DR. SALEM GHARBIA | LECTURER IN WATER SCIENCE AND PRINCIPAL INVESTIGATOR AT ATLANTIC TECHNOLOGICAL UNIVERSITY, LEADER OF THE SCORE H2020 PROJECT

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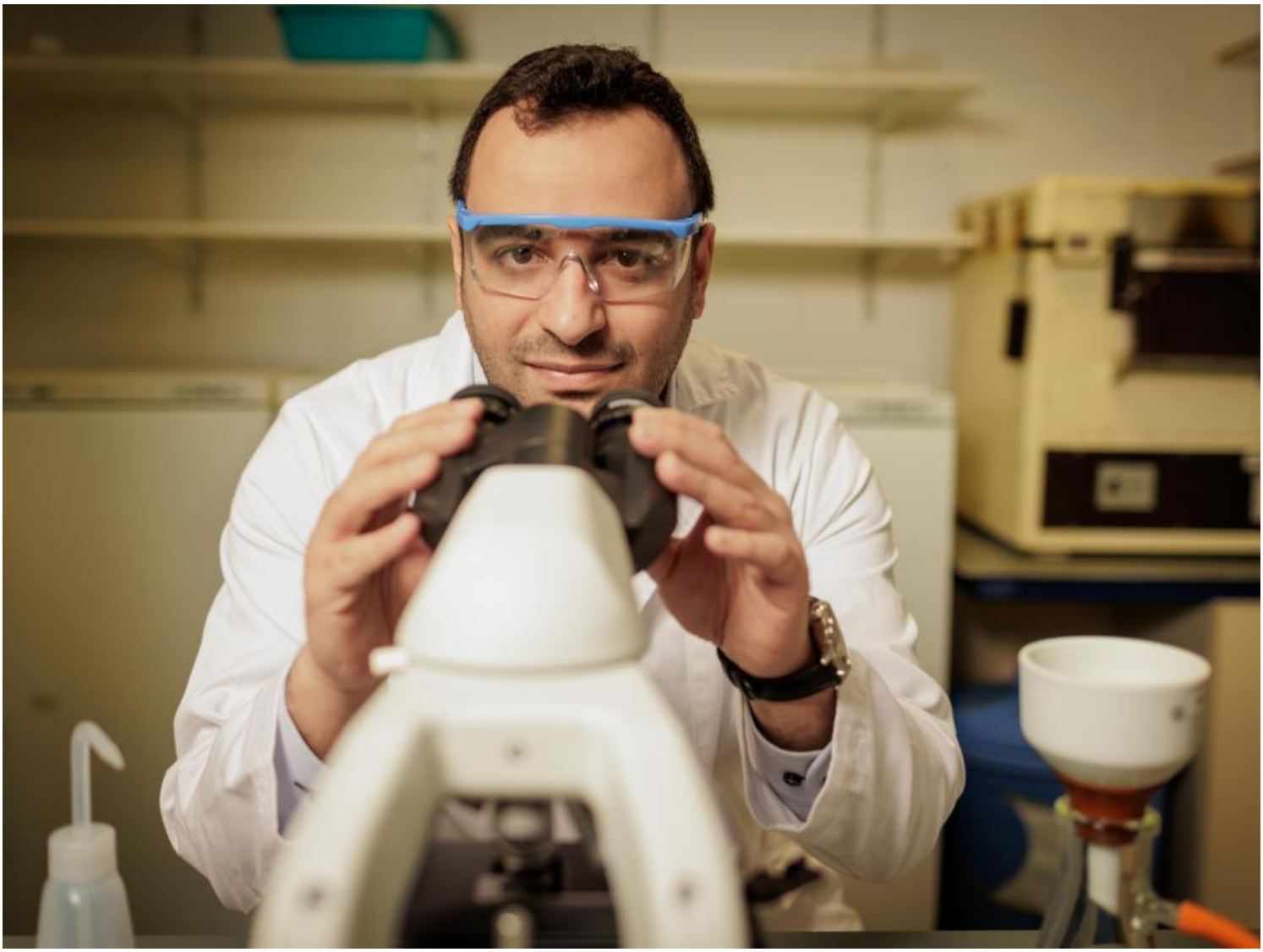

Dr. Salem S. Gharbia is a Lecturer in Water Science and a Principal Investigator at ATU Sligo. Leader of the H2020 SCORE project, about Smart Control of the Climate Resilience in European Coastal cities, water resources, climate change and integrated environmental systems modelling with Geographic Information System (GIS) are his main fields of interest. Dr. Gharbia worked for both academia and consultancy as the environmental modeller who developed the GIS-based hydrological algorithms that were used in the flood risk assessment project for the Shannon River catchment (CFRAM project), the largest catchment in Ireland. Also, he worked for the Palestinian Water Authority (PWA) as a water planning engineer managing many water and wastewater projects. Gharbia is an expert in modelling, simulation and solution processes with novelty in developing solution algorithms using GIS platform. Dr. Gharbia has over 35 research publications in the last four years, and he secured circa Euro 11M in research funding over the previous 5 years.

The SCORE project aims to improve knowledge of climate risk in coastal cities using new technologies aligned with innovative participatory methodologies such as Living Labs. Where did this idea come from?

The idea for Score came from from the need for an integrated framework that enables communities to act on climate change in a systematic way. This systematic transformation must offer a triple-win solution: benefiting the economy, benefiting society, and ensuring that the environment is not harmed. These are the three main benefits you want for any transformative solution if it is to be effective.

In looking for a solution that meets takes all the boxes, we find nature-based solutions or ecosystem-based adaptations, which, by definition, provide all three types of benefits and the additional benefit of doing no harm, while allowing us to introduce engineering. This results in hybrid nature-based solutions. That's why we don't call them nature-based solutions, but ecosystem-based adaptations.

We also have the condition that we need to apply a systematic transformation. A transformation that can be replicated in all communities is absolutely needed: it has to be applied systematically, and it has to be developed with systems thinking. In this way, we have to incorporate all the systems that generate impact and think about them in an iterative way, which allows a systematic, documented and iterative application of the solution that leads to more resilience in the community.

> ***«Three principles are sought in any transformative solution: that it benefits the economy, that it benefits society, and that it ensures that it does not harm the environment.»***

It is also necessary to adopt a methodology for systematic transformation. There are different methods on which a lot of research has been done, but from experience, we have been developing Living Labs together with other teams as a methodology to act on climate change for several years, with European funding. And it has been approved as an effective way to apply systematic transformation within environmental systems. In coastal cities, however, there is a major handicap, because in a coastal environment there are many interacting systems and it is necessary to work together with all stakeholders. The living lab concept, which could be useful, needs to be improved, and that is why we designed the Coastal Cities Living Lab (CCLL), based on the LL methodology.

The third essential component to make it all work is digital technologies. Living Labs are great for making the process iterative and for integrating and involving stakeholders, but they are not a great tool for assessing environmental risks and monitoring the local environment. And at the same time, the ecosystem-based adaptations that were presented with the UN Adaptation Gap Report in 2020 are great, but we are not really able to identify the benefits of them, so how can we measure the benefits?

NAIDER is a partner of the European SCORE H2020 project. We co-lead the WP2 work package

together with IHS-Erasmus University of Rotterdam.

The only solution to do this in an agile way is to deploy technologies that measure benefits, predict different scenarios and link all components. Based on artificial intelligence, integrated environmental modelling and responsive local technologies, we can get real-time data from our local environment into our digital twin system, run the simulations and send them to the coastal city living lab as a framework, and then iteratively apply them, get feedback and repeat the process again. This is how we arrived at SCORE's concept of having an integrated solution or framework that can be replicated and scaled up, based on three pillars: living lab, ecosystem-based adaptation and digital technologies.

And, of course, there is a part that is basically passion: we are always passionate about what we do. Concern for the environment is our starting point, but you have to build on the expertise already developed and funded by the European Commission. We have to make sure we make the most of the results already available and not reinvent the wheel. This is how the SCORE concept started. What we did was to work out the concept and start talking to interesting people who had the same passion as me in this, and it worked. We started to work out the concept of the project in 2018 and these five years we have been working on the concept and developing the ideas and the framework behind it with the same people. It's a great team working for a great cause and making a difference.

Halfway through the development of the project, what tools, tricks or skills are necessary to set up and manage an €10M project and a team that brings together 28 international entities to work in a coordinated manner?

Coordination, especially for such larger projects, is a very complicated task. It is not an impossible job, but you have to make sure you are good with people. When there are many people working on the same or different tasks and their jobs depend on other people's deliverables, it can be difficult. They can become stressed by deadlines and workloads, especially in these types of busy projects. It is therefore essential to take the initiative, reach out and make sure that if someone is struggling, they are supported and trusted. Sometimes we have to look at KPIs, but don't hold them against anyone, especially if they are your partners for so long.

In the beginning, I participated in every meeting of every work package. Not because I didn't trust the partners, but because they didn't know each other and I was the only person holding the consortium together. But I started to withdraw a bit from micromanaging, because people are smart and well qualified and if you micromanage them they are not going to produce. Then the work package leaders and the task leaders started to take their initiatives by energising the work together. I still act as a coordinator, my role is to hold it together and worry about the strategic: where are the problems? If there are potential risks, what are they and how do we register them? How can we mitigate them? We have a lot of problems in implementations, but we have never had a complication that we couldn't solve by talking to each other.

> ***«The concept of SCORE is to have an integrated framework that can be replicated and scaled up, based on three pillars: living lab, ecosystem-based adaptation and digital technologies.»***

The CCLL methodology is a new way of collaborative, bottom up and multi-stakeholder working as a new form of governance. You have said that your experience shows that this Living Lab approach is an effective way of working, but what are the main obstacles you continue to encounter in this methodology and, if you could, would you add any other ingredients to the formula to make it more successful in the future?

Yes, of course these are feasible and effective ways of working, but I still see some things missing.

Social innovation can greatly enhance the benefits of living labs. Living labs are a methodology that allows for engagement, and from which many by-products can be obtained. If you involve social innovation, you can also incorporate more behavioural change aspects into living labs. These are two things that can be improved in the living lab as a concept.

Also, we have talked about three pillars, so working on an additional pillar on financial sustainability would be great. In a Score work package we tentatively worked on financial sustainability, trying to prove the concept. But it would really have to be a pillar and a channel. We have an integrated solution that works, but we don't accompany it with a very solid sustainability plan. You have to make ecosystem-based adaptations an attractive proposition for investment. You have to get investment banks to move and commit to invest in your solutions. Otherwise, this solution will not be widely deployed.

Dr. Salem Gharbia is responsible for coordinating the European SCORE H2020 project, which brings together 28 international organisations, from the Atlantic Technological University in Sligo, Ireland.

New technologies are gaining acceptance and are increasingly available to citizens and therefore to cities, which can apply models and simulate the impact of policy decisions before implementing them. What new windows/ possibilities are opening up in terms of sensorisation and citizen participation? What are the new trends/ tools?

Well, the use of those technologies and the involvement of citizens and all that framework that we put together comes from the fact that we don't know enough about our local environment to a stage where we can make decisions. So, the overall objective is to have real-time data to feed into our models to ensure that we have realistic models that allow us to plan and make decisions. Given this fact and the need to feed the data in real time, it is necessary to monitor multiple points around the structure. You can't have just one sensor, you need hundreds. And you know you need hundreds of them, but you don't have the budget and human resources to deal with them and have highly sensitive knowledge. Dealing with citizens can be very interesting, but at the same time very

difficult, because people come from different backgrounds and you have to make sure that the process is simple, effective and understandable for them. Many tools have been developed to empower citizens to act as citizen scientists and deploy sensors. However, there are a lot of technical issues and challenges beyond engaging citizens: you have to ensure the necessary infrastructure is in place; you have to think about the programmes and how to transfer the data from the sensor kits to our digital platforms; and then how to fit it into the models through the digital twins and how to use it to develop scenarios. Then we have to look at how to communicate the results of the scenarios to the team in the living labs to discuss and reflect, make changes and report those changes back to the living lab and the digital twin.

This is an iterative process and, as you can see, we rely heavily on real-time data feeds. Now, that real-time data feed may be a sensor or it may be an opinion, or it may be data collected from social media... but it's still called a real-time data feed and that's in practice one of the many challenges that we find with citizen science and how it's enabled.

> ***«****Ecosystem-based adaptations must be made an attractive proposition for investment, otherwise they will not be widely deployed.****»***

Do you think that the results that are being achieved will have a real impact on the way cities work and deal with climate change? What else is needed for cities to make them react?

I think there is no chance for cities to survive in the future or increase their resilience without using a framework like the one we are developing in SCORE. It may not be exactly what we are developing in SCORE, but it will be something based on a systematic form of transformation. Based on ecosystem-based adaptations and with a strong involvement of technology, and it will probably have to be linked to financial sustainability and investment, as I mentioned, and social innovation, probably just to make sure that we have the full package in this shared work.

However, there is no other way to do it within our current knowledge. The only way to address climate change and build resilience in a collaborative, replicable and scalable way is to use an integrated framework. Unfortunately, there is no choice.

If we look at the European Commission's policy recommendations and the results of new projects, they all focus on nature-based solutions, systematic transformation and the development of digital technologies, because these are the three main pillars of adaptation.

> ***«****The only way to address climate change and build resilience in a collaborative, replicable and scalable way is to use an integrated framework.****»***

Now they have to reach a stage where we look at the financial sustainability of these solutions, because we cannot maintain sustainability by relying solely on funding from cities and the European Commission. Normally, solutions have to stand on their own two feet and have a sustainability plan. That is the part we are missing.

Given your experience in European projects, do you think that the methodologies, tools and other results obtained tend to have continuity beyond the duration of the project, and are the materials sufficiently disseminated and replicated for others to make use of them and to see their impact?

There is no doubt that the leading cities participating in the project will see short-term results during the SCORE period. Longer-term impacts will be satisfied by the partners, and hopefully further development and deployment will follow once we influence policy at European and local level. This is why SCORE has so far produced five policy briefs that we are trying to communicate to local and European policy makers, because if we have scientific evidence that they work, they should be adopted into policy and then implemented and rolled out. At the moment, we are only testing the prototype, and a wide roll-out is needed before we can see a full impact across Europe.

Several cities have contacted us to adopt the solutions and participate in the process. Resources are always limited, and when you are developing and testing things and trying to put together manuals and tools and make it look like a framework and write the policy that would have to go with it, you don't have a lot of your budget and resources to spare to look at other case studies. In fact, we would love to expand those ten case studies to include another ten, but we don't have the resources. But what we can do is look for the next opportunity (funding projects) where we can improve the system: use it in other case studies so that we can improve the system already available and deploy in an additional city.

> ***«There is no doubt that the leading cities participating in the project will see short-term results during the SCORE period.»***

What we can also do is share all those policy briefs and the manuals, courses and tools we have developed. Everything SCORE develops is open source. Hopefully, that will allow other case studies to follow the example of what we are doing.

Do you think cities around the world are working enough to combat the climate change and its impacts? Or should the efforts be much more? Are new funding opportunities coming from Europe for cities to adapt to CC?

I've been working on this for the last 12 years, and I'm not going to stop, because it's what I think is going to work, and it's pretty much aligned with the European Commission's climate adaptation mission. So what we are doing is, even within the European strategy, adapting. So we are not getting into another garden. We are practically integrated into the system, and there are many gaps that we have discovered in developing the prototypes within SCORE that we want to address as part of future funding. We are already doing that, targeting funding and looking at it, and we will continue to do that, because all we do is research and innovation: giving them scientific evidence and then translating that scientific evidence into policy recommendations. Give it to the policy makers and then make the policy change. And once the policy has changed, then implementation will start at the city level and that's what we want to see.

So yes, we are not going to stop. And this team will keep working.

Family photo of Dr. Gharbia with all the CCLL and SCORE Project partners, including NAIDER, at the second consortium meeting held in June 2023 at the Universitat d'Alacant.

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