



What is the impact of BEAMS research? An evaluation of REF impact case studies from UCL BEAMS

Despina Biri, Kathryn Oliver, Adam Cooper

Introduction

The genesis of the ‘impact agenda’ in the UK can be traced back to the Thatcher government, which required all public expenditure to be scrutinised, to demonstrate ‘value for money’ and to show ‘efficiency, effectiveness, and economy’. A 1993 white paper, “[Realising our potential](#)”, detailed this stance with reference to higher education more specifically, although prior work evaluating the impact of higher education on the economy exists ([McNicoll 1993](#)).

Within universities in the UK, the impact agenda has taken the form of evaluation of academic practice and output. The latest round of the Research Excellence Framework (REF 2014), which assesses the quality of research generated by UK Higher Education Institutions included a section for academics to provide evidence of their impact on policy, industry or practice. These are referred to as ‘impact case studies’, and consist of a description of the research, and of the process through which this led to impact beyond academia. These developments point to a need to capture impact, and to categorise the different impact types, beneficiaries and pathways to impact in order to monitor and support academics in this process.

The Engineering and Physical Sciences Research Council (EPSRC) Impact Acceleration Grant project, hosted at the [UCL Department of Science, Technology, Engineering and Public Policy \(UCL STEaPP\)](#) (thereafter referred to as the STEaPP Impact Project) is a study examining the extent to which and the means by which research undertaken in [UCL Departments within the Faculties of the Bartlett, Engineering, and Maths and Physical Sciences \(BEAMS\)](#) has had or could have an impact on relevant public policy within the UK. As the name suggests, BEAMS academics carry out research on the built environment, architecture, engineering, mathematics and physical sciences.

The STEaPP Impact Project aims to map prior and on-going UCL research within BEAMS that impacts or could impact on public policy organisations with science/engineering-relevant portfolios in the UK. The project aims to map UCL research against central government engineering policy interests and work closely with central government departments (such as the Department for Business Innovation and Skills, the Department of Energy and Climate



Change and the Department for Transport), the Royal Academy of Engineering and EPSRC staff to produce useful models to enable improved interaction of UCL research with these audiences. This will be achieved through a stakeholder symposium in Summer 2015, at which the results of the qualitative and quantitative analysis will be presented. Representatives of governmental departments and engineering institutions will be invited, along with other policy and private sector actors identified through the case studies and interviews. Academics from BEAMS and related departments will also be invited to participate. Using participatory and collaborative methods we will use this symposium to develop a set of guides for best practice in impact promotion and assessment for UCL and related audiences.

Methods

This report summarises the main findings emerging from BEAMS impact case studies (n= 70) submitted to REF 2014, as analysed during the STEaPP Impact Project. The set of codes used for this analysis were developed by the UCL [Research Impact Curation and Support \(RICS\) team](#), with reference to case studies submitted by all UCL schools, to better monitor and support research impact at UCL. Impact case studies for all UCL Schools are available publicly on [this](#) website. The analysis presented here is particularly timely, in light of the publication of REF2014 results in December 2014. We aim to provide insight into the impact types, pathways to impact and beneficiaries of UCL BEAMS research, using a methodology which could also be applicable to other areas of UCL research. It should, however, be borne in mind that this analysis forms only part of the STEaPP Impact Project, data collection for which is additionally being carried out using literature review and qualitative interviewing.

All BEAMS case studies were read and coded using a data extraction form which built on categories of impact type, beneficiaries, and pathways developed by the RICS team. In addition, we collected data on the place of impact and timing/duration of impact¹. In addition, the outputs listed by each case study were collected in free text form (not using codes). Data extraction was carried out by reading each REF impact case study in full, then assigning

¹ Data for timing/duration of impact is not presented in this report. The reason for this is that it became clear during the analysis that most of the impacts reported in case studies (n=43) took place during the 2000s. This corresponds with the [requirements for REF impact case studies developed by HEFCE](#), which state that: “a. The timeframe for the underpinning research will be up to 15 years between the publication of at least some research output(s) that made a distinctive contribution to the impact, and the start of the assessment period (January 2008). This timeframe may be extended by a further five years for some UOAs, if the sub-panel makes an exceptional case for doing so”.

codes with reference to the coding frames developed by UCL RICS for each parameter. In many cases, multiple codes were applicable, and were assigned when applicable in order to convey a more accurate picture of the types, pathways and beneficiaries of the impact. During data analysis, these multiple codes were counted as separate from each other in every case study, so that a case study may report multiple impact types, beneficiaries and/ or pathways to impact.

To better demonstrate how coding was carried out, a worked example is presented. In the example below, a [fictional] case study is presented in summary, followed by a table of codes which may be applicable.

“Professor X’s work with [Company Y] and [Professional Body Z], led to the creation of a new medical device for the diagnosis of [Disease A], and to the updating of guidelines which have now been adopted nationally and internationally. In addition, Professor X has been active in disseminating the results of his research to wider audiences, and has written articles for professional and wider public audiences, in addition to appearing in a discussion about the new guidelines on BBC Newsnight. This has helped to raise awareness about the importance of early diagnosis for [Disease A], and the adoption of the new guidelines has led to a saving of £3m for the NHS”.

This description of impact would be coded as follows:

Table 1 – Data extraction form used to code BEAMS impact case studies (n = 70)

Impact Case Reference	UCL01-X_redacted
PI/ Co-I	Professor X
Unit of Assessment	General Engineering
Outputs (list all) (not analysed for this report)	Creation of a new medical device; updating of guidelines; articles for professional and wider audiences; media appearances
Beneficiaries (list all)	NHS; Other health systems or services ; Wider public; Commercial / industry (individual companies); Professional or practitioner bodies; Specific patient group(s)
Pathways to Impact	Collaborative research (e.g. with industry or hospitals); Contribution to policy evidence; Media appearance/ coverage; Publication of popular texts; Research cited in guidelines;



	Research fed directly into clinical practice
Impact Types	Public discourse; Policy; Professional training and practice; Health; Businesses, organisations and sectors
Location of Impact	UK; International (unless specific countries are cited)
Impact sub-types (not analysed for this report)	PDI: Public awareness, attitudes or understanding; POL: National or local guidelines or policy; POL: International guidelines or policy; PRO: Professional practice; HEA: Guidelines; HEA: Outcomes for patients or related groups; HEA: Cost savings to a health system; BUS: Business sector or activity; BUS: Spin-out or new business
Funders (not analysed in this report)	EPSRC; Company Y; Wellcome Trust
Time period of Impact (not analysed in this report)	1998 - present
Notes	redacted

When the information presented above had been gathered for all case studies, analysis was carried out by adding up the number of times each code for impact types, beneficiaries and pathways to impact was used in the entire case study sample. This analysis was only possible where RICS codes were available, i.e. for impact types and sub-types, pathways to impact and impact beneficiaries. Once the frequency of different codes had been determined, the information was presented graphically, and key observations summarised. This information is presented in the next section.

Findings

Findings are presented graphically, with a short summary of the main observations and some examples following. Under each heading, impact types, beneficiaries, pathways and place of impact are presented graphically for UCL BEAMS as a whole. A short summary of the main findings then follows.

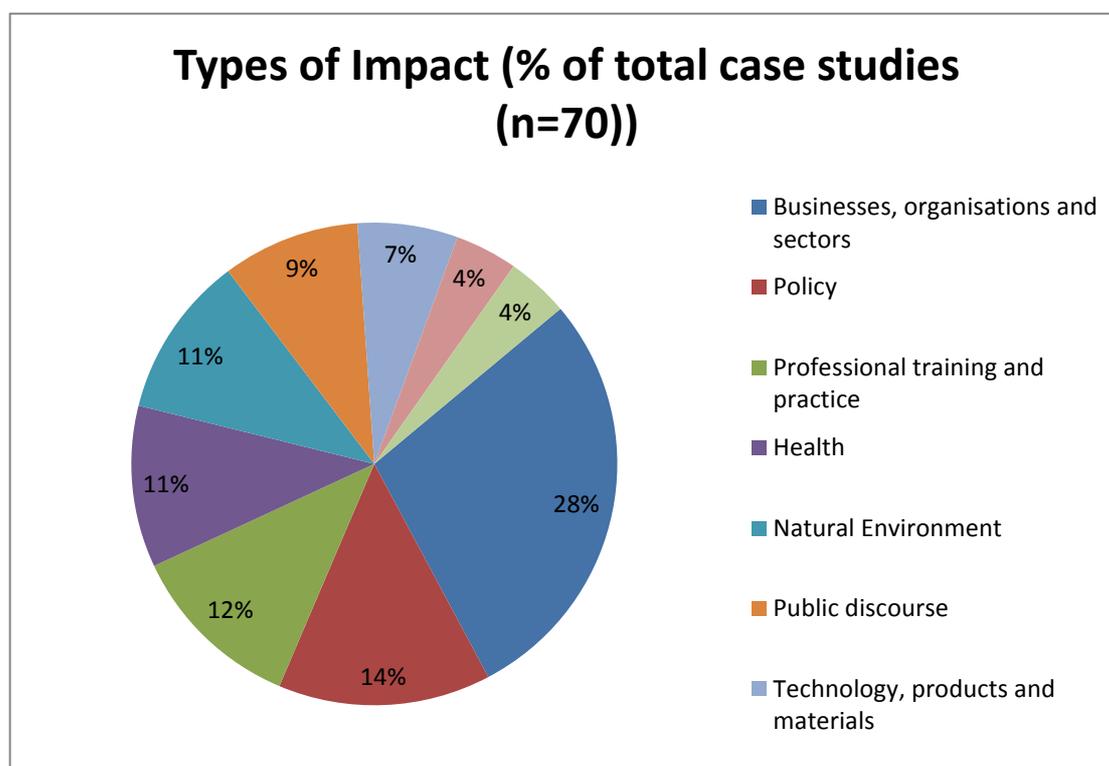
At this stage, data is presented in aggregate form for the whole of UCL BEAMS. This is in keeping with the intention that this report be used as a reference. It is expected that as the STEaPP Impact Project progresses, an analysis of impact by sub-type, beneficiary and pathways sub-groups will be



possible. In addition, analysis by Unit of Assessment (a term used in the REF roughly corresponding to a university department and/or disciplinary area) could then be carried out, which will allow for analysis on the different impact types, beneficiaries and pathways that distinct disciplinary areas can be expected to have. However, drawing direct comparisons between different research areas is not our intention, because certain disciplinary areas will differ in the ways in which they create impact in important respects.

Types of Impact

Figure 1 – Pie chart showing the % BEAMS impact case studies (n = 70) describing different impact types



Most case studies across UCL BEAMS reported impacts on businesses (n = 34) and policy (n= 17). For example, academics list the creation of spin-out companies using UCL research, job creation, improvements in business operations and performance, as some of the possible impacts of BEAMS on businesses. Some of the listed impact types on policy include: informing local or national guidelines, decisions by a public service or regulatory authority and contributing to public or political debates.

Other significant types of impact are on professional training and practice, health and the natural environment. Impact on professional training and



practice includes developing content for and delivering Continuing Professional Development (CPD) and other training courses; impacts on health include contribution to clinical guidelines, while impacts on the natural environment include the management of environmental risks (including carbon emissions). Some specific examples include:

- Influencing the practice of design companies and architecture firms through the development of a new theory of public space use
- Creating a social enterprise which makes use of crowdsourced mapping data to develop community maps – applications include noise mapping and transport and mobility maps
- Developing a tool used at the Department for Energy and Climate Change (DECC) to inform its Energy Efficiency Strategy
- Developing a methodology for postoperative outcome assessment, which has subsequently led to a change in clinical guidelines in the UK and internationally.

For brevity and clarity, impact types occurring <5 times are not shown in the chart. These impact types include international development, societies, communities & groups, cultural life, research and academic disciplines and public services.

Beneficiaries

In this section, an overview of the beneficiaries of UCL BEAMS research is presented. First, a breakdown of beneficiaries into government/ public (non-governmental)/ private/ third sector/ other, is given, with a detailed presentation of beneficiaries (as defined by UCL RICS) following. Beneficiaries may overlap, so that a particular case study may refer to government bodies, individual businesses and the wider public, for example, as benefiting from aspects of the research described in the impact case study.



Beneficiaries by sector (% of total number of case studies (n=70))

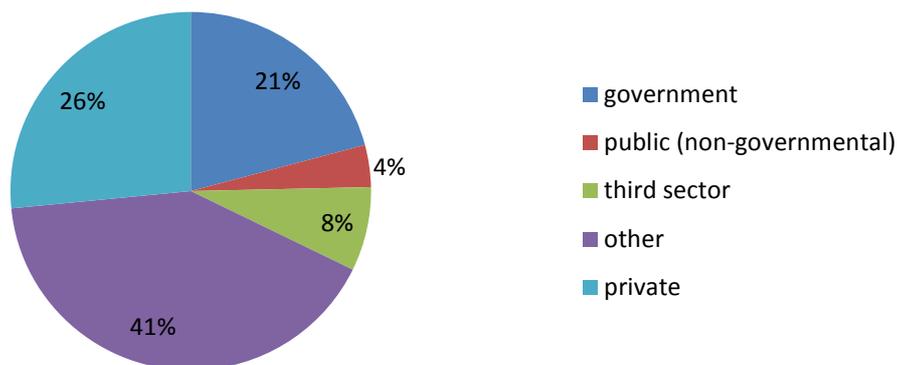


Figure 2 – Pie chart showing % BEAMS impact case studies (n = 70) categorized by beneficiary sector

As was shown in the previous section, the private sector is one of the main beneficiaries of UCL BEAMS research. This includes individual businesses and industrial sectors (e.g. hydrocarbon) and professional groups employed in the private sector. Government is the next largest beneficiary, at international, national and local level. Other public sector organisations benefiting from BEAMS research include the NHS and higher education research, while third sector beneficiaries include international and local non-governmental organisations (NGOs).

When comparing the two charts in this section, a discrepancy is evident, in that the chart of beneficiary types indicates that the ‘other’ group of beneficiaries (which includes – schools; specific communities or groups; professional bodies; arts and heritage organisations and practitioners and the wider public, among others), is the largest category of beneficiaries. This is because, even though categorising beneficiaries using the RICS typology was not difficult, each category may include organisations with diverse models of ownership – for example, not all schools are public; some are private, while others still are registered charities. It is not possible to make this distinction using RICS typology, which is why the ‘other’ group is largest in the chart above.

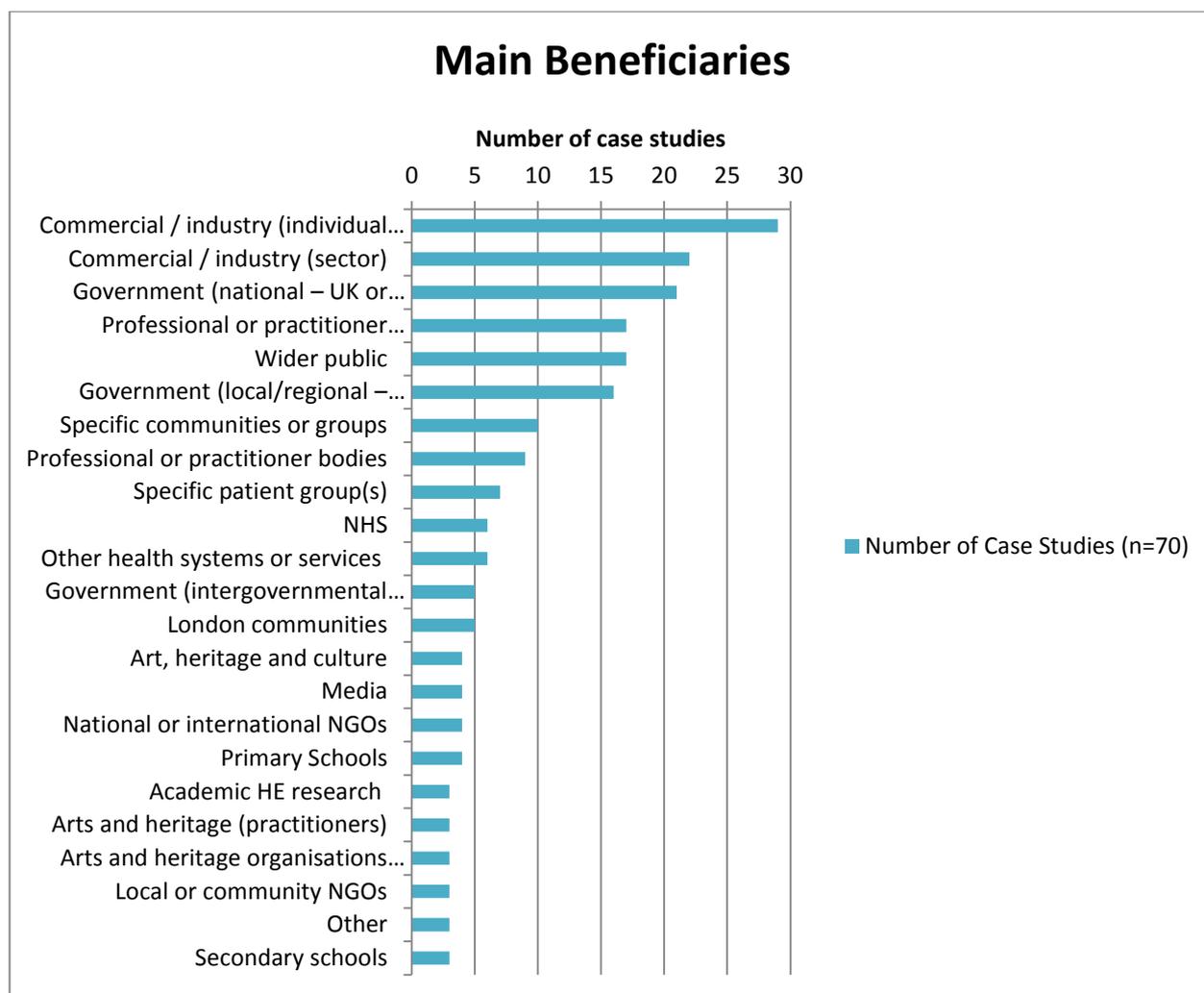


Figure 3 – Bar chart showing the number of BEAMS impact case studies (total n = 70) citing different beneficiaries

Unsurprisingly, given the impact types presented in the previous section, the greatest number of beneficiaries of BEAMS research are the commercial and government sectors, as well as professional organisations and groups.

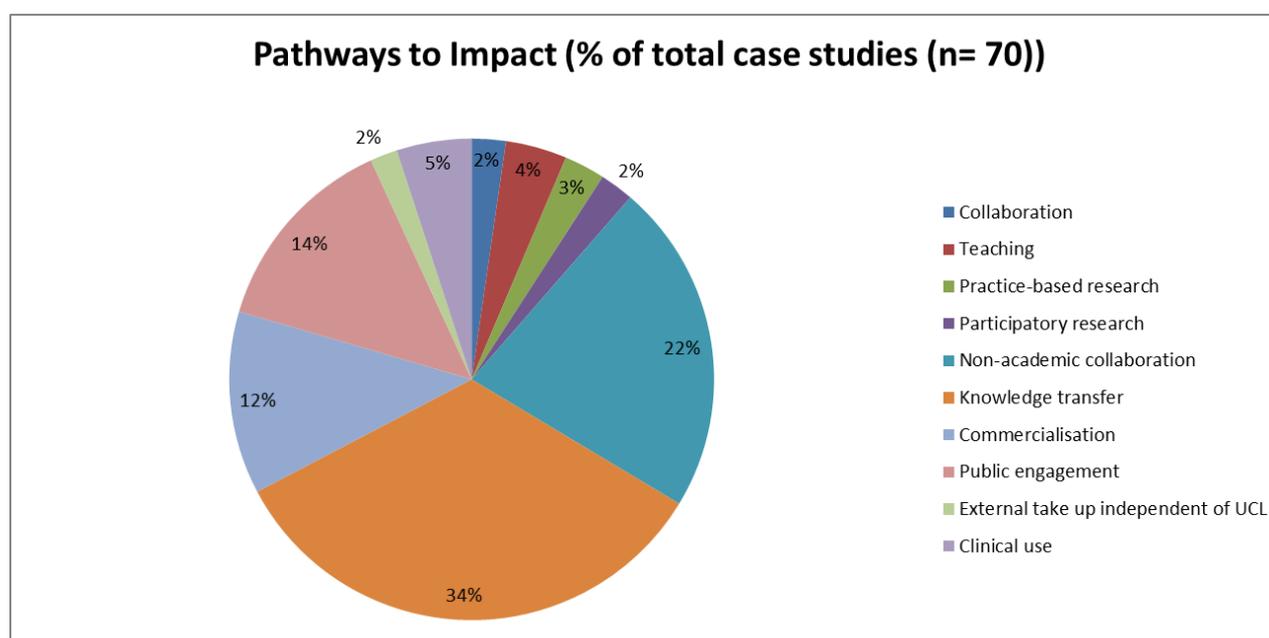
Some specific beneficiaries include the hydrocarbon, automotive, space, software and pharmaceutical industries, the UK Department of Energy and Climate Change, the UK Department for Transport, the UK National Health Service (NHS), police forces in the UK and overseas, and architectural design firms. The wider public, otherwise unspecified, is also frequently listed as a beneficiary. However, specific named groups may overlap with the wider public. For example, a case study may list impact on schools in addition to impact on the wider public.

Pathways to Impact



The term “pathways to impact” refers to the *ways* or *routes* through which research impact occurs. Pathways to impact are very wide ranging, from knowledge transfer activities through to public engagement and collaborative research. In the typology developed by UCL RICS, each of the categories presented in the graph below included sub-categories, which can be thought of as belonging to the same ‘family’ of pathways to impact (for the full list, see the Appendix). For example, the Knowledge Transfer pathway included the following sub-categories among others: Advisory Role; Contribution to policy evidence; Development of new technique(s); Membership of expert group; Provision of Continuing Professional Development or other training; Provision of data.

Figure 4 – Pie chart showing the % BEAMS impact case studies (n = 70) describing different categories of pathways to impact



As can be seen in the chart above, knowledge transfer and collaboration activities with industry, government and other beneficiaries were by far the predominant pathways leading to impact identified in the impact case studies. Commercialisation of research and public engagement are other commonly cited pathways.

Examples of types of pathways to impact include providing advice/ consultancy to government or professional bodies and/or businesses, research contributing to policy evidence, carrying out research in collaboration



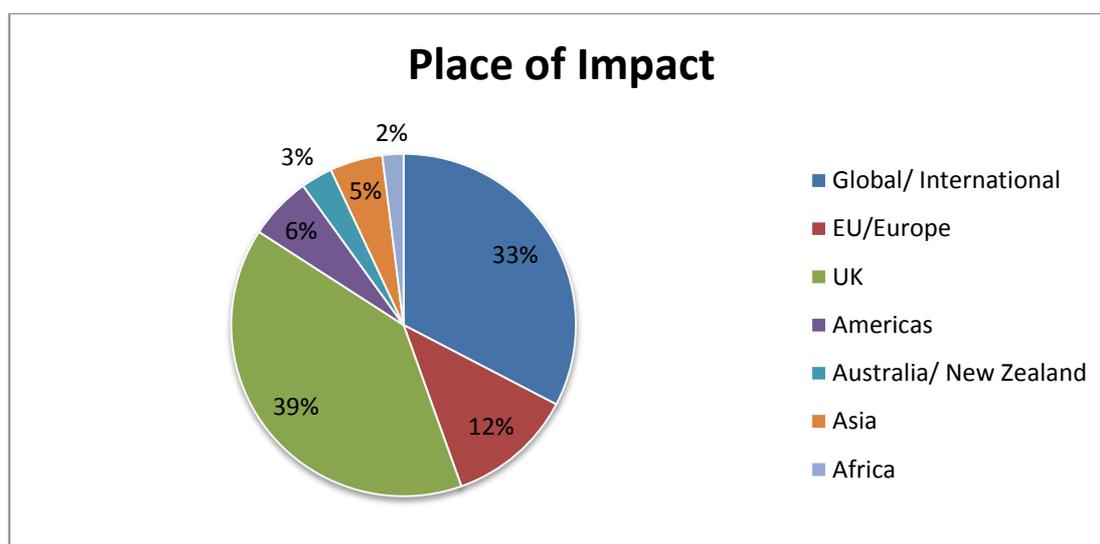
with non-academic partners, patenting, establishing spin-out companies, media appearances of academics or participation in public engagement events.

Specific examples from case studies include:

- The creation of a Knowledge Transfer Partnership, together with a consultancy firm and policy stakeholders, which facilitated the understanding and uptake of a contracting framework for UK infrastructure projects
- The organisation and participation in public engagement activities on physical sciences, leading to an increase in applications for study of physical sciences subjects at UCL at undergraduate level.
- The creation of a spin-out company to commercialise prosthetic implants for patients affected by bone cancer
- Collaborating with the Chartered Institution of Building Services Engineers (CIBSE) to develop guidance on Urban Heat Islands (UHIs – i.e., urban areas that are significantly warmer than surrounding rural areas due to human activity), thereby mitigating the negative effects of this phenomenon on urban dwellers.

Place of impact

Figure 5 – Pie chart showing % BEAMS impact case studies (n = 70) by place where impact occurred



Most impact case studies for BEAMS research described impacts within the UK, although global/ international impacts were also cited. One case study reports a change in clinical guidelines both within the UK and in health care



systems abroad. Another case study reports collaboration between UCL academics and police forces outside the UK for the development of crime prevention strategies.

Discussion

This section addresses some observations made during the creation of this report, and points to some of the limitations of the present study.

Given the disciplinary focus of BEAMS, it may be surprising that health appears to be an area in which many impacts have been reported (making up 11% of total case studies (n= 13)). Possible reasons for this may include the interdisciplinary character of BEAMS research, the application-driven nature of clinical research, or perhaps impacts on health may be judged by academics to be more valuable than impacts on other areas.

In addition to identifying the sector to which beneficiaries belong to, identifying the beneficiaries of research more generally may pose difficulties for researchers. This is related to what is referred to in the literature as “the problem of attribution”, whereby the source of knowledge acquired is not always easy to identify for users of research.

The distinction between pathways and types of impact may be difficult to draw. Readers should bear in mind that impact *types* refer to the general categories of the impact(s) being described in a given case study, while pathways refers to the *means* through which these impacts occurred. For a full list of the typology developed by RICS for impact types, beneficiaries and pathways, please refer to the appendix at the end of this report.

UK impacts may overlap with non-UK impacts. Identifying where and how research is used may be difficult for researchers to identify and demonstrate in an impact case study. This is also indicative of the difficulty of knowing who may access a piece of research or how they may use a technology arising from research. This may explain why global/ international impacts make up the second largest group of places of impact, described in the previous section.

This study had some limitations. First, only BEAMS case studies were analysed. Therefore, any EPSRC-funded projects outside of BEAMS have not been identified at the time of writing, and the possible impact types, pathways and beneficiaries of these have not been identified.

Second, analysis focused only on case studies submitted to REF2014, not on other case studies of impact (e.g. from other institutions, countries or

disciplinary areas). As such it is not possible at this stage to compare and contrast the effect of REF requirements on the types of case studies submitted versus other case studies of impact.

Finally, information on interdisciplinarity has not been collected from case studies. It is therefore not possible at this stage to determine whether REF requirements (as interpreted by UCL) favoured/ did not favour interdisciplinary research approaches.

The analysis presented here could be extended to include more impact case studies, whether within UCL or from across the UK. A UK-wide study would be facilitated by the [publication of all research impact case studies in a publicly available database](#).

Conclusions

Businesses and government are the main cited audiences for UCL BEAMS research. As such, non-academic collaboration and knowledge transfer activities take place predominantly with these groups. Therefore the main types of impact are on businesses, organisations and sectors and on policy.

However, the range of impact pathways, beneficiaries and types is still broad, and includes impacts on professional training and practice, health, the natural environment and public discourse.

As noted in the introduction, the STEaPP Impact Project is a larger study of which this analysis of impact case studies is only a part. In addition to the data presented here the project researchers are also conducting an extensive literature review on the concept and metrics of research impact, and qualitative interviews aiming to capture academics' and policymakers' experiences of research impact. More details can be found on [STEaPP Impact project website], or by contacting [Dr Kathryn Oliver](#) or [Despina Biri](#).



APPENDICES

Appendix 1 – Types and Subtypes of impact

Appendix 2 – Impact beneficiaries

Appendix 3 – Pathways to impact

The typology presented below was developed in 2014 by UCL's Research Impact Curation and Support team as a way of categorising, monitoring and supporting impact at UCL. It is not an exhaustive list, and is a work in progress, which may evolve significantly.

Appendix 1 – Types and subtypes of impact

- Public Discourse
 - Public awareness, attitudes or understanding
 - Public discourse/debate
 - Public engagement/involvement in research
- Policy
 - Data provided to fulfil treaty or reporting obligations
 - Decisions by a public service or regulatory authority
 - Ethical standards
 - Legislation
 - National or local guidelines or policy
 - International guidelines or policy
 - Public or political debate
- Justice, rights and welfare
 - Access to justice and other opportunities (including employment and education)
 - Legal and other frameworks
 - Social welfare, equality, social inclusion
- International development
 - Improvement of human development
 - Improving humanitarian action and relief
 - Improving monitoring of development and humanitarian action
 - Social equality, human rights and justice
- Public services
 - Access to services
 - Costs of public services
 - Provision of services
 - Quality of public services
 - Take-up or use of services
- Societies, communities & groups
 - Community cohesion
 - Community regeneration



- Outreach and engagement of marginalised or under-represented groups
 - Work of NGOs, charitable or other organisations
- Professional training and practice
 - Content and delivery of CPD
 - Professional practice
 - Professional understanding
 - Standards in training of professionals
- Health
 - Access
 - Clinical or lifestyle intervention
 - Control of diseases
 - Costs
 - Diagnostic or clinical technology
 - Drug
 - Guidelines
 - Indicators of health and well-being
 - Outcomes for patients or related groups
 - Public awareness of a health risk or benefit
 - Public behaviour
 - Public health and quality of life
 - Development of a drug
 - Change in or development of new guidelines
 - Improved cost-effectiveness of an intervention
 - Cost savings to a health system
 - Improvements in access to and/or take-up of services
- Quality of Life
 - Prevention of harm
 - Quality of life or lifestyle
- Cultural life
 - Creative practice and expression
 - Cultural life of a community or nation
 - Engagement with cultural heritage and/or the arts
 - National or international heritage
 - Preservation, conservation and presentation of cultural heritage
 - Processes of commemoration, memorialisation and reconciliation
 - Production of cultural artefacts, including for example, films, novels and TV programmes
 - Tourism and the quality of the tourist experience
- Natural Environment
 - Animal health and welfare
 - Biodiversity
 - Climate change and natural hazards
 - Environmental risk or hazard (including emissions)
 - Environmental standards



- Natural resources, including energy, water and food
 - Public awareness or behaviours relevant to the environment
- Built Environment
 - Built environment
- Infrastructure & Transport
 - Accessibility
 - Infrastructure
 - Mobility
 - Transport
- Businesses, organisations and sectors
 - Business sector or activity
 - Corporate social responsibility
 - Costs
 - Dispute resolution
 - Jobs and employment
 - Mitigation of potential losses
 - Performance or productivity
 - Regulatory environment or governance of business entities
 - Skills and/or understanding, including transfer of skilled people
 - Social enterprise
 - Spin-out or new business
 - Strategy, operations or management
- Technology, products and materials
 - Global technological change
 - Materials, products, technology
 - Standards
- Finance & Investment
 - Access to finance
 - Alternative economic models (such as fair trade)
 - Investment in research and development
- Teaching and Education
 - Academic performance
 - Access to higher education
 - Assessment
 - Delivering and training highly skilled researchers
 - Educational content
 - Uptake of specialised subjects
- Research and academic disciplines
 - Contributing towards the health of academic disciplines
 - Knowledge and scientific advancement
 - Methodologies, equipment, techniques, technologies, and cross-disciplinary approaches



Appendix 2 – Impact beneficiaries

- Academic HE research
- Academic HE teaching
- Non-HE research
- Secondary schools
- Primary Schools
- Vocational and continuing education
- Government (local/regional – within the UK or overseas)
- Government (national – UK or overseas)
- Government (intergovernmental organisations)
- EU or other European organisations
- Military
- Local or community NGOs
- National or international NGOs
- Think tanks
- Quangos
- Commercial / industry (sector)
- Commercial / industry (individual companies)
- Professional or practitioner bodies
- Professional or practitioner groups or individuals
- Arts and heritage organisations (museums)
- Arts and heritage organisations (performing arts)
- Arts and heritage organisations (policy and funding)
- Arts and heritage (practitioners)
- Arts and heritage organisations (heritage sites)
- Arts and heritage organisations (libraries and archives)
- Art, heritage and culture
- Tourism
- Media
- London communities
- Specific communities or groups
- Charity/advocacy groups
- Specific patient group(s)
- NHS
- Other health systems or services
- Wider public
- Natural environment
- Flora
- Fauna
- Other

Appendix 3 - Pathways to impact



Academic

collaboration/partnership

Creating community of research
Participation in collaboration, network or consortia
Visiting academic at UCLs
Use of scientific facility
Other collaboration within academia

Research-based teaching

Curriculum design
Outreach/ widening participation
Postgraduate research
Production of policy papers, guidance
Postgraduate taught
Teaching materials
Other

Practice-based and design-based research

Production of art or artefact
Design of Buildings and/or interiors
Design of spaces

Collaboration in research/ participatory research

Action research
Development of joint funding proposals
Existence of research project
Involving/ employing local people
Participation in research

Academic dissemination

Non-academic collaboration/partnership

Artistic collaboration
Collaborative research (e.g. with industry or hospitals)
Commissioned research
Consultancy
Demonstration of prototype or new material(s)
Knowledge Transfer Partnership
Mentoring
Provision of professional services
Research fed directly into professional practice (e.g. via researcher running or being employed by a company)
Secondment
Sustained engagement with a community or group



Other collaboration with business, commerce or public corporation

Knowledge transfer beyond academia

Advisory Role

Contribution to policy evidence

Development of new technique(s)

Membership of expert group

Provision of CPD or other training

Provision of data

Provision of materials / products

Publication in practitioner journals

Talks and workshops for specialised audiences

Transfer of skilled people

Other knowledge transfer beyond academia

Commercialisation

and

Social

Enterprise

Licensing

Spin out

Patenting

Provision of research-based services

Social enterprise

Other commercialisation

Public and media engagement

Events, talks or workshops

Exhibition

Media appearance/ coverage

Media consultancy

Media production

Online / social media engagement

Patient and Public Involvement (PPI)

Publication of popular texts

Web resource

External take up independent of UCL

Citation / use / take-up of research

Clinical use

Research cited in guidelines

New service set up

Research fed directly into clinical practice