



<https://doi.org/10.1038/s44172-025-00444-z>

# Industry–academia interface: the value of collaborative research and development with Danielle Densley Tingley

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**Professor Danielle Densley Tingley is an environmental engineer based at the University of Sheffield in the UK. Her research focusses on reducing the impact of the built environment on the planet using a number of strategies. Here, Dani shares her perspectives on the benefits of collaborative R&D in building a research career and in addressing grand challenges.**



Credit: University of Sheffield

## 1. Tell us about your career pathway and current research interests

After graduating with a dual degree in Structural Engineering and Architecture, I was keen to develop my construction expertise in a way that could genuinely make a positive difference in the world. This led me to undertake a PhD that explored lower-carbon means of construction, and particularly the value of designing structures for deconstruction and reuse. At the time, 15 years ago, few people even considered the embodied impacts of extraction, processing, manufacturing, transporting, maintaining, and disposing of materials. It has been exciting to see that change over the last decade. After my PhD, I

undertook several post-doctoral positions across the UK, broadening my experience to different methods to reduce whole life carbon and implement circular economy strategies in construction. My research interests remain in this space, and now I lead a research team who have been awarded £6.4 m research grant (BuildZero) to investigate whether society's needs from the UK's building stock can be met with zero raw material extraction, zero carbon and zero waste.

## 2. Tell us what collaborative R&D means to you?

Collaborative research and development is something I'm enthusiastic about as a mechanism to have a positive impact on the construction sector. In the broadest sense, collaborative R&D is about working with industrial partners to both shape research projects as you're developing them and working collaboratively on live projects. This can take various forms, which I categorise into two main groups: academic-led R&D and industry-led R&D.

Academic-led R&D will tend to be government-funded, with varying levels of industrial input depending on the project. Often, partners will contribute time to help steer research direction to ensure its applicability. In practice, this might be through participation in advisory boards or workshops to help shape research proposals. Involvement of industrial partners in these ways ensures your research will have a real world impact, e.g. in the BuildZero research project we're working with partners to co-create a material stock and flow model for London, this is a necessary research output for us to evaluate circular economy potential in the city, but by working with partners from an early stage we're also building the model in a way that our industry partners could make use of it. Industrial partners may also contribute funds towards these projects. A common example of this in the UK is part or full funding of PhDs, where you may have industrial supervisor(s) who work alongside the academic supervisor(s) to guide the research direction. In these academic-led projects, the academic team do most of the work, with the partners inputting a small percentage of their

time in order to provide expertise throughout the project and help guide research that can make a practical impact.

Industry-led R&D, on the other hand, tends to be driven by a technical or business challenge that a firm wants academic/research input for, e.g. development of building design tools that can then form part of a commercial offering for the business. Industry-focused schemes, e.g., Innovate UK funding, the EU's Innovation Fund, or Canada's Strategic Innovation Fund, would fall in this category. Industry can also directly fund researchers to conduct R&D where they require specific expertise or where access to specialised equipment/facilities is needed. Industry-led projects are likely to have a larger time input from the industrial partner.

## 3. What do you see as the key differences between collaborative R&D and academic R&D?

The key difference with collaborative R&D compared to purely academic R&D is that the latter can be entirely research-led, with little concern for real-world practicalities or application. Academic R&D can be more open-ended and exploratory, although this of course, depends on how it is funded. Academic R&D also tends to sit earlier in the technology readiness levels (TRL) and might be considered less immediately impactful - by nature of the work being more exploratory and less applied.

Collaborative R&D, by contrast, tends to be more specific and applied in nature and may be more fixed in terms of expected outputs. However, this does depend on how it is funded, i.e., the amount of industry funding, as if it is at least partially government funded, there will likely be some flexibility in outputs. The extent of industry funding can also determine who owns the outputs of the research; if entirely industry funded, then the industry funder may wish to own the outputs, although this is typically agreed on a project-by-project basis. Depending on what Intellectual Property (IP) agreements are in place as part of the contract of work, there may also be limitations on publishing the work. This is worth discussing with the industry partner at an early

stage to see what they would or wouldn't be comfortable publishing, so it can be written into the contract. Some partners might agree to an embargo, i.e., the work can be published several years after completion of the research. Or if they don't see a conflict with commercial exploitation of the work, they might be happy with publication more immediately.

#### 4. What originally motivated you to explore collaborative R&D, and how did your early projects come about?

I started to explore collaborative R&D to try and create more impact from my research. By working directly with partners, it felt like a good opportunity to develop solutions that industry was specifically looking for that could reduce environmental impacts once they were put into practice.

During a research project I was working on as a post-doctoral researcher, I grew my industrial network, which was largely because part of my role was to disseminate research findings into practice. It was through this network that my first collaborative R&D projects came about. I was approached to get involved in some industry-led funding proposals as an academic on the team. Growing your network and reputation within the industry can be a way to take the first steps to get into collaborative R&D.

#### 5. How has collaborative R&D been useful in your career development?

Collaborative R&D has been important for my career development. Those early R&D projects helped to demonstrate a funding track record and played an important part in me being offered a lectureship (Assistant Professor) position. I've worked on a number of collaborative R&D projects since then, and they have continued to help me create impact from my research, bring in funding and grow my networks, all of which have been essential to progress in my career. I've just been promoted to Professor, and I believe that my collaborative R&D work has played a big role in getting me here.

#### 6. Is there any typical scenario in which a collaborative R&D opportunity comes about? And how do you decide whether a project is worth taking on?

For me there have typically been two different types of scenarios where collaborative R&D opportunities have come about: (1) where I've got an existing relationship with the R&D partner and a project naturally develops, and (2) where I'm approached to undertake a collaborative R&D project (these have typically come from referrals by someone in my network).

In the first example, because the project naturally develops, I have tended to help shape it with the partner, so they have always been projects that I have wanted to take on. In the latter example, I have tended to assess if the project firstly aligns with my research ethos (does it have the potential to reduce environmental impacts), if it does then I would meet with the potential partner to understand more about the project scope and what they're looking to get out of it, and then I consider if I, and my team, have the capacity to take the work on, and that the budget is sufficient to undertake the work.

There are also specific events and forums, typically linked to government funding calls, which can be useful to network with the community within a space, e.g., the EU Research and Innovation Community Platform, and from these, R&D opportunities could arise.

#### 7. How do you see collaborative R&D fitting into a research agenda tackling grand challenges such as the Sustainable Development Goals?

I think collaborative R&D is an important part of a research agenda that aims to tackle grand challenges. If you want to conduct research that facilitates the delivery of one (or more) of the sustainable development goals, then it is important to transfer your research into practice. Collaborative R&D can be an effective way to do this if you take on work that is in synergy with the grand challenge that you're addressing. Many government grants for grand challenge research

also specifically encourage collaborative R&D to ensure that the research can be transferred into practice as quickly as possible.

#### 8. What are your key pieces of advice for researchers interested in building collaborative R&D opportunities?

I have three key pieces of advice:

1. Build your industrial network - this is likely to be the gateway to collaborative R&D opportunities.
2. Work across TRLs to understand how to grow and develop a research idea from an early TRL through to later stages, where you might work with an industrial partner to help put it into practice.
3. Talk to colleagues in your field who have experience in collaborative R&D to understand typical hourly/daily rates for someone of your level of experience and in your research area. This is very useful if you are approached to undertake contract research or consultancy.

This interview was conducted by Rosamund Daw, Chief Editor, *Communications Engineering*

Published online: 23 June 2025

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