RESEARCH FOR ALL

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Developing university–society partnerships with a focus on climate change impact research using the 'business assist' model

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Abstract

This article explores the experiences generated through a programme of engaged research with university–society partnerships focused on businesses, climate change impacts and environmental technologies. The programme was co-created through research and development collaborations between a university, several large organizations, including the Met Office, Plymouth Marine Laboratory, Regen SW and IBM, and ten small to medium-sized enterprises (SMEs). Through a critically reflective narrative account and two case studies, which represent the perspectives of all involved, this article considers the processes of engagement, their effectiveness, the outcomes delivered and recommendations, as well as the context and influence of European policy – represented by the 'business assist' (BA) model – on creating engaged research. The co-creation of mutually beneficial space emerged as a key success factor, which challenged the short-term focus of the BA model.

Keywords: engaged research; innovation; narrative; research and development; SME; university

Key messages

- Personal contact and developing trust through periodic support and continuity of contact is still more important than online searches and automated support.
- Knowledge brokers added value through dedicated engagement and facilitated contact with the university and programme partners to proactively engage businesses in climate change impact-related research.
- Combining engagement approaches was valuable for encouraging the development of skills with existing and new team members, and accommodating restrictions on projects supported by particular funding bodies.

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Introduction

The category of small to medium-sized enterprises (SMEs) is defined by staff headcount (employing fewer than 250 people) and annual turnover (not exceeding 50 million euros). SMEs constitute a considerable part of the economic base of many countries (Biondi *et al.*, 2002; Lukács, 2005; Bennett, 2008; BIS, 2010; OECD, 2010), and in the European Union they represent 99 per cent of all businesses (European Commission, 2017). Such enterprises utilize natural resources throughout their operations and supply chains, and consequently have impacts on the natural environment (Coles *et al.*, 2016). In the context of the UK, since the late 1990s there has been an increase in policy support for SMEs (Bennett, 2008) and since the beginning of the 2000s there has been increasing European emphasis on improving SME capabilities to innovate in environmentally friendly ways and for sustainability (Biondi *et al.*, 2002; Li Rosi *et al.*, 2007; Ward *et al.*, 2010).

Numerous programmes have been undertaken to engage SMEs with themes including climate change, to stimulate awareness of the impacts on the businesses (for example, natural resource availability, such as water availability) and the need to adapt both business operations and offers to the market (Biondi *et al.*, 2002; Ward *et al.*, 2012; Coles *et al.*, 2016). Studies to date have focused on the role of SMEs in 'tackling' climate change and understanding how changing their actions and abilities to innovate contributes to mitigation and adaptation (Taylor *et al.*, 2003; Ipsos MORI and Shell Springboard, 2005; Revell *et al.*, 2010; Coles *et al.*, 2013; Coles *et al.*, 2016). However, few studies have approached these themes of climate change impacts through university–society partnerships or engaged research.

Universities are well placed to take a central role in the co-creation of knowledge and tools with external stakeholders from industry and government, to assist business (and their offers to the market) adapt to climate change impacts (Trencher *et al.*, 2014). Research and development (R & D) is crucial in the business innovation processes (Raymond and St-Pierre, 2010), and the concept of R & D collaborations to support engagement between businesses, research and the wider world is not unique. Past research has identified that collaborations between SMEs and private sector sources (such as lawyers, suppliers and business networks) on aspects including business strategy, staff recruitment and turnover growth, showed strong positive relationships. However, such relationships were not evident between government-backed collaborators, for example Business Link, a government-funded advice and guidance service for English businesses (Robson and Bennett, 2000).

Consequently, this article aims to reflect upon the process of using university–society partnerships to co-create knowledge and tools to help business operations (and their offers to the market) adapt to climate change impacts. The European Regional Development Fund (ERDF) supported the project, which brought together the Centre for Business and Climate Solutions (comprising the University of Exeter and the large organizations) and over 200 SMEs, ten of which undertook engaged research in the context of R & D. In accord with the EU funding, the 'business assist' model of SME engagement was followed. This paper will introduce the business assist model and critically reflect on the engagement techniques used within it, focusing on two R & D collaborations as case studies, as well as the outcomes achieved and lessons learned.

The business assist model and engagement techniques

The Centre for Business and Climate Solutions (CBCS – 'the centre'), located at the University of Exeter ('the university'), was established to provide a spectrum of engagement activities with south-west-based SMEs. This included the utilization of existing research outputs to facilitate change within the business and the co-creation of further research through R & D projects. There was a focus on climate change impacts across sectors, including tourism, construction, water, marine and energy, and an overarching theme of environmental technologies. This theme of engagement attracted the support of university partnerships, including with the Met Office, Plymouth Marine Laboratory, Regen SW and IBM. These large organizations provided access to expertise to supplement that of the university, resulting in a cohort of academics and practitioners that could drive engaged research.

Part-funded by the European Regional Development Fund (ERDF, from 2003 to 2007), the centre was required to use the business assist model of engagement to facilitate business change, undertake engaged research and deliver several growth-based targets to enhance the region's gross value added (GVA, a measure of productivity – readers are referred to the centre's ERDF summary report for such information (CBCS, 2015)). The business assist model consisted of 12 hours of contact time between representatives from the SME and appropriate experts from the university partnerships (organizations and companies previously mentioned) via a knowledge broker (business engagement specialists from the centre). Under the rules of the ERDF (2011), the business assist model could comprise the provision of advice and guidance, non-competitive consultancy, mentoring, networking, knowledge translation and technical services, including research and development. Ten SMEs were involved in the R & D business assists, which were allowed to exceed the 12 hours in order to better engender engaged research across the university–society partnership.

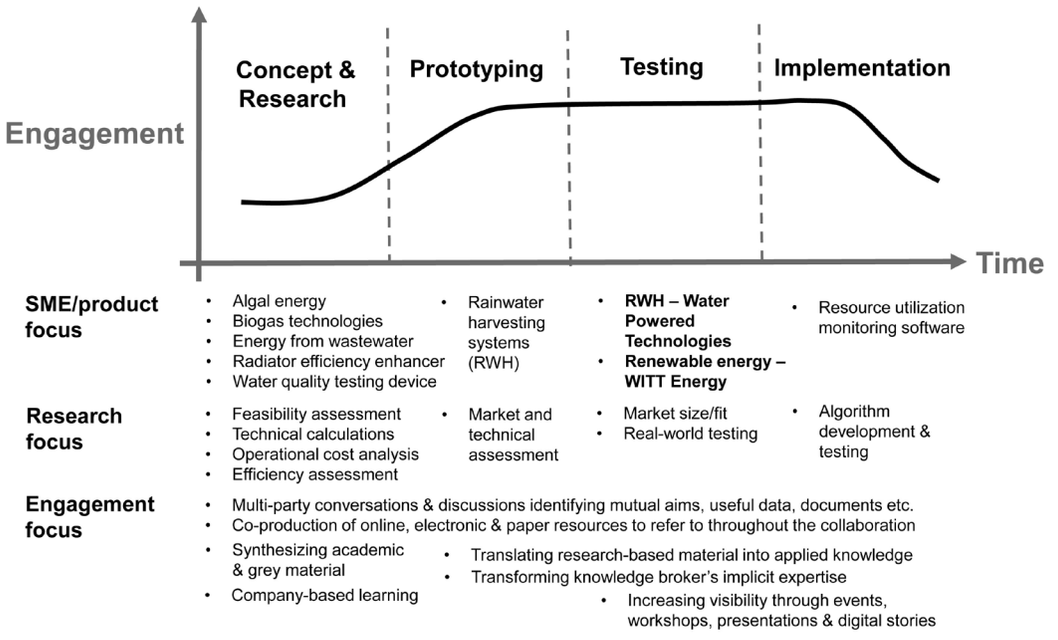
The knowledge brokers used the creative reconstruction approach, which translates abstract, conceptual and technical notions into accessible images, allegories, artefacts and activities (Bauer and Gaskell, 1999). This approach was chosen above the more common, but highly criticized (Phillips *et al.*, 2016), information deficit model, as the SMEs were not deficient in information; instead they wanted to engage in state-of-the-art research to generate new knowledge through which to shape their products, processes or services. Engagement techniques were selected with this in mind, along with the driver of needing to engage a cohort of over 200 SMEs to meet funder requirements. Initially, techniques focused on holding conversations with businesses, academics and practitioners to derive mutually beneficial aims and objectives and identify materials that could be used (for example, data, documents, models or other software tools). This was followed by de-jargoning, interpreting and reconstructing materials into formats more easily accessible for all members of a collaboration. Next, for some business assists, activities focused on transforming and articulating the knowledge broker's implicit knowledge through the application of calculations or compiling online, electronic and paper resources. For other SMEs there was collaborative attendance at events, delivery of panel discussions and engagement with, or circulating resources through, networks. In some cases, we used social media to reach SMEs and raise awareness, including through Twitter and digital stories launched on the centre's YouTube channel (www.youtube.com/channel/UCQd06ptgtiX_ZgcH_FOYkhw). There was also significant co-creation and delivery of workshops and presentations on arts and energy, strategic carbon reduction, flood

risk and resilience, future-proofing buildings, sustainable water and drainage systems, exploring algal energy and environmental accreditation. Other techniques included writing reports for non-specialist audiences – covering topics including those above; company-based learning (where students completed projects in collaboration with the businesses) – for example, a local tourism business wanted to assess the hydraulic and financial implications of relocating its water storage tank to be more efficient and the student wanted to develop their computer modelling skills; and developing a community of practice focused on environmental technologies. Within the broad business assist programme, workshops and reports proved to be the most popular, with high attendance and usage, respectively. Additionally, the translating of the knowledge broker's implicit technical knowledge in a particular research area was also well received, with SMEs highlighting the resulting formation of trust and confidence as being of substantial importance.

The community of practice activity was also particularly successful, as a range of businesses was interested in both developing and implementing environmental technologies. This acted as a springboard for ten intensive R & D business assists to create engaged research. We focus on these assists within the rest of this article.

These SMEs were actively undertaking product or service innovation, and were at varying stages of the product development life cycle, which required new research to be undertaken and new knowledge to be created to support the commercialization of the products. Some businesses were introduced to techniques that they may not have otherwise experienced, which enabled them to consider further the situation of their products within different sectors and markets. Figure 1 summarizes the focus of the SME/product, the focus of the engaged research and the focus of the engagement technique at the various stages of the product/service life cycle. Reflecting on our experiences, we could identify that at the beginning of the life cycle (concept and research), the types of research activity that the SMEs wanted to partner in were best attended to through conversations, co-production of resources, synthesizing material and company-based learning. During the middle of the cycle (prototyping and testing), translating research into applied knowledge and using a knowledge broker's expertise to co-create new knowledge were the most important engagement approaches. Towards the end of the life cycle (implementation), conversations and co-production remained important, but required attending to through different engagement techniques, such as helping to increase visibility through a range of outlets and media. The SMEs' internal capacities to embark on engaged research were limited at the beginning and end of the life cycle (primarily due to technical expertise or resource constraints on maintaining ongoing collaboration during the product launch phase, respectively). Consequently, engaged research during these phases was lower, as university assistance was provided in a more direct, less collaborative way than in the middle of the life cycle, where co-creation processes were key (and internal capacities were more supportive of engaged research). Through reflecting on engagement in relation to two case study R & D collaborations, with WITT Energy and Water Powered Technologies, the following section explores lessons learned for researchers and businesses undertaking engaged research through collaborative R & D.

Figure 1: Diagram exploring the small to medium-sized enterprise (SME) product development life cycle alongside engaged research focus and engagement techniques used



Note: SMEs presented as case studies in this article are named and shown in bold.

Case studies: Reflections and lessons learned

As previously mentioned, the reflections and lessons represent the experience of the authors, and thus include university, large organization and SME perspectives. Of the engaged research methods utilized in the overall centre programme, those primarily used within the R & D collaborations included creating space for conversations, knowledge transformation and exchange, performing experiments, writing accessible reports, catalysing networking opportunities and making digital stories. Reflections on these methods will be expanded upon through two case studies, WITT Energy and Water Powered Technologies (WPT).

Case study 1: WITT Energy Ltd

WITT Energy Ltd (Whatever Input to Torsion Transfer) is an SME developing a groundbreaking disruptive kinetic energy transmission device to generate electricity from motion. In the marine environment, the WITT uses natural occurring motional energy from the rolling action of the sea (ocean kinesis) to produce electricity. Mairi Wickett, WITT Energy's managing director at the time of the CBCS programme said that 'due to the scale of application, it was difficult at the beginning to explain the potential scope of the product' to potential investors. The CBCS business assisted by 'opening doors with key personnel to help promote the technology and bring expertise to weak areas within the business, such as assisting with testing and development'. The collaboration began with a meeting convened by the knowledge broker, the WITT team and relevant experts from the university and Plymouth Marine Laboratory. After discussions, arrangements were made for the WITT team to undertake testing

of their prototype using Plymouth Marine Laboratory's boat. The conversion of the rolling action to usable power would mean that electricity could be generated on site to power data gathering or navigational buoy sensors (which is currently done using solar panels with high battery maintenance costs). The tests enabled new knowledge (theoretical performance curves) to be created that showed power could be generated using the WITT to reduce the need for on-board battery capacity and frequency of battery replacement.

This co-created research output enabled WITT Energy to approach and network with a range of investors and manufacturers to develop the device into a marketable product. It also enabled the university to produce materials, including a digital story documenting the science and innovation journey of WITT, to be used in research and teaching (www.youtube.com/watch?v=ffQEVsVWO_Q). After the centre assisted, WITT Energy won Technology Strategy Board funding to further develop and produce the WITT for the vessel market. They also went on to win the Ocean Exchange's Gulfstream Navigator Award for applicability across multiple industries to generate a positive impact on the economy and the environment.

Case study 2: Water Powered Technologies

Water Powered Technologies (WPT) is an SME developing an innovative rainwater harvesting system based on its foundational invention the Papa Pump (a zero-energy pump). The pump has been successfully used for several years to deliver energy- and carbon-free water to agricultural premises in the UK and worldwide. WPT was interested in expanding and investigating other applications for their pump, and the centre was able to assist by using knowledge-broker skills and experience combined with technical input from WPT to generate new knowledge through an assessment of a scaled-down Papa Pump for use within an urban drainage application. The CEO of WPT stated that:

> … sustainable urban drainage systems is a sector which requires a lot of academic support to provide the solutions that the regulators are setting. The collaborations through the centre enabled us to identify the solutions that we should be aiming at as product developments.

The collaboration began through an initial meeting between WPT's managing director and a knowledge broker at an event convened by the university in collaboration with another large company interested in a range of alternative water supply and sustainable urban drainage systems. After the initial meeting, potential options were explored to undertake engaged research on their rainwater harvesting device. Further meetings and site visits to the SME's test facilities built trust and understanding of the needs of each party.

From the discussions that took place, an initial piece of computer modelling-based research was devised, to estimate how WPT's system could reduce the effect of storm water through storage and, in addition, how it could be an alternative water supply. Consequently, a company-based learning activity was devised to embed a student with the company to: (1) develop a simple spreadsheet tool through which system performance could be modelled, and (2) install meters and loggers on one of WPT's client's systems to generate performance data. Thoughts about how the system should be represented and various data sets were shared, enabling the model to be completed and applied to generate results. These were then interpreted and recontextualized in a more meaningful way for WPT in relation to political drivers that could be met through the application of their device (namely, surface water

management and flood risk reduction). The new knowledge created through this engaged research, and the resulting output, enabled WPT to refine their system and provided evidence to utilize when networking and seeking funding. The collaboration was also summarized in a digital story (www.youtube.com/watch?v=kDVY1FwkNC8).

Opportunities created using the business assist model

In both case studies, the production of a highly engaging digital story allowed parties to reflect on the collaboration, and some key success factors emerged. Digital stories are an expressive way of making the complexity of issues and outcomes of engaged research more meaningful to a wider audience. Reflecting on these collaborations identified the presence of a dedicated knowledge broker as being key to their success. Through the knowledge broker, the SMEs could communicate with, and be supported in liaising with, relevant experts and students working in appropriate research areas. The knowledge broker could also translate academic research artefacts (such as journal articles) and industry technical documents into more accessible formats, as both academics and businesses had limited capacity to do so themselves (either in terms of resources or experience of the style of the material from the other party). This is in line with research findings from Bougrain and Haudeville (2002), where the level of internal capacity to facilitate collaboration was crucial.

Additionally, the SMEs could receive signposting opportunities to increase visibility and networking through which to showcase the new knowledge generated through the engaged research. In effect, the knowledge broker acted as an intermediary, the role of which in SME collaborations is well established (Narula, 2004; Lee *et al*., 2010), but contested in public engagement and engaged research (Durie *et al*., forthcoming). Also key to their success was the series of meetings at events and the business's premises, which reinforced the value of such activities in strengthening bonds, trust and appreciation of what each party could bring to the engaged research process.

The case studies presented, along with many of the other SME collaborations, revealed that successful networking and building of trust was often based on mutual understanding and interest. In the context of WITT, the initial contact was established at both a personal and professional level through sharing of mutual interests, which included outdoor footwear! This highlights the importance of creating physical space for people to interact, even in the age of technology, where personal contact continues to be vitally important. In addition, the CEO of WITT mentioned that the knowledge broker 'immediately saw the scope and potential of WITT Energy', and the CEO of WPT stated that his business 'required a lot of academic support' to generate the required new knowledge to access the sustainable drainage sector. This highlights the benefit of university–society partnerships, and having skilled knowledge brokers with research interests and background experience of the research area, rather than employing a knowledge broker who has limited in-depth knowledge.

Challenges experienced using the business assist model

Reflection on the challenges imposed by the 12-hour business assist model, and even the extended R & D version, was undertaken by the university, large organizations, SMEs and an independent evaluator (Vallance, 2015).

We concluded that the 12-hour business assist model was too short a duration to facilitate engaged research of real benefit to most businesses, despite the best effort of the knowledge broker to do so using the range of engagement techniques outlined.

The longer R & D collaboration facilitated engaged research in a more comprehensive way that was more likely to lead to the creation of usable data and new knowledge, and consequently to ongoing collaboration, as it better suited the duration across which some engagement techniques need to establish rapport, trust and confidence. In some cases, this was prevented by the short-term focus of some SMEs, who needed to focus more on day-to-day operations than longer-term impacts or benefits derived through new knowledge generation.

Although 10 R & D collaborations were undertaken, only 5 product launches occurred (during the duration of the project), whereas 20 other businesses (a subset of the overall 200 SMEs enlisted on the programme) were able to launch new processes or services without undertaking specific engaged research through R & D collaborations. This finding is of interest for funders and policymakers, as policies and strategies aimed to support R & D activities may not necessarily result in the desired levels of GVA (a measure of productivity, mentioned in the previous section). Instead, it may result in the generation of engaged research, enhancing the likelihood of future collaboration and longer-term socio-economic benefit. Additionally, this contributes to the explanation of why government-backed schemes may not always result in successful business growth (Robson and Bennett, 2000). A further challenge potentially compounding this was the level of paperwork that was required to satisfy funder recording and auditing requirements. Several SMEs expressed to the knowledge broker that the amount of paperwork required for a relatively short duration of engagement was too extensive and onerous.

Many SMEs lacked internal resources (that is, people, time and know-how) to be able to consider undertaking engaged research with larger organizations and universities, which is in line with findings from other research. Bougrain and Haudeville (2002) identified that the success or failure of an innovative project was not related to technical collaboration or R & D intensity, but to the level of internal capacity that could facilitate collaboration. Research by Narula (2004) and Lee *et al.* (2010) reinforces this, as well as asserting that SMEs collaborate more effectively when utilizing intermediaries and networks. These studies focused on the process of innovation, the source of advice, internal capacity and networking. This article has reflected upon the process of engagement and has identified similar results. Future ERDF programmes could perhaps aim to enhance internal capacity to complement assistance from external organizations in order to overcome such limitations.

Finally, a lack of immediate resources (including capital) meant that the engaged research identified could not commence with some SMEs until the centre and partners could find and secure other sources of funding, creating delays in collaboration. For some SMEs, the technology or process they were developing 'didn't fit' with the existing sociocultural system, because it was not seen as suitable for replacing an existing technology/process or did not yet show a favourable cost–benefit, and therefore was not eligible for funding to support engaged research.

Lessons learned to improve engagement of SMEs using the business assist model

Considering the above case studies, opportunities and challenges, we propose the following lessons learned:

- Personal contact and trust was still more important than online searches and automated online support. New relationships were maintained by providing businesses with periodic support and continuity of contact in order to keep

exploring engaged research opportunities. This echoes existing guidance, which highlights that making contacts and developing mutual understandings and trust involves a combination of personal bonds, strategy and good fortune (CCANW, 2015).

- Value was added through access to dedicated project resources to engage and facilitate contact with the university and programme partners. Inclusion of a knowledge broker with the relevant skills (combining knowledge of the subject and ability to communicate well with SMEs), time and scope enabled proactive engagement of businesses in climate-related impacts.
- Utilization of a range of creative reconstruction and public engagement techniques, as summarized in Figure 1, was vital for undertaking engagement activities in the business world and communicating through business networks (rather than academic ones). These techniques enabled the team to talk with, and learn from, the business community directly, which could also apply to other public networks and organizations.
- Quantifying the short- and long-term economic impacts of 12 hours of assistance time was impossible and perhaps impractical. Focusing on the provision of a longer period of support to businesses could have improved this, which may have also improved the quality and robustness of the engaged research undertaken.

Conclusion

Through critically reflecting on the engaged research experiences between a university, large organizations and a group of small to medium-sized enterprises, this article has identified that outcomes useful to all parties can be created. These outcomes were created using engagement techniques such as co-designing and delivering workshops and presentations, writing reports for non-specialist audiences, holding panel discussions and events, co-creating digital stories, undertaking company-based learning and developing a community of practice around engaged R & D. Key success factors included a role for intermediaries (particular to business environments), engaging with collaborators in their own spaces and using a range of engagement techniques across the product/service life cycle. These key factors reinforced the value of fundamental activities in strengthening bonds, trust and appreciation to enable engaged research to take place. For the programme under focus, which was funded by the EU, there were challenges experienced, which included time-limited engagement durations in order to reach required targets on the number of businesses engaged and onerous paperwork obligations. Business-side challenges were also experienced, such as difficulty considering the outcomes of collaborations and limited expertise and resources inhibiting their engagement. This was particularly evident at the beginning and end of the life cycle, when internal capacities limited opportunities for co-production. Future programmes could perhaps aim to enhance internal capacity to complement assistance from external organizations. Finally, lessons learned reiterate the value of using combined approaches, encouraging the development of engagement skills with existing and new team members, and considering restrictions related to projects supported by particular funding bodies.

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Notes on the contributors

The authors are based in the south-west of England and worked together to explore the science and art produced when a university, large companies and small businesses collaborate to achieve engaged research relating to climate change impacts and environmental technology innovation.

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