

<b>Institution: Nottingham Trent University</b>
<b>Unit of Assessment: D34 Art and Design: History, Practice and Theory</b>
<p><b>a. Overview</b></p> <p>This submission builds on previous RAE submissions, sharing their range of activity: from research embedded in creative practice to design development deploying methods from applied science. This range of approaches is the unit's distinctive strength, making alliances between rigorous technical creativity, cultural and social insights and art practice. Academics contribute to the unit from two schools, the School of Art and Design and the School of Architecture, Design and the Built Environment, both in the College of Art, Design and the Built Environment at NTU, their work managed by an Associate Dean for Research in the College, and a Research Coordinator in each school. This statement describes how the strengths in that diversity have been focused since 2008 through research groups that present areas of strong current performance and income generation, and areas that are being supported for development over the next REF period. The success of this strategy shows in a marked increase in income, a community of researcher-practitioners with strong regional and international links and a vibrant research student body.</p> <p>The research groups are: <b>Fine Art</b> - practice-led enquiry in art that engages with ethical and social questions and themes of place; <b>Advanced Textiles</b> - work in textiles that integrates smart technology with fibres, fabric and clothing through design and application-orientated R&amp;D; <b>Creative Textiles</b> – combining historical/anthropological research in textiles with contemporary practice and with heritage organisations; <b>Sustainable Consumption</b> - integrating design and social science approaches to sustainability, contributing to policy and social innovation; <b>Product Design</b> - design-led research in product engineering for sustainable manufacture and for health.</p> <p>The work of the research groups is underpinned by <b>developing</b> areas of research, including work on regional and international textile heritage, digital craft and photography in a globalised image-culture. Beyond these, <b>focused</b> areas of development include Fashion Marketing, Design Processes and Innovation and Creative Technologies. A key feature of the research environment in the unit is the porous boundaries between these areas of work - individuals move between them as appropriate. Examples include Fashion and Textile postgraduates with creative design backgrounds focusing on the most advanced work in computerised production technology, or realising in garments experimental work on fibre-embedded electronics.</p>
<p><b>b. Research strategy</b></p> <p><b>Relationship to RAE2008.</b> RAE5 for NTU's submission to the former UoA 63 set the following strategy for the period 2008-2013: to increase the number of research active Readers and Professors in School of Art and Design, to increase Postgraduate Research Student numbers and to increase the number of successful bids to external research funding bodies. This submission to REF 2014 provides clear evidence that the unit has successfully delivered on this strategy. Six Professors (Cooper, Cox, Dias, Higgins, Kent, Newling) and four Readers (Breedon, Crabbe, Edwards, Oddey) have been appointed since 2008, which has increased the establishment of research leaders from 9 to 14 (12.2fte). This recruitment has moved the organisation of research in the UoA from a structure based on subject groupings, to one that focuses the unit's strengths to engage with specific groups of research users. For example work has focused on industrial innovation (Su, Breedon, Crabbe) and on collaboration with research users in art and heritage (Higgins, Briggs-Goode, Fisher). PGR recruitment year on year held steady in the face of economic pressure on self-funded students. Of the 14 completions in the period, three were RCUK funded students (two AHRC CDA and one EPSRC CASE student). Four were recruited through the AHRC's transitional block grant award. The end of the period saw three students recruited to the EPSRC UK INDEMAND Centre to enrol in academic year 2013-2014. The average size of the student body over this period was 34.</p> <p>External funding won by the unit has grown year on year since 2008. With year on year growth of over 50% from 2008/9 to 2011/12 and an average from 2008/9 to 2012/13 at £454,500 per annum, income from all sources rose from £68,000 to £830,000, totalling £2,250,000 over the period.</p> <p><b>Aspirations 2014-2019</b></p> <p>With the revised research structure now in place (detailed below), the strategy for 2014-2019 is to:</p> <ul style="list-style-type: none"> <li>• use the UoA's national and international profile to grow activity in areas of focus including the</li> </ul>

**Environment template (REF5)**

University's thematic priority area, Creative Economies, and in design innovation.

- increase the quality of all relevant forms of output – patents; monographs; journal articles; creative practice – and the proportion of research active staff by managing workloads.
- consolidate and where possible continue growth in research income, while growing the focused areas for development outlined above through leadership appointments to coordinate development of research, research students and teaching activity.
- maintain the focus on PhD activity, culture and student experience, increasing numbers as a consequence of increased research activity and supervision capability.
- use the group structure to further link art and design practice to work in other disciplines, to support national and international priority agendas, e.g. the Technology Strategy Board and EU 'Grand Challenges'.
- improve our research impact in all areas, and in particular to build cross-disciplinary work in advanced textiles through a commercial R&D centre that contributes to UK economic regeneration.

**Structure to support interdisciplinary and collaborative research**

The characteristic of the unit is its range of activity. The well-managed research groupings create a 'matrix' of research strengths that links art and design practice to work in other disciplines and is the platform through which the research strategy 2008 - 2013 has responded to the university's Strategic Plan to grow quality in research. These links go in several directions – towards science and engineering (Dias, Su); humanities (Edwards, Ferry, Brown); social sciences (Cooper, Fisher, Kent). Collaborations between researchers pave the way for future development, such as work in interactive arts that feeds into NTU's Creative and Virtual Technology lab (CVT). This is the platform for the UoA's development in Creative Technologies - an interdisciplinary and exploratory digital Art & Design-led research centre where architects, artists, crafts makers, designers, engineers and computer scientists collaborate to explore the potential of new visualisation techniques and digital design models and processes. This connectivity is also reflected in the UoA's involvement in Nottingham's development of a 'Creative Quarter' and in plans for growth over the next five years including research that grows out of subject strengths, centred on design processes in professional and everyday settings and the relationship between fashion, culture, markets and innovation. These actions to shape the research strategy respond to both internal opportunities and external factors, addressing the 'grand challenges' that face society through research that has 'critical mass', is internationalised and facilitated by the cross-disciplinary matrix.

The effectiveness of this strategy, which is set, monitored and evolved by the School Research Committee, is manifest in bidding success and the development of strong cross university and external relationships, particularly addressing the challenges of environmental and economic sustainability. Examples include: £5m UK INDEMAND centre led by University of Cambridge (Cooper) (EPSRC Ref: EP/K011774/1); EPSRC feasibility account 'Smart Materials – Designing for Functionality' (Fisher, Dias, Johnson, Breedon) (EPSRC Ref: EP/IO16414/1); AHRC funded Creative Economy Knowledge Exchange (CEKE) network with the University of Nottingham (Briggs-Goode); work on fabric antennae with the University of Sheffield funded by Defence Science and Technology Laboratory (DSTL Ref: DSTLX1000073729) and with University of Loughborough funded by EPSRC (Dias) (Ref: SP/02/5/10); National Institute for Health Research funded work on stroke rehabilitation with Nottingham University Hospital (Breedon) (i4i Ref: II-LA-0712-20004); European Union FP7 Environment programmed supported a project on LED lighting with 12 partners across Europe (Su) (FP7 Ref: 282793); series of WRAP funded projects on clothing lifetimes (Cooper, Fisher, Townsend). The matrix approach also facilitates cross-disciplinary PhD supervision with the School of Arts and Humanities, cross-disciplinary engagement with local arts agencies such as Nottingham Contemporary and New Art Exchange and contribution to the UoA's £1.78m EU funded Future Factory project to provide sustainable business development support to SMEs (see REF3a) (ERDF Ref: EMX05560).

Our strategy in the years beyond REF 2014 includes strengthening the research groupings by enhancing their impact. Consequently, 2008-13 has seen areas with significant impact potential scaled up through actions at College level. For example, in the area of Advanced Textiles, the College has made significant investments towards setting up a commercial R&D centre and work in the Fine Art group has focused on the impacts of practice-based enquiry on society, evident in

the impact of work of individuals on systems of belief (Newling, Judd).

The research groups have strong international links including projects funded through EU grants (Su: Marie Curie- Asia Link) and the Leverhulme Trust (Edwards). The Fine Art research group is engaged with the Society of Artistic Research, a collaboration across Europe developing on-line archiving and publication of research through art practice, to which the School of Art & Design gives financial support as a sponsoring institution. Through analysing and developing the impact of our research, we have identified areas for consolidation and development that build on the UoA's historic strengths, as well as emerging themes, and individuals. The revised research groups all show strong academic output or impact, and in several cases both, inclusively promoting our areas of high performance by providing individuals with opportunities to develop their research and practice. This is reflected in the monthly Researcher Forum, a platform for consultation and discussion open to all research-active staff. In summary, the strategy for managing UoA D34 2008-2013 has been to promote excellence and performance through the concentration of research groups thereby improving the quality of outputs, matching this with support from QR funding for emerging groups and early career researchers, enhancing collegial support for groups and for individuals through workshops and development events and to use the research groups as platforms through which to win research funding.

### **Research Groupings**

The research groupings representing our areas of strength are: (i) Advanced Textiles; (ii) Fine Art Research; (iii) Sustainable Consumption; (iv) Creative Textiles and (v) Design for Health and Wellbeing and (vi) ADMEC (Advanced Design Manufacturing and Engineering). Other established areas of work focus on the regional textile heritage and the embodied knowledge that underlies both established and emerging craft practice, photography practice in a globalised image-culture and art & design pedagogy.

**Advanced Textiles**, led by Prof Dias builds on the UoA's long track record in textiles (see REF3b 'Advanced Textiles'), addressing specific design domains, generating and applying knowledge in the innovation of fibre materials, producing smart and intelligent textiles to be exploited by international industry partners including Intel, Stoll, and Adidas, and NHS Trusts. The group's unique expertise in fibre processing, characterisation and production through knitting, weaving and braiding focuses on electronic textiles - integrating electronics into the core of yarns to produce robust, fully flexible, machine-washable smart clothing. Potential applications for the core technology range from monitoring the body's vital signs in the medical industry, to performance monitoring of athletes, to measuring the performance of structures in architecture and textile composites in the aerospace industry. Income to the group includes funding from EPSRC, EU, and the Leverhulme Trust and it is in partnership with a number of global companies. As well as engaging with design in the School, the group collaborates across disciplines with, among others, Sheffield, Loughborough, Southampton and Salford Universities, generating 9 patents since 2008.

The **Fine Art Research** group, led by Profs Higgins and Shave, brings together practice-based work that engages with local, regional, national and international contexts for practice through formal and informal institutional structures. The group's focus includes concerns integral to art, as well as art's relationship to the challenges that face culture and society. It brings together several clusters of interest, including work that inspects belief systems (Newling, Davey, Judd, Higgins); work that ascribes a critical value to provisionality or contingency in art practice (Cocker); performative practice that engages with elements of urban and other spaces (Brown, Cocker); critical craft practice, spanning applied arts practice and materials-orientated art practice (Townsend, Fisher C., Maier). Twice a year the group comes together for a 'summer lodge' and a 'winter lodge' at NTU, to test practice, critique and dissemination, inviting international colleagues and feeding into the development and dissemination of individuals' research, practice and teaching. This ensures that the school has 'porous borders' and strong relationships with arts institutions locally (Nottingham Contemporary, The New Art Exchange) and internationally (Bergen Academy of Art and Design, Norway) as well as with international bodies such as the Society for Artistic Research and interventions including World Event Young Artists (Shave). In the period members of the group have won £294,500 from Arts Council England to support their practice.

The multidisciplinary **Sustainable Consumption** group, led by Tim Cooper operates in the international field of design research on environmental and social sustainability. Members are drawn from across the College, integrating expertise in design with frameworks drawn from the

social sciences. Through Cooper it is part of a new £6m RCUK funded UK INDEMAND centre (EPSRC Ref: EP/K011774/1), which aims to promote sustainable materials use in UK industry. Group members bring particular expertise in research relating to product lifetimes, influencing policy and understanding everyday practices, particularly in the clothing and electronics sectors. The group has secured significant funding from the Department of Environment, Food and Rural Affairs (Defra) and the Waste Resource Action Programme (WRAP) for a series of projects concerning design, manufacturing and behavioural influences on clothing lifetimes (Cooper, Fisher, Townsend). Building on Cooper's international profile in sustainable design and his influence on policy and the literature on product longevity (see REF3b 'Public Policy on the Sustainability of Consumer Goods'), the group integrates Fisher's work on the materiality of social practices, connecting to the Design Research Society Special Interest Group Objects, Practices, Experiences and Networks. It also provides support to Future Factory, impacting on SMEs.

The **Creative Textiles** group, led by Edwards, promotes research in textiles, dress and material culture that engages with both theory practice, with a major focus on the significance and meaning of textiles across cultures and covering a range of social contexts and historical periods. Edwards' own research in *Global Cultures of Textile and Dress* involves local, national and international collaborations with academic partners and others from industry, cultural institutions and practitioners, including V&A, British Council, Garden Silk Mills (India) and Maiwa Handprints (Canada). The group has won significant funding from the Leverhulme Trust for Edwards' research and curation of Indian Craft textiles and dress (£45,000). Through Ferry it has a strong profile in work on the history of Victorian and Edwardian interiors and material culture. The group includes a sub-group working on *Lace Heritage*, developed out of 2008 AHRC funding led by Briggs-Goode, to develop an on-line catalogue for the School of Art and Design lace collection. This work has developed national and international collaborations with V&A, the Bowes Museum and the Cite de la Dentelle et de la Mode, Calais and a close relationship with Nottingham's City Museums and Galleries, as well as funding from the Pasold Research Fund and AHRC/ EPSRC Science and Heritage programme. In parallel, this activity has stimulated work concentrating on understanding and putting to use the embodied knowledge in textile craft and industrial production. This *Digital Craft and Embodied Knowledge* sub-group, led by Townsend has underpinned further funding from the Science and Heritage programme in collaboration with the V&A, Nottingham City Museums and Galleries, the national archives and historians at Manchester Metropolitan University and NTU.

The **Product Design for Health and Wellbeing** group, led by Breedon, has built a track record for cross-disciplinary research, product development and innovation addressing a range of users. Dr Breedon has strong links with the Nottingham University Hospital and Medilink (East Midlands), through medical device development and biomaterials using and enriching design methodologies and adding value to the health sector through person-centred work (Kettley). Current projects include development of medical devices using smart technologies and materials, including responsive ocular prosthetics; stroke rehabilitation systems; Cricothyrotomy devices; artificial muscles; monitoring of personal physical activity/inactivity; biomimetic additive manufacturing to produce non-homogeneous medical devices using 3D printing. Breedon chaired the first international conference on Smart Design in November 2011 and chairs the Biomaterials Special Interest Group as part of Biomat-IN, a collaboration of five European clusters working to foster innovation in the area of biomaterials through transnational cooperation.

The **Advanced Design, Manufacturing and Engineering** group, led by Su, engages design methods with production through product life cycle analysis, sustainable design and enabling technologies for product design, including manufacture, condition monitoring, wireless computing, and sustainability technologies. Its impact through sustainable product design and development include an eco-lighting product now marketed in Europe. Funding since 2008 totals £1.5 million from programmes including FP7, RC and other governmental and regional funding programmes and industrial partners such as ALJ-Toyota, Boots, Philips, Chemineer, Merlin Robotic Systems, and Nottingham City Hospital. The group has a strong international reputation and relationships in particular with European countries and China through partnerships with a number of research institutions including Fraunhofer (Germany), Sirris (Belgium), Wuppertal Institute (Germany), State Key Laboratory of Mechanical Transmission (China) and Harbin Engineering University (China). As the founder and leader organiser, the group has run a series of International Conferences on Advanced Design and Manufacture since 2006 (<http://www.adm-global.org/ADM2013/home.php>).

Several areas of work in the UoA have strong potential for development beyond 2014, Product Design among them, further realising its ability to address social, environmental and economic challenges through research that crosses disciplinary boundaries, engaging applied science with culturally informed human-centred approaches. Other, emergent, groups in the UoA also have potential for development, for instance in Fashion Marketing with the appointment of Kent in 2013. The research groups are self-governing communities of scholars, resourced and supported by the College Management Team (CMT) via the School Research Committee. Each has a web site showing their thematic concerns, members, projects and impact from their activities as well as external collaborators, both academic and industrial.

### **c. People, including: Staffing strategy and staff development**

The UoA supports individuals' research in the following ways: participation in research group events; focused training structured around the NTU Researcher Development Framework; mentoring by senior researchers (research group leaders); peer mentoring and critique of practice through the Summer Lodge and Winter Lodge (Fine Art Research); Research Office support for bidding; monthly 'researcher forum' meetings; fortnightly research seminars. Overall, we operate to share good practice and stimulate bidding through peer-review of outputs and mentoring – developing individuals' progression through the awards and titles system.

Alongside the appointment of new Professors and Readers since 2008 we have included a number of Visiting Professors, researchers and students in our work, supporting our planned development and international networks through the university's visiting student and visiting scholar schemes. This has attracted 3 students and 15 scholars over the period. The UoA develops individuals through the research groups to help them to manage their time and take a strategic view of their research and practice, its contribution to the aims of the UoA and its role in their career progression. This is achieved by linking individuals' research plans, the yearly appraisal system and the University-wide Management of Academic Workload (MAW) system, making it possible to reflect research performance in the annual Personal Development and Contribution Review (PDCR) with their line managers. The Deans of the two schools, the ADR and Research Coordinator work closely to ensure this system resolves demands from teaching and from research, ensuring support for ECRs and newer researchers (Harty, Hurley).

Developing early/ mid-career staff is based on three principles: providing informal and formal mentoring; supporting the development of individuals' research/ professional networks; involving individuals in shaping future research through the Researcher Forum. Targeted financial support is available through applications to QR funds, managed through the School Research Committee to facilitate project development and bid writing, fieldwork and outputs (inter alia). QR funds also support short periods of research leave, conference attendance and production costs for outputs as well as funding to enhance impact by supporting staff in publicising their work.

This integrated approach has led 4 staff to be promoted to research posts as Professor (Higgins) and Reader (Crabbe, Breedon, Edwards). Consequently, the unit has a balanced demography including early, mid-career and experienced researchers, and professors on fractional contracts for continuity and mentoring. Formal mentoring by research leaders includes subject-specific bidding and publication surgeries, complemented by college-wide events to shape research plans beyond 2013 including workshops and seminars that draw in external academics as contributors and participants to develop networks and research themes, for instance in collaboration with the Design Research Society through the OPEN Special Interest Group. Other activities, such as the annual College Conference, the University-wide regular Low Carbon meetings, and engagement with the Future Cities initiative of the City Council provide opportunities for cross-pollination and cross-disciplinary development.

The university has embedded the Vitae Concordat and Researcher Development Framework into its core systems, to support researcher career development of research staff, with NTU's Equality and Diversity Champion participating as part of the Vitae Equality and Diversity Champion Network. NTU holds the European HR Excellence in Research Award, in recognition of its commitment to enhancing the working conditions and careers for its researchers. A wide range of case studies informed by NTU's work in this area are available on the Vitae website. The NTU Graduate School focuses on PGR development, training and supervisor training, while the College focuses on improving the quality of the publications, impact and income generation. For example, there have been staff training sessions for PR and engagement with the press, and investments in

promotion of research (production of videos, etc) and enhancing impact. Research assistants, fellows and PhD students are all attached to specific research projects and assist in bid writing, conference organisation, impact data collection and analysis and broader research issues to assure training a new generation of researchers.

Fractional and category C staff are integral to the staffing strategy in the UoA. The submission includes 9 fractional staff (Harty, Goworek, Judd, Oddey, Andersen, Cocker, Maier), and two fractional professors (Newling and Higgins). Their creative practice connects the unit to national and international networks of researchers and practitioners, ensuring the influence of our research on practice. The category C member of the unit (Davey) has been supported through QR funding as a key member of the *Fine Art Research Group*. The College Research Office supports individual staff, providing targeted updates on funding calls and submission deadlines and supporting grant application processes, both directly and by maintaining relevant databases, while the University's Research Grant Capture Team support and coach staff on bid writing. Such efforts have increased income generation to the unit since 2008.

**Research Students** In the period 2008 – 13, 14 PhDs have been awarded and the average size of the student body has been 34. Among those 14, individual careers paths have included starting their own arts research consultancy, winning research posts, including in a world-leading sustainability research unit at University of Sussex, and entering academia as a lecturer. Five PhDs were awarded in the year 2007 – 2008. In NTU's PhD student body, 74.2% qualify with a research degree.

The strategy for postgraduate research has been to identify and advertise PhD projects linked to areas of research strength, meaning that many of the PGR students have received industry funding. Its success is marked by RCUK's recognition of the quality of the unit's research training, funding ten studentships – two AHRC Collaborative Doctoral Award, four AHRC Transitional Block Grant, one EPSRC Case studentship, three EPSRC studentships via the UK INDEMAND centre. The UK INDEMAND centre shows the strategy mentioned above in action, with a strong formal relationships between PhD students and the research project. The centre funds three PhD bursaries over its five year life, with the university committing three further matched bursaries. This builds on the university's support for PhDs through the Vice Chancellor's annual bursary competition, which supports areas of strength that match the university's research strategy. Bursaries at school level have also been provided in the REF period to support the schools' research strategy. The Unit is engaged in a range of initiatives to maintain the sustainability of its PGR community, notably its inclusion in the AHRC Doctoral Training Partnership bid as part of the successful Midlands Three Cities Consortium. Across the Consortium, this equates to funding of £14,600,000 for 205 PhD studentships, accompanied by a Student Development Fund and a Cohort Development Fund, which all institutions in the Consortium match on a one-to-one basis. This delivers 410 studentships for the Consortium for arts and humanities, which will play a major role in the future sustainability of postgraduate research in our UoA.

**Managing students.** Research student management reflects the cross-disciplinary ethic of the research environment, both in their supervision and in formal training through a certificated programme delivered through the three years of a full time student's career in collaboration with the Schools of Arts and Humanities and Education. The Graduate School is responsible for research student administration, working closely with this unit's Postgraduate Research Tutors to administer student recruitment, training, progress monitoring, transfers, examinations and awards. Operational overview and research degree governance rests with a College Research Degrees Committee.

**Collaboration – across disciplines and institutions.** PhD students' theses, many of which are practice based, frequently reproduce the connections between disciplines implied in academic staff's research, requiring collaboration over supervision across the university with Cultural Studies, History, Psychology and Business Studies. Cross-institutional collaboration over the region also supports students' training through NTU's involvement AHRC funded programmes such as Design Advanced Research Training led by the Birmingham City University. A durable relationship between NTU, Birmingham City University, Sheffield Hallam University and Coventry University also results in regular regional PhD seminars. Most recently, students in the UoA have been involved in the AHRC funded Skills Development project 'Knowledge Exchange in Design' capitalising on the relationships built up through research projects with institutions including the

British Library, The V&A and The Natural History Museum.

**PhD students in the UoA.** These collaborations show the approach to PhD activity shares characteristics with the research environment more generally, valuing the developmental aspect of supervision for individuals in building their own research profiles. The numbers of students in the UoA makes this a reality, reflected in jointly authored publications. This is followed through with PhD students assisting on research projects and by using QR funds to support data collection to enhance their training and careers. The day to day experience of PhD students includes interaction with the research groups through events, seminars, workshops etc. in which they play a crucial role, both contributing and learning. For example, practice-based PhD students participate in and contribute to the Summer Lodge and Winter Lodge run by the *Fine Art Research* group.

#### **d. Income, infrastructure and facilities**

**Income.** The unit's approach to generating research income requires individuals to take responsibility at all levels – Early Career Researchers to research leaders – supported by regular research surgeries and information sharing about opportunities at the monthly Researcher Forum. Bid writing is supported by the college team of two administrators and a research grant specialist, the college finance team and the NTU Research Grant Capture Team. This support is complemented by temporary and permanent research fellows (Kuksa) to generate research bids. Combined with the mentoring system this structure engages colleagues at all levels in the grant capture process increasing income from all sources from £68,000 (2009) to £830,000 (2013), totalling **£2,250,000** over the period. Grant capture (including unspent income) has included Knox's participation in the FP7 SERVIVE project (<http://www.servive.eu/>) (£86,000 2008-2011) (FP7 Ref: 21372) which brought body sizing expertise to a major project on the mass customisation of clothing and is related in its focus to Dias' work on the medical application of customisable knitted devices. This has won £465,249.00 from EPSRC/MRC for a 2010-2013 project with the University of Loughborough on fabric with embedded electronics (Ref: SP/02/5/10). Breedon's work on design for health applications has brought funding from NIHR (I4I Ref: II-LA-0712-20004) to NTU of £96,000 (project total £320,000) for stroke rehabilitation work. Grant capture from EU framework programmes by Su has amounted to £985,000 for projects that focus on the engineering of sustainable products, and environmental impact accounting systems. Grant capture by Cooper's Sustainable Consumption group includes a £1m award as part of the UK INDEMAND centre for sustainable energy use the Universities of Cambridge, Leeds and Bath (EPSRC ref: EP/K011774/1) This group has also attracted income from Department of Environment, Food and Rural Affairs to study consumer understanding of the sustainability of clothing (Fisher and Cooper, £60,000, EV 0405) in 2008, and subsequently from WRAP (2011-13) for projects on measuring, specifying and communicating aspects of clothing longevity (£81,400), guidance on design for longevity of clothing (£35,000) and clothing behaviour (£10,525).. Cooper's work on consumption has also attracted funding from the Council of Europe (£5,250).

Income to the Creative Textiles group includes Edwards' award of a Leverhulme Fellowship from 2012-2013 worth £45,000 to continue her work on Indian textiles, supporting the craft in the context of development and entrepreneurship. The Lace Heritage sub-group has captured significant grant income from AHRC to develop an online catalogue of the collection (2007-9, £40,000) and for a research network, funded through the Science and Heritage programme (2009, £25,000). Growing out of this work, the Digital Craft and Embodied Knowledge sub-group won a Development Grant of £97,000 from Science and Heritage in 2013 (Townsend and Fisher) to identify ways to capture the knowledge in the last remaining machine lace manufacturer in the region with V&A and The National Archives (AHRC Ref: AH/K005952/1). The commitment of the UoA to developing research themes and connections with other researchers is evident in further successful networking bids - the AHRC supported 'Performing Space' (£2,837, 2008) and 'Foundations for Object Theatre' (£35,000, 2012) (AHRC Ref: AH/I022104/1).

**Facilities.** Grant capture by Dias stimulated investment of £36,000 from QR and £189,000 from NTU in state of the art smart knitting and other textile technology. This is available as teaching resource and supports PhD student work. Industry partners have also supplied equipment worth £75,000 as in-kind contributions to research projects. University funding of £80,000 has also been invested in research resources in Interactive Arts, Photography and Graphic Design, areas that are early in the trajectory of research development, to stimulate activity relating to creative technologies and media production. £20,000 has been invested by the university in 3D printing

equipment, which has had immediate application in the development of patents for work on 3D printed heart valves (Breedon, Output 4). Su's work on low-energy lighting has been supported by £40,000 for LED test equipment and £300,000 has been invested in a Creative and Virtual Technology lab (CVT) to support development of 'Creative Technologies' work.

#### **e. Collaboration or contribution to the discipline or research base**

**Esteem:** Staff in the unit are active as external examiners and advisors, members of professional and learned societies and scholarly peer-reviewers with 3 being members of the AHRC's peer review college 2008-2013. Notable is Cooper's evaluation work for the Irish Environmental Protection Agency and Research Council of Norway and his membership of a Royal Academy of Engineering Working Group and 3 conference advisory boards (Sustainable Innovation, 2012; Sustainability in Crisis, 2011; Learning Network on Sustainability, 2010). He has also given evidence to a House of Lords enquiry on Waste Reduction. Fisher contributed to a US Environmental Protection Agency seminar on Packaging Waste. Colleagues are editors of international journals: Oddey (Scene), Su (International Journal of Design Engineering) and Townsend (Craft Research), have guest edited journals (Su, Fisher), and advised Museum collections (Pepper, MIT holography museum). As well as a dozen invitations to externally examine PhDs, colleagues have been invited to speak at venues of international standing including the School of Oriental and African Studies, Oxford's Pauling Centre, the India International Centre, New Delhi (Edwards) and an international PhD symposium in Lucerne, Switzerland (Fisher).

**Contribution:** Burnett has served in various roles for the International Organisation of Scenographers, Theatre Architects and Technicians and as Hon. Secretary of the Society of British Theatre Designers. The international nature of these contributions is underscored by their consequences in reference publications, an example being Ferry's contribution to the Design History Reader. Su and Breedon's organisation of international conferences (as above) represent significant contributions to the field of Design. Shave's role in bringing World Event Young Artists to Nottingham is an equivalent contribution to the field of Art.

**Collaboration:** The UoA's long-standing collaborations with regional and international cultural agencies (as below) are complemented by our significant links with industry, many for the purpose of R&D and advanced product development. The Advanced Textiles group has partnered with Advanced Therapeutic Materials Ltd, Baltex, Entell Fibres Ltd, Exo and Smart Life and more recently Burberry and Boots, in the context of a suite of projects engaged with the medical, automotive and defence sectors. Breedon's Health and Wellbeing group collaborates with Nottingham University Hospitals NHS Trust. The UK INDEMAND centre is collaborating with Jaguar, Land Rover, Siemens, Tata, and BP. Finally, the Future Factory project, outlined above, constitutes a major pathway for the contribution of academic research in the unit to the broader discipline of design.

**Funded research networks** RCUK support to build the knowledge base and strategic alliances has been evident in three network grants. The research programme developing in the Lace Heritage Group and Digital Craft and Embodied Knowledge has built on the Science and Heritage funded 'Understanding Complex Structures' research cluster in 2009 which was a collaboration between NTU, Nottingham City Museums and Galleries, the Victoria and Albert Museum department of textiles, and the Natural History Museum. The Spatial Practices group in Fine Art won funding from AHRC to support 'Performing Space' in 2007-8, a series of workshops that brought together artists and technologists through the AHRC's ICT Methods Network scheme. In 2011 Myatt won support from AHRC for 'Foundations for Object Theatre' in collaboration with the University of Loughborough, both of which represent significant collaborative contributions to the discipline.

**Future Economic and Cultural Regeneration.** The Local Enterprise Partnership supports the regional regeneration initiative being developed round Smart Textiles (Dias) and smart cities (Su). The Smart Textiles development is supported by the National Composite Centre and the Centre for Process Innovation. The development of Creative Technologies has strong links to the city's Creative Quarter. The Head of College is on the board and Visiting Prof. Rachel Jones, is a consultant for the Technology Strategy Board's Connected Digital Economy catapult.