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| Institution: University of Cambridge |
| Unit of Assessment: 16: Architecture, Built Environment and Planning |
| <p>a. Overview</p> <p>This is a joint submission from the University of Cambridge's Departments of Architecture and Land Economy. Although in different Schools, there is collaboration in areas of mutual concern, including environmental sustainability, green buildings, urban design and the functioning of cities. Both are committed to research that is original, significant and has an impact on stakeholders. Both Architecture and Land Economy were ranked first in their respective sub-panels in the 2008 RAE.</p> <p>Architecture, along with the Department of History of Art, forms a Faculty within the School of Arts and Humanities. There are important links between them; two members of History of Art (Salmon, Howard), whose research is most relevant to this UoA, are returned with this submission. As one of the UK's first research institutes in Architecture, the Martin Centre (MC) has had half a century of successful impact on intellectual advancement as well as on policy and industry, nationally and internationally. Current research covers four major themes: i) Sustainable Design; ii) Urban and Regional Planning; iii) Building Construction and Risk; and iv) Cultures of Architecture and Cities. Urbanism remains a key integrator for much of the Department's research; cities are investigated both at micro-level in terms of their links to communities and individual buildings, and at macro-level, analysing regional, state and global systems. These varying scales are relevant to funded research projects in the areas of environment and human behaviour, mobility, history and philosophy of architecture, design and media communication, risk assessment and mitigation in the built environment, and socio-spatial conflict in cities.</p> <p>Land Economy is a freestanding Department within the School of the Humanities and Social Sciences. Research is focussed in two main thematic clusters: i) the Environmental Economy and Policy (EEP) group and ii) the Real Estate and Urban Analysis (REUA) group. EEP focuses on theoretical and empirical research on land and natural resource management, especially biodiversity, land and rural environment and climate change mitigation/adaptation. A growing theme is the importance of interaction between environmental policy and economic and legal systems with quantitative modelling of these interactions. REUA studies resource allocation in land and real estate markets, urban and regional economies and public policy, ranging from real estate finance, focussing primarily on the private sector, through development of land, property and cities, to broader questions of planning, macro-economic interactions and public policy, property law and land rights. There are three major funded research centres within Land Economy: i) the Cambridge Centre for Climate Change Mitigation Research (4MCR); ii) the Cambridge Centre for Housing and Planning Research; and iii) the Rural Business Unit. The Department also hosts the Cambridge Centre for Economic and Public Policy. In late 2013, the Cambridge Real Estate Research Centre (to be led by Lizieri), with substantial funding from the property industry, will be launched.</p> |
| <p>b. Research strategy</p> <p><i>i. Reflection on RA5a of 2008</i></p> <p>The two Departments submitted separately to the 2008 RAE. We consider progress individually.</p> <p>Architecture, in the 2008-14 period, more than doubled its awarded research income, leading on projects worth nearly £13 million, or approximately £800,000 per established academic post. This is not fully accounted in the net HESA figures that do not reflect the Department's leading role on a number of multi-institution projects, including two multi-million pound projects and many medium-size and smaller grants. With this collaborative research, Architecture has sought to break traditional disciplinary boundaries by engaging closely the physical and social sciences, by direct investigation of architecture, materials and construction, both built and unbuilt, and in enhancing the research potential of converging integrated digital techniques and communications.</p> <p>In 2008, research in Architecture focused on the contribution of architecture and urbanism to sustainability. This research focus has been maintained and successfully developed, investigating and analysing the historical, cultural and technical context in which buildings and cities are developed and inhabited, and identifying applications and means of dissemination of knowledge essential to developing effective sustainable design. A rich environment of collaboration exists within the University (e.g. with Engineering, Computing, BP Institute), and with other institutions</p> |

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within the UK, Europe, U.S, China, Africa and the Middle East.

Between 2008–2013 the Department led large and complex research projects in sustainability, such as **Short's** Design and Delivery of Robust Hospital Environments in a Changing Climate (DeDeRHECC, EPSRC, £738K), as well as his research applied to practice (see: Case Study). The sustainability research scope overlaps significantly with the Urban and Regional Planning group, widening to investigate the performance of entire cities, as in **Echenique** and **Steemers'** Regional Visions of Integrated Sustainable Infrastructure (ReVISIONS, EPSRC, £3.2M) and **Echenique, Steemers** and **Jin's** 'Energy Efficient Cities' (EECI, EPSRC, £846K).

During the REF period, Architecture developed other research areas that reflect the scope of architectural and urban enquiry today. Activities of the Building Construction and Risk group inform practice: experimental research in **Ramage's** use of new/old materials like brick and bamboo aided the construction of his **multi-prize-winning Mapungubwe Interpretive Centre**; **So** and her colleagues contribute to policy on the role of architecture in natural disasters (see: Case Study). Historical study is a main theme in the Cultures of Architecture and Cities group, most recently, confirmed by **Howard's** 'Domestic Devotions: The Place of Piety in the Italian Renaissance Home' (ERC Synergy, total award £2M). The group also focuses on key themes in socio-political, theoretical and digital research. **Pullan's** ESRC Large Grant 'Conflict in Cities and the Contested State' (CinC, £2.6M), has revealed the significance of conflict in an architectural reading of cities. **Penz** has studied digitization, film, architecture and urbanism in several AHRC grants.

The 16 academics submitted from Architecture produced nearly 90 peer-reviewed journal articles, 30 edited or authored books and over 70 book chapters; they have delivered over 100 keynote, public and plenary lectures.

Land Economy's 2008 RAE submission identified three priorities:

- *To attain an international standard of research activity across its research groups.*
- *To enhance the integration of research activity within and across research groups within the Department without diminishing the scope for individual scholarship.*
- *To widen and deepen leadership in international research through collaboration and networking and to gain wider recognition for the Department's research activity.*

Measures of success in meeting these priorities include international recognition of research and researchers. Staff presented over 50 keynote addresses in the REF period, many internationally. Faculty won best paper prizes at ARES and ERES conferences over the REF period (**Alcock, Allmendinger, Fingleton, Fuerst, Lizieri**). A number of faculty hold honorary or visiting positions in top institutions around the world. Total research awards of £12M reflect collaborative research efforts and deepening of international networks, seen below and in the outputs. Researchers engaged with international bodies, national government, industry and professional bodies (with achievement of RTPI accreditation complementing the RICS partnership and Law Society exemptions). Increasingly, research cuts across the research groups identified above: e.g. **Fuerst's** work on the economic value of green buildings draws on environmental sustainability policy and the analytic base of real estate economics, and informs agent-based modelling in **4CMR**. Faculty have been active in disseminating our research to stakeholder groups (see: Impact Template).

A continued high volume of output, in leading academic journals across a wide range of disciplines (including, *inter alia*, economics, environmental policy, law, finance, geography, housing, law, planning, and regional science outputs), in books and other formats, resulting from collaborative research projects combining our different disciplinary skill-sets, through a wide range of international research collaborations with a renewed focus on stakeholder engagement and policy-relevant research (see: Impact Template), provide substantial evidence of success. The 26 academics submitted from Land Economy, produced over 200 journal articles, 24 books and 40 chapters over the REF period.

ii. Research Strategy for 2014-19

Architecture will continue to build upon existing strengths and promising new directions through a combination of funded research, excellent academic outputs, and the development of new opportunities to engage with stakeholders and policy makers. Three areas stand out: firstly, the Department will continue to promote rigorous and internationally acclaimed research on sustainability in the built environment and on the changing problems and development of cities. In

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addition to proven funding sources in the Research Councils and the EU, the Department will prioritise other areas of funding, including industry. This, as well as policy and cooperation with government bodies and NGOs, reflects changing concerns in our research as well as the interests of new appointments in the Department.

Secondly, Architecture will build upon and extend new strengths, especially in cross-disciplinary areas related to architecture and urbanism as well as exploring untapped possibilities for exploiting the advantages of collaborative research. Overlapping areas of socio-political forces, natural hazard, economic disparity and conflict in rapidly changing cities will be central.

Thirdly, structural changes will be used to provide a realistic balance between topical responses to new developments in architectural and urban research, and long term nurturing of areas of strength and significance in the Department's research. While the MC remains the main umbrella for the Department's research, clusters within it have been created to take best advantage of the expertise of new staff, enhance our existing four research groups, and respond to the wider, changing environment: research configurations recently established or re-established include the **Centre for Urban Conflicts Research (UCR)**, **Cities South of Cancer (CSC)**, the **Cambridge University Centre for Risk in the Built Environment (CURBE)**, the **Cities and Transport Modeling group**, and the **Sustainability and Health Research group**.

Land Economy's Strategic Plan seeks to build on the progress made over the REF period, to: "*further develop research excellence and thought leadership in Land Economy and to maximise research impact and blue chip income*" with specific goals of:

- *increasing tangible support for research activity and centres within the Department;*
- *launching and growing new research centres of excellence in Property Law and Real Estate;*
- *enhancing the quality, visibility and impact of our research output.*

To meet the first goal, Land Economy will seek to diversify funding sources: in particular, we aspire to increase the level of industry and international funding for research projects, while continuing to pursue grants from research councils, the EU and charitable foundations. Within the research centres, it is intended to create a stable funding base that will provide security for post-docs and contract research staff that will foster career development and the conversion of funded research projects into quality research outputs. Central to this strategy is the need to increase further the visibility of research beyond specific field journals and communities to reach international academic and stakeholder audiences. This is a specific brief of the Departmental research committee with a budget assigned to dissemination; user engagement will form part of the staff appraisal process.

c. People

i Staffing strategy and staff development

Architecture currently employs 13.5 (FTE) University Teaching Officers (UTOs) and is committed to maintaining existing UTO numbers with the relevant expertise to sustain research excellence. It currently employs 14 (FTE) research staff, funded directly from research grants and a research administrator and a part-time research secretary, paid from overheads income. The latter are overseen by the Head of Research.

Four new appointments in established posts augment the research groups: **So** – risk and the revival of CURBE; **Sternberg** – culture of architecture and cities and UCR; **Heo** – sustainability and building performance overlapping with health research; **Hernandez** – culture of architecture and cities and CSC. These posts re-establish Departmental strengths in history, theory, urban culture and structures, and add specific support to the Sustainable Design group. Most importantly, the Department has implemented a rigorous new workload allocation system, ensuring an equitable distribution of teaching and administration, leaving the majority of time for research.

The success of the Department's research ethos is demonstrated in the filling of senior academic posts by departing staff: Carl, Chair at LMU; Schäfer, Chair at UCL; Chenvidyakarn, Chair in Thailand. Research staff have moved to permanent academic posts: Schuldenfrei, Hong Kong; Lu, Chair, Nanjing; Roudavski, Melbourne; Wallach, SOAS; Sternberg, Cambridge; Hagen-Zanker, Surrey; Adhvaryu, Assoc. Prof., CEPT, Ahmedabad; Caruso, Assoc. Prof. Luxembourg; Grinevich, Southampton; Yun, Chair, Kyung Hee, Korea.

Land Economy similarly experienced a change of personnel over the REF period. Barker, Bond, Glascock, Guan, Iglori, Köhler, Moore, Roberts and Whitehead left or retired over the REF period;

as with Architecture, many have gone on to professorial positions elsewhere. Incoming staff have included **Abreu, Alcock, Allmendinger, Crawford-Brown, Fuerst, Lizieri, Lees, Mercure, Viñuales** (to the newly established Harold Samuel Chair of Law and Environmental Policy) and **Voors**, a mixture of younger, rising academics and senior staff with established international reputations. Emphasising the international outlook of the Department, the submission includes twelve different nationalities.

Both Departments have been successful in securing prestige research fellowships: examples include two Mellon fellowships, Mercure's ESPRC fellowship, Fair's Leverhulme fellowship, the AXA research fellowship awarded to Guan and two Marie Curie fellowships.

The University supports career development of its members in a variety of ways, including an Emerging Leaders Programme (open both to teaching and research staff), the Senior Academic Promotions mentoring scheme, and provision of a wide range of skills and career training opportunities. Recognition for research excellence is established through a rigorous annual Senior Academic Promotions Exercise (involving international assessors). Staff in the submission promoted over the REF period through this process include **Campbell, Pascual, Salmon, Silva** and **Sunikka-Blank** (senior lecturers); **Monk** (principal research officer), **Kontoleon** (reader), **McHugh, McCombie** and **Penz** (professors).

All University teaching officers are entitled to one term's fully paid sabbatical leave for each six terms of service. Over the REF period, 17 of the faculty whose work is submitted here were granted sabbatical. Further arrangements supporting academic research include: entitlement to one year's paid sabbatical after a three-year period of senior administrative responsibility; career progression for contract staff; unpaid leave to pursue research opportunities; generous maternity, paternity and adoption leave, with provision for graduated return to work; flexible working arrangements to meet childcare or other responsibilities; excellent childcare facilities; career counselling; equity-sharing housing schemes; travel support for research visits and conference attendance; and an extensive programme of staff development courses at all career stages. The Returning Careers scheme helps staff resume research careers on returning from a career break, buying out teaching and administrative duties, funding conference attendance and providing research assistance.

Staff have access to pump-priming research funds through the Newton Trust and other School schemes to prepare for major external funding bids. The University, Colleges and Departments assist with travel and subsistence for international visits and for conferences and collaborative work. In Land Economy, further research support is available due to generous funding from its alumni association, the Cambridge University Land Society, and its external Advisory Board; Architecture maintains a Research Fund generated through research overheads to pump-prime and support staff research activities.

The University is committed to diversity and inclusivity. Applications from women for senior academic positions are encouraged through development workshops, reviews of working practices and remuneration, with the Gender Equality Group (on which **Sunikka-Blank** and **Stemers** served) examining any causes of gender-based unequal pay. Initiatives in the STEMM areas (eg. WISETI, Athena SWANN) are being extended to Humanities and Social Sciences. The University operates an Equal Opportunities Policy fully compliant with the Equality Act 2010. The "Dignity@Work" policy clearly sets out University procedures for dealing with harassment, bullying and other inappropriate behaviour. The University has received a number of awards for staff provisions, including **highest ranked UK HEI on the Stonewall list** (2012, 2013) and the inaugural **Employee Engagement Award** (2012) from the Employers Network for Equality and Inclusion.

Support for Early Career Researchers

The University considers it has a responsibility to develop young academics through post-doctoral work and research fellowships to full independence; both Departments are fully committed to this. A significant number of those submitted began their research careers at Cambridge or were recruited at an early stage. In Land Economy, **Abreu, Lees, Mercure** and **Voors** are ECRs. Funding for research fellowships comes from the Research Centres, from the UK Research Councils, from organisations such as the Andrew W Mellon Foundation and from the very competitive junior research fellowships supported by the Colleges. **Abreu's** College post, prior to her appointment to a Departmental lectureship, was funded by an endowment to Pembroke College; others began their careers as doctoral students (**Lees**) or research assistants (**Mercure, Voors**). In Architecture,

current early career researchers are **Sternberg, Heo and So**; Sternberg and So were doctoral students and postdocs in the Department. **Sunikka-Blank** received an Early Career Fellowship from the Centre for Research in the Arts, Social Sciences and Humanities (CRASSH).

Postdoctoral researchers now form the largest staff group in the University, prompting a major development in North West Cambridge (NWC), with the first £300M phase due to open in 2015–16, to provide high-quality and sustainable housing for over 600 postdocs and graduate students. The University has created the role of Director of Postdoctoral Affairs to coordinate and develop strategy for the postdoctoral community, spearhead fund-raising for further NWC facilities, and act as an advocate for postdocs. Emphasising the embedding of research in the University's strategy, Land Economy has been awarded two fully funded PhD studentships to investigate the impact of NWC on house prices in the region and the take-up of green technologies.

ii Research Students

Both Departments have extensive PhD programmes: currently Architecture has **53** and Land Economy **68** students with **89 PhD students graduating** from both Departments over the REF period (incl. 8 supervised by Howard and Salmon). First-rate training and education is fundamental in both Departments. Land Economy students participate in Cambridge's ESRC Doctoral Training Centre and students from both Departments undertake modules in the cross-disciplinary Social Science Research Methods Centre and have access to a wide range of methods, transferable skills and career development programmes available through the University. Departmental staff contribute to these programmes. Plans for further cross-disciplinary PhD programmes in Architecture and Land Economy include the newly funded EPSRC CDT on Future Infrastructure and Built Environment. To ensure satisfactory progress, both Departments have critical examinations at the end of the third and seventh terms. A logbook of student activities is kept. Students are allocated, in addition to their supervisor(s), an academic mentor. Limits are placed on the numbers of students per supervisor (normally a maximum of six) to assure adequate supervision. Graduate students are provided with desk space in the Departments (although many choose to use the resources provided by their colleges) and with appropriate IT for their research.

In **Architecture** 49 PhD candidates were approved, **doubling the number of completions** from the last RAE. In addition to the generic School of Arts and Humanities Postgraduate Skills Training, to promote employability, PhD students receive subject specific training in Design Research Methodologies, complemented by reading groups. Third and fourth year PhD students present their work at the annual PhD Colloquium. PGR students organise four seminar series: the weekly MC Research Seminar and fortnightly History and Theory Seminar (both funded by the MC), and the fortnightly Cities Seminar (with Geography and Anthropology) and The Guild: Experiencing the World in the 19th Century seminar (with History of Art and English) (both funded by CRASSH). The PGR community organises conferences like the 'Centenary Symposium: 100 Years of Research + Practice' (2012) and edits the annual Cambridge Architecture Journal, *Scroope*.

PhD students come from the Far East, North and South America, Middle East, Australia and New Zealand as well as Europe (and the UK). Graduate students in Architecture win grants from AHRC, EPSRC, Cambridge Commonwealth Trust, Cambridge Overseas Trust, Cambridge Gates Trust, College scholarship or award, International agency, ORS-Overseas Research Scholarship, other overseas funding (government and private), UK Charitable foundations. Some are supported by and part of larger research grant projects. Their papers are well-received at conferences and have been awarded prizes, such as Katz Feigis's Morris Prize from the Society of Architectural Historians of Great Britain. The Faculty's Kettles Yard Fund supports graduate travel for research.

Land Economy students are similarly international with current students from the EU, South and North America, SE Asia, the Indian sub-continent and Oceania. They have won studentships from the ESRC, more recently as part of the ESRC DTG, and industry-funded awards (e.g. from the IPF ET); major grants frequently have in-built doctoral components (as in **4CMR** which currently supports four research students). Colleges provide individual grant support and the two University studentships to monitor NWC, as noted above. Thirty-six PhDs graduated in the REF period; 22 additional LE graduates were returned with the Development Studies submission.

Land Economy has a formal Departmental programme of doctoral training for all students, focussing on generic research skills and processes. Students present their work at an annual Research Symposium, with external discussants and staff members present. There are regular

Departmental doctoral seminar series, alongside a Departmental seminar series that brings internationally-renowned researchers to the Department and subject-focussed series run by the specialist research centres **4CMR** and **CCHPR**. These departmental programmes are augmented by cross-departmental specialist seminars (e.g. the Cambridge Finance series, which brings together finance researchers from across the University, from the business school, economics, mathematics, law, history and land economy. Zavadov and Pinter both won doctoral essay prizes in this series, and Land Economy students have presented at specialist international conferences organised by Cambridge Finance. Doctoral students are encouraged and funded to attend seminars and conferences to showcase their research and to build academic networks: many students have won prizes at international conferences and competitions: eg. Scott at the ARES (Seattle) and ERES (Milan), Steiner and Garza at International AREUEA (Singapore) and Ormond at ERES (Edinburgh); Chami won the Grand Prize in the Dow Sustainability Innovation Student Challenge Award and Lindner won the 2013 Leontief prize in input-output analysis. Recently, ESRC funding in 2013 allowed eleven doctoral students to visit Hong Kong, Wuhan and Beijing.

d. Income, infrastructure and facilities

i. Research Management

In both departments the overall research strategy is monitored by a Research Committee (in Architecture, chaired by the Director of the MC), which reports to the respective Faculty Boards. The Committee reviews output, vets research proposals and funding bids, administers the Department's research travel and research infrastructure budgets and ensures adequate resources are available to support funded and private research.

The Schools' Research Committees oversee all research activity and, supported by two cross-School Research Facilitators, foster strategic initiatives for inter-disciplinary research across Departmental and School boundaries. The University maintains checks on research standards. Initial ethical review of research is carried out using discipline-specific expert knowledge. Any questions beyond local committee expertise are referred to School-level Research Ethics Committees, constituted according to relevant Research Council guidelines; they provide expert review in most cases. The Committees are overseen by the University Research Ethics Committee, which advises on complex cases, hears appeals against the School-level decisions, and oversees the University's Research Ethics Policy. The system provides flexibility for straightforward non-controversial projects and measured prudence in dealing with more complex issues.

ii. Research Funding

Both the amount of funded research and the breadth of funding sources shown in REF4b indicates the range of research expertise in the two relatively small departments - Architecture and Land Economy. It further reflects the policy and societal relevance of the research. Total net research income 2008 to 2013 exceeded **£13 million**, not including research work recorded as consultancy or classed as charitable donations nor distributions to other HEIs where Cambridge lead the project. The contribution of the two Departments to funded research, as awarded, generated a **gross research value exceeding £24million**.

Within **Architecture**, 62 funded research projects were administered by the Martin Centre over the REF period, with a net income of £6.7M and lead responsibility for nearly £13M. Two large projects started during the 2007/08 academic year: 'ReVISIONS' (£3.2M, EPSRC, **Echenique, Steemers**) and 'CinC' (£2.6M, ESRC, **Pullan**). A new multi-million pound grant was awarded in 2013 for 'Domestic Devotions' (£2M, ERC Synergy, **Howard**), in collaboration with colleagues from Medieval and Modern Languages and History. The EPSRC remains the largest source of funding at 58%; other sources include ESRC, AHRC, the British Academy, the Royal Society and Government departments, the EU, charitable foundations and industry (notably, Anglo-American Trust, Leverhulme Trust, Isaac Newton Trust, Department of Health, West Hertfordshire NHS Trust, Ramboll Ltd and Buro Happold Ltd).

Land Economy has been successful in obtaining funding from a wide range of funding sources with some £6million of net research income, 81 research awards made, and lead responsibility for research grants of £12M. In addition to UK research councils grants (notably ESRC and EPSRC, also British Academy), funding came from global organisations (UN, World Bank, EU), national Government, local authorities, charitable foundations (Joseph Rowntree, Leverhulme, Three Guineas Trust inter alia), professional bodies (RICS, IPF, EPRA, ULI, INREV) and industrial

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funding. The **Real Estate Research Centre**, launching in 2013, has initial funding of £440K from personal donations and industry sources (e.g. British Land, Credit Suisse, Deloittes, Land Securities). **4CMR's** Three Guineas Trust funding was renewed in 2012 (£618K). Staff participated in major international projects such as the €7M FP7 EcoFINDERS project on ecological indicators and European soils (**Pascual**) or the \$600K project on biodiversity regulation in China (**Kontoleon**). DCLG provided £1.2M funding for **CCHPR's Dataspring** UK social housing data project.

The University itself provides substantial support for research through key strategic initiatives, help for early career researchers and pump-priming for substantial research proposals. The Cambridge Humanities Research Grant scheme (CHRG) has a budget of £300K (2011-2015), while the Newton Trust small grants scheme provides infrastructure support for data collection, networking and pilot activities. Researchers from both Departments have benefited; grant support has also come from the Cambridge Conservation Initiative. There is strong support for cross-disciplinary research e.g. **Kontoleon's** funding from the Vice Chancellor's Discretionary Fund for a pilot project combating neglected tropical diseases in Uganda. The University provides further support in the form of School research facilitators who offer grant application training and help identify opportunities; a cross-School ESRC Strategic Committee assists with social science proposals.

iii infrastructure and Facilities Supporting a Vital and Sustainable Research Environment

Over the REF period, both Departments were able to improve their physical facilities and benefited from general improvements to the University's built estate and research infrastructure.

The University invested £3.7M in a new studio building for Architecture as well as a major refurbishment of the main Scroope Terrace facilities; this enabled the MC to move to the main Architecture site in 2008. The consolidation has proved enormously successful in linking the different research groups, promoting further cross disciplinary research and interest in each other's methods. It has also helped to connect teaching with research. The significant increase in MPhil and PhD students as well as researchers requires a further expansion and a feasibility study for expansion is currently being commissioned.

Investment in the physical structure of Land Economy's Silver Street offices has improved circulation and created common space to aid interaction. Expansion into an adjoining building (part funded by charitable donations) has provided dedicated space for 4CMR and permitted more doctoral students to have dedicated offices close to their supervisors. The move also permitted improvements to information technology provision: a specialist spatial analysis and GIS laboratory (LISA (director: **Silva**)) was established with University and industry funding, to bring together expertise and to provide a greatly enhanced platform for the spatial modelling that informs work in a number of the specialist research areas in the Department. In the longer term, Land Economy will move to a purpose-built new location on the New Museums site as part of the University's capital plan, where proximity to the Cambridge Conservation Initiative and to Geography will further enhance collaborative research.

Architecture and Land Economy benefit from the University Library (UL), a legal deposit library housing over six million volumes, attracting researchers from across the world. A digital library is available 24 hours a day, providing access to over 21,000 full-text electronic journals, around 400 databases and a growing collection of electronic books. The UL is one of 105 libraries within the University and its colleges. Both Departments have their own specialist libraries, maintained by University library staff. Researchers and students can also access specialist libraries such as the Squire Law Library (one of the three largest law libraries in the UK), the Marshall Library of Economics and the specialist library and information service in the Judge Business School. This collaborative information system enables easy access to important data sources: for example, the Wharton Research Data Service and other economic and financial resources.

e. Collaboration or contribution to the discipline or research base

i. Support for collaboration within the University

The University has made substantial investment in promoting collaborative research within Cambridge, including Strategic Research Initiatives and Networks that bring together leading researchers across departments and disciplines, with funding available for the development of research programmes, support for funding applications and, where appropriate, infrastructure support. Within the University, Land Economy and Architecture researchers are involved with – and have led in the formation of - Strategic Research Initiatives/Networks in Energy (**Crawford-Brown**,

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Jin, Short, Steemers), Cambridge Conservation Initiative and the Conservation Working Group (**Hodge, Kontoleon**), Public Health (**Short, Steemers**), Global Food Security (**Allmendinger, Hodge**) and the Public Policy SRI (**Howarth**) – which has seen the launch of Cambridge Public Policy and a new research-led Masters' Programme, with first intake from 2013. The cross-School Forum for Sustainability and the Environment was founded in 2013 (**Steemers, Crawford-Brown**) and the World Health Organisation Collaborating Centre was founded in 2012 (**Steemers**).

The University invested **£16M** in developing the Alison Richard Building (completed 2012), partly to accommodate CRASSH, a major international centre for interdisciplinary, collaborative research in the arts, social sciences and humanities, as well as area studies groups and cross-disciplinary seminars. CRASSH includes formal support for multi-disciplinary seminars and early career researchers, as well as conference funding, logistics and space (benefitting **Penz, Jin, Hernandez**); **Pullan** served on its Management Committee (2008-12).

ii. Evidence of collaboration with researchers outside Cambridge

In the space available, we can only state primary examples of the extensive research collaborations in the two Departments. Many of these are international; others bring together academics and practitioners or tap into specialist expertise in Cambridge through formal cross-disciplinary centres and strategic research initiatives.

Architecture's largest sources of research income derive from collaborative projects. Examples led by Cambridge include 'CinC', (ESRC Large Grant, 2007-13, £2.6m, PI: **Pullan**, with Exeter and Queen's University Belfast, and a network in Europe and the Middle East); 'ReVISIONS' (EPSRC, 2008-12, £3.2m, PI: **Echenique**, Col: **Steemers**, with Leeds, Exeter, Surrey, Newcastle, Aberystwyth); Solutions (EPSRC, 2004-08, £1.75m, PI: **Echenique**, with UWE, UCL, Leeds, Newcastle); DeDeRHECC (EPSRC, 2009-12, £739k, PI: **Short**, with Loughborough, Leeds, Open University). Other collaborative projects include: 'Multimodal, Efficient Transportation at Airports' (EC FP7, led by the German Aerospace Center Institute of Air Transport and Airport Research, 2012-14, £166k, PI: **Steemers**, Col: **Dray**). 'Cinematic Geographies of Battersea' (AHRC, 2012-13, £157k, PI: **Penz**, with Liverpool and Edinburgh and English Heritage); 'Low carbon cities in China: from policy to implementation' (2011-14, Tsinghua-Cambridge-MIT Low Carbon Energy University Alliance, US\$600K, PI: **Steemers**; Col: **Jin**).

Architecture researches the effects of destruction in earthquake areas across the globe, most recently in SENSUM (PI: **So**, EC FP7, 2013-14, £144k, with Helmholtz Centre Potsdam, German Research Center for Geosciences, European Centre for Training and Research in Earthquake Engineering, Italy, Deutsches Zentrum für Luft- und Raumfahrt, Stiftelsen Norges Geotekniske Institutt, Institute of Geology, Earthquake Engineering and Seismology Tajikistan, Central-Asian Institute for Applied Geosciences Kyrgyzstan). A Marie Curie Fellowship facilitated collaboration with Ben Gurion University, Israel (2010-12, **Pullan**) and another hosted an Italian academic (2010-12, **Penz**). In some cases charitable donations have contributed to international collaboration such as **Ramage's** 'Eco House' (Anglo-American Foundation) and **Pullan's** feasibility study 'Upgrading Historical Areas in Baghdad' with researchers from Baghdad Technical University (CARA 2011-12).

In **Land Economy**, **4CMR** are working on an EU funded consortium project (€4.5M) to develop tools for climate change adaptation – ToPDaD - involving research institutes and universities in Austria, Belgium, Finland, Germany, the Netherlands and Switzerland; in the €3.7M FP7 CarbonCAP project are examining consumption-based accounting in collaboration with institutes and universities in the Netherlands, UK, Denmark, Austria and Norway; have a research collaboration with the Chinese Academy of Sciences developing consumption-based accounting models for energy usage in China to assess mitigation strategies; are undertaking research with Doshisha University, Japan examining low carbon contributions of alternative transport modes and, within the UK, are part of the Tyndall Centre consortium of Universities developing models on climate change interaction funded by EPSRC and LEWEC. **4CMR** are leading the economic analysis of adaptation on the Arcadia project, a multi-disciplinary EPSRC project analysing climate change in urban areas involving Cambridge, Oxford and the Tyndall Centre. **4CMR** have been represented at CoP and the Intergovernmental Panel on Climate Change, with members serving as lead authors of IPCC assessment reports.

Other collaborative research in the area of environmental economics has examined agricultural and forestry policies in developing and emerging economies. Outcomes will aid in developing new

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policy not only locally but in other comparable areas on the globe. For example, **Kontoleon** and **Voors** are PIs on projects funded by the Cambridge Conservation Initiative evaluating the Gola Forest programme in Sierra Leone working collaboratively with the RSPB, the Gola Forest Programme and the Universities of Wageningen (NL) and Chicago. **Kontoleon** is also leading a Newton Trust funded project assessing field experiments on household and community behaviour in conservation initiatives in Liberia and Sierra Leone (again with Wageningen and Chicago). British Academy funding has been obtained for research on social impacts of windfall gains in Sierra Leone. Other collaborative research in this field includes **Pascual's** participation in a global programme examining the role of 'payment for agrobiodiversity conservation services' at farmer level (involving UC Berkeley, CRNMA in Peru, the MS Swaminathan Research Foundation in India and Bioversity International); and a substantial programme examining biodiversity regulations, implementation and governance in China (with **Kontoleon** as lead) working cooperatively with the Chinese State Environment Protection Administration and collaboratively funded by the European Commission and UNDP. **Kontoleon** is a member of the International Advisor Panel to the Chinese Ministry of Environmental Protection.

Other China initiatives include: **Morrison's** research on planning policy and affordable housing in Shenzhen, (Urban Planning, Land and Resource Commission of Shenzhen); **Bao's** work on urban land and residential markets in the face of rapid urbanization in China (Academic Research Fund of the National University of Singapore) and research with Huazhong University on risk management of financial derivatives in China. **Bao**, **Alcock** and **Lizieri** participated in an international real estate research symposium in Beijing leading to further collaborative work and exchanges in real estate finance; collaborative research relationships with Renmin and Beijing universities in real estate and urban planning are being developed; FAPESP funded **Lizieri's** visit to Sao Paulo.

iii Contribution to the Academic, Research and Stakeholder Communities

Architecture staff sit on many national and international advisory bodies that affect stakeholders in various ways; this includes: **Stemers**-International research advisor for FCT (Portugal's Science Foundation), International expert on the Singapore government's Clean Energy International Advisory Panel, Hong Kong RAE panel co-chair, President of PLEA (Passive and Low Energy Architecture – an association of over 2500 academics and practitioners); **Short**-NHS Design Review Panel, MBN KTE Board for Health member; Heath Technical Memorandum panel, Mental Capital and Well-being panel, Advisor to WHO; **Pullan**-RCUK-GU Security in Cities; RIBA Futures panel on Security and Architecture; **Howard**-British Academy Council, Humanities Working Group, Comitato Scientifico Collana sulle Chiese-Fondazione Cini (Venice), British Architectural Trust Board, International Board Universita degli Studi, Padua; **Salmon**-Chair British School in Rome Faculty of Archaeology, History, Letters; National English Heritage Advisory Committee; **Echenique**-advisor to Minister of Transport of Chile; jury for international competitions (Qatar, UK). Annually, the Martin Centre hosts up to five visiting scholars, funded by their home institutions, who collaborate with Departmental UTOs on research projects and initiatives.

Membership of Peer Review Colleges and other review bodies includes: **Echenique** (EPSRC), **Stemers** (EPSRC, FCT-Portugal, Hong Kong RAE); **Pullan** (ESRC, EURIAS); **Short** (RCUK Health and Well Being, NHS Design, Australian Research Council); **Howard** (ANVUR-Italy, Max Planck Institute, ERC); **Salmon** (Paul Mellon Centre, English Heritage). Members of editorial boards include: **Stemers**-Architectural Research Quarterly, Architectural Science Review; **Pullan**-Memory Studies, field; **Short**-Building Research and Information; **Campbell**-Journal of Construction History. Major academic conferences that have brought together academic stakeholders in their respective fields include: **Penz**-Urban Cinematics (2009), Cinema and the Museum in the 21st Century (2011) Still Architecture (2012), Cinematic Urban Geographies (2013); **Jin** organises the annual international Applied Urban Modelling conference in Cambridge (since 2011). Conflict in Cities hosted several events including an international conference in Jerusalem that brought Israelis and Palestinians together with researchers and practitioners from other divided cities (**Pullan**, **Sternberg** 2010); **Pullan** organised a series of round tables on the future of Jerusalem, held in Jerusalem and London's Chatham House (2009-10); **Campbell** has served on the organising committees for the International Congress on Construction History (Cottbus 2009, Madrid 2012); since 2007, **Echenique** and **Jin** have held biannual symposia with Tsinghua and Sao Paulo Universities to compare growth trajectories and policy options of London, Beijing and Sao Paulo.

Land Economy faculty have contributed to learned societies domestically and internationally. These include: **Abreu** (ERSA's EPAINOS prize committee; organising the 2013 British and Irish section conference); **Fuerst** (directing the GIF sustainability working group, Germany; the academic advisory board, Homburg Academy, Canada); **Kontoleon** (director of BIOECON, with their conferences, the largest academic group to focus on the economics of biodiversity, hosted by Cambridge); **Lizieri** (research committees of EPRA and IPF). Land Economy faculty members have organised conferences, for example: serving on the organising and scientific committees of AGILE, the Asian Real Estate Society, EFA, ERES, ERSA, the International Society of Ecological Economics, and RSA, and making international keynote speeches (**Crawford-Brown** in Japan, Taiwan, USA and UK; **Dixon** in the Netherlands; **Hodge** in Austria and Malaysia; **Lizieri** in China and the Netherlands, **McCombie** in Brazil and Mexico; **Morrison** and **Silva** in China; **Viñuales** in Argentina and Switzerland). The Department also runs a number of focussed seminar series such as the Economics of Austerity series held in Cambridge (**Arestis, Tyler**).

Land Economy's contributors to Peer Review bodies include: **Allmendinger** (ESRC), **Bao** (HK Research Council), **Crawford-Brown** (ESPRC, US EPA), **Dixon** (AHRC, JASB), **Fuerst** (Arthur Sloan Foundation), **Hodge** (ESRC, NERC), **Kontoleon** (ERF, FP7), **Lizieri** (HK RGC, Luxembourg RC), **Pascual** (FORMAS, Sweden), **Silva** (UKHAE, NCF Portugal, Israel Science Foundation), **Viñuales** (Swiss National Science Foundation). Staff edit or are on the editorial boards of the over forty journals, ranging from economics and finance to law and planning theory. Interactions with Government bodies include: **Arestis**, chief academic advisor to the Government Economic Service of HM Treasury; **Crawford-Brown**, expert panels of HM Treasury, DECC, US Environmental Protection Agency and OFWAT; **Dixon**, academic member of the Chancery Bar Association; **Hodge**, DEFRA advisory panel; **Howarth**, UK Council of JUSTICE (the International Commission of Jurists); **Lizieri**, expert advisor for DCLG, advisor to the Barker Review of Land Use Planning; **McCombie** economic consultant to World Bank, Asian Development Bank; **McHugh**, advisor to New Zealand and Canadian Governments on the land rights of indigenous; **Monk**, DCLG HCA and HMPA expert panels. Land Economy engages with academic and stakeholder communities through Visiting Fellows, appointed for three to five years. Current fellows include Kate Barker, John Healey, MP, Erwin Bulte, Harry Garretsen, Tim Swanson, and Chris Webster. Visiting Fellows provide an important link between the academic and policy worlds. As well, a number of funded visiting research fellowships encourage international collaboration; these have been held by Needham (Nijmegen), Peiser (Harvard) and Ling (Florida).

The success of the two Departments has been recognised in international honours and awards. For Architecture this included **Echenique's** OBE (2009) and Distinguished Alumnus of the Catholic University of Chile (2009); **Howard's** election as Fellow of the British Academy (2010); **Penz's** Chevalier dans l'Ordre des Palmes Academique (2009). For Land Economy, **Arestis** received the Queen Victoria Eugenia Award of the British Hispanic Foundation and was honoured with the title of *patrono* by the Associação Keynesiana Brasileira; **Lizieri** was elected Weimer School Fellow of the Homer Hoyt Institute; **Arestis** and **McCombie** were elected Academicians of the Academy of the Social Sciences (AcSS); **Fingleton** and **McCombie** were elected Fellows of the RSA, the former also awarded an international fellowship of the Regional Science Association. At the same time, both Departments take seriously the need for continuity of exemplary and challenging research in new generations of scholars. Accomplishments in this area include: **Abreu**, as sole author of 'Good practices in the selection and use of outcome indicators' (2012) for the EC; **Heo's** Outstanding Young Contributor Award from the International Building Performance Simulation Association in 2013; **Hernandez's** CSC group running hand's-on workshops in communities in Indonesia, Columbia and Mexico; **Lees'** research being used by the Sentencing Council and Ministry of Justice to harmonise approaches to environmental offences (waste); **Sunikka-Blank's** small CHRG grant (£7.9K, 2011) to collaborate on energy performance, became an article downloaded over 3,000 times, and developed into a book analysing German retrofit policy (Springer 2013); **So's** role as part of a team developing Prompt Assessment for Global Earthquake Response (PAGER) at the U.S. Geological Survey's National Earthquake Information Center; and **Voors'** receipt of the 2013 WASS most promising researcher award and appointment as technical advisor to the RSPB.