

Institution: University College London

Unit of Assessment: 16 – Architecture, Built Environment and Planning

a. Context

Impacts deriving from the diverse research of The Bartlett, UCL's faculty of the built environment, affect many aspects of **people's homes, workplaces, institutions, public buildings, cities and cultural values**. We conceive our impact 'reach' as being multi-level in that it operates at local, national and global scales, affecting many groups. The 'significance' of our research impact comes by making noticeable changes in our many fields of expertise in Architectural Design, Planning, Development Studies, Energy Efficiency, Urban Design, Construction, Project Management, Transport Infrastructure, Cultural Heritage, Digital Data Modelling, and so on.

The main non-academic beneficiaries of our research can be broadly subdivided into **industry partners, professional and practitioner audiences, policy-makers**, and the **general public** in Britain and abroad who benefit from improvements made directly or indirectly by our research to the built environments they inhabit. More specific beneficiaries of Bartlett research since 2008 include construction companies, businesses linked to the built environment or non-construction trades, clients and end users, policy officials, cultural producers, professional practitioners and the mass media. Our research has had impacts on: **Public awareness; Policy-making; Health, welfare and quality of life; Environmental benefits; Cultural and artistic benefits; Community development; Skills, knowledge and resource transfer; Standards and guidance; Innovation and entrepreneurship; Economic benefits**.

Impacts from the Faculty's cross-disciplinary research are able to capitalise on the twin potentials offered by being located in London - a world city at the centre of the UK economy - and UCL's strength as a leading global university with major international links. The global reach of our research impact is evidenced for instance by the Development Planning Unit's (**DPURG**) extensive work across the Global South, which directly benefits many people living in poverty in informal settlements; by the Space Group's (**SG**) space syntax proposals for Middle Eastern cities such as Jeddah, invaluable for town planners there; by Planning's (**PRG**) involvement in European transport policy via its SINTROPHER and OMEGA Centres, so as to inform railway policymakers; and by the initiatives of the Centre for Sustainable Heritage (**part of CBES**) to remedy the effects of climate change on Europe's historic cultural fabric on behalf of many museums and conservation bodies. In terms of our local impact on London, examples include the Centre for Advanced Spatial Analysis' (**CASA**) development of the 'City Dashboard' for the Mayor of London, Boris Johnson; Architecture's (**ARG**) involvement in designs for the South Bank Centre's skateboard park or pavilions for the 2012 Olympic Games, which were viewed and used by the general public in various London venues during the period of the Olympics; and the input of **PRG** to the Mayor's London Aviation Policy or the Mayor's Design Review Panel on the future of London's design governance, which has benefitted local politicians and officials alike.

b. Approach to impact

The Bartlett has developed an approach to impact that increasingly is focused on our engagement with external stakeholders. In terms of developing pathways to The Bartlett's research impact, these are very much framed by UCL's vision of Grand Challenges, especially the themes of Sustainable Cities and Human Wellbeing. The multidisciplinary and interdisciplinary approach of the Grand Challenges also enables Bartlett researchers to contribute to wider institutional impacts, as was shown by the *UCL-Lancet Commission on Healthy Cities* - published in *The Lancet* in May 2012 - which consisted of a team of scholars from medical and non-medical disciplines but led by Bartlett academics. UCL's internal financial support for research groups to develop external socio-economic impact is extensive, and nowhere better shown than in the substantial initiation funding given to starting up the Energy Institute (**UCL-E**) as an important policy-informing group.

Furthermore, we have been successful in accessing dedicated knowledge transfer (KT) funding streams. Between 2008 and 2013, we were funded to a total sum of £562k from various knowledge exchange sources such as the EPSRC Collaborative Training Account - e.g. **CASA's TOTeM Labs** project (£119k, Hudson-Smith-PI) and **CBES's Condition Assessment Information System** project with Max Fordham LLC (£75k, M. Davies-PI) - or by NERC and Higher Education

Innovation Fund (HEIF) awards. The Bartlett has also been involved in a variety of projects that were funded for public engagement purpose, plus we are regularly engaged in public policy outreach events, including invited lectures and briefing meetings.

Alongside these external impetuses, The Bartlett's approach during the REF 2014 period was also largely informed by our previous experience of longer-term research projects in the faculty over many decades. To cite an example from **PRG**, Hall has been influencing London's planning policies since the late-1980s through his work on concepts like the Urban Renaissance and Thames Gateway, or more recently in debates about a potential Thames Estuary airport. Hall was also the co-author of a 1999 report titled 'London's Spatial Economy: The Dynamics of Change', as commissioned by the London Development Partnership, that being the body set up to prepare for the Greater London Authority (GLA). His report contained the first written proposal for Orbital, predicated on the need to improve public transport access between suburban areas which are otherwise entirely car-dependent. The project was taken up by Nicky Gavron (then Deputy Mayor of London) and found its way into the *London Plan*. It has since been implemented as the London Overground Orbital railway, which was completed in December 2012 to great acclaim. Our aim is to combine temporal variations in our research impacts - i.e. short-term, medium-term and long-term benefits - with the different kinds of multidisciplinary and interdisciplinary research undertaken in our disciplines that span the natural sciences, social sciences, arts and humanities. As such, The Bartlett's approach has four defining elements:

1. Fostering links with industry partners

The Bartlett Faculty promotes numerous activities intended to facilitate and maintain industry links, including joint-appointments with business partners. The **UCL-E** and now from 2011 the Institute for Sustainable Resources (**UCL-ISR**) exemplify this approach, including the BHP Billiton Professorship (funded out of a \$10m institutional partnership), a new appointment linked to the promotion of 'real-world' implementation of our research. Furthermore, since its formation in 2009, **UCL-E** has had an advisory board of eminent industry experts in fields like physics and engineering, and its external links are further supported by tie-ups with the Energy Technology Institute and by £1m of funding which comes either via the Technology Strategy Board (TSB) or directly from industry. Leading partners in these connections include EDF, E.ON, PassivSystems, Lloyd's Register, Johnson Controls and Arup. UCL-E also co-hosted the 'Creating Climate Wealth' summit with the Carbon War Room and TSB at UCL in September 2011, and it is currently collaborating with KPMG and the International Council on Clean Transportation to develop a virtual centre for shipping energy efficiency data and analysis methods. Another example of industry links by researchers is the Stakeholder Committee set up by **CBES** for its Complex Built Environment Systems Platform Grant, this being chaired by Jeremy Watson, who was formerly Arup's Global Research Director and Chief Scientific Adviser to DCLG, before moving recently to UCL.

Knowledge Transfer Partnerships (KTP) serve as another vital part of our engagement with industry, and indeed The Bartlett is one of the major providers within UCL. Notable examples include the academic leadership by Pitt (**CBES**) of several KTP schemes with the Ministry of Defence. These include currently a Public Finance Initiative (PFI) project whose industrial partners are Modus Services, Amey and Skanska, in which Pitt's role is to develop new processes for facility management operations. In **PRG**, Hickman's commissioned work by the Asian Development Bank on Chinese multi-modal economic hubs focuses particularly on knowledge transfer to companies. Scholars in Construction and Project Management (**C&PMRG**) have since 1996 been investigating PFI/PPP financing, leading to a KTP project with the Construction Industry Council and other industry partners - again including KPMG - which from 2009-11 developed an evidence base of operational project management performance. Another of its KTPs was with Vinci Civil Engineering (2008-10), and this led to a fourfold increase in that company's bid strike-rate plus increased repeat business and market share growth, all achieved over a six-year period. The Bartlett has also fostered industrial links through the widespread delivery of CPD programmes for architects and other professionals, including those created by Morris in **C&PMRG** for the International Project Management Association.

Another significant area is in consultancy services. Space Syntax Ltd, an organisation offering strategic, evidence-based advice in economics, planning, design, transport and property development, is one of the most successful spin-off companies to have evolved out of any Built Environment faculty in the UK, is closely based on **SG** research. A Director of Business

Development, David Cobb, was appointed by The Bartlett in August 2009 to develop closer research links with industry. Prior to this faculty post, Cobb had been instrumental in coordinating the *Urban Buzz* knowledge exchange programme, which continued through to December 2008 and also involved Penn (**SG**), Oreszczyn (**UCL-E**) and Broyd (**C&PMRG**, but then working at Halcrow). *Urban Buzz* was funded to the tune of £5m by the Office of Science & Technology and HEFCE (through HEIF 3), and was precisely a research impact initiative to help build sustainable urban communities. More recently, 'Bartlett Means Business', which is an annual enterprise activity run by the Faculty's Enterprise Advisory Group, was set up in 2012 to investigate and enable new forms of commercial engagement with external partners based on our research.

2. Engagement with professional and practitioner bodies

The Bartlett Faculty also develops its research impact through close links with the built environment professions, including encouraging our staff to take the lead in important external research roles whenever opportunity arises. Morris, for example, is a senior advisor to the Association of Project Management's *Body of Knowledge (6th Edition)* and a Vice-President of that body. Broyd is a Vice-President of the Institution of Civil Engineers, Chair of the Strategic BIM Industry Review Panel of Crossrail, and a Member of the Cabinet Office's BIM Strategy Implementation Task Force. Penn and Fraser are, respectively, the ex- and current chairs of the RIBA Research & Innovation Group, while Gallent serves as a policy expert for the RTPI and as a Policy Council Member for the TCPA. Having members of staff in these sorts of prominent positions within relevant professional bodies facilitates the Faculty's research impacts by creating more opportunities for collaborative research programmes with non-academic partners. Recent examples include the 'Carbon Buzz' element of the *Urban Buzz* programme, the work for which was carried out by Aedas Architects along with the Building Research Establishment and RIBA.

Many members of **ARG** are engaged as or work with architectural practitioners in producing accessible research outputs that can facilitate best practice. In turn this helps us to act as an 'incubator' for the design work of around 80 part-time staff, many of whom are successful architects in Britain or continental Europe. Since the 1990s our architectural research has influenced new forms of interdisciplinary practice, whether this is via Gage's model of interactive design technologies which ex-students have used to set up their own companies, or the role of Bartlett history and theory staff in interpreting and developing the outputs of artists and architects through monographs/catalogues – e.g. AHMM (Borden), Hawkins Brown and Apolonijia Susteric (Rendell), and Sarah Wigglesworth Architects (Forty). The Digital Manufacturing Centre London provides an in-house hub which also carries out cutting-edge digital manufacturing for many local architectural firms. Also exemplifying direct links with practitioners, Cassar (**CBES**) has since 2007 led the cross-disciplinary *Science and Heritage Research Programme*, jointly funded by AHRC and EPSRC. In this role she oversees the delivery of 37 collaborative research projects across the UK, the key emphasis being on external coordination and outreach activities.

3. Engaging with policy-makers

To promote the value of The Bartlett's research to policy-makers and identify effective pathways to enhance policy impacts, much of our research is taken directly into the governmental arena. For instance, Lowe and Oreszczyn (**UCL-E**), Ekins (**UCL-ISR**) and Cassar (**CBES**) have since 2008 been advising Government Chief Scientists including David McKay, Jeremy Watson, Mike Kelly and Anita Charlesworth. M. Davies (**CBES**) has acted as Expert Advisor to the World Health Organisation and is a contributing author to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). He also leads the UK team in the International Energy Agency Annex 55 work. Other international boards on which our staff members sit include the EU FP7 Environment Advisory Group and United Nations Economic Commission for Europe Gothenburg Protocol. Within the UK, members of The Bartlett sit on the TSB's Sustainable Innovation Advisory Group, Department of Energy and Climate Change (DECC) Interim Science Advisory Group, and Department for Culture, Media and Sport Science and Research Advisory Committee. The CBES team has thus impacted on many national and international policy formulations, including, recently, the DEFRA CCRA report, GLA London Plan, Approved Document F (Building Regulations) and World Health Organisation's mould guidelines.

Likewise, Ekins (**UCL-ISR**) is a member of the UN Environment Programme's International Resource Panel, European Resource Efficiency Platform and EU Environment Commissioner's Expert Economists' Panel on Resource Efficiency. Since 2008 he has provided regular advice and

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support to ministers, scientific advisors and civil servants in the Treasury, DEFRA and DECC - including for the latter's 'Energy Efficiency Deployment Office'. Strachan (**UCL-E**) has very close links to the CCC, IEA and IPCC (e.g. he was lead author of IPCC AR5 Chapter 7 on Energy Systems). In **C&PMRG**, in collaboration with Imperial College London, A. Davies is a member of the Crossrail Innovation Forum and co-author of the Crossrail Innovation Strategy, creating the world's first innovation strategy for a mega-transport project. Baddeley has in 2013 joined DEFRA's Hazardous Substances Advisory Committee. From **PRG**, Hall has been appointed by the Secretary of State for Transport to advise on improving the design quality of train stations, and is part of the Greengauge 21 high-speed rail advisory group and the Eco-Town Challenge Panel. Other impacts include the work of Rydin for the West End Commission, Carmona for Design Council CABE, and Marshall on 'Link and Place', which has since been included in UK policy guidance. 'Live' action-research by **DPURG** has been instrumental in many governmental policies in the Global South, such as in introducing cable-car transportation to relieve poverty in informal settlements. Cabannes is an expert adviser on participatory budgeting and urban agriculture to the Chinese Academy of Sciences, and heavily involved in resource innovation projects for cities like Guangzhou and Chengdu. Cassar (**CBES**) has long led the way through her contributions to UK and European parliamentary inquiries on research priorities and funding for cultural heritage protection, as well as in developing the European Strategic Research Agenda for Cultural Heritage.

4. Public engagement activities

Essays and monographs written by architectural historians and theorists within **ARG**, such as Borden and Rendell are often undertaken as co-research with artists or architectural practitioners, and contribute to publicly accessible resources such as artworks, catalogue essays and museum/gallery talks. These include pieces for the Domo Baal Gallery (London), Maribor Art Gallery (Slovenia) and Bologna Museum of Art (Italy), and invited contributions to the steering committees of art commissioning agencies such as Situations. Other examples of artistic impact include the vital role played by the Graz Kunsthhaus in the cultural policy of that city, and the major international exhibitions curated by Migayrou as Head of Architecture at the Centre Pompidou in Paris, such as that on the Italian Tendenza movement, which went on show in mid-2012.

Further instances of significant public engagement are **CASA's** work for Oxfam in 2012 as part of the *Tales of Things* project, using crowd sourcing and data flow streaming, and **DPURG's** vital contributions to community participation projects in Africa, India, etc. The public benefits of these research impacts is frequently recognised by the award to our staff of important honours and major design prizes, and in invitations to give keynote talks and convene workshops at world-leading museums/galleries/biennales, and in appointments to prestigious official positions.

c. Strategy and plans

Our future impact plans respond strongly and positively to the *UCL Research Strategy 2011-15* and *UCL Enterprise Strategy 2011-15*, which together seek to make UCL a world-leader in terms of university-based entrepreneurship and collaboration with external businesses. In parallel with this pan-UCL approach, The Bartlett Faculty's strategy will be implemented by our Research Advisory Group (RAG) and Enterprise Advisory Group (EAG).

We have hence devised a general strategy fleshed out by detailed ideas as to how we can best construct new pathways to impacts and achieve stronger real-world impacts. That strategy is rooted in the four elements of impact mentioned above. To assess whether these targets are being met, we are currently developing a range of SMART indicators to capture and assess research impact as it happens - such as through enhanced recording features inputted by staff into UCL's IRIS research information system. The three key aims of our future impact strategy are:

(1) Increased Involvement in Real-World Projects: In alignment with the UCL Enterprise Strategy's aim to increase the number of university spin-outs and consultancies, The Bartlett will make greater use of institutional resources such as UCL Business PLC (UCL's technology transfer office) and UCL Consultants Ltd (which facilitates academic consultancy contracts). Using the incentives now offered to UCL staff in terms of their work outside academic being considered as meeting promotion criteria, along with a chance to earn extra income through consultancy, we will increasingly encourage staff to run companies with real-world external projects - just as is already being done by Marmot (**CBES**) in office space planning, Ruyssvelt (**UCL-E**) through his energy consultancy firm, Karimi (**SG**) as Director of Space Syntax Ltd, and McLaughlin's (**ARG**) in his

multi-award-winning architectural practice. We also intend to devise more ways for us to partner with external companies on research and implementation projects, including KTP and CPD outreach activities. As an example, **C&PMRG** is now engaged with oil and gas companies on developing best management practices, and is heavily involved in Building Information Modelling (BIM), for which Broyd has just been appointed by DBIS to lead the 'Level 3' BIM Task Group. **UCL-E** has been invited by the French energy company, EDF, to be the future UK partner in their major new European Centre and Lab for Energy Efficiency Research (ECLEER). We have also just launched an annual £50k Research Materialisation grant for staff to construct physical prototypes or curate public exhibitions, plus our planned B-MADE fabrication centre in **ARG** will be very much open to external partners. Our Director of Business Development is increasingly active in developing links to stakeholders in the world's largest urbanisation programmes in China. For instance, the China Planning Research Group is working increasingly with the Urban Planning Society of China and Planning Department of Jiangsu Province. Major research outputs, such as the *Fabricate* book from our 2011 conference of the same name, are also now being translated into Chinese for dissemination among businesses and state officials there.

(2) Increased Public Engagement: We intend to work more closely with UCL's Public Engagement Unit to devise new methods to ensure that our research enhances public understanding and achieves socio-economic impact, especially through our multidisciplinary and interdisciplinary work. Thus, for example, in **ARG**, some staff (Fraser, Hill and Rendell) will be editing a major new Ashgate book series on 'Design Research in Architecture' to disseminate the work of practicing architects across the world. Other colleagues are now working with UCL Collections to create temporary exhibition spaces linked to cultural events, and our recent acquisition of the renowned Survey of London will enable us to develop better links to local communities, not least by enhancing public access to its already extremely popular website.

(3) Increased Public Policy Influence: UCL has appointed a Head of Public Policy whose remit includes: helping to translate research and expertise into public policy impacts; developing UCL's reputation as a source of high-quality research able to inform policymaking; establishing UCL as a hub for dialogue and debate on public policy; and capturing, supporting and publicising examples of existing UCL impact on policy through 'wisdom' developed via the Grand Challenges. In turn, The Bartlett is one of the key contributors to UCL's new Department of Science, Technology, Engineering and Public Policy (STeAPP), which was created in 2013 to enhance the impact of scientific, technological and engineering expertise within a broad range of public decision-making environments.

Hence a central ambition for The Bartlett is to increase our policy influence significantly at the local, national and global levels - largely by ensuring that we are represented on key official committees and policy-making groups, such as **CBES** in Low-Carbon Futures. Cassar has recently carried out a full internal survey of the existing links of staff to policy-making. This will shortly result in the creation of a new faculty-level post of Public Policy Engagement Coordinator, whose task will be to facilitate knowledge exchange between our researchers and policy-makers. As another example, the CBES group is soon to begin undertaking research into the links between dwellings and well-being to improve energy and other policies affecting housing in Britain, based on the need to adapt to and mitigate climate change. To maximise the external impact, their project will make increasing use of the 'Participatory System Dynamics' approach to engage repeatedly with larger numbers of key stakeholders via interviews and workshop sessions.

(4) Improved External Communications: In a complementary and interdependent plan, The Bartlett will also be targeting an improvement in its media engagement. At the institutional level, support for this is offered by the UCL Media Relations team, which is well versed in dealing with different forms of publicity. Working in conjunction with The Bartlett Faculty's Communications Team, we intend to increase coverage both in traditional media and new, online forms like Facebook or Twitter. Within UCL, we plan to partner with The Slade and History of Art to promote the creative arts-and-humanities side of public engagement. The scope and diversity of research in The Bartlett, now that it has expanded in size, provides us with a greater 'surface area' through which to achieve external impact, while our challenge is going to be how to develop, capture and disseminate this properly. One method to do so will be the use targeted publicity and branding, thus building up awareness of our research projects among identified beneficiaries: i.e. industry partners, professional and practitioner groups, policy-makers, and general public. A plan is now

being devised by the Faculty Communications Team - in conjunction with UCL policies - both to retain the commitment of existing stakeholders and also identify new audiences and end-users for our research.

(5) Facilitating staff engagement: Also essential to the process of enhancing future research impact is to ensure that Bartlett staff members are provided with adequate time and financial/organisational support to develop projects in 'real world' situations. To help with this, the terms of the current Faculty-wide sabbatical system will be tweaked to include work on impact initiatives and public dissemination. In **ARG**, for instance, the intention is to create more of the Research Associate posts to bring in further leading practitioners. We anticipate a huge task for our Faculty Research Manager in helping staff devise projects to maximise external impact. Lectures, workshops and other training sessions will be held to develop a stronger impact culture among our researchers, as improved feedback mechanisms will be introduced to capture, collate, and then inform our staff about the most successful impacts stemming from current research projects.

d. Relationship to case studies

Our 15 selected Impact Case Studies cannot possibly hope to describe the full range and diversity of either the pathways to Bartlett research impact or the nature and extent of those impacts. They do, nonetheless, exemplify the four central strands of our approach outlined above:

(1) Fostering links with industry partners

Space Syntax Ltd (UCL16-PEN) provides a useful demonstration of the formation of a spin-off company from **SG** that now conducts research for a wide range of local authorities, property developers, and other stakeholders. Other close industry links are evidenced in the detailed analysis of and guidance on the benefits and deficiencies of using PFI/PPP to finance large UK public sector building projects, produced over many years by scholars in **C&PMRG** (UCL16-EDK). Similarly, our extensive involvement in KTPs and other direct methods of knowledge transfer can be seen in **ARG's** transfer of interactive design technologies to a variety of leading companies in London and elsewhere (UCL16-GAG).

(2) Engagement with professional and practitioner bodies

The use of our research to help professional practitioners to find out how they can better plan our cities are shown in the case study from **PRG** about our influence on many proposals for infrastructure investment being drawn up by local authorities (UCL16-GAL). Other impacts include working closely with professionals dealing with low-income social groups in cities, as shown in the **DPURG** case studies on climate change resilience for informal settlements in the Global South (UCL16-ALL) and on the implementation of planning infrastructure such as cable-car transportation in the poorer districts of cities like Medellin (UCL16-DVL).

(3) Engaging with policy-makers

The **CBES** group has produced a tool for DECC to enable the health impacts of the large-scale implementation of low energy-interventions to dwellings to be evaluated, and monetised, thereby informing analysis of its cost effectiveness (UCL16-DAV). Furthermore, the MARKAL Modelling project (UCL16-STR) in **UCL-E** has greatly helped to set the UK's carbon budgets, and thus shape everyday energy usage. Policy engagement can also be seen in the take-up by conservation bodies like UNESCO and English Heritage for research by the Sustainable Heritage Group in **CBES** (UCL16-CAS). Our research into street lighting has produced a switch to the use of white lights, leading to a substantial drop in the UK's carbon emissions (UCL16-RAY). In **PRG**, Carmona's role in framing policies to improve urban design governance through coding (UCL16-CAR), Hall's major input to policy initiatives such as the HS2 high-speed rail link (UCL16-HAL), and Hickman's promotion of sustainable transport (UCL16-HIC), all represent useful examples.

(4) Public engagement activities

Many of the research projects in **ARG** are linked to the public communication and dissemination of its key outputs. Some have a strong and direct cultural and artistic impact, as exemplified by the Graz Kunsthaus (UCL16-FOU), which has become a popular icon in people's minds and has helped to regenerate a run-down urban district through cultural tourism. Borden's leading input to public campaigns for providing skateboard facilities, including the current controversy over that for London's South Bank Centre, likewise informs and engages a wide public audience (UCL16-BOR).