

Institution: University of Sheffield
Unit of Assessment: 16 - Architecture, Built Environment and Planning
<p>a. Overview</p> <p>We have an established reputation for research excellence, driven by the vitality of our intellectual culture and the careful nurturing of our research community. Our research seeks to set academic agendas and to have a long-term transformative purpose in the world. Our departments of Architecture (ARC), Landscape (LSC) and Town & Regional Planning (TRP) were each graded 5 in the 1996 and 2001 RAEs; and they were ranked =3 (UOA30), =5 (and the leading school of landscape, UOA30) and 2 (and the leading school of planning, UOA31) respectively, in 2008 (by THES average score). We are part of the University's Faculty of Social Sciences. Our research groups have cross-departmental, interdisciplinary membership. They are: ARC: Architectural History, Theory and Education, Architectural Sciences and Technology, and Community Participation and Future Practice; LSC: Art, Culture and Media, Designed Ecology and Social Research; TRP: Planning Theory and Practice, and Spatial Theories and Processes.</p>
<p>b. Research strategy</p> <p>i. RAE 2008 research strategy: progress and evaluation</p> <p>Our departments' RAE 2008 strategies had much in common, reflecting similarities in our core principles and approaches. Our objectives were: (i) to maintain and enhance existing strengths whilst addressing issues of increasing national and international concern, such as climate change and the impact of the built environment on quality of life; (ii) to expand the scale, ambition and reach of our research by enhancing international, interdisciplinary and user collaboration; (iii) to continue to reproduce a well-founded community of researchers, including further development of our highly regarded doctoral provision; (iv) to challenge and progress intellectual debate in our field; and, through these means, (v) to engender creative and constructive change in academia, policy, practice, industry and wider society.</p> <p>All of our RAE2008 objectives have been achieved or exceeded. The quantity and quality of our research income have increased significantly (income 36.5% higher, with over 40% from RCUK), as have the interdisciplinary and international aspects of funded projects and broader research activity (for example, the proportion of EU government funding has grown by more than 150%). This reflects our increased ambition, the effectiveness of our support strategies and the research infrastructure investments made during the assessment period (amounting to over £4m). Our staff has increased by 11% (FTE; here and subsequently, reference is to <u>all</u> Category A staff). Our doctoral communities have continued to grow (by 24% since 2008), with the White Rose ESRC Doctoral Training Centre (DTC) further enhancing our PhD training. We have exploited the nature of architecture, landscape and planning as applied, interventionist disciplines to improve research quality, user engagement and impact (see REF3). Consequently – and most importantly - we continue to make internationally significant contributions to understanding in our field.</p> <p>Our intellectual agenda is driven by the need to examine how knowledge about the world is turned into actions designed to make it a better place. We work at the interfaces between theory and practice and between expert and lay knowledge to maximise the ways that they inform one another. We draw on a wide range of understandings and experiences to remain in the forefront of methodological and theoretical developments in our field; to define and re-frame questions in novel ways; to derive original explanations of real-world matters, both philosophical and practical; and to enhance our impact by developing more effective approaches to the complex problems constantly faced by citizens, industry, policy-makers and practitioners. Thus, and for example:</p> <p><i>Campbell</i> (1 [numbers, here and subsequently, indicate REF2 outputs]) and <i>Wagenaar</i> (1) have made leading contributions to understanding the relationship between knowledge and action, with implications across the social sciences. <i>Wagenaar</i> (2-4) has furthered understanding of the continual dialectic between policy formulation and implementation. <i>Campbell</i> (2-4), <i>Ferrari</i> (3) and <i>Gough</i> (2) have developed and applied theories of justice and ethics to demonstrate their centrality to urban policies and their outcomes. <i>Tait</i> (1) has opened up new perspectives on debates in planning theory about trust, public interest and planning practice and <i>Flint</i> (1, 4) has provided novel insights into how concepts of citizenship, responsibility and cohesion are used to construct problems in housing, urban and social policy.</p> <p>Pioneering field research in South Africa and India has challenged both existing academic</p>

and policy understandings of the lived experience of informal settlements (*Meth*, 2) and established approaches to participation and engagement in international development studies (*Williams*, 3). In addition, we have advanced the conceptualisation of housing sub-markets (*Watkins*, 1) and demonstrated the economic illogic of contemporary property investment decision-making (*Henneberry*, 1, 3), with significant implications for the theory and practice of property analysis. And *While* (1) has developed innovative frameworks for understanding the unfolding and contested processes of urban environmental governance.

We have developed - with users - new theoretical models of spatial, environmental social agency and engagement through design (*Awan*, 1) in neighbourhoods (*Petrescu*, 1-3) and buildings (*Wigglesworth*, 1, 2). Our innovative investigations of artificial lighting and illuminance (*Fotios*, 1-3), of subjective psycho-acoustical urban soundscapes (*Kang*, 2, 4) and of housing occupancy feedback (*Stevenson*, 1, 2) have significantly broadened the development of models, methodologies and standards in these areas. Ground-breaking work on vernacular versus expert aesthetics has shown how lay people perceive and are affected by designed (*Thwaites*, 1) and everyday landscapes (*Rishbeth*, 1, 2) in home (*Dempsey*, 1) and school (*Thwaites*, 4) settings.

Through critical, theoretical engagement with history we have revealed excluded narratives relating to architectural design and materiality (*Samuel*, 1, 4), to cultural connections with 'other' places (*Blundell-Jones*, 3, 4) and to other disciplines such as art, sculpture (*Walker*, 1, 2), psychoanalysis and philosophy (*Petrescu*, 4), and to the undervalued contributions of managers and maintenance staff to designed landscapes (*Woudstra*, 4). By integrating ecological science with landscape design we have developed understanding of how to design urban vegetation that is able to meet the challenge of climate change (*Cameron*, 3), that is self-organising and sustainable (*Hitchmough*, 1, 3), and that is meaningful to ordinary people (*Jorgensen*, 3).

ii. Future research strategy

Our research strategy maintains the themes of RAE 2008. Our **aim** is to exploit the quality of our research community and environment, and our distinctive intellectual position to address the wicked problems of urban development through outstanding research. To achieve this, our **objectives** are: (1) to increase the quality and number of our academic staff, research assistants and research students; (2) to provide the intellectual leadership, guidance and support needed to enable everyone to realize their research potential; (3) to secure more and higher quality funding and to manage it more effectively to deliver greater intellectual contribution, user engagement and professional/social impact; (4) further to develop our links with key partners and stakeholders to facilitate the co-production of knowledge and to enhance its impact on industry, policy and practice; (5) further to develop the inter-disciplinary and international dimensions of our research in terms of networking, projects and influence; and (6) to continue to raise the quality of our doctoral training through the development of the White Rose ESRC DTC.

A range of methods are in place for managing and monitoring progress against these objectives and actions including: (a) biannual individual research meetings based on long-term research plans; (b) regular reviews by our Research Committees and the Faculty that include the application of research project, funding, output and impact metrics; (c) an established process of reflection on key aspects of research excellence; and (d) action by specialist staff (Directors of Academic Development, of Research and of Research Schools; Grant Capture Officers).

iii. Priority areas for development

Strategic initiatives. In 2013 we established the *Sheffield Urban Institute* (SUI) to act as a catalyst for interdisciplinary built environment research within the University. SUI aims to generate innovative solutions to enhance the environment, economic vitality and social equity of cities worldwide in response to the opportunities and challenges of global urbanism. Within Sheffield the Institute will develop innovative links between our design and built environment specialisms and the University's world-leading expertise in science and engineering. This hybrid interdisciplinary approach will explore new methodologies and techniques to create a unique and agenda-setting hub of expertise. SUI is one of a small number of projects supported by the University's 'Futures 2022' programme of initiatives which aims to grow areas of existing research strength over the next ten years so that they are internationally highly competitive. It will be an important mechanism for extending the scale, scope and ambition of our research and user engagement. In addition, we are

creating a *Centre for Designed Ecology* further to advance pioneering research on the incorporation of ecological and social theory into the design of sustainable urban vegetation; and a *Building Local Resilience* platform to integrate interdisciplinary research on the resilient design of urban buildings and neighbourhoods.

Research topics. In addition to the development of our existing strengths and strategic initiatives, we have identified three areas for targeted investment and the development of cluster based support. The first is methodological: examining the understandings produced by the **co-production of knowledge** through action research and related methods, on the one hand, and the use of ‘**Big Data**’, on the other. The second two are substantive. Our research potential relating to **housing policy and design** has been enhanced by recent recruitment and we plan to become a centre for innovation in the delivery of well-designed and sustainable housing that meets social needs. Similarly, we will bring distinctive built environment perspectives to bear on **international development**, emphasizing community engagement, informal action and design. This will be supported by the Sheffield Institute for International Development (launched 2012, with University start-up funding of £800k) and through the International Development pathway of the White Rose ESRC DTC.

Funding streams. As our REF outputs demonstrate, small and medium sized grants and practice-based consultancy may be used effectively to support world-class research. We will continue to make use of these opportunities. However, in our experience, large grants can significantly extend the scope and scale of research and its impacts, especially when that research involves large inter-disciplinary, international teams. For this reason, particular emphasis will be placed on developing the ideas and networks required for large projects in the areas identified above, funded by Horizons 2020, ESRC, AHRC, EPSRC, the TSB, Leverhulme and Nuffield.

Postgraduate research (PGR) activity. Our Research Schools are an integral part of our continual pursuit of research excellence. We will build on their distinctive character and standing through the White Rose DTC to attract the most able PhD students in our discipline. Priorities include the further development of the infrastructure for interdisciplinary PhDs, the strengthening of our pathways within the DTC and deepening the engagement between PGRs and research users.

c. People:

i. Staffing strategy and staff development

Our staff is pivotal to our success. We manage career development and succession planning through a combination of: (i) the recruitment and development of excellent early career researchers; (ii) the support and development of existing staff to achieve promotions at all career levels; (iii) training in research leadership; and (iv) the recruitment of senior colleagues to reinforce intellectual leadership and academic management. We offer a lively but demanding culture of excellence within which staff may thrive.

Between 2008 and 2013, our staff has increased by 11%. The departure of senior professors (*Crook, Lawson, Plank, Selman, Sharples, Swanwick, Till*) was addressed by recruitment (*Bauman, Flint, Samuel, Stevenson, Wagenaar*) and promotions to Chairs (*Dunnett, Fotios, Petrescu, Watkins*). This was balanced by the appointment (particularly in the last two years) of a group of new, young Lecturers of great potential, in parallel with some promotions to Senior Lecturer and Reader. Consequently, the average age of staff has declined from 49.1 years to 46.7 years, while the proportions that are Lecturer and Senior Lecturer & Reader have changed from 27% and 44% to 35% and 37%. The overall percentage of female staff has increased slightly (39% to 40%) but this masks a marked increase in the proportion of female Professors (17% to 31%). We have increased our overall research capacity, supported developments in new areas (such as neighbourhood resilience, digital visualisation and design, housing and homes, and international development) and consolidated existing areas of strength (such as history, planning theory, and participative design) while maintaining our research leadership, management and mentoring capabilities. We have also attracted internationally leading researchers and practitioners as Visiting Professors, Visiting Fellows and Visitors (for example, Susan Fainstein, John Forester, Piet Oudolf, Raf Orłowski, Carl Steinitz, Kongjian Yu). We will extend our visitors programme to facilitate collaboration with senior policy-makers, practitioners and other research users from the UK and world-wide.

We have a highly developed support framework for our staff. Early career academics have reduced loads to allow them to establish their research (within departmental Work Allocation

Frameworks). Workloads are monitored and good practice is shared to enhance efficiency. There are comprehensive University, Faculty and departmental programmes of mentoring and staff review, including the 'Sheffield Leader' programme for all levels of academic and research staff. All probationary staff undertake the University's Certificate in Learning and Teaching. Compulsory dual supervision of doctoral students enables new academics to work with more experienced staff, while the sharing of draft papers and research proposals and the formal review of the latter is routine for all staff. There is an established programme of study leave that balances individuals' development needs with the strategic requirements of the departments. We audit and share research plans to provide individual and collective support and to inform investment priorities. Early career researchers also benefit from Faculty initiatives to support their development.

In 2012 the University received the *HR Excellence in Research* award from the European Commission and we are committed to go beyond the seven principles of the *UK Concordat for the Career Development of Researchers*. We agree academic development strategies with research associates that include: time and funding to pursue research collaboration and dissemination; individual mentoring; bi-annual reviews of research plans, training and support needs, in addition to annual appraisals; tailored training and support events at departmental and Faculty levels; advice on and peer review of publications and grant applications; and opportunities to gain experience in teaching, academic network and event organisation and impact activities. An important initiative has been a focus on bridging the gap between PhD/PDRA activity and an academic career. Wherever possible – and in addition to specific job requirements - University Teacher and Research Assistant posts are treated as transitional appointments, leading to full academic positions and careers. In addition to internal promotions from such roles since 2008 (for example, *Awan, Dempsey, Ferrari*), others have progressed to academic careers elsewhere (for example, at Seoul National University of Science and Technology (Head of School); Queen's University Belfast; University of Nottingham Arab Academy for Science and Technology, Alexandria, Egypt; University of Liverpool).

The University's framework for Research Ethics and Integrity (REI) places good academic practice (Rigour, Respect and Responsibility) at its core and applies to all research active members of the University. A consistent framework for REI training was introduced across the University in 2012 for research staff and students. REI is audited annually by the University Research Ethics Committee (UREC), which undertakes a rolling programme of departmental inspections. These procedures enhance the quality and integrity of our research.

ii. Research students

We have been leaders in doctoral training for over 20 years and have an international reputation for excellence. Our Research Schools are vibrant, exciting places. Academic rigour and emphasis on knowledge into action ensure that our research students are intellectually embedded in their disciplines and aware of the practical implications of their work. This produces distinctive PGRs who are much in demand and crucial to the future of our disciplines and professions.

We recruit high quality students from across the world, an increasing proportion of whom hold competitive scholarships; for example, from RCUK (15; TRP awarded the highest number of ESRC quota studentships within the discipline during the REF period); overseas universities, governments, ministries and embassies (23), and the National Council of Science & Technology, Mexico (7). We have one of the largest PGR cohorts in the field in the UK. Registered research student numbers grew by 24% between 2008 and 2013 (from 138 to 171 FTE). 102 PhDs were awarded in the REF period, compared with 89 for the RAE 2008, an absolute increase of 15% and a relative one (awards per FTE staff by years of period) of 40%. Our doctoral training infrastructure has been significantly enhanced by the introduction of Research Council DTCs. Our students work within the White Rose ESRC DTC that was established in 2011. It is operated by the Universities of Sheffield (lead institution), Leeds and York and is one of the largest DTCs in the UK. It is a model of collaborative PGR supervision and development and **enables us to combine rigorous generic and high quality specialist training across a wide range of disciplines and subject areas, creating coherent support tailored to the particular requirements of each research student that runs throughout the life of the PhD.**

Core social science training is delivered at Faculty level. Our subject-specific training is provided through a designated 'Planning' pathway, drawing on our departments' long tradition of shared doctoral training. We also make a major contribution to the 'International Development' and

'Environment and Sustainability' pathways. Students can access additional specialist training from across the DTC over the course of their PhD. The DTC also runs an annual conference and other events and activities. This provision is available to all PhD students (not just those funded by ESRC). All students have a primary and a secondary supervisor and all academic staff are involved in research student supervision. Progress is monitored through biannual reviews. In addition to the written PhD, we offer a PhD by Design and a PhD with Integrated Studies. Ethical responsibility is stressed, accompanied by intellectual excellence linked to progressing theoretical, methodological, policy and practice agendas.

We give particular emphasis to interdisciplinary training and supervision. Our departments and research students (the latter allocated through invited proposals) are members of two ESRC DTC networks: 'Transformative Justice' (*Meth*) and 'Beyond the Riots' (*Flint*). Our other interdisciplinary PGR studentships are linked to: an ESRC Multidisciplinary Award network covering social science and engineering; the EPSRC low-carbon futures (e-futures) DTC; and the University's cross-cutting Digital World and Energy and Environment programmes. ARC and LSC are also part of the AHRC collaborative awards scheme. We currently co-supervise PhDs with the Departments of English, Geography, Mechanical Engineering, Civil & Structural Engineering, Computer Science, Animal & Plant Sciences, Chemistry, Politics, Psychology, Sociological Studies and Management. Supervisory practice is also informed by the staff's international PGR activities (as External Examiners for 71 PhDs in 15 countries) and collaborations (as co-supervisors of PhD students based in seven countries and as occasional overseas research student mentors, e.g. *Campbell* via AESOP/ACSP events) during the REF period. We also emphasise co-operation with other research partners; for example, through CASE awards (4) and the BEARS network that links several of our interdisciplinary PGRs with a local authority supervisor and an industrial advisory board to work on co-produced projects.

Our research students are fully involved in the life of their departments, benefitting from co-location and access to a wide range of facilities (see d ii) and membership of an appropriate research cluster. They run regular PhD seminars that include presentations from invited academic staff from Sheffield and elsewhere, reading groups, publishing workshops and employability sessions. Each department runs a seminar series involving leading scholars and practitioners. Each organises an annual PhD research conference that is open to all our PGRs. Participation in conferences and writing for publication is actively supported to develop academic craft and scholarship. Students have organised four national PhD conferences and special sessions at other conferences (e.g. RGS-IBG). Students have access to the University's Learned Societies Fund and additional departmental resources to support conference travel. They are encouraged to secure competitive external funding for such activities and to take on early career leadership roles (e.g. *Young* on HSA conference organisation and executive committee). Frequent visits by international PhD and post-doctoral students further enrich the PGR environment.

We provide structured support for PGRs' career development. Their training needs are identified in an annually updated Doctoral Development Plan. We offer them appropriately supported opportunities to contribute to teaching, and encourage them to enrol on the University's Postgraduate Certificate in Higher Education (ILT recognised); and to contribute to major research projects in support roles such as subject review or data entry. We run biennial workshops on careers and publishing in addition to students', University and DTC provision. The quality and standing of our Research Schools are evidenced by: (i) the prestigious awards held by incoming students (see above); (ii) the prizes and awards for their research (including: Garden History Society Award, 2011; Landscape Institute Award, 2011; RIBA President's Medal for best PhD, 2012; Italian Urban Institute INU (Istituto Nazionale di Urbanistica) Award, 2010-2011; Santander Research Mobility Award, 2011; Mexican National Housing Institute prize for best PhD, 2011; London Centre for Social Studies (LCSS) Prize, 2013); and (iii) their career destinations (examples from the REF period include an ESRC Fellowship [University of Sheffield Management School], a University of Manchester Hallsworth Fellowship, a range of lectureships [including the Indian Institute of Technology, Madras; Chiba University, Japan; University of Calgary] and policy posts in organisations such as the China Academy of Urban Planning).

d. Income, infrastructure and facilities

i. Research income

Compared with the RAE 2008 period, there has been a significant increase in our absolute and proportionate research income at unit and department levels; and a marked growth in the

share of that income derived from high quality, competitive sources. Research income grew by 21.9% (£1.17m) overall; while average annual income grew by 56.5% in total and by 36.5% per FTE staff. RCUK funding increased from 35.5% to 41.7% of income and EU government funding from 14.0% to 35.6%, reflecting greater involvement in large, collaborative, interdisciplinary, international projects (see e), in line with our research strategy (see b i). The rise in income for KT activities was also notable (see e ii and REF3a).

The links between research funding and research outputs are far from straightforward. We treat funded research projects as part of a wider, more complex process of knowledge production and dissemination that requires careful management to achieve high quality results (see other sections of REF5). We are adept at such management (see REF2 and examples below). We use precisely tailored small grants very effectively. Support from the Energy Saving Trust and Stewart Milne Group (£30k, 2008-9) for the first ever comprehensive building performance evaluation of a Code for Sustainable Homes Level 6 Zero Carbon Home, resulted in *Stevenson's* (1) identification of the lack of resilience in this type of home and the need for more robust solutions. *Samuel's* sixth British Academy Small Grant (£5k, 2010) led to the publication of two books (1, 2), one of which (1, *Sacred Concrete*) has been shortlisted for the RIBA President's Medals for University Based Research. *Tait* also used a British Academy Small Grant (£5.6k, 2007-08) to support fieldwork upon which is based his analysis of the role of trust in the local land use planning process (1, 2).

More substantial, free-standing projects underpin other leading intellectual contributions. *Williams'* research on embedding poor people's voices in local governance through participation and political empowerment in India (ESRC/DFID, £391k, 2008-2011) has produced findings that challenge current notions of citizen engagement in the global South (1-3). *Thwaites'* Leverhulme grant (£156k, 2008-2010) has supported ground breaking research on the spatial dimensions of human emotional fulfilment in outdoor open space (1-3). *Fotios'* work (2) on road lighting for pedestrians (EPSRC, £173k, 2008-10) demonstrated that lamps of broader spectral power distribution significantly enhance visual perception and performance. Our involvement in major research programmes further extends our academic reach through, for example, *Lange et al's* (3) discussion of a novel model integrating real time 3D visualisations with financial, physical and ecological appraisals (arising from Urban River Corridors and Sustainable Living Agendas, EPSRC, £0.375m/£2.4m, 2008-2012). Future growth in this area will occur as outputs emerge from our current large awards, for example: Photovoltaics for Future Societies, EPSRC, £1.2m, 2011-15 (*Chiles*); MERLIN, EPSRC, £0.4m/£1.2m, 2011-15 (*Fotios*, with UCL and City University); Stimulating Enterprising Environments for Development and Sustainability, EU Interreg, £0.24m/£1.96m, 2012-2015 (*Henneberry*, *Inch* and *Tait* with 8 EU partners).

Research income strategies

During the REF period research support has been enhanced at departmental, Faculty and University levels. We emphasise a strategic approach to grant income generation that aligns it with the realisation of individual potential and our broader research aims. All academic staff maintain 3-5 year research plans that are reviewed annually in meetings with Research Directors (*Petrescu* [ARC]; *Dunnett* [LSC]; *While* [TRP]). Dedicated income capture officers (*Sorrill* ARC/LSC; *Beecroft* TRP) have been appointed during the REF period. There is an annual research and travel budget (e.g. TRP: £800 pa per academic staff) that includes allocations from the University's Learned Societies Fund (with provision also made for PDRAs and PGRs). The three departments have research stimulation budgets to support bid development (a total of £56k for 2012-13) and our research clusters are sources of new ideas for research proposals, impact and publication. Our research income strategies are also informed by intelligence from our industry partners (see e ii).

Faculty research support is substantial and growing, providing help with funding proposals, enhanced PGR management and new opportunities for interdisciplinary collaboration. Funding is available for pilot research, network creation, conferences and seminars, the development of research proposals and the pursuit of major research initiatives. For example: *Fotios*, *Lange* and *Henneberry* currently hold Faculty Advanced Research Fellowships totalling £309k to underpin research development; and *Henneberry* and *While* were awarded £85k in 2013 to develop an interdisciplinary research programme on critical infrastructures. There is additional Faculty/University support for the development of major funding applications (for example, to Horizons 2020, ESRC, AHRC, Leverhulme).

ii. Infrastructure and facilities

During the REF period we have benefited from substantial University investment in research infrastructure and facilities. ARC and LSC are accommodated in the Arts Tower, the £36m refurbishment of which was completed in 2011. Their Research Schools are co-located on floors 9 and 10. PGRs have individual workspaces, their own kitchen and 24-hour access to the building. The Faculty has provided capital funding of £241k for new facilities and equipment for building science research (ARC) including a semi-anechoic chamber, a reverberation chamber, a wind tunnel, an artificial sky and heliodon, light simulation models, a thermal imaging camera, a range of environmental sensors, surveying equipment and video editing facilities. There is also a model-making workshop with three 3D printers, two laser cutters, a CNC router, machine tools and software packages, a new materials library (with additional £17k funding from Alumni) and a new prototyping workshop in the George Porter Building. Four senior and three junior technicians with dedicated office areas support the IT, print, model and photography activities in the workshops. £120k was provided by the Faculty to develop new LSC laboratories to support research in designed ecologies and digital technologies; and to acquire iPads for use in field surveys. Additional space provides a base for visiting scholars from around the world. Significant investment in TRP's building (£1.5m) has created dedicated, purpose-designed space and IT facilities for its PGRs who had previously been located in dated accommodation elsewhere. Additional room has also been made available for visiting scholars (eight new workspaces) that has enhanced the research environment. The creation of more extensive and flexible office accommodation for research associates has supported the growth of funded research activity.

e. Collaboration or contribution to the discipline or research base

Collaboration – across disciplines and national and other contexts, and with research subjects and users – generates novel ways to look at the object of study, producing new understandings and more penetrating insights. It greatly enriches our research environment.

i. Interdisciplinary research and support

Interdisciplinary research is a pre-requisite of an effective response to the complex problems encountered in the planning and design of the landscape and the built environment. Practically, it reflects the multi-faceted character of these problems. Intellectually, it prompts the creation of new perspectives and paradigms outside the traditional canons of our applied disciplines – and the subjecting of these ideas to robust testing from a range of established theoretical perspectives, resulting in higher quality research.

Our staff is drawn from a wide range of disciplines including - in addition to architecture, landscape and planning - ecology, economics, geography, politics and urban studies. 80% of staff have undertaken significant interdisciplinary work during the REF period with colleagues in almost 100 (sub)disciplines (from anthropology to vision science; criminology to theology) in 18 departments in the University of Sheffield and departments in over 200 other universities. This work has been in support of scholarship, academic debate and the development of ideas on the one hand, and funded research projects and programmes on the other. It frequently involves industry and international collaboration (see e ii and iii below).

In relation to scholarship, for example, collaboration with a mathematical plant ecologist helped *Hitchmough* (3) to develop a sophisticated quantitative understanding of the dynamics of designed vegetation. *Woudstra* worked with historians to develop new perspectives on the relationship between landscape and social-cultural history. New understandings of the use of discretion in policy implementation have derived from *Henneberry's* (2) work with a political scientist and *While's* (1) insights on eco-state restructuring arise from long collaboration with human geographers. *Blundell-Jones* has published extensively with *Woudstra* to provide more coherent theory on how the exterior spaces of buildings relate to the interior.

Research projects are an equally effective source of interdisciplinary advance. *Dunnett* worked with Sheffield Engineering (EC Framework 7, £571k) to integrate understanding of how different plant species and types affect storm-water run off from green roofs. *Fotios's* MERLIN project (EPSRC, £417k) with a vision scientist has demonstrated the role that perception plays in road lighting. *Wigglesworth, Tait* and *Barnes* (SchARR, a health analyst) are currently exploring how better design can facilitate mobility, connectivity and wellbeing for older people, using a participatory approach to design research (AHRC/EPSRC, £705k, 2013-15).

As indicated by these examples, working across theoretical and methodological boundaries is an inherent aspect of our research environment. It informs all of our research support mechanisms (see c and d i). We also benefit considerably from the Faculty's Interdisciplinary Centre of the Social Sciences (ICoSS) that runs seminars, workshops and training events on interdisciplinary scholarship and research, and the development of interdisciplinary research networks, projects and programmes. The Research Exchange for the Social Sciences (RESS) provides major support for interdisciplinary knowledge exchange with industry and government and for generating impact from such research.

ii. Research networks and industry collaborations

We work strategically with key industrial partners and networks that can most benefit from, and enhance, our research expertise. This mutuality means that our research is informed by and has impact upon the current needs of research users at international, national, regional and local levels. It also ensures that users are a source of new ideas and understandings and of resources, and are directly related to our research groups, thereby enriching our research environment. Over 70% of our staff have had significant research engagement with industry during the REF period. They have worked with almost 250 companies and organisations (for example, ARUP, Balfour Beatty, BP, DFID, the National Physical Laboratory, Phillips, Rightmove plc, UN-HABITAT) in 39 countries (including the USA, Brazil, Germany, Kenya, India, China, Japan, and Australia). This activity frequently involves interdisciplinary and international work (see e i and iii). It is based on long-term relationships, many of which have been supported, since 2008, through 39 institutionally funded KT projects (£440k via HEIF, see REF3a) and six EPSRC/ESRC Knowledge Transfer awards (totalling £222k). Apart from increasing impact, this work helps to shape our wider research priorities reflected, for example, in *Watkins'* critical analysis of local housing systems with Fordham Planning (ESRC, £109k, 2008-10) and *Samuel's* work on housing design with volume house builders, involving Taylor Wimpey, Radian RSL, Design for Homes and the RIBA (AHRC, £250k, 2012-13). We have also developed direct industry funding of PhD research, with Igloo, Boningale Nurseries (Wolverhampton) and the Royal Horticultural Society providing studentships in 2013.

Such work allows theoretical questions to be integrated with the more near market concerns of the funders, and produces high quality research outputs as well as societal and impact benefits. Our innovative emphasis on participative, action research methodologies leads to the fundamental involvement of research users and/or subjects in the co-production of knowledge from research projects (see REF3a, sections b 3 and 4). Examples include *Wagenaar's* (2) major contribution to prostitution policy in the Netherlands and Austria, and *Petrescu's* work on new urban infrastructures using design participation that was supported by strong links with the French Ministry of Ecology (R-Urban project). Finally and very practically, industry partners may provide important resources for research. LSC obtains external fieldwork space from Sheffield CC, the Green Estate and the RHS to run long term ecological experiments (5-10 years compared with the 3-year maximum supported by conventional research funding) with a commensurate and unmatched increase in research perspicacity (*Hitchmough*, 2).

iii. National and international academic collaborations and networks

The research of over 90% of our staff involved inter/national collaboration during the REF period. They worked with colleagues in over 220 universities in every continent (including Harvard University, University of Sao Paulo, ETH Zurich, University of Cape Town, Indian Institute of Technology Madras, Beijing (Peking) University, University of Tokyo, University of Sydney).

We participate in international collaborations and networks in order to exchange ideas, to understand better the perspectives of others and to promote our own scholarship and research internationally. This allows us to contribute to and draw from emerging strands of thought in other countries and to reinforce our status as intellectually leading departments. Such work frequently involves interdisciplinary and industry collaborations (see i and ii above). These activities enrich our research environment and are measures of success, especially the quality of the resulting intellectual contributions.

Thus *Campbell* has worked closely with Fainstein (Harvard) on the application of theories of justice to planning that challenges planning theorists and urban policy-makers to focus on substantive policy outcomes alongside processes of inclusive deliberation (3). And *Meth's* long-

term fieldwork in South African townships with researchers from the University of KwaZulu Natal underpins her challenge of dominant assumptions about the interconnections between violence, fear, gender and place (1-4). *Hitchmough's* collaboration with Sjoman (SLU Alnarp, Malmo Sweden) combines the latter's contacts with the Institute of Botany, Romanian Academy of Science, with the former's expertise in the ecology and design of climate responsive vegetation to produce new insights into herbaceous vegetation types for use in warming urban climates. *Kang's* leadership of the EU COST soundscape network has made a major contribution to our understanding of soundscape and the built environment. *Stevenson* has begun work with Baborska-Narozny (Wroclaw University of Technology, Poland, EU FP7-PEOPLE-2012, IEF, £250k) to develop a new building performance evaluation methodology that includes social learning and usability studies, building on her previous work with UK housing developers (1, 2, 4).

In addition to individuals' activities, our departments have an established network of universities with whom we pursue research. All involve staff exchanges/visits at Professor and/or Fellow levels and the degree of PGR and PGT interactions is growing. The institutions are: the Universities of Harbin and Tongji and the Beijing Forestry University; and the Universities of the Witwatersrand and Aalborg. A recent development that reflects our focus on theory into action is the partnership between Sheffield and the University of Seoul that also draws on their respective relationships between Sheffield City Council and the Seoul Metropolitan Government to further research and knowledge exchange.

iv. Wider academic and professional contributions

We play a major role in leading and supporting the development of intellectual debate in our field. During the REF period our staff have **presented more than 1,000 conference, seminar and workshop papers** - including over 500 invited papers, 100 keynote papers and 100 plenary papers - in 47 countries. Colleagues are **Editors of 10 journals**: *Architecture and Culture*, *European Journal of Acoustics* (for environmental noise), *field: journal of architecture*, *International Planning Studies* (European Editor), *Housing Studies*, *Journal of Landscape Architecture* (for 'The Thinking Eye' section), *Journal of Temporal Design* (Associate Editor), *Landscape Research* (Associate Editor, shortly to succeed as Editor), *Planning Theory and Practice* (Senior and Associate Editors) and *Regional Studies* (for property and planning). They have **Guest Edited special issues of 10 journals**: *Built Environment*, *Building Research and Information*, *Criminology and Criminal Justice*, *International Journal of Housing Policy*, *Journal of Environmental Management*, *Journal of Landscape Architecture*, *Multitudes*, *Planning Practice & Research*, *Town Planning Review* and *Urban Studies*. Staff are **members of the Editorial Boards of 50 international refereed journals**, including *American Review of Public Administration*, *Architectural Science Review*, *Landscape and Urban Planning*, *Journal of Property Research* and *Journal of Planning Education & Research*. They have also **reviewed papers for over 230 journals** including all the leading titles in our fields and have **reviewed proposals for 21 publishers**, including CUP, OUP, Routledge, Taylor & Francis and Wiley-Blackwell.

Staff have **reviewed research proposals for 49 funding agencies in 17 countries**, including the national science foundations of 13 of them, and amongst others in the UK: AHRC, ESRC (plus College Members), EPSRC (plus College Member), British Academy, British Council, Leverhulme, Nuffield, Royal Society, TSB and Wellcome; and hold scientific advisory positions with government research funders in Denmark, Germany and Italy. Staff are also active in providing / contributing to research-based CPD events. We make a substantial **contribution to the work of 72 professional associations and learned societies** in our field, including eight European and six international organisations. These cover our related professions (RIBA, LI, RICS, RTPI) and subject areas (for example, International Association of Acoustics & Vibration, Architecture Humanities Research Association, Garden History Society, Housing Studies Association). In 29 instances, staff play significant roles in these organisations, such as Chairs, Trustees, Board and Committee Members, Scientific Advisers and Journal Editors. Many staff have received **recognition for their research**, including: *Kang's* Tyndall Medal, 2008, UK Institute of Acoustics; *Wigglesworth's* RIBA Northern Network Project of the Year Award - White Rose Award, 2011, for Sandal Magna Community Primary School; *Rae's* Early Career Excellence Award, Regional Studies Association, 2010; *Campbell, Dabinett and Henneberry's* election to the Academy of Social Sciences, 2010; *Hitchmough's* BNA Fellowship 2012 for his work on the Olympic Park; and in 2013, *Lange* was the first ever recipient of the ECLAS Outstanding Researcher Award.