The expert view: a discussion about the work of Engineers Without Borders Australia and good engineering

Interviewer: Gareth Byatt – Principal Consultant, Risk Insight Consulting
Interviewee: Pete McArdle – Chief Engineer, Engineers Without Borders Australia

September 2023

Traditional sand filtration methods are solving complex engineering problems in Cambodia (Image: EWB Australia)

Pete,

Thank you very much for making the time to discuss the work of Engineers Without Borders Australia and some thoughts and aspects of how people can work together to avoid disasters around the world. I was delighted to interview one of your team, Stephanie Hamel, in July 2021 about EWB Australia's work in Vanuatu, and it has been good to follow your activities for a while.
Could we begin this discussion by summarising your background and experience, and the work your organisation does?

Pete: Sure. I have been involved with EWB Australia in different ways for a long time. I have been a chapter member since my university days, and I have served on the Board too. I have been in the Chief Engineer role since April 2023. Prior to this, I spent about 10 years working for the Red Cross / Red Crescent Movement in different engineering and coordination capacities, assisting relief efforts in various crisis situations around the world. I have been deployed to situations of armed conflict in Iraq and Yemen, as well as disasters and public health crises in other parts of the Middle East plus Africa, the 2015 Nepal earthquake relief effort, Ebola in Sierra Leone, and have recently supported COVID-19 operations in Asia-Pacific.

With regard to the activities of EWB Australia, the organisation was formed in 2003 and, as we explain on our website, our vision is for a world where technology benefits all. We define technology as any means that humans use to adapt the environment, and perhaps I can provide some examples of this later. It is not focusing on the internet, AI and smartphones.

Given our name, there is sometimes an assumption that EWB Australia operates much like MSF, but the work we do is a typically little different. It's worth outlining that EWB Australia currently focuses on four countries – Vanuatu, Cambodia, Timor-Leste and Australia, where work closely alongside First Nations communities.

It's an interesting time to talk about disaster risk and taking anticipatory and proactive action to reduce the negative impact of disasters. We have been through an internal review recently for our engineering programme, to unpack what we do and articulate how we measure our impact.

We follow an EWB Australia strategy which was developed in 2020, and this guides us in what we do. Now we are moving forward with more granular detail to review what we do to maximise our impact, emphasising that engineering is a social profession as much as it is technical.

Gareth: As part of your work, do have linkages with organisations in other parts of the world, in geographies outside of the areas where you operate, including perhaps with agencies like UNDRR and UNDP?

Pete: Yes, absolutely. We work with various partners located in the countries where we operate and also some who are further afield. With UNDRR, we were involved in the Asia-Pacific Ministerial Conference on Disaster Risk Reduction 2022 that took place in Brisbane in September of that year. We also link our work to regional and global frameworks, such as the Framework for Resilient Development in the Pacific and the Sendai Framework for Disaster Risk Reduction 2015-2030.

Gareth: Regarding the impact of projects that you undertake and linking to your EWB Australia strategy, do you consider quantifiable targets together with qualitative ones, and how to ensure that quantifiable targets relate to measures that matter?

Pete: Absolutely, there are several angles to looking at the assessment of our work. Our primary driver is to address the needs that communities themselves identify, and to work through these with them. To do this this we need to clearly articulate the benefits and impact of what we do.

EWB works to bridge the gap between quantitative and qualitative data, in design; in how we talk about our work; and perhaps most importantly in how we learn. It's a difficult space to operate in, because it requires multiple and very different ways of thinking, and an appreciation that there are different understandings of knowledge with different groups of people. Understandably, as a profession that works so much with numbers, the engineering sector often errs towards quantitative targets, and that's fine for say pump design or power generation. But even those two examples are deeply linked with rights, justice, and culture – things that engineering has a huge impact on but are not measurable in litres or kilowatts. For this, we need to be skilled at and comfortable engaging with perspective and values, which bring depth and richness to how we understand a situation, including disaster threats and hazards.

Gareth: Considering what we've just discussed about having good quantifiable and qualitative targets, are there particular themes to the work you undertake?

Pete: Our work is guided by outcomes, as distinct from outputs – or you could say it's the change our work will bring for partner communities, rather than tying our projects to any one discipline of engineering.

Most of our work is currently in the WASH ([Water, Sanitation and Hygiene](#)) sphere, not because it has been a specific target area, but rather that it tends to be in demand as high-impact work in the places where we operate (which aligns with our focus and strategy to have the biggest impact with what we do). We carry out other types of work as well. Some of our projects are "defined scope projects", where we know what the output of the project will be; others allow for research, product development, and innovation. All have an articulated pathway towards a goal of positive change.

For example, projects that are identified by communities to address a need will often benefit from having a series of iterations to develop a solution. In order for the iterative approach to work, we need to plan a project to deliver outcomes this way, which includes not assuming that the first iteration of scope is how it will ultimately be delivered.

Gareth: The iterative approach to certain projects EWB Australia carries out gets me thinking about innovation that really focuses on defining "the Why" and not jumping straight to "the How" and "the What" of a solution (which is all too easy to do).
I think this point aligns with the initiative that Professor Ilan Kelman, Ana Prados and I are working on, called Disasters Avoided.

We want to show how integrated upfront action can prevent disasters from happening, and we are highlighting examples of disasters that have been avoided through intelligent action – which includes spending enough time to define "the Why" for upfront investment and projects.

Pete: Yes, we sometimes need to acknowledge that we won't find the solution until a lot of listening and learning is undertaken, and that our ideas towards a solution may need refinement through a process of iteration. We appreciate that such projects can take longer than those that do not have as much iteration in them. But often if you are willing to invest more time and money up front, typically in a pilot first, a better project can then be rolled out at a larger scale (always recognising the importance of local context).

Gareth: It's interesting to hear about your "regular types of projects", and those that have a more iterative approach that builds in a process of refinement through iterations. Just going back to and linking with the earlier discussion point about setting targets and objectives, do different types of projects have different measurements of impact, depending on what you are seeking to achieve?

Pete: They do indeed. As I mentioned earlier, we use quantitative and qualitative metrics for measuring our project impacts. Those of us in the global engineering community (of which I speak as one) often focus particularly on quantitative measurement, since we think of our work as having physical outputs. Whilst this is true, qualitative impacts are also important to focus on, and one of the things we aim to do at EWB Australia is to bridge technical and social aspects and make a connection between them.

Perhaps I can ask you something on this point. I am interested to know what you've seen for measuring impact, when we seek to measure "a lack of something" or something that doesn't happen. I think that it is not so much that it is hard to measure, but what is harder is that a lack of something doesn't attract the interest from people and groups.

Gareth: Thanks for this question. One of the things we are looking at in our Disasters Avoided initiative is how people are showing the benefits and impacts of action to avoid bad things happening. We are seeing some good visual examples. For example, we have seen visual articulation on maps of the positive impact achieved by upfront planning and investment, to reduce the impact that major events such as wildfires or flooding can have. Earth observations can show how resilience in a particular area is protecting areas, and if an event such as a wildfire or a flood or an earthquake occurs, these visualisations show how areas have been saved and protected. Sometimes we have seen calculated quantified benefits for life, livelihoods and nature. For example, looking at a Bird's Eye view of a community, with information provided about the number of people living in the area, the financial value of residential and commercial properties, the value of local industries etc, we can see how proactive action helps to avoid a disaster when a hazard is threatening the area.

On the qualitative side, we also hear plenty of stories of how people – individuals and families – have avoided a disaster, which we feel are important to capture and share.

Pete: The perspective about avoiding disasters is an interesting angle for EWB Australia in that we have engaged in the disaster risk area for some time in many of our projects, but we haven't necessarily used the language of "disasters avoided" or "disaster resilience". I am interested to see how, through mapping our work, whether it makes sense to categorise relevant work we do as disaster risk reduction (DRR), or anticipatory / proactive action to avoid a disaster. Perhaps we will see a few surprises when we look at our portfolio through a different lens. Some of our work may well fit into the "disasters avoided" space, even if it uses alternative language.

To give you an example, [our First Nations programme](#), which has been ongoing for at least a decade, has a major emphasis on relationships and resilience through relationships. Listening is a big part of what we do on this programme. Perhaps we could call it knowledge exchange – what we know is that the listening side of our work in this programme is crucial. A lot of the programme is helping the engineering sector to understand what it means for First Nations people to live on country, and what engineering can look like on this land, and to be informed by 65,000 years of engineering wisdom (rather than the other way around).

There is great potential to be guided and informed by traditional knowledge in a wide range of projects to reduce disaster risk. We have been working in the space of traditional knowledge in Australia for a while; in the other countries where we operate much of our work is more of a classic type of DRR focus. I think there is a common linkage that we can tap more into for all our projects moving forwards. It's about ensuring that we speak to the issues properly.

Gareth: There is much we can learn from those who have local and traditional knowledge. I can see that the countries where you operate all have valuable local knowledge about what can work well, and I completely agree about the value of listening. In our Disasters Avoided work, we often see examples of how local knowledge can and does contribute greatly to avoiding disasters , which usually means making the time to listen to people and to engage in a good discussion and debate. For example, we are seeing how the nation of Australia is moving forward with various actions to avoid and minimise wildfire disasters, which includes appreciating the value of First Nation and indigenous peoples knowledge and ideas, and incorporating them into overall efforts and activities. Outside of Australia, I have seen examples such as [The Report of the Wildland Fire Mitigation and Management Commission](#) in the US, which was released in September 2023, which includes a section on the importance of enabling indigenous stewardship and wildfire mitigation work.

Pete: On this point, a good memory I have of this way of thinking is a discussion I had with someone back when I was a student working on my thesis, about water scarcity and conflict. I was talking with someone who works in that field, who said to me "we don't want concrete on Country".

It has always stuck with me, because the engineering mindset is to go in and fix something, usually by creating something (using concrete and / or some other material / structure). Sometimes, though, the best and most resilient solution is to take things away or adopt a completely different approach.

Gareth: Thanks for this example, Pete. I often wonder about the balance between so-called "grey infrastructure – human-made defences – and green/blue nature-based solutions, be it for water resilience, wildfire resilience, earthquake resilience or drought resilience. We can see how in relevant circumstances human-made flood barriers – so-called "grey infrastructure" – make sense. For example, the Thames Barrier in London has proven its worth in the many years of its operation (I know there are some questions now being asked about whether it will need to be upgraded), and infrastructure in Hamburg's Hafen City is key to its resilience against flooding also. Whilst knowing this is the case, often we can achieve a resilient outcome by working with nature and tapping into local knowledge to define how to best do so – maybe with a blend of grey (human-made) infrastructure and nature-based green/blue infrastructure and solutions. Context is always key. I am reminded of a recent UNDP/GCF project in central Viet Nam that focuses on building flood-resilient homes (human-made structures) and also restoring mangroves (a nature-based flood resilience solution) in a way that works for the community – for example, ensuring people can maintain fishing routes through the mangroves.

I wonder if there is, or should be, a link to risk and vulnerability assessments that agencies and others use to determine resilience and vulnerability of different areas, and to ensuring that this thinking is infused into such assessments so that we listen to locals properly and learn about their knowledge and ideas before determining solutions. My Disasters Avoided initiative collaborator, Ilan, uses a term "engage the first mile" rather than 'the last mile", to describe community collaboration coming first. Consult and engage properly with the community, then develop the solution(s) and discuss how they can best be implemented.

Pete: These examples do make sense. A big part of the work we should do is to break down assumptions and to know that we may not have the best answers until we listen to a wide range of views. This approach opens a whole different perspective to us, and I daresay it also includes learning from examples around the world, not just in "our backyard".

Gareth: Do you have some examples of this open mindset, where from active listening you have seen things in a different light, perhaps coming up with a solution that you wouldn't normally have thought of, that has led towards good outcomes and impacts?

Pete: I find that it can happen in big ways and also in little ways. Some outcomes from this type of engagement in a project are tangible, such as the development of the non-electric washing machine project in Vanuatu, where a need was identified by a Mother's Group, and through iterations we refined it to where it is now.

The Disasters Avoided project highlights examples of proactive action around the world to avoid disasters.

The iterative development process we used took longer than a simple engagement process with one or maybe two feedback loops, but by being guided by revisiting what their needs are and being ready to adapt after collecting feedback, we achieved a good solution that is practical and that they can and do use, and that's what counts (going back to our discussion about impact).

Another example that speaks to this is a project we have undertaken for a First Nations community in the Kimberly area of Western Australia. What we discovered, by keeping an open mind and listening, was that while there were some water-focused challenges to solve, what they really wanted was community space. What we ended up helping them with was a basketball court. This is not your typical WASH / shelter type of work, yet it was something the community needed to help with social cohesion and social resilience. We were guided by the community – appreciating of course that we need to ensure benefits are being delivered. Stepping back from an engineering mindset where we may think of interesting technical solutions to overcome a problem, a basketball court is instead simple and definitely not high-tech, but it's a solution that is serving their needs.

Gareth: This First Nations example, and the washing machine project in Vanuatu also (hopefully [this knowledge is being seen by others around the world](#)) make me think about "Are we framing the right question?" when we start a project. We draw assumptions, we have inbuilt (often unconscious) biases from our experience and other influences. Spending enough time up front to define the question and problem is key.

Pete: It certainly is. Community cohesion is one of the high-level outcomes that we have landed on through our recent strategic refresh, and this is linked to understanding the problem or challenge that we need and want to solve with them. We hear the word "resilience" used a lot, and whilst it is fine in concept, people often do not really know what they mean when they say it, or they have a particular view and do not think of others or the complete picture of resilience. For example, in engineering we talk about resilience in the physical sense, and the physical world's ability to withstand a disaster. Yet there is a crucial social resilience space as well. Strong social connections that are a key part of resilience, and the best outcomes integrate social cohesion with the physical aspects DRR.

It's Important for an engineering solution to be informed by how you can support the social cohesion.

Gareth: This discussion about the meaning of resilience makes me think about the work of a range of groups in Bangladesh to avoid flooding disasters, and the societal cohesion that fosters this approach ([see this BBC article as an example](#)). I wonder how local communities can make best use of a range of technology, including leveraging Earth observations, digital tools and more basic technology solutions for social cohesion and social resilience.

Pete: *Absolutely. If we can understand and then leverage these types of opportunities, we should aim to see how we can apply them. It's linked to our discussion point earlier, about making the time to listen and learn before we get into solution mode.*

Gareth: For some of your projects, do you make use of Earth observations to get an overall view of some of the risks and opportunities that community groups face (be it from satellites or lower-level drones)? We are seeing some interesting examples of how Earth observations satellite imagery and drone footage can help avoid disasters.

Pete: *It is something that we are interested in exploring to see what the options are. People can often see some potential in a technology without knowoing entirely what it will look like in practice.*

I'll give you an example that is a little left field. One way we have used drone technology is related to learning programmes for undergraduate students. The EWB Challenge is a curriculum-integrated design challenge for undergraduate STEM students in their First Year, and it takes place across a number of universities in Australia, and other parts of the world (about 10,000 students take part in it annually). We present students with a real-world problem and invite them to put forward designs to solve the problem. It's about the mindset and approach more than technical needs. As part of this we have developed some online content, and we have used drones to map and provide context to the problem that we are presenting to the students. So, we are using it in a certain way, including showing undergraduates some of the possibilities with Earth observations.

Gareth: Very interesting. I think also of how organisations such as NASA provide support to students.
What kind of involvement do you have with the private sector? I recall from my discussion with Stephanie two years ago some work you were doing with Arup.

Pete: *The private sector is very supportive of our work, I am pleased to say. As well as monetary donations, we have and continue to invite partnerships with the private sector through which firms can offer their staff's skills and capacities to our projects. Our work with Arup continues – they are active on some of our projects. Aurecon has worked with us on water treatment; and Douglas Partners, a geotech firm, has supported us with some excellent work in flooding contexts (geotechnical testing and investigations). On the subject of geotech, one thing that has been emerging from some of our work is that Geotech expertise in particular can be hard to access despite huge demand in disaster settings (for reasons of scarcity and also cost), so when we can make use of private sector assistance, it is very much appreciated. The same is true for our academia partnerships, I'd like to add.*

Gareth: Your examples of leveraging geotech expertise and water management make me think about skills in these areas in the mining sector (which is of course a large part of Australia's economy) and whether they may be able to support disaster resilience projects in a pro bono way, perhaps with geotechnical assistance and water engineering. Maybe the same is true for water companies / utilities?

Pete: It is interesting to see different approaches from different organisations. We can indeed think about how public utilities, such as water companies, and perhaps mining businesses too can help with disaster risk work. I remember discussing with one water utility their focus on lead indicators when they have to deal with matters such as water restrictions in the areas they oversee, to get ready and be proactive rather than rely on reactive (lag) indicators. Their focus on lead indicators is coming from a different point of view than those of us who may refer to say, anticipatory action or upfront activity, but we are both talking about the need to be pre-emptive and proactive.

Gareth: Good point about lead and lag indicators, Pete (and relates to our earlier discussion about quantitative and qualitative metrics). I have found that the use of such indicators is quite widespread in the private sector. When we also draw on expertise in the academic world we can hopefully gain good insights into various aspects of disaster risk.

Pete: I agree. If we think about how we want projects to be community-led, some of these linkages are not obvious at first. It's a question of looking at the need from different angles and making the time to think through how to create the best solution. I can see that mapping, photography and other technical assistance can add value, if we can think about the right opportunities for them. If we can find out about examples of how different technologies have been used, we can see how we can perhaps apply them in different contexts.

Gareth: In terms of the mindset, something I have spoken with a few people about is to keep in mind a counterfactual mindset, in which we find out about and understand what has happened in the past, but that it could have evolved differently.

Here are a couple of examples:
- A downward counterfactual mindset (e.g. for multi-risk cascades)
- A counterfactual mindset to learn from successes in avoiding disasters

Pete: Yes, I can see counterfactual thinking as being a helpful concept in how we think about events and disasters, both from the past and for the future.

Gareth: Where does EWB Australia get its resources and finances from? Is it a blend of partners that come together to help fund your activities?

Pete: It is indeed a blend of partners and resources. While we receive considerable support from the Australian Government, EWB's donor base is also a little atypical, in that we also receive funding support from the corporate engineering sector. We also have work with donors such as the ADB; and we offer socio-technical consulting services to the humanitarian sector. Going back to our earlier discussion about showing the benefits of anticipatory and upfront action, a key part of our discussions is to show donors what is possible with anticipatory action.

Gareth: Just continuing the discussion about partners from different sectors, what kind of role do you see the insurance sector playing in the reduction of disaster risk?

Pete: This is an interesting point. At the UNDRR conference in Brisbane in 2022, I recall a representative from a Japanese public disaster insurance body speaking about how the insurance sector focuses heavily on risk reduction, which is not surprising when you think about it, but nor is the insurance sector always active in the DRR space. There has clearly been decades of thinking in the insurance sector that has engaged heavily in risk reduction and analysis, which we could perhaps tap into to a greater extent.

Gareth: Thanks for this perspective, Pete. I know some people who work in Risk Engineering teams in large insurers, and it makes me think about the work they do to assess properties for risks, such as fire engineering, and also the work of insurers to provide parametric insurance to release funds early in a disaster event.

Can I finish this interview with one last question: what would you like to see focused on more in the years up to 2030, to help to reduce and avoid disasters?

Pete: We've spoken earlier about anticipatory action, and there is increasing momentum and focus on this, which I am glad to see. As conversations are more widely held, pre-emptive and proactive humanitarian action is more and more on people's radar. However, being so intertwined with things like climate science, early warning systems, and associated technology, it will need strong engagement with folks who can see and understand both the social and technical aspects of disaster resilience. What's more, those of us who engage in this space have so much to learn from traditional knowledge systems – not only the 'what', but also the 'how'; the complexity and interconnectedness of systems, actions, and perspectives. The more comfortable we are with multiple truths; the more we are ready to sit with paradox and understand that the best solutions come from diverse knowledges and values; the more effective and transformational we can be.

Thanks very much for your time, Pete. I look forward to continuing to follow the work of Engineers Without Borders Australia.