The new shared sequencer at Aberdeen University is part of an integrated research facility initiated by the Schools of Medicine and Dentistry and Biological Sciences
- It will be underpinned by existing statistical, bioinformatics, high performance computing and data management capability and expertise
- Sharing this capability and expertise adds value to multi-disciplinary research, new advances in research fields and increases in training provision that could not be delivered by one School.

Benefits from Shared Facility

Usage of the machine and costs per sample

- Sharing the facility between Schools means that the Sequencer can be fully utilised, with high occupancy rates of around 75% once fully operational
- The cost per sample is reduced by access to a superior machine- which has the capability to multiplex (pool) samples analysed in a single run without additional cost or time incurred.
- Costs per sample can be reduced by 30-40%by utilising the system to run multiple projects

Increasing multi-disciplinary work, involving a breadth of expertise

- Biologists bringing in ecologists to use genomics, which is revolutionising the discipline
- Statistics and bioinformatics expertise for use of genomic data –provides data management expertise alongside, the wet / biological capabilities for using the Sequencer
- Collaborations with Data Management and High Performance Computing teams
- Development of user friendly tools for data management and analysis by biologists to improve their knowledge of statistics and bioinformatics, informing next stages of research
- Provides new ideas for biologists to sharing data with the wider collaborators

Better provision for business

- The Centre's capabilities and equipment provide a sequencing service for business
- Spin out companies and SMEs will have access to both the facility and associated statistics and bioinformatics capability at cost.

Management expertise (rather than academic time) to run the facility

- Centre Manager post: provides a wider expertise than one PI – removes bias towards one discipline
- Centre Management ensures Academic time spent on research; increases business orientation of facility; less short term and project orientated
- Allows building of expertise across two sites with Centre staff willing to work across both, servicing customers in two locations. Such staff provide an efficient way of service delivery.

Recruitment

- Wider range of disciplines interested in genomics than ever before
- Facility, alongside centralised HPC provision, is attractive recruitment tool, as academics do not need to develop these series / activities themselves as are being provided by the institution. Pump priming budgets available for new starts and those new to facilities.

Links to NHS Genetics

- The Facility is linked to the NHS Genetics labs for diagnostics and clinical work, which has spare capacity that can be utilised.

- This also allows the sharing of expertise and capability – for example clinical protocols, regulatory requirements and training –

Next steps

- Planning to offer genomics teaching across the entire cohort of PhDs, Masters and staff of the College – common training elements in bioinformatics, genomics, data management and stats – new cutting edge training element to the students.

Background

- New Sequencer facility at Aberdeen University was initiated by the Schools of Medicine and Dentistry and will be run and managed by the College of Life Sciences and Medicine for wide use across the University and beyond.
- High level case was expressed by clinical academic and a biologist, but University acknowledged the facility spans a wide range of science – this opened new possibilities for research, and other avenues for funding
- Funding was sourced within 6 months -50% HEI funds; 50% charity
- Sequencer will operate as a full service facility, addressing a continuum of research problems, run by a Centre Manager
- The space for PG students, researchers and visitors, is based on the “old” / historic campus, maximising proximity to a range of disciplines to use the facility.
- Medical campus (on an adjacent site) provides a complementary sequencer facility. Staff spend time on each site, build connections with disciplines
- Two year process to plan, design, implement and install the facility.
- 500k for equipment, plus 200k estates work. Longer track record of genomics existed as basis for this shorter term project to create a Centre.

Efficiency in Research and Innovation: Technology Strategy Board

- The Technology Strategy Board provides effective support to over 4,000 businesses per annum and is delivering an increased portfolio for less cost, in a highly specialised area. **The growth in competitions has increased six-fold, whilst staff resource to deliver has increased three-fold.** Regular benchmarking undertaken through the TAFTIE Group (the European association of organisations similar to TSB) suggest it is more efficient than its peers.

- The number of funding competitions delivered in 09/10 was 39 with an admin budget of £13.6m. During this period 482 projects were supported.
  - In 12/13 the TSB will deliver over 90 (potentially up to 120) competitions with an administrative cost of £23.3m with over 1,000 projects to be supported.

- SMART Awards: are delivered by 4 FTE plus flexible resource where needed, which is comparable with the same resource delivering the scheme at a single RDA. Costs for Technical assessment have **reduced from £450 per application to £300 per application.**

- The TSB provides expertise to support delivery of innovation and R&D programmes for a number of Government Departments and Regional Growth Fund awards, without any additional resource to do so. **Approximately £100m of total annual TSB spending (out of £450m) is provided by external bodies and managed by TSB, without additional admin costs**. The TSB is also likely to take responsibility for directly managing funding from EU programmes (e.g. ERDF) in the next two years, which will also need to be done within existing or declining admin budgets.

- The TSB has developed an integrated system from design to monitoring and claims delivery and due diligence allowing the highly efficient running of its programmes. Previous successes (SR07 period) in improving efficiency include **reducing the costs of running the Knowledge Transfer Networks by 40% (£10m pa in cash savings).**

- The TSB needs the continued level of specialist expertise to ensure correct implementation and to maximise the desired outcomes for business and growth

1) Operational Efficiency Savings: Key examples include

a) The administration budget has been cut by 18% from 2010/11, with an increase in the delivery of programmes: saving of £5.2m a year. (admin budget reduced from £28.5m to £23.3m)
b) Delivery of Knowledge Transfer Partnerships (KTPs): £300k saving per year: IT enhancements (£100k) and reducing number of regional delivery advisers (£200k), with further savings planned.
c) SMART Awards: 4 FTE delivering programme, plus assessment resource when needed, compared with 44 core RDA staff: saving approximately £2m a year. Technical assessment has gone from £450 per application to £300 per application.

2) Added value and productive efficiencies across the public sector

d) **SMART Awards:** new innovations in process e.g. ability for business to start spending within 20 days of notification of award and the ability to allow SMEs to make claims on a monthly basis rather than quarterly, making it easier for innovative companies to manage their cash flow.
e) **Funding competitions:**

- Increased number of competitions and grants awarded – funding a larger number of companies on less administrative resource.
  - The number of competitions delivered in 09/10 was 39 with an admin budget of £13.6m. During this period 482 projects were supported.
  - In 12/13 the TSB will deliver over 90 (potentially up to 120) competitions with an admin cost of £23.3m with over 1,000 projects to be supported.
- Funding competitions: streamlining application questions, proportionate with the levels of funding available (e.g. for the majority of competitions where the level of grant funding available is below £100K the applicants are required to answer only four questions, compared to ten questions for grants in excess of £100K.)

f) Delivering for other areas of Government and embedding capability in public sector, for example:
   - **Advanced Manufacturing Supply Chain Initiative**: original project: £25m for 4 LEPs, spend increased to £125m as a national competition. Use of TSB expertise on design and delivery of the application and assessment process, delivery mechanisms, competition rules and guidance to applicants, and state aid advice. Equivalent of 0.5 FTE over a nine month period (spread across a number of people providing a range of skills and levels including senior management time), plus specialist expertise and advice for external supply chain assessors (£55k indicative cost).
   - **Sustainable Agriculture Innovation Platform** – managing £40m of investment on behalf of DEFRA (£30m) and BBSRC (£10m). LINK programme in DEFRA transferred to TSB to deliver as part of the Innovation Platform.
     Cost savings across public sector from TSB expertise and programme management Indicative savings estimate: 4 FTEs per yr. (70k each with on costs), for 3 yrs. = £840k total. (DEFRA had a team of 6 FTEs)
   - **Innovation Vouchers -** The Innovation Voucher portal brings together over 40 innovation voucher schemes operating in the UK, making it more efficient for business to find the support they need.

International benchmarks

The TSB compares favourably in terms of administrative and management costs in comparison to similar organisations overseas. For example

- Tekes – Finland: Face to Face distributed model.
  Staff 390 (incl 90 in the regions); Budget £490m a year
- VINNOVA – Sweden.
  Staff – 200; Annual budget £190m
  TSB 160 staff; Budget £370m a year core budget (with c. £40m a year additional co-funding from other parts of Government)

Summary Table- Headcount, competitions and projects delivered

	2007-8	**2008-9**	**2009-10**	**2010-11**	**2011-12**
Headcount	55	84	116	135	160
Competitions	10	24	39	57	70
Registrations	3,041	3,616	6,913	10,204	16,133
Applications	1,255	1,335	3,129	3,350	5,192
Funded projects	235	230	482	667	932