On the Menu:The Role of Innovation in Crisis Situations

**SPEAKERS**

Laura Ferris, Mark Fletcher

**Laura Ferris** 00:05

So hopefully everyone can hear me okay. Thanks very much to everyone for joining us today. My name is Laura, I work on the Ofwat Innovation Fund at Nesta Challenges and on behalf of myself and the rest of the Ofwat Innovation Fund team, just want to say we're really excited to welcome you to this On the Menu session today. So I'd just like to start by kind of giving a quick bit of background on the On the Menu event series itself, and then I'll introduce you to today's session speaker, Mark Fletcher, who I'll hand over to to do the kind of exciting and interesting part of actually taking you through the event. So the On the Menu series is a set of free, informal lunchtime learning events launched by the Ofwat Innovation Fund team with the aim to kind of showcase new technologies and innovation methods, and host discussions about how those technologies and methods can be used and applied in the water sector specifically. So today's event will explore the role of innovation in the climate crisis. And you'll find out kind of more about why innovation is so crucial in crisis situations and learn more about innovative approaches and solutions borne out of extreme situations that already exist. So we're very excited for this session to be led by Mark Fletcher, who's an Arup Fellow and Global Water Business Leader. And I'm going to hand over to him in just a second to get us started. Just before that, a really quick reminder that we are recording today's session as well. So without further ado, Mark, please take it away.

**Mark Fletcher** 01:26

Thanks very much, Laura. And I would encourage, if you've got any comments, thoughts or questions, feel free to use the chata as we go through or the Q&A. I think that'd be really helpful. So good afternoon, I'm just back from COP26, where the need to focus on mitigation and the causes and adaptation to the impacts of climate change have never been more important. Building resilience for people, places and the environment is essential. So I thought I'd share how we've adopted innovation in our thinking, in lots of ways, with the essential threat of a climate crisis driving our actions.

**Mark Fletcher** 02:14

Oh, that's, that's encouraging. Right okay, I'll try that. I'm gonna take a couple of deep dives and a few shallow ones. I hope you learn something in the process and it prompts you to think even a little differently with my subtle nudges. And innovation in this case isn't just about technology. This is about innovation in the way we think. We thought that might, it might help. We're already experiencing extremes, as evidenced recently in Vancouver. How we adapt and build resilience is really important for every project that we work on. And so we can think about some of those extremes affecting, now affecting public transport, that those horrendous pictures in China. Or we can think about basement flooding in New York from stormwater. We think of fluvial flooding down rivers in Germany, and how devastating that's been for communities. And we can think about national droughts like we've had in Taiwan. I don't think we need any more wake up calls. If we're not awake by now, we should be. My first deep dive came about from considering the point at which more people lived in urban than rural areas and the increasing experience of climate extremes. I thought we needed a framework of understanding and shared this with a few like-minded friends and individuals at Stockholm World Water Week. But I'll set the context of that. So I was at Stockholm for our chat, because I responded to an email from a guy called John Matthews who was at the Alliance for Global Water Adaptation. They're based in Washington DC, and they had seen our design with Water Framework online. I responded to the email and got invited to go to Washington. And it was probably at the time, it was a sort of a chance or a happenchance email and response. But I joined and I'm now on the board. But I met a group of people from World Bank, Dutch Government, US State Department, Stockholm Water Institute, Rockefeller Foundation, and a lot of others, who were thinking differently about climate change and the need to focus on adaptation and resilience, not just mitigation. So a beer mat idea, co-funded initially by Arup and the Rockefeller Foundation, has now become reality. Our approach to water resilience in cities has now been applied to 15 cities worldwide. But the initial pilot cities were Miami, Mexico City, Hull, Amman and Cape Town. All had significant shocks and stresses but for today I thought I'd give a deep dive on Cape Town. But I can't do so without acknowledging the great work done by Living With Water partnership multi-agency, responding to the findings of the Pitt Review following the floods of 2007. An innovative multi-agency approach and they've embraced the City Water Resilience approach. And that multi-agency is Environment Agency, East Riding Council, Hull City Council, Yorkshire Water and Hull University, as well as the as the people of Hull and wider Hull. So the City Water Resilience approach. It comprises five stages, which I'll explain. It uses a water resilience maturity framework, sort of rose diagram to assess maturity. And it also uses a digital tool for mapping water governance across the water cycle.

**Mark Fletcher** 06:34

Cape Town is now known as one of the drought case studies worldwide that people refer to. Day Zero's been burnt into many people's memories. Well, water resilience has been increased for about 4.7 million citizens. We collaborated with the City of Cape Town during the 2015 to 2019 drought to develop and implement the City Water Resilience approach. And that's a multi stakeholder participatory process. It's aimed at developing a shared understanding of the resilience challenges a city faces and develop a shared action plan. This included interviews, focus groups and workshops with more than 120 stakeholders across Cape Town and the Western Cape. Our work with the City of Cape Town covered a variety of shocks and stresses across the water cycle, including pluvial and fluvial flooding, wash provision and water quality. However, in today's presentation, we're going to focus on the drought. I'll cover the context of the drought, short term response, longer term, and sorry, longer term planning to improve resilience and some of the lessons learnt the main ones. So to provide some context, I wanted to share four graphs and these are the only graphs in the presentation. And they might be quite hard for some of you to see but I can just about manage with my bifocals. Starting in the top left corner, the three year drought in Cape Town started in winter of 2015 and lasted until 2018. Cape Town's always experienced highly variable rainfall patterns. They designed their system to achieve 98% supply assurance in a given year. The three year drought was a one in 590 year event based on historical rainfall records. But due to climate change, we're experiencing additional uncertainties in rainfall temperature and wind. I should have turned one in 590 year into a probability but it was beyond me. Between 2015 and 2018, the El Nino and increased demand on the Western Cape water supply system due to population growth, economic activity, invasive species, lead to drought. In terms of reservoir storage, this resulted in dam levels reaching a critical level at the end of 2017 with projections that the city would hit Day Zero initially on the 12th of April 2018 and later this moved to the 28th of June, when the city would be forced to shut off taps to homes and businesses because reservoir levels were perilously low at 13 and a half percent of their total. In response Cape Town mounted an effort to reduce their water consumption through restrictions for households and businesses, but also through reducing water losses. At the peak of restrictions between the end of 2017 and autumn 2018 daily consumption was limited to 50 litres per head per day. Cape Town successfully managed to get through the drought and avoid Day Zero by successfully reducing water use, including losses by over 40%. Cape Town's initial response comprised of plans to both increase supply and reduce demand. In terms of demand, residents were urged to limit their water use to 50 litres per day with detailed information on how to do this, this is about changing behavior. Dam reservoir levels were announced every week on the radio and a water outlook report regularly published to increase public awareness of the issues. So it became a sort of a collective challenge, a collective problem, or a common purpose to solve. Cape Town also created an online map with green dots showing which houses were complying with restrictions, and those which weren't. And those failing to complete with restrictions may have had a water management device installed. In addition, Cape Town embarked on a large programme of water pressure management, much like we do in the UK when we have drought conditions. From a business perspective, some breweries stopped production, made groundwater sources available to the public supply. Others installed water saving devices in their production lines, influenced their supply chain to encourage them and incentivise their customers to use less water.

**Mark Fletcher** 11:32

In terms of supply, Cape Town initially explored large supply schemes, but the timeframes just weren't feasible. Instead, they commissioned three temporary desalination plants alongside additional aquifer abstraction, and a water recycling plant. Outside of the city, agriculture played a role as well. Farmers limited their production to the most efficient areas of their fields, using satellite data and soil probes to understand crop growth and water status. In February 2018, one water user association, a representative body for farmers in the Elgin area, released additional water from their dam to provide additional 10 million litres for the city. Pushing back Day Zero by just under a month. This is everybody working together across the catchment. I thought it might be interesting just to share the latest initiative that was presented at COP26 that we're doing with the World Business Council for Sustainable Development. Taking this 50 litre idea, applying it to a home to explore what can be done at the household, neighborhood, city and regional scale. And I'd implore you all to look this up on the web. There's some great videos around it. But it's sort of taking Cape Town a step further in terms of practical things that we might do in mainstreaming. Great work by World Business Council for Sustainable Development. So that's the City Water Resilience approach. Some of the things you've got to do in the first place is establish a city champion, understand the water system and its governance. i.e. map the roles and responsibilities across it. Understand existing resilience plans and programmes. And the output is a city characterisation report. In step two, assess the urban water resilience against goals and indicators, effectively building your resilience maturity.

**Mark Fletcher** 13:46

These are shown for Cape Town on the left. And for Miami. These helped to show the resilience across a suite of shocks and stresses, not just a single one. The idea is not just to respond to one thing, but actually build resilience for the city across the expected shocks and stresses that cities could potentially experience. And step three, quite importantly is how you start to develop a sort of practical action plan. A sort of absolute fundamental. And that could include specific initiatives like maybe a decision support system to optimise and manage your resources, maybe an adaptive master programme, and a focus on how you might improve formal settlements, and how you might make changes to governance to improve how agencies work together. So that's just a sort of a bit of a flavour of the innovative ideas. And steps four and five, they're about implementing and evaluating and adopting the approach even further. In the medium and longer term, Cape Town has developed its water strategy, Our Shared Water Future, which sets out its strategy to become a water sensitive city and an associated implementation plan. The implementation plan was informed by the City Water Resilience approach. Cape Town was the first city to implement City Water Resilience approach. Through the process, more than 120 stakeholders were involved and developed nine actions, including designing and establishing an approach to co-fund water infrastructure services, develop a decision support system to enable effective management and optimisation of water resources. And these have formed part of the implementation plan for the water strategy. Some of the lessons learned from Cape Town were captured through what I would say a really innovative oral history and lessons learned programme called the Cape Town Drought Response Learning Initiative, which was co-funded by Arup and the Resilience Shift at Lloyd's Foundation. It's a collection of 39 video interviews with city and water decision makers in Cape Town, which have been distilled into lessons to be learned from this crisis. A scenario-based approach makes for more informed evidence-based decision making. Thinking in terms of adaptation pathways, allows for flexibility as we learn more over time. Transparent and open communication with the public during the crisis is essential for building trust. Cape Town's section 80 committee and Scientific Advisory Committee, the Water Alma Report and dam level dashboard are all good examples. Household behavior is difficult to change, but it's achievable with the right mix of incentives, restrictions and communications of urgency, sharing the problem. And I think socialising the solutions. Adaptability and creativity of the private sector in responding to the crisis can be leveraged to bring significant reductions in their own consumption, as well as influencing behavior change in supply chain staff and customers. Water resource pricing and financing mechanisms must align with the necessity of reducing water consumption. Language matters. The Day Zero campaign affected enormous reductions in demand, but in many ways at a cost to the city's reputation. Integrated water governance is a key for adaptive capacity. Clear roles and responsibilities across planning, financing, operating and maintaining, monitoring and regulating water are needed, with coordination between actors to ensure they're prepared for and can respond to production stresses. Every day is Day Zero for some residents in a city, it's essential to consider the impact of the crisis on the most vulnerable population. Now a bit of a change. With COP15 the biodiversity COP at Kunming in China just proceeding COP26, the sort of a climate action COP in Glasgow, I'm seeing much more focus on nature-positive, nature-based solutions. We've been working for four years with Rajendra Singh the Stockholm Water Prize Laureate in rural Rajasthan, trying to capture ephemeral rainfall to green up catchments, and support local agricultural enterprise at a village scale. This is practical innovation

**Mark Fletcher** 18:49

in a country where people have been migrating from the villages to the cities, and this is an attempt to get them to return back to the villages. Greening rural catchments with simple, johad dam structures, these capture one or two rainfall events, built by villages with some pragmatic engineering input. What they do is they help to reestablish vegetation and support farming in otherwise barren catchments because it only rains once or twice a year and if you don't capture the rain, it's gone. And this isn't scale providing sustainable solutions across over 360 square kilometers. It enables up to three harvests a year, shifting people from subsistence farming to cash crops. It's great for female empowerment, and it's a significant increase in vegetation. And it gave me an opportunity to reunite with Rajendra Singh. Who I actually shared a cab with to COP21 in Paris. Grateful that we're doing things in action and we're not just talking, we're not just blah blah blah-ing. And at scale we're working through an innovative procurement approach. This is government to government on the national adaptation programme in Peru. I think a really important thing for the UK in a post-Brexit world. The scale of the 2017 El Nino was huge. It's the worst to hit Peru since 1925. And I won't insult your intelligence by reading out what you can see there. It's devastating. It had a huge impact on a large number of people. And we've carried out a huge amount of remote assessment using digital tools at catchment scale, because of COVID-19 and the fact that we were starting this remotely. Just to give you a sense of scale, the programme area's about the size of England with 17 basins and seven cities. And we are incorporating trees at scale over 15 million. And that's not monoculture trees to avoid that question, but it's to help slow the flow in the upper catchments, and reduce flood peaks. And it's really important that I acknowledge that this is a cross-UK initiative with HR Wallingford, Fathom, Mace, Gleeds, and others. And I thought to finish, we would talk about how we can think about scenario planning. I know Ofwat's introducing thinking on adaptive pathways against future climate scenarios. And I think this is a really innovative approach. And I thought we'd share an approach we developed to look at urban water. We had an idea to think about what the future of urban water was in some cities that were rapidly growing like Manila, some huge cities like Sao Paulo, and let's call some cities that we saw were growing through their suburbs like Sydney. We ran workshops in the cities, we co-invested in this and we followed up in Sydney, and explored a whole range of futures. And this ultimately led to our current role advising Sydney as their consultants. I must say that what we learned from this also helped inform our City Water Resilience approach, you could say it gave us confidence to innovate. So what we thought about was whether service provision would be a single utility, separate for gas, water, electric, or it was an integrated utility. And whether that service provision would be centralised, or whether it was decentralised. I won't go into the detail, all of this is available on the web, so you can download what came from it. But when you think about resilience of say, water treatment, does a centralised system offer greater resilience? And I've got a feeling that a decentralised system means that if you lose just one asset or one asset system, you don't lose the whole lot. So it might encourage us to think more about decentralised systems but that not might be the most economic, efficient solution. So there are trade-offs and I think that's the important thing I'd learn or share from this.

**Mark Fletcher** 23:39

We found it to be innovative, it opened up new ideas, it opened up new relationships, and they provided a number of fresh perspectives. But I think perspective's really important, you have to actually experience the city to understand the tensions that are rapidly urbanising and growing city experiences. And it prompted me to just share a session from COP26 I was at. The woman to might right organises seed banks across China. It's at individuals scale, where farmers look at the plants that are more productive when they have too little water or too much water. And they separate out the seeds and keep them in jars. And these are then, they look at that these strains and share them across the whole country, they're building seed banks across them. And the young woman to my right who represents over a million young girls in China, they want to become more active in the fight against climate change. Engaging young people with innovative ideas in the governance of their future. I've got to say it was also the most refreshing gender diverse discussion that I had. The one I had on the Ganga in India was 15 men and one woman which we did call out. And to finish, I was also invited to meet the winners and finalists of the Earthshot Prize with His Royal Highness Prince William and Michael Bloomberg. The Earthshot formula is urgency plus optimism equals action. It's a huge innovation competition. Our roll is to accelerate and increase the impact of the ideas. And it also made a busy two weeks exceptionally busy. But their themes are, protect and restore nature. Well, we can't disagree with that. Clean our air, revive our oceans, build a waste free world and fix our climate. So it's going on in real time, it's engaging people all around the world. With ideas like living sea walls that they're researching in Sydney, Australia, and also in Wales. And co-composting of sewage and biological waste in Kenya using black soldier fly larvae, and the Reeddi solar charged battery particles in Nigeria. It's the highest profile innovation competition in the climate crisis space. And small companies have found it easy to engage with. I wonder whether we could maybe take some of the learning from this for our Innovation Fund at home to see how we can make it easier for SMEs to engage with their ideas through the innovation competition where they've got. So a bit of a checklist. Don't be daunted by scale. Always consider the local context. Identify champions, especially local champions, aim to communicate to build a common focus, a common purpose. Be prepared to co-fund. A burning platform can help, forms a realistic timescale for implementations. Try to consider risk at all stages and from all perspectives. Encourage innovation from all sources and look at any barriers from all perspectives, such as in the UK, we've got to try and make it more accessible for SMEs in my view. And what is the value of a different perspective? This was Polar Zero, the installation at COP26 of the green or the public zone. It's an artist we're collaborating with called Wayne Binitie from the Royal College of Art. And by working with a British Antarctic Survey, he extracted out from an ice core from 1765. This is before the Industrial Revolution. And he also had a section of ice core melted, and he was recording gas bubbles popping and crackling. And he set that noise to some music by Brahms, he's a concert pianist, he's a real polymath, but it's innovation everywhere. So I keep my wax crayons in my pocket when Wayne's around. But what it simply illustrates is the air within that little pocket has 275 parts per million of CO2. If we sample the air outside, it's 415 parts per million of CO2. And I'm not sure I would have come up with an installation like that purely from an engineering perspective. We all have a take on things. So innovation can come from anywhere. Think practically, think different, and solve challenges in the local context. Those things are essential. We're in an existential climate crisis. This is not a dress rehearsal. I hope you enjoyed it. And if you've got any questions, and I think we're about okay for time. Thank you. This is the point at which you virtually chat because everyone's fine.

**Laura Ferris** 28:46

Thanks very much, Mark. That was brilliant. Super, super interesting. I hope the attendees got as much out of it as I certainly did. We do have a couple of questions I can see in the in the Q&A. So I'll just

**Mark Fletcher** 29:04

I can't see. Okay. I can see them now yeah.

**Laura Ferris** 29:09

You can see the Q&A. Okay, perfect. Well, I'll read them out loud for the benefit of everyone. And then yeah, if you can answer them, that'd be great. So the first one, thinking about centralisation versus decentralisation in the context of your work in Rajasthan. How did you manage local needs versus the impact of reduced river flow for communities further down river catchments?

**Mark Fletcher** 29:27

Yeah, I think this is a really good question. The interesting thing about this is that because these are one or two storm flows, what we're doing is just taking a sample of the flow we aren't taking all the flow, because the downstream catchments in the intervening space have got more than enough water coming down. But I think this idea of introducing if you like decentralised small-scale storage, rather than one big storage, I think that allows for a greater storm flows than you're looking to hold and pass down the overflow. So it means that you hold enough for your village, but you also pass any additional extreme flows down, and then a small sample taken at the next village, and so on and so forth. I'm all for continuity of when you've got, you know, when you've got regular rainfall, but when you have one or two storms, it's a bit like the work we did with bodies in Oman, is you have to try and capture the rain when it falls. Otherwise, in this case, it will just flow downstream in a huge flood flow. I hope that helps Mr Anonymous or Mrs or Miss Anonymous attendee. That's my response to that, what's the next one?

**Laura Ferris** 30:57

I think if we go for, so, Rob, you had a question. And so he said, fascinated by the lessons, decentralised solutions and demonstrate resilient savings by smaller scale. Do you think that crisis is the only way to innovate quickly enough to make effective decisions?

**Mark Fletcher** 31:13

That's a really good question, Rob. And I don't think it is and what we actually did in the future of urban water work, we didn't respond to the crisis there. What we did was we created some alternative futures and explored, in those alternative futures, what extreme events, what impacts they might have on whether decentralised and centralised work. We saw the case created for futures. I've done the same sort of exercise where I looked at too much and too little and too hot and too cold when I was working with NERC on their water security, on a major programme for their water security research. And I actually could plot on those axes, extreme events that had happened within five years in the UK, at a time when people were questioning whether we would get any extremes or not and whether even climate change was happening. And I actually found by looking at those scenarios, it was a really good way to start to understand what's going on. I think trying centralised and decentralised, I think it's not completely binary. I think you can do a little bit of both. But I think scenario planning helps you work through it. But really good question that, Rob. And I think that's the way we've got to start thinking. There are things that we learn in crisis. Sometimes we do the obvious response, and that isn't always the most effective response. But there are things that we can mine and learn from, from a burning platform. And we've tried to do that in Cape Town, which is why I did a bit of a deeper dive. And because it was like a slow crash. It didn't happen overnight. It wasn't a shock. We were responding to a shock that became a stress over time. I'm sorry, I've got to look at the just another question. Question that's just gone off.

**Laura Ferris** 33:27

Sorry, Mark. I think that one was from Mike and Mike, I believe my colleague Rhys is going back to you with a written response. That's more one for the Innovation Fund. But I have a couple more questions for you, Mark, as well. So from Caroline, what kind of impact did the water restrictions in Cape Town have on communities? Did it create more violence and inequalities do you think?

**Mark Fletcher** 33:51

I think it brought people together, ironically. By the sort of, it's not name and shame, but by showing the spots of who had done things and who hadn't done things, the whole purpose was to try and encourage everybody to do something towards working together to try and contribute towards the solution. It is a fine line, I think. It's a fine line. It's the sort of naming and shaming in crisis that we have to be to be mindful of I think. I don't think there's no black and white answer. We could probably share our recent experience of Covid in terms of what's worked and what hasn't in how you get everybody to work together on a common challenge, or how in some ways you could isolate people. And I think in some communities that has happened and it's been very regrettable. I hope that answers your question. But I'd invite other people's opinions as well because when you, you know, this whole idea of, we're all in it together, we had a provocation or a debate for young water professionals at COP26, where we said, you know, as an individual, is there anything that we can do in a climate crisis? Or do we just leave it to the big corporations and the agencies. And by having the debate, it was clear that it wasn't binary, there's things that we all can do. And there's things that we can lend weight and support to influence bigger organisations and agencies that represent us, we just got to work on it, I think, on a number of fronts. And it was a really healthy debate at COP, I think it went out on YouTube as well, so people should be able to catch up.

**Mark Fletcher** 33:52

Great. I think another question that we had from Caroline was, what kind of long term changes and plans do you think Cape Town has to kind of do to avoid Day Zero kind of occurring again?

**Mark Fletcher** 36:09

I think it is embracing medium and long term plans. It's about reducing demand, it's about using time to build resource, it's you know, it's across the board. The challenge with uncertainty going forward is we've sort of built our cities and our infrastructure around the certainty that we thought we had sort of equilibrium in the climate. And when we don't, it makes it really challenging. And if I just flip to Peru, that just goes with the uncertainty of an El Nino, and the impact it didn't just have on Peru, it affected other neighbouring countries as well. And the real challenge on how you then start to put back and what do you design for when you go to build the infrastructure going forward? Or plan your cities? How do you, you know, would you plan for people not to be exposed to storm or floodwater, by planning in different locations, and sometimes you just have constraints that, that, that limit that. If it was all really simple, we would all be doing it. And I think I've tried to share some of the complexity of it. And there's a lot more detailed papers on Cape Town that explain it far more articulately than my blundering effort. Because I think that an awful lot was happening. What I really liked was by interviewing a whole different set of people, they weren't saying the same thing. They saw the events from wholly different perspectives. But the great thing about, say, breweries and business working with its supply chain, and motivating its supply chain and customers is it's that sort of blitz spirit where we all come together and pull together, which I think can be really positive. I think I've seen another question. I'm not sure I understand that question.

**Laura Ferris** 38:28

I think that's one for Rhys to go back to again. I don't believe we have any, any other questions?

**Mark Fletcher** 38:37

Could I just make a point? I opened an exhibition just before lockdown of Leonardo da Vinci's work. It was across about a number of museums around the country. And Leonardo da Vinci spent his life fascinated by water, but really struggling how to draw it. My notebook has the sort of Great Wave off Kanagawa by Hokusai. In Japan from a completely different place. He managed to draw water simply and convey its power. Yet somebody like Leonardo da Vinci struggled with it. Sometimes from a different perspective, anybody can see things and we should value what comes from that. And if you need and Earthshot, I'd really encourage people to read up on it. Because I think it's a great opportunity for us to see how innovation in practice from the smallest idea can come to fruition, which I think is quite, quite well...

**Laura Ferris** 39:38

Yeah, absolutely, it's incredibly powerful. I think we've got another question that's come in from Nicola. So are there any particular innovations or initiatives from the work you've spoken about that you think would translate well in England and Wales? If so, what do you think would be important first steps to like implement these if you're coming at them for the first time?

**Mark Fletcher** 39:56

So absolutely. I was going to include the master plan of Shanghai, where we looked at blue and green infrastructure at scale, I put Peru in instead. But we took that, we then developed it and approached in Tirana and then we used it in Mansfield. I know from Shanghai to Mansfield, and that's been used to justify over 80 million pounds of investment around green solutions in the UK for Severn Trent Water. So what I'd say is, you can take an idea, but understand the context. By the time that we're doing that here, I think we've been able to improve the approach or the granularity of what we're doing. The 50 litre home is directly transferable, so we can take what we're doing there. But if they're all the right sort of things that Waterwise have been championing and organisations like that, which is brilliant work that we should be looking towards. But that's another one. And I would say that, as far as digital evaluation of catchments, I think it's as relevant here as it is anywhere else. And what we developed in Peru and what Fathom have been doing, they're already looking at applying to other places around the world. And I know that some of these things appear like they're big scale and it's alright you're talking about that you're a big company, it's big scale, but the thinking isn't, the thinking's simple. It's the way we think about breaking the problem down, not the scale at which we deal with the solution. And I think that if we can think that solutions can be from a personal, from a domestic and the neighborhood catchment. And, you know, if we can look at those scales, not just look at one, not just think technology's the answer, then I think that we've got a much better way of developing a much more sustainable and resilient world. Oh, yes. And it really is important to say, language matters. And, you know, a 1 in 100 year flood doesn't mean anything but a 1% flood means a lot more for me. And I spent my career seeing people revising the 1 in 100 is now 1 in 50. And it confused and bamboozled people. We just work on probability. And also, if you live near a river, it's going to flood. You know, I know that sounds obvious but we've developed whole cities, next to rivers, and haven't really designed them for the change in our climates and more extremes to come. Sorry, Laura. I'm probably rambling on, but I'm not intending to.

**Laura Ferris** 42:41

No, no, no, that's no problem at all. It's all great stuff. I think we've had another question come in. So thank you so much for submitting all your questions. It's great. So another anonymous attendee has said appreciate that the natural solutions you brought forward and how they encourage female empowerment alongside the soil sensors and technologies. From what I've learned today, it seems there is a need for multiple solutions from different perspectives, as she said, so do you think there is enough technological systems already existing? And is it that they need scaling within context and collaboration of actors?

**Mark Fletcher** 43:12

I think, I don't know who asked that question. That was a brilliant question. Having spent, you know, a number of years now working with technologies, I think there's very few things that we haven't had an idea or a technology around. We seem to struggle with implementation. And sometimes we struggle because we want the perfect when maybe just enough, it's a bit like everything's going to be real time well, maybe real enough data. So that maybe if we got one reading a day, not 10 second readings for 24 hours might be enough in terms of in the data space. I think we've got plenty of good ideas, we've got plenty of technology, I think it would be better if we extracted a lot of the value out of some of the technology we've already got. But I don't want to discourage people from having new ideas. Sometimes the clever thing is taking three different technologies or sensors, and combining them and making sense out of what comes out of it. That might be where the innovation comes. So but don't stop innovating. That's what I'd encourage everybody, you know, to do. And if you are frustrated, convey your frustrations through to us because we want to make sure our Innovation Fund is as engaging and inclusive as possible.

**Laura Ferris** 44:41

Yeah, absolutely. Thanks so much, Mark. I can't see any more questions coming in. And if anyone does have any, please do submit them because we've got a little bit more time. Oh, we've got another one. So, Tom Williams says with this catchment based approach, I think most are agreeing that this is the way to go. So how do we push it to happen and get all the interested parties to work with each other versus what the minimal legal requirements are?

**Mark Fletcher** 45:09

So another good question, Tom. The reason why we, you know, we've open sourced all the work that we're doing on the City Water Resilience and we've used Hull, is to say, we had a major event in 2007, right. We had a Pitt review that said there's lessons to be learned across the country. One of the areas was Hull, we tried out the innovation at Hull, we've looked at how we've got to take a catchment approach, not a city approach. And actually, when we started the City Resilience approach, all the cities were just talking about to their boundaries and so this idea of thinking catchment-wide. But the important innovation that comes out of Pitt and comes out of the City Water Resilience is multiagency working, everybody working together. And there's again, open source, our water digital tool that can map governance across the water cycle that came out of City Water Resilience that people can use. What that does is look at roles and responsibilities across the catchment. Now, when we first introduce something like sewage treatment in this country or water treatment, the people who introduced it because it was such a dramatic change in the health of the population, they were lauded, they were the highest of society and you see the assets they constructed, they were beautiful assets but we seem to have forgotten that over time. And as we've forgotten it, I think we've lost sight of the roles and responsibilities across the cycle. When you then get a shock, or an extreme that you haven't experienced within our lifetime, you then realise that it's really important that we understand that water cycle, whose role and responsibility it is so that we can manage it far more effectively, that's as important across the catchment as it ever was. It's just that with more extremes, we become, you know, or it's become even more significant for us, because there are things beyond our experience.

**Laura Ferris** 47:18

Thanks, Mark.

**Mark Fletcher** 47:21

I can assure you that the anonymous question isn't a planted question from someone. And I did say I'd given an overview of some of the things today. But there are, it's why I encourage people to write detailed papers about what we do, share through your institutions. I think we've had a drop off of that latterly. I'd like to see a lot more things shared, a lot more things open source, so that any innovations can get out there. And we are there for people to make money, make a profit and be successful. That's the whole purpose of what we're trying to do. It's funny when you get silence, because I've said something and I've been on one of these with 5000 people with the Royal Academy and you still get silence, and you don't know if people are shouting in the aisles or throwing rotten fruit at you or not. You just don't know, do you?

**Laura Ferris** 48:28

You don't know. But I can assure you, I'm sure everyone's listening very intently. It's just the webinar set up. But I guess we can wrap up there for today if we've got no more questions coming in. So just want to say thanks, once again, to everyone for joining us today. And especially big thanks to Mark for leading the session, and kind of answering all those questions. We really appreciate when everyone kind of comes in and adds questions and gets the discussion going. So thank you very much. Just before we go, I'll be launching a quick poll to kind of get a sense of your thoughts on today's session. So I'll do that just before you leave. But yeah, thanks very much and have a great rest of your day everyone.