

CASE STUDY

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# The true value of materials: BRIDGE (Building Research and Innovation Deals for the Green Economy)

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## Abstract

Assessing the value of materials, lifecycle and applications was central to the European Union INTERREG IV project BRIDGE (Building Research and Innovation Deals for the Green Economy) 2011–2014. Here, the complex philosophies of sustainability (protection of people, profit and planet) underpinned innovation, knowledge transfer, data visualization and design thinking, to develop green entrepreneurs, and market differentiation in Southern England and Northern France Channel regions.

The model followed transdisciplinary collaborative research methods resulting in 'green best practice', which was visualized and disseminated extensively via digital technologies, mixed media and exhibitions. Information generated by the research was debated and shared at cross-channel conferences, business-to-business, incubation events, workshops and research exchange visits focussing on two materials: textiles and wood, sourced in the UK and France. Partners came from universities, regional authorities, non-governmental organisations and business communities to discuss the economic, environmental and societal value of these regional materials and innovative proofs of concept, eco and sustainable design products, processes, services and material experiments were generated from this collaborative peer learning, community of practice approach. More sustainable proof of concept products and systems were developed by knowledgeable practitioners which embody an understanding of green business, where the philosophical rationales and complexity of ethics, climate change and waste issues, for example, were communicated through materials and objects to expert and non-expert audiences and consumers. This embodiment and honest communication of knowledge in a product is a unique selling point, creating market value and consumer differentiation through narrative. Stakeholders exchanged complex data, methods and ideas towards developing green employment opportunities, informing a research theme for UK and EU funders to the year 2020 and beyond.

This is a descriptive narrative on the evolution of the project which enables incisive, reflective and theoretical analysis to take place simultaneously in other publishing areas to assess the longer term impact and value of BRIDGE in subsequent transdisciplinary projects. This work contributes to literature on value and use of materials with a focus on collaboration, design, innovation, applied research and societal benefit to develop green employment.

**Keywords:** Design; Innovation; Materials; Knowledge transfer; Green; Sustainable; Transdisciplinarity; Textiles; Business

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## Background

This paper reflects upon the aims, objectives and outcomes of the 2.4 million euro-funded project BRIDGE (Building Research and Innovation Deals for the Green Economy)<sup>1</sup> which was informed by Brundtland's classical description of sustainability:

*'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'*<sup>2</sup>

The intentions for this article take a very particular form: in that it *describes* aspects of what took place in the complex BRIDGE project and provides the (vital) contextual platform for further discussion and aligns with other project publications with different foci taking place simultaneously to produce a cluster of outputs. In the field of creative practice there is a tradition of describing the narrative of a project's evolution—which is the aim of this article and separates descriptions of research process from analysis and theorizing. However, the scale and scope of the project makes it difficult to steer a path through this description, where reflection and analysis in such a recently concluded project is not its purpose.

The question was how to develop a new generation of creative and business thinkers, thinkers that would be knowledgeable considering the sustainable (or green) agenda; a global, multifaceted and complex subject. For the purpose of understanding the larger concept of sustainability, the BRIDGE project focussed upon two local material streams common in France and the UK where material lifecycles were analysed via the cradle-to-cradle concept (Braungart and McDonough 2009). The analysis of the lifecycle of two materials functioned as a scalable knowledge toolbox to interrogate sustainable philosophies and processes and practice to up-skill stakeholders. Timber and textile material production, products and disposal became the basis of the study where artefacts to visualize data became a significant part of project deliverables during January 2012 to December 2014. The project partnership consisted of design, science, technology, engineering, mathematics and business colleagues (the D-STEM-B model, conceived by lead author Farrer in 2011). The intention of the process was to develop a mixed methods skill toolbox from the partners' best practice, where outcomes from each discipline could be shared, discussed, considered and applied to products and systems for existing and new markets. The analysis and application of the concepts, both practical and theoretical, from the mixed methods toolbox was estimated by the project leaders to contribute to a deeper understanding and up-skilling in sustainable production and consumption issues. All those involved in this

research project were informed by relevant *eco supply chain narratives* the knowledge about which was subsequently transferred to the thousands of people, who engaged with the work (evidenced in feedback) at BRIDGE exhibitions, conferences, seminars, business-to-business (B2B) events, media exposure and through social networks.

The lead partner was a French government development agency MIRIADE (Mission Régionale pour l'Innovation et l'Action de Développement Économique, France), who devised the overarching BRIDGE concept for green development to include SMEs (small and medium enterprises), HEIs (higher education institutions) and NGOs (non-governmental organisations) as a French and English collaboration to secure EU funding. The partner's expertise was in the material fields of research, agriculture, product design, retail, and disposal in the UK and French regions and those who joined the consortium outlined their contribution to and aims for the project. Finally, a core of nine partners across regions and fields of expertise was consolidated through workshop debates and email exchanges to develop the concept of Building Research and Innovation Deals for the Green Economy, BRIDGE. The partnership breadth enabled knowledge transfer amongst the group, including business incubation support and enabling the practical development of more sustainable materials products and services to inform the creation of sole traders, SMEs and non-profit organisations for an increasingly aware European green consumer. The effects of linking these partnerships, facilitating new knowledge and access to eco markets could increase employment—which was at the heart of the project. The consortium used research literature, symposia, exhibitions, field work, workshops, B2B events and practice to discuss and investigate lifecycle analysis, improve ecological material processes, and zero waste, re-use, up-cycling and closed loop practices. Sustainable design thinking was one of the core components that needed to be understood and adopted as fully as possible by the partners, green businesses and education. A complex digital communication toolbox for partners, commercial contacts and the public was established to map producers in the geographical locations and explain to interested parties the projects' rationale and development. Web links to information streams and social media increased engagement and knowledge transfer between the communities of learners who were at various stages of their understanding.

The INTERREG funders (Joint Technical Secretariat, European Commission) monitored the deliverables for the BRIDGE project work packages every 3 months over the 3-year period. The deliverables included eco-design research, development and innovation; exhibitions and workshops; new research and development projects and product outcomes; hosting cross-channel gateways and

symposia; forming a database and live website for green growers, makers, users and entrepreneurs in southern England and northern France; a mapping of primary and secondary material resources and student exchanges and bilateral agreements between French and UK universities, 10 new businesses and research and development outcomes.

## Case description

### Operating strategy: an account of the BRIDGE project—mechanisms and methods

The BRIDGE project follows a transdisciplinary approach, which is suitable for a project interested in environmental, economic and social issues because it is a method that recognizes wholeness and the value of otherness. It was philosopher Jean Piaget who first presented the theory of transdisciplinarity in a lecture, in 1977, which described a connection between and beyond disciplines, which worked together to provide transparent sets of methods of communicating work and data to each other outside of their respective discipline silos. Describing complex concepts such as sustainability needs a web or network of information, with many different strands: Piaget found one phrase that could make all the connections: transdisciplinarity. This multimethod approach rather than one method was critical for BRIDGE collaborators, who brought a range of expert research and knowledge to the project through critical debate, exploring material technology and creative practice leading to new understanding and innovation expressed by Mills (2014):

*'As technology progresses, there is the need for increasing specialisation. There is also the need for increased collaboration amongst those with specific expertise. This is one of the reasons that networks (in their broadest sense) assist with innovation—and their importance continues to grow.'*

This statement defends the use of a complex partner network such as this in the BRIDGE project where the intention was to provide a unique development opportunity for new cross-border collaborative methods and opportunities to cascade best practice, knowledge and experience in ecological terms. The knowledge gleaned from conducting the project could be applied across geographical areas to support those committed to developing green businesses and new markets in UK and French regions with high unemployment due to industrial and agricultural decline. Using materials as the focus for dialogue and innovation, local authorities, research, eco design, business incubation, production, biotechnology, agriculture and waste reprocessing could come together to debate and facilitate opportunities for

research development and collaboration. In addition, communicating the complexity of sustainability to a non-expert audience in countries through visual 3D and virtual artefacts, formal and informal events and Internet presence was a challenge. Communication of the aims and objectives and outcomes is deemed to be a success following analysis of qualitative unstructured interviews, written and verbal commentary and anecdotal evidence from the public, learners and professionals who engaged with the project. The impact from these knowledge exchange and sharing events enabled transdisciplinary thinking, resulting in information up-skilling for sustainable design solutions. The products created market differentiation and built consumer confidence through an honest narrative on material origin, lifecycle and product transparency, important for customers sceptical of the green credentials and 'green wash' of some brands. It was noted that the importance of a transparent, environmentally and ethically sound business or developing a sustainable mission statement and philosophy for a brand was not properly understood in each country or by each partner. For instance, the French partners did not have an equivalent for the word or meaning of sustainability and used a combination of *green, eco, environmental* or *ecological* terms, where the focus was in general on quantitative measurements. From a UK partner perspective, sustainability combined societal, environmental and economic elements, which was informed by a combination of quantitative and less measurable qualitative knowledge. These complex convoluted holistic concepts were shared between partners in a variety of ways and caused tension in debates. This was unsurprising and a consideration of the practical epistemological implications of transdisciplinarity working. When there was a clash of philosophies and methods, it was because different discipline stakeholders come from different positions in the sustainable debate and had to explain their start point. Also, we defined our methodology as *transdisciplinarity*, which implied some type of social constructivism and so the project's sets of methods and stakeholder views were accommodated within the overall transdisciplinary framework by the concept focus on sustainable materials, which was essential to capture all debates and consolidate the disparate group. So this project became highly relevant as a cultural and social up-skilling tool for business and education in both countries and a learning curve in research method terms.

The partners for green entrepreneurial development and innovation in materials were represented by commerce, education and government from both geographical regions and were from engineering, academic institutions ESITC CAEN (École Supérieure d'Ingénieurs des Travaux de la Construction de Caen, France), Esitpa (France); from business incubation, WSX (West Sussex Enterprise, UK),

Normandie Incubation (France) and Orne Development (France); from waste reprocessing, Remade Southeast (UK) and government departments Medway Council (UK, local authorities) and, as mentioned previously, MIRIADE. The lead design and material partner was the University of Brighton (UK, UoB). The core BRIDGE research team members from University of Brighton were recruited from the College of Arts and Humanities (CAH), Pharmacy and Bio-molecular Sciences (PABS) and the School of Environment and Technology (SET), creating a large interdisciplinary team of 30 design, science and business experts in their respective fields. The Principal Investigator (then director of the Design Research Initiatives DR-i) was Professor Joan Farrer, who through collaborative partner discussion initiated the concept for the UK part of the work packages from the point of view of sustainable materials, design research and innovation. Farrer built upon her research projects and international networks in sustainable and smart materials which supported the importance of sustainability and job creation which remains a major driver in Horizon 2020 EU funding policy. The BRIDGE project was people focussed, in line with the European Commission's social inclusion policies:

*'Social investment is about investing in people. It means policies designed to strengthen people's skills and capacities and support them to participate in employment and social life.'*

The challenge was understanding how the diverse working partnership could optimise and transfer mutual knowledge and skills to inform disciplinary and commercial practice and ultimately inform government employment and environmental policymakers through the INTERREG programme and JTS network reporting. Also defining our terms of reference and importance (e.g. eco/green/sustainable) in a bilingual context, in different cultures and societies, with a different degree of understanding was complicated as were logistics in terms of geographical distances and effective communication. The solution was a series of frequent cross-channel virtual and face-to-face exchanges facilitated by regular structured and coordinated meetings and visits to partners arranged around key events or gateways. These meetings enabled partners to really understand each other and were conducted in Southampton, Medway and Brighton in the UK, and Rouen, Alençon and Caen in France and were mapped out and agreed as essential in the milestone project calendar through partner discussions. These exchanges provided opportunities to get to know and understand the partners, trade formal and informal sustainable material knowledge and instigate debate. Given the wide scope and

potential presented by this project and its contributors, where it was acknowledged the importance and impact could be long after the project ended, the overall approach was open-ended, experimental and iterative throughout. From their respective backgrounds (academic, scientific, engineering, design and trade) the partners brought their unique skill sets, perspectives and creative and practical working methods to the proposition of creating green commerce to develop future entrepreneurs. Various methodologies were drawn upon to target the most productive forms of communication and collaboration. These included narrative studies—not in a traditional sense; however, more as a method of gaining background information from the various partners regarding their current understanding of supply and disposal chain issues, for example. The studies of each partner then became a basis for continued improvement either individually or collaboratively through the project development, using their strengths to establish ethical purchasing policy through to using biomaterial replacements, for instance. Quantitative analysis took place whenever figures and data gathering were used within research and development of BRIDGE. Human interaction occurred through head counts and footfall at meetings, conferences, in and outside exhibitions and in institutions. Virtual interaction data gathering was done through media, social networking and broadcasting. Qualitative methods were used to understand the importance of and select case studies, including participatory and hermeneutic research. A mixed methods approach following on from the concept discussed earlier of transdisciplinarity enabled an understanding of how a diverse network project like BRIDGE, impacted upon the appreciation of the true value of materials, including waste which is also a raw material, not just in economic terms but also philosophically. Enabling collaborators to build bridges between academia and industry in the UK and France, to debate sustainable practice, deepen knowledge and share information, this led directly to a new environment for innovation and philosophical thinking. The RCUK Strategic Vision document (2011–2015) outlines the importance of developing:

*'innovations to ensure that the UK has a productive economy, healthy society and can contribute to a sustainable world.'* BRIDGE addresses this by closing *'the gap between researchers and users, with each influencing the other.'*

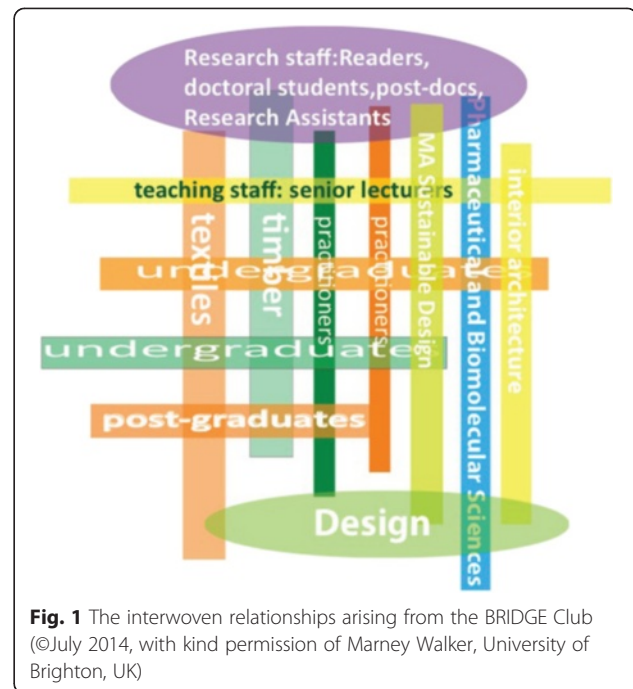
#### **Study developing green material entrepreneurs: Pedagogy BRIDGE Club**

The Universities in France included the following: ESITC Caen, a heavy engineering construction and architectural institution with a very traditional built environment technical remit; ESITPA, an agricultural institution, forestry,



farming and bio-science; in the UK, the University of Brighton which offers all subjects was involved. Through various student teaching and learning techniques in both countries, such as lectures, workshops, debates, field trips, different discipline working collaborations and international exchanges, the BRIDGE project was used to explore and develop with students, staff and alumni the complex subject matter of sustainable design and production and consumption which is becoming an educational requisite. The students were given theoretical and practical insight to supply and dispose chain issues, ethics, material sources, production and disposal. Current sustainability literature was debated and expert speakers on the subject were interrogated which led to the community of learners contextualising their own work within recognized scholarly texts and expert practice. Knowledge of carbon transport miles, understanding water table pollution or ethical textiles production, for example, was then applied to their product design and development. An improved understanding of better material selection for example and environmentally sound methods of production and the incorporation of design for deconstruction and re-use ensued. This applied knowledge was drawn from a transdisciplinary network and formed the basis of the development of BRIDGE's green entrepreneurs working for a more informed society.

To facilitate rapid student learning and up-skilling in relation to research and innovation for the green economy at the University of Brighton, a BRIDGE Club was established, which met every 2 weeks. This was an open forum for transdisciplinary discussions, knowledge exchange, collaboration and project development and delivery. Parties from the academic and local community in fashion and textile design, design and craft, graphics, architecture and science were involved as illustrated in Fig. 1, 'The interwoven relationships arising from the BRIDGE Club'. The principal focus of these sessions was to investigate sustainable issues from primary material streams of textiles and wood. This was innovative insofar as, through a non-elite forum, the club provided a perfect opportunity to foster challenging exchanges across and between disciplines and, in turn, highlighted the importance of interdisciplinary thinking for current and future environmental solutions. The club facilitated opportunities for participants to discuss a wide range of topics and included speakers from members of allied groups such as the Sustainability Action Network (a grassroots collective of students and staff), C-Change (a carbon reducing campaign run by staff and students), the Waste House (development of a living laboratory for ecological architectural design) and the Green Growth Platform (a network championing sustainability and supporting business growth) enabling



**Fig. 1** The interwoven relationships arising from the BRIDGE Club (©July 2014, with kind permission of Marney Walker, University of Brighton, UK)

a more unified awareness of activity within the sector that was shown across the partnership. Alumni contributed to sessions discussing positive and negative aspects of the evolution of their ecological careers and different pathways to success taken after study, which provided mentoring and knowledge exchange. The BRIDGE funding provided new materials, machinery and equipment for numerous innovative research and development proposals, experiments and techniques through workshops and knowledge transfer sessions, events and exhibitions. A series of supporting comments from students confirmed that the BRIDGE project was informing the learning community about the complexities of sustainability and altering the perception of the value of materials.

The following quotes are taken from unstructured interviews and written evidence relating to the significance of the project on these young green entrepreneurs at UoB:

*'The BRIDGE Club has influenced my work in a number of ways. It has enabled me to broaden my mind in terms of designing ecologically.'*

-Alice Liptrot, Textile Design Undergraduate student

*'You would get different perspectives, and you would all be looking at the same materials and objects, but everyone would bring their own angle of perception towards it, which is really helpful from a creative*

*point of view, if you are all talking about the same thing and seeing things differently.'*

-Lawrence Lawson, Design and Craft Undergraduate student

*'We realised, that we have done all these crazy experiments and worked out practically how we can apply the material to different things, but you could put them all together and it could look like one big mess. The breakthrough was when we took a step back, and worked through a concept and brought in different interesting elements of what we could apply structurally, rather than putting practical techniques together to form a structure. We have actually thought, if we form a structure, and then use these techniques in different ways, rather than just pushing them all into one shape. So that was a breakthrough yesterday to come up with the design of the actual structure.'*

-Sheldon Marie Stansfield, Design and Craft Undergraduate student

*'There are little seeds of kind of possibilities that can only happen if you are put in those positions or meet those people, who are looking at things from a different perspective'*

-Clare Evans, Design and Craft Undergraduate student

*'The trip has provided a greater sense of scope to help me understand how the idea of sustainability is multi-faceted and may be applied in different ways. It was refreshing to try to understand the problems of sustainability from the perspective of these manufacturers, without any kind of 'green-washed' or misinformed ideas. The trip was a valuable opportunity for me to build upon some aspects of my earlier research and could lead to future initiatives based on what I came away with from the trip. This has helped bridge a gap between my understanding of some of the real world drivers for change and a move towards sustainability.'*

-James Dart, Design and Craft Undergraduate student

This concept is called 'flipping the classroom'<sup>3</sup>, where students learn from one another, and off-site in a peer learning community and experience accelerated learning on a voluntary basis, without being restricted by marks, scores or module results, which allowed complete immersion in the research project.

By exploring a live teaching model with university partners, which was supported by EU-funded research and, therefore, not a drain on institutional budgets and resources, high level engagement in sustainable theory and practice with undergraduates, postgraduates and staff was facilitated. This engagement was all outside of the standard curriculum activities and led to informing and being subsumed into the curriculum and into the core of student work and philosophy.

#### **BRIDGE exchanges and fieldwork**

As a result of facilitated cross-border knowledge exchanges between France and the UK, where participants explained their research and commercial thinking, the BRIDGE project partners were able to challenge their understanding of the sustainable agenda (people, profit and planet) and re-assess their position and future direction from a more informed perspective. The exchanges between the UK and the French commercial and educational communities challenged and invigorated the business and research teams through many eco events focusing on lifecycle analysis, production and disposal methods; concepts around 'make local', 'supply local', 'sell local' and 'dispose of local', as opposed to a global manufacturing supply chain process. These concepts led to heated discussions between designers, engineers, entrepreneurs and scientists about material value and environmental benefits versus simply price and a true cost calculation of goods.

Bridge Club members and partners saw an example of sustainable business practice on a field trip to a fibre producer and processor where the function of the study was to experience sustainable green philosophy and zero waste processes in action and in so doing learn from the experience as illustrated in Fig. 2. The BRIDGE community of learners saw at Diamond Fibres mill in East



**Fig. 2** Diamond Fibres Ltd. (© June 2013, with kind permission of Carolyn Watt, University of Portsmouth, UK)

Sussex, a profitable SME considered to be a fine example of green economy innovation and local entrepreneurship. Diamond Fibres use old and new technology to take and process wool from small local sheep flocks (such as the ancient and rare breed of sheep Black Wensleydale Longwool). Hand-spinners, felters and fibre artists and textile designers use the wool in the natural colour ranges from the sheep fleece. The business provides a bespoke high-quality fibre processing service of carding, spinning, and yarn-plying for products which have a traceable and sustainable narrative using minimal chemicals which is increasingly important for a green consumer. The CEO of the business explained the use of different eco processes employed in turning raw material fleece, into yarn, where the end product colour range is a blend of fibres without dyes and minimal chemical intervention. Any discarded wool fibres, which are brittle, from the mill, are used in local agriculture as soil conditioners or as insulation. The function of this (and other project field trips) was to experience and learn from a successful SME who could illustrate the process of sustainable supply chain cradle-to-cradle life-cycle production, from animal breeder to the final end product. This was a scalable business which had created a unique selling point, market differentiation and jobs in a rural location.

### Communicating research

In order to communicate the research and challenge existing business and education practices, it was imperative to communicate with as many people as possible throughout the project and so, from the outset, BRIDGE was underpinned by a series of carefully devised UK and French events that presented and explained the results to the outside world, rather than keeping the research within the silo of the institutions involved. Here, we report specifically on some of the UK research communication events and not on those which ran in tandem in France where the French events focussed upon employment, business start-up and incubation rather than material sustainability and process are being reported in separately.

### The Brighton BRIDGE Circus conference and The True Value of Materials exhibition

The Brighton BRIDGE Circus conference was an information exchange and knowledge transfer event, which was held over 2 days in Brighton in December 2013. To mark the interim point of the project, the academic conference was supported by a gallery exhibition 'The True Value of Materials' that showcased sustainable products and materials from emerging creative green entrepreneurs. The sustainable agenda was explored by theoreticians and

makers, who produced scholarly literature and/or physical products encapsulating the thinking and narratives for the event for all those interested. The conference's speakers included scientists, engineers, designers, practitioners, academics and experts in D-STEM-B fields and all presentations were simultaneously translated into French. The structure and agenda highlighted the diversity of 'green' perspectives, knowledge and experience on the issue of sustainability and showcased the opportunities presented by transdisciplinary relationships. Participants were invited to be provocative, and the presentations generated a number of discussions. Data analysis showed that there were approximately 300 delegates in attendance at the conference who used social networks to communicate the event content in the UK and France.

The True Value of Materials exhibition saw more than 900 visitors to the gallery, which was also seen through the gallery windows by passersby in vehicles and on foot in the city. The show ran for 2 weeks and had 30 exhibitors, including businesses, artists, designers, scientists, academics and alumni from the UK and France (Fig. 3). The intention of the creative product exhibition was to communicate the complex theories and research of the material agenda and to showcase work produced by people who understood the ethos and championed the philosophy of sustainability. In addition to the exhibition, workshops took place showcasing a range of textiles and production activities where more than 40 people participated. The Brighton BRIDGE Circus celebrated *a brand new green*: a green that showed new designs, new materials, new potentials and new uses to celebrate the future green entrepreneur and design for sustainability. The curator was careful to select and exhibit a range of sustainable product outcomes and proof of concept pieces such as sports equipment made from knitted and woven flax, items composed of biodegradable resins and new conceptual garments made from wool combined with plastic waste. Transdisciplinary ideas were shared and new territories of investigation were enabled such as a development of a milk protein thread, where designers, scientists and entrepreneurs gathered to explore concepts, analyse possibilities, develop technology and finance research using a collaborative research approach. Some of the exhibits represented the simple, local use of natural materials; others were provocations, concepts, symbols, works of the imagination visualizing data and examples of the mutability of materials and their impact as drivers of sustainable thinking for the green entrepreneur.

Ultimately, BRIDGE established a green web between regions of France and the UK as a step towards creating employment using sustainability as the core driver of progress





**Fig. 3** The True Value of Materials exhibition (© December 2013, with kind permission of Exploding Sky Images, UK)

#### **Knowledge Transfer Network (KTN) Materials Research Exchange, 2014**

The importance of the BRIDGE project was recognized by a UK government invitation from the Technology Strategy Board (TSB) to exhibit at the prestigious Knowledge Transfer Network (KTN) Materials Research Exchange, which took place in Coventry, UK, in 2014 and which the TSB organize. The event attracted over 500 commercial and research visitors, the majority of attendees from universities such as Oxford, Brunel and Southampton and the private sector, including Jaguar Land Rover, GKN Aerospace and Morgan Advanced Materials.

This is a prestigious exhibition of leading research institutes in the science, technology, engineering and mathematics (STEM) disciplines. The aim and scope of the exhibition was to showcase the richness of UK materials research, bring closer collaboration between the industry and the UK materials research base, increase public and private funding, and private equity support for commercialization. The show provided an opportunity for KTN to facilitate the coming together of all the finest material research in the UK through exhibition stands, seminars, workshops, keynotes from government ministers and presentations of student research posters. This event enabled BRIDGE to present work from a sustainable design and production, materials and creative industry perspective.

#### **The Eco Technology Show, 2014**

The Eco Technology Show, organized by an esteemed advisory board, was held at the Brighton Centre and took place in 2014. The show exhibited low carbon technologies across the built environment, energy, transport and resource efficiency sectors and offered a forum for networking opportunities through exhibiting stands, communication hubs, keynotes, panels and talks. In total, there

were 136 exhibitors and 70 keynotes, panels and talks during the show. The Eco Technology Show was an opportunity for BRIDGE partners to network with businesses.

The Eco Technology Show had 3500 visitors over 2 days: 26 % general public and 74 % trade (18 % public sector, 35 % private sector and 10 % building and property professionals). Visitors came from the south of England, Scotland, Wales, Northern Ireland and Ireland and other countries in Europe.

To communicate the project widely, BRIDGE hosted a 1-day symposium titled 'The True Value of Materials: Waste' on the last day of the Eco Technology Show. The partners in the project from the UK and France all participated in, and attended, the symposium; which brought speakers' together to consider the following question: 'Is waste the new raw material?' Again, this provided a platform for discussion of transdisciplinarity and sustainable materiality (Fig. 4).

Quantitative data was collected from these showcases; however, at the time, it was unclear what impact these events would have on our community of learners. Eventually, from the qualitative questionnaire data and quantitative data on visitors and their businesses, it became apparent that there is a wide interest in sustainable materials and a will to engage with production and consumption from all those involved.

#### **Discussion and evaluation**

##### **Visualizing research: a series of examples from the BRIDGE project**

BRIDGE led directly to the establishment of new entrepreneurs through their engagement with sustainable material values, learned during their involvement with the partners and activities throughout the 3-year project term. Sustainable principles, using local eco materials and traditional light touch production techniques, informed their processes through interdisciplinary knowledge exchange. A





**Fig. 4** BRIDGE stand at the Eco Technology Show, 2014 (© June 2014, with kind permission of Ashley Davison, LikLife Images, UK)

selection of UK green entrepreneurs are acknowledged here as narrative case studies because the project directly impacted on their work, either via providing funding or providing insight towards new learning, research and development and commercial opportunities.

James Dart, 3D designer (Master’s degree at École Cantonale D’Art de Lausanne (ECAL) in Switzerland), focused his research on new sustainable material knowledge using flax and knitted formed structures (Fig. 5). His knowledge and rationale for using degradable bio-resins for sport accessories came directly from his engagement with BRIDGE and bio-resin producers in the UK and his understanding of the environmental crisis of the use of non-biodegradable composites in products, something at odds with the wellbeing messages from the sports industry.

Clare Evans (Master of Sustainable Design, UoB) considered fashion and textile waste (Fig. 6). The concept

behind her project was to use raw material waste in a new material for contemporary applications. Textile waste from French partner ESITPA that was being repurposed into insulation blocks used for walls was combined with corn starch plastic, heat pressed into sheet material and then moulded into contemporary luggage. The products are visually intriguing and the consumer’s wish is to know more of the narrative.

Toni Hicks (textiles designer and Senior Lecturer in Textiles at UoB) and her team held ‘The Continuum’ workshop to demonstrate textile processes, which allowed participants to experiment with different material properties and techniques to improve sustainable manufacture (Fig. 7). Needle punch felting, wet felting, knit, heat pressing, lamination and laser cutting were used on wool and flax from sustainable sources in the south of England and northern France, and waste materials, including plastic bags, hair, dog fur and beeswax, were incorporated. The materials were selected because



**Fig. 5** James Dart (Duo Lin): BRIDGE p was showcased as part of the BRIDGE Circus, KTN Coventry event and Waste event and has gone on to study at ECAL at Masters level (© December 2013, with kind permission of James Dart, ECAL, Switzerland)



**Fig. 6** Clare Evans, The Fluff and Nonsense project (© June 2014, with kind permission of Ashley Davison, LikeLife Images, UK)



**Fig. 7** The Continuum: a group of staff and students worked on 'The Continuum' demonstrating some of the properties that wool and flax possess when combined in different techniques. The final product was exhibited at the Brighton BRIDGE Circus (© December 2013, with kind permission of Exploding Sky Images, UK)

of their communicative properties regarding the environment and ethics. Visitors to The True Value of Materials gallery were encouraged to touch the pieces and reflect and comment upon the issues surrounding the sustainable agenda. Books of provocative pertinent comments are an additional record of the project impact on consumers.

Kirsty McDougall, designer at Dashing Tweeds (Senior Tutor in Woven Textiles at the Royal College of Art), exhibited Lumatwill™, a fashion fabric that combines reflective filament with traditional worsted or tweed wool yarn that has a recycled content (Fig. 8). The cloth appears to be a traditional man's suiting or tweed but is reflective in certain light and would suit the urban cyclist or pedestrian. The company uses British tweed textiles and workshops to create traceable durable fabrics and garments as part of a sustainable philosophy, which has a brand identity and a niche clientele with significant disposable income.

Jasmine Nicholls, a textile designer, was interested in sustainability within the textile industry using local organic material suppliers and multimedia as a marketing tool. Nicholls' business, 'Rudimentary', employs a responsible design ethic, ideals of utility and simplicity in fabricating desirable yet durable products (Fig. 9). Her distinct uses of waste materials have been manipulated and constructed to convey a sophisticated approach to recycling textiles. Through the BRIDGE project, valuable contacts with local practitioners, suppliers and retailers were made and work exhibited in all events.

#### Case study exposure; online presence and dissemination

MIRIADE presented the first iteration of the BRIDGE channel eco-cluster website at the official launch of



**Fig. 8** Lumatwill™ was created in 2005 by Kirsty McDougall and Guy Hills as part of the range of fabric offered by their woven textiles fabric business, Hills McDougall and Dashing Tweeds (© December 2013, with kind permission of Exploding Sky Images, UK)

BRIDGE in Caen in 2012. Further to input and feedback by all the partners, the website was officially launched at the Eco-Design event in Alençon. This web platform<sup>4</sup> documented BRIDGE events and activities and, in July 2013, provided an online platform through which members could identify potential partners to develop innovative projects and cross-channel collaborations.

The BRIDGE research team at UoB documented their design research scoping activity via a WordPress blog<sup>5</sup> created and edited by Marney Walker. A Facebook page and Twitter account (@BrightonBRIDGE), edited by Mylinh Nguyen, Carolyn Watt and Harriet Parr, were developed to share knowledge and to document design research and development activity. The blog attracted views from a global audience across 77 countries worldwide, with 4881 views from the UK, 529 views from France and 328 views from the USA as of November 2014 Fig 10.

For quantitative analysis as of 11 November 2014, the blog had received 6707 views, with 1953 visitors. Figures 11 and 12 illustrate how views and visitors during BRIDGE activities increased significantly when articles were posted leading up to and about the events. The screenshot image in Fig. 13 shows search referrals from different websites, with the highest coming from UoB's Faculty of Arts website with 398 referrals, followed by 275 referrals from Facebook and 116 referrals from Twitter. Other referrals came from people affiliated with the BRIDGE project's personal websites.



**Fig. 9** Jasmine Nicholls (Rudimentary): BRIDGE part funded materials for this work which was showcased work as part of the BRIDGE Circus

The BRIDGE Eco Cluster website, led by MIRIADE, attracted 3943 visitors by February 2015 and initiated 5581 connections between academics and business in the field of sustainability.

**Conclusions**

**What we learned**

*Science and design: building on new connections and recognizing mutual benefits*

Given the diversity of the partners, their understanding of the green economy and the distance they have travelled regarding subject knowledge, the mutual benefits for the contributors are only beginning to become apparent. The number of deliverables were ambitious yet all were achieved in the time frame, but further work is needed to build on and analyse these new connections,

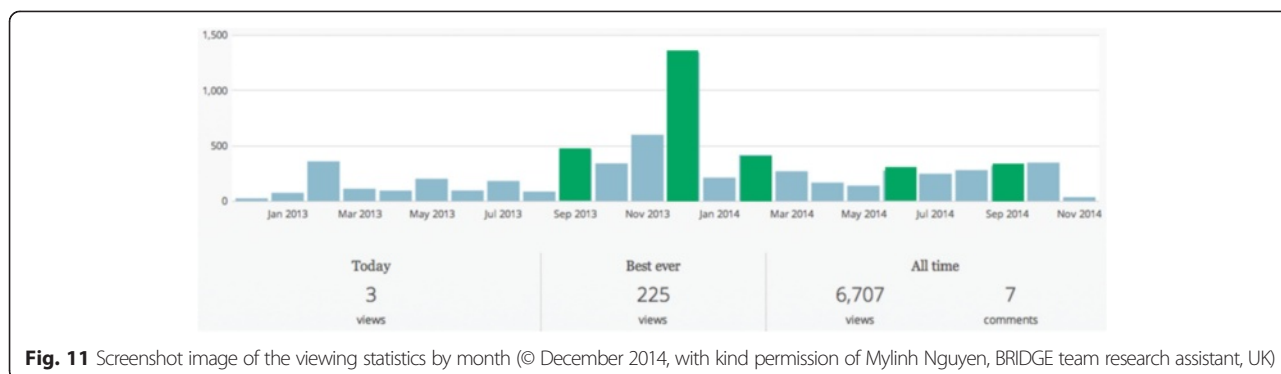
**Top Views by Country for all days ending 2014-11-11 (Summarized)**

[7 Days](#) | [30 Days](#) | [Quarter](#) | [Year](#) | [All time](#)



**Fig. 10** Screenshot image of summary views by country (© December 2014, with kind permission of Mylinh Nguyen, BRIDGE team research assistant, UK)





relationships, knowledge and methods, in order to, improve upon, communicate and consolidate the benefits of new knowledge that the BRIDGE project facilitated. Theoretical analysis of different elements and impacts of the project research is currently taking place for a range of international publication, which includes business, education and design journals. The rationale for the importance of this descriptive journal article is to publish the transdisciplinary methods narrative here, separately and urgently, in tandem with the development of other publications which are related to each other but with different focus thus enabling the whole complex project picture to be communicated and understood. In addition, the work has been presented at conferences in China, the UK and Spain. Data gathering and analysis on technological developments, research and development innovations and new startup businesses from BRIDGE is work in progress and communication of the project relating to sustainability, good practice and partner experience is broadcast as short videos on YouTube sites. A new follow-on research project building upon BRIDGE structure and methods from a sustainable job creation and social innovation point of view is in development which speaks to the following bullet points:

- Future partnerships to include other disciplines informed and underpinned by design thinking, innovation and knowledge transfer.
- Taking advantage of emerging funded research opportunities including technology materials, design

science and business collaboration, as a motivator for employment.

The above two suggestions, from lessons learned in two countries, are contingent on a coordinated approach to communicate, engage and explore findings and dissemination methods in order to maximize and maintain engagement and improvement across discipline areas to the expert and non-expert. Managing a complex multi-site multi partner project such as BRIDGE with such diverse stakeholders in terms of outputs, practice, experience, location and age groups was a challenge, which needed diverse communication methods to deliver a consistent message. Now, there is a depository for data and information on the project, accessible by all partners and the public for open source information to be used as a possible building block for other initiatives for increased employment, education and better environmental processes.

This work contributes to a growing body of literature with a focus on transdisciplinary thinking within design, wellbeing and sustainability and will serve as a basis for future studies and development for externally funded research projects, the potential to influence government policy in the education and the small business sector. The new green entrepreneurs who are emerging using closed loop more sustainable research models with an appreciation of materials are one solution to the issue of overproduction, irresponsible consumption and waste, where all materials are a valuable commodity.

Date	Event	Views	Visitors
September 2013	The Bentley Wood Fair	470	113
December 2013	Brighton BRIDGE Circus	1,341	328
February 2014	The Green Business Start Up Launch Pad KTN Materials Research Exchange	419	89
June 2014	Eco Technology Show	279	80
September 2014	Make Lewes Festival SheSaid Brighton	321	93

**Fig. 12** Table showing how certain events and blog posts correlate to the viewing and visitor figures (© December 2014, with kind permission of Mylinh Nguyen, BRIDGE team research assistant, UK)



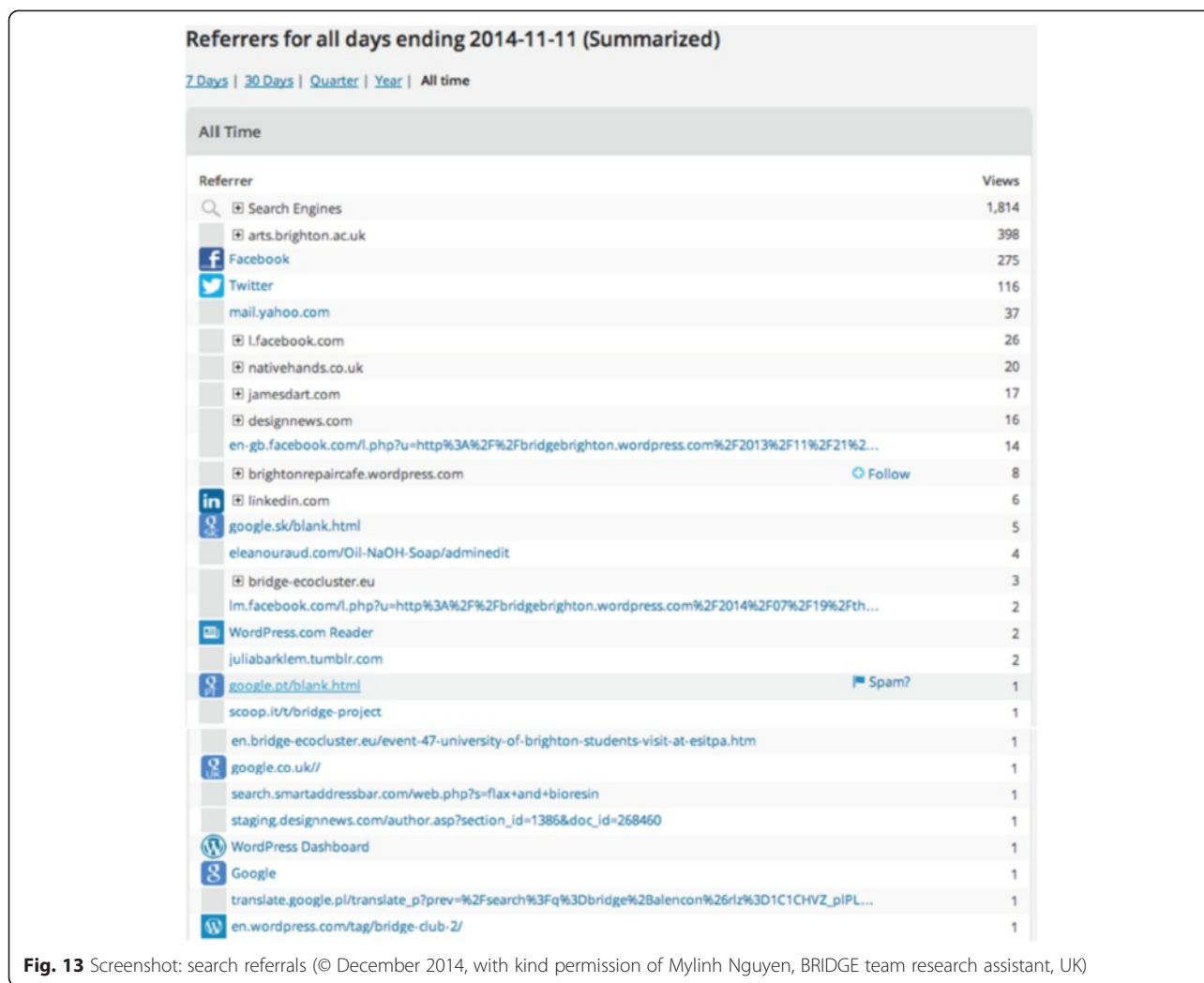


Fig. 13 Screenshot: search referrals (© December 2014, with kind permission of Mylinh Nguyen, BRIDGE team research assistant, UK)

**Growing green entrepreneurs: creating a toolkit of skills and knowledge**

The long-term impact on the young entrepreneurs, who have engaged in the challenges presented by BRIDGE in sustainable design and new business practices, and how that has influenced their future career contexts and directions, will be measured over time. The project created a simple how-to toolkit for new green business start-ups, loans and grants, with pathways to mentors and expertise. This guide is intended for young entrepreneurs, researchers and engineers in France and Britain who are interested in starting a business in innovative technologies. The guide explains all the steps to take and useful contacts to establish in order to facilitate the process of creating these types of business projects in Europe. Educational institutions particularly in textile material product design courses are beginning to recognize the importance of creating opportunities to engage young people at an earlier age in sustainable business development, using research projects such as

BRIDGE to showcase the potential outcomes to inform, inspire and create opportunities as they progress and thus create market opportunity and differentiation.

In terms of the authors' original insights in relation to material sustainability, design and innovation, the project findings have underlined that producers and consumers take meaning and understanding from materials and products, in order to give value to goods and these meanings should be honestly communicated. Through the many artefacts and products produced throughout the project, exhibited and discussed in the UK and France, the stakeholders began to understand the holistic narrative of and the origins, product journey and the true cost rather than price of an item. Using the trans-disciplinary approach, the community of learners began to differentiate between 'good and bad' products and processes and relate their understanding of production and systems to the sustainable pillars in Brundtland's description, people, profit and planet to their understanding of honest brand identity. To address the issue

of green innovation in terms of production, consumption and reuse of materials, a multi-faceted approach is necessary to develop green entrepreneurs and business for the discerning consumer, and as the project yielded information from those involved, giving information with integrity in as simple a way as possible transferred complex knowledge to the non-expert consumer. The partners concluded that the creative industry has expertise in the communication field regarding Building Research and Innovation Deals for the Green Economy and the research project has confirmed that the collaboration with Design, STEM and Business (D-STEM-B) partners true innovation in transdisciplinary and applied research towards a more sustainable future lies.

### Endnotes

<sup>1</sup>University of Brighton, 2014. BRIDGE Project Website. [online] Available at: <<http://arts.brighton.ac.uk/projects/bridge>> (Accessed 9 May 2014) INTERREG-funded BRIDGE project was a European Union INTERREG IV-funded project, which aimed to demonstrate the opportunities for eco innovation arising from transdisciplinary research partnerships. The project linked nine partners from southern England and northern France from diverse settings: design research, sustainable construction, waste reprocessing, business incubation, agricultural engineering and sustainable materials research. BRIDGE aimed to build partnerships for cross-border economic development and complementary centres, business and design incubators, in order to share the best practice in eco design between the two countries.

<sup>2</sup>From the World Commission on Environment and Development's (the Brundtland Commission) report *Our Common Future* (Oxford: Oxford University Press, 1987). *Our Common Future*, also known as the Brundtland Report. Our Common Future United Nations 1987 UN Documents: Gathering a Body of Global Agreements has been compiled by the NGO Committee on Education of the Conference of NGOs from United Nations websites with the invaluable help of information and communications technology.

<sup>3</sup>Educators Technology (2013) Website <http://www.educatorstechnology.com/2013/09/flipping-classroom-simply-explained.html>. Accessed 13 July 2015.

<sup>4</sup>BRIDGE Eco Cluster (2014) Website. <http://en.bridge-ecocluster.eu>. Accessed 13 July 2015.

<sup>5</sup>BRIDGE Brighton (2014) Website. <http://bridgebrighton.wordpress.com>. Accessed 13 July 2015.

### Abbreviations

B2B: business to business; BRIDGE: Building Research and Innovation Deals for the Green Economy; CAH: College of Arts and Humanities University of Brighton; D-STEM-B: design science, technology, engineering, mathematics and business; DR-i: Design Research Initiatives University of Brighton; ESITC CAEN: École Supérieure d'Ingénieurs des Travaux de la Construction de Caen; FR: France; HEI: higher education institution; KTN: Knowledge Transfer

Network; MIRIADE: Mission Régionale pour l'Innovation et l'Action de Développement Économique; NGO: non-governmental organisation; PABS: School of Pharmacy and Biomolecular Sciences University of Brighton; RCUK: Research Council United Kingdom; SET: School of Environment and Technology University of Brighton; SME: small and medium enterprise; STEM: science technology, engineering, mathematics; UK: United Kingdom; UoB: University of Brighton; WSX: West Sussex Enterprise.

### Competing interests

The authors declare that they have no competing interests.

### Authors' contributions

JF, lead author, was the Principal Investigator of the INTERREG IV BRIDGE project leading the University of Brighton, UK. JF was appointed in January 2015 to the University of Portsmouth Faculty of Creative and Cultural Industries as Associate Dean of Enterprise and Innovation and Professor of Design and Innovation. All authors, JF and CW contributed to the BRIDGE project, participated in the design, coordination and drafting of the manuscript. All authors read and approved the final manuscript.

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