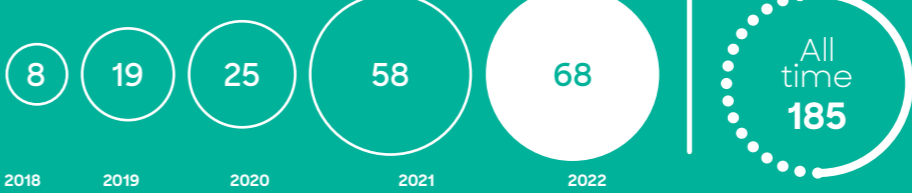


Journeys in innovation and technology

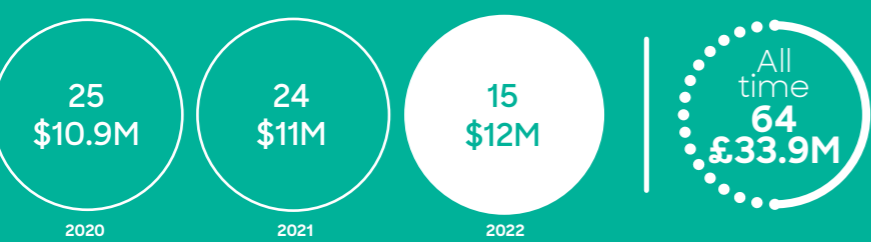
Innovation
Report
2022

The big picture view of 2022

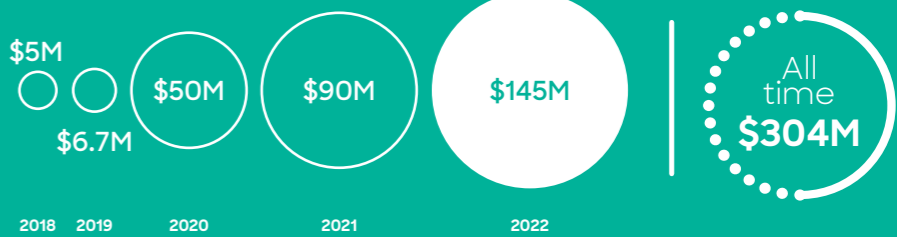
Licenses



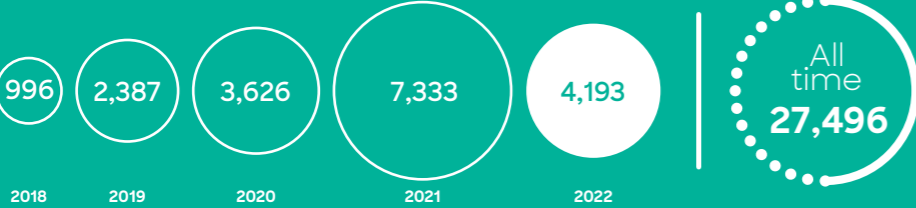
Research Translation Grants awarded



Startup capital raised



Innovators trained



Red Sea Global
NEOM

Dow
IBM
SIRC
Aramco
Sabic

Monshaat
Ma'aden
Modon

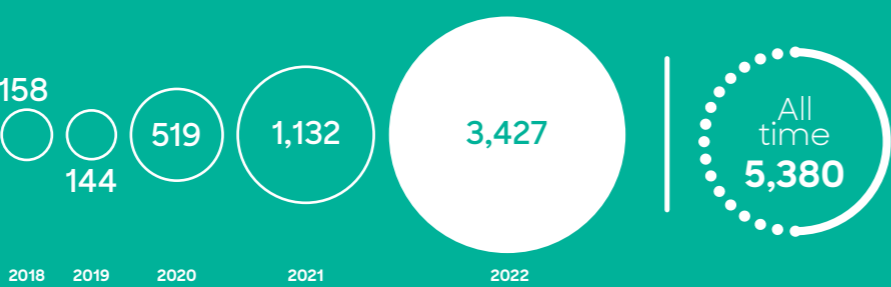
Red Sea
KAUST
Jeddah

Riyadh

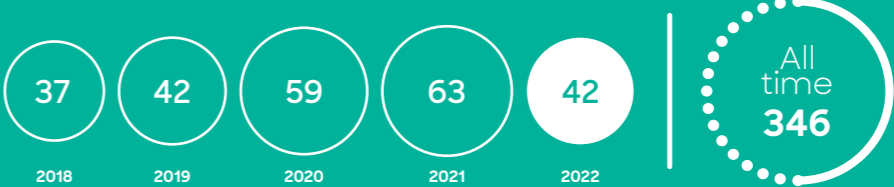
Our strategic
innovation
partnerships

Ministry of Communications & IT
Ministry of Environment, Water & Agriculture
KACST
RDIA
MISK
SAB

TAQADAM Accelerator applications



Startups in our ecosystem





KAUST Innovation: the deep tech heart of Saudi Arabia

**At KAUST Innovation,
we take new ideas on the
full journey from the lab to
real-world impact.**

Deep tech focuses on innovations that solve fundamental challenges with new approaches that benefit society.

At KAUST Innovation, we focus on tech that can push Saudi Arabia, and all of humanity, forward. We find routes to technological progress that work in harmony with the environment. We develop technology that can bring food and water security to people in the harshest climates. We look to build new industries that can improve the quality of life.

Everything innovation needs, in one place

Creating a deep tech ecosystem isn't only about driving research, inventions, or startups forward. It's about developing a network of connected and collaborative sectors that support the full journey, from start to finish. It has to complete the full journey, from start to finish. KAUST Innovation exists to support each innovation's progress towards making a difference in the real world.

Tech pioneers can join us as students, academics or industry partners. We can take a single innovation through testing and prototyping, funding and startup venture, all the way through to commercial production.

The Kingdom's Vision 2030: our ambitious goal

The Kingdom of Saudi Arabia's vision is built around three key objectives, which are the starting point for every journey we take.

1

Growing a thriving economy
For an economy to thrive, it needs plentiful jobs. Saudi Arabia is determined to build a strong contingent of entrepreneurs and SMEs, establish brand new industries and strike a healthy balance between imports and exports.

2

Supporting a vibrant society
To offer a secure future, the Kingdom is focused on developing new opportunities, improving healthcare and entertainment, and fostering a sense of national pride.

3

Driving an ambitious nation
The Kingdom strives to be a world leader in all kinds of areas – engineering, sustainability, urban planning and (importantly) technology.

Innovation is key to achieving these goals. We make sure every innovation we work on has the potential to help push the Kingdom towards its 2030 vision.



Our mission is simple: Apply technology

Here's how we do it.

5
Providing a world-class home for deep tech

3
Training entrepreneurs and SMEs

1
Solving industry challenges

4
Growing impactful startups

2
Developing world-changing technology

Professor Raquel Peixoto's KAUST research in commercialization: Customized medicine for corals. An underwater probiotic irrigation system protecting a diverse and valuable ecosystem.



Taking innovations out of the lab and into the world

The translational gap from research to commercialization is “real” – too few valuable innovations make it to real-world impact. We’re changing that.

Researchers at KAUST are constantly working on ground-breaking solutions and producing a wealth of scientific discoveries. They’re finding new ways to improve food security, protect our environment and create smarter machines, to name a few.

At KAUST Innovation, we power the ecosystem that enables those scientists to develop new technologies and launch businesses that can make an impact.

Here’s how we do it:

Turn research into technologies

Our Tech Transfer Office (TTO) partners with KAUST scientists to develop and commercialize their research into new products and services.

Bring the right people together

We connect sectors to get an innovations off the ground – researchers, industry, government, investors, founders and more.

Support every step of the way

From grants and investments to training, mentorship and market access, our teams deliver a unique innovation and translation service.

A space for deep tech

A lot of the R&D happens right here at KAUST in our Research and Technology Park.

RedSea: desert-grown tomatoes take off (literally)

The Saudi-grown tomato’s journey – from a research project to a multi-national business to an airline partnership to being served in your in-flight meal.

The journey so far: a RedSea refresher

KAUST startup RedSea is at the forefront of agtech innovations. Since being founded in 2018, RedSea has proved it’s possible to grow some of the world’s most popular produce in some of the world’s harshest climates. Their produce reduces the use of fresh water usage by up to 90% and is available in grocery stores across Saudi Arabia.

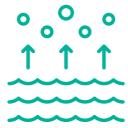
In 2022 RedSea became the official global arm of Red Sea Farms. Based in Arizona, the agtech company has expanded operations with some big supply deals, and its greenhouse cooling technology is now available to growers in countries around the world as well as in-Kingdom.

In another significant development in 2022, RedSea partnered with SAUDIA, the Kingdom’s flagship carrier, to lower “food miles” by replacing imported in-flight foods with sustainable, locally-sourced foods. Airline guests can now enjoy desert-grown tomatoes, cucumbers and peppers served on board and in departure lounges.

Encouraged by these successes, RedSea plans to sustainably produce more food in-Kingdom. But how can the company grow vegetables in environments with hot temperatures, lots of sand and very little rain?



Here's how RedSea addresses the challenge:



Precision climate control that uses sea water and solar power for evaporative cooling, liquid desiccants and solar-integrated fan systems



Remote monitoring tech for autonomous, efficient indoor agriculture

1



Build greenhouses with nano-technology to let in light while limiting heat

3



Bio-engineering tech that creates crops able to thrive in high heat and salt water

This system produces remarkable results. For example, it saves 300 liters of freshwater per kilogram of produce – a 90% reduction compared to traditional outdoor farming.

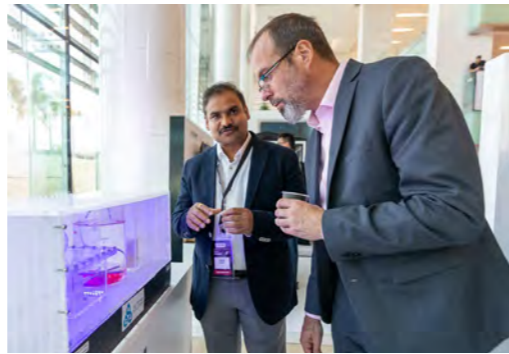
The next leg of the journey: reaching more people

The future of agriculture hinges on feeding people healthy food. RedSea's goal is to distribute their produce to more communities, and also get their technology to growers in other parts of the world to create a far-reaching, ripple effect of providing accessible, sustainably-produced agriculture to communities in need.



Al-Miyah Solutions: recycling water more efficiently - and for more people

Aerobic Granulated Sludge (AGS) technology has looked promising on paper for some time. KAUST Innovation and Al-Miyah Solutions are pioneering applications for industrial use.



Water is a priority resource in Vision 2030. The Kingdom needs to reuse more wastewater and extend wastewater recycling to the 40% of the population that isn't connected to the main sewer network.

The journey so far: a pilot project with some astounding results

KAUST startup Al-Miyah Solutions, has created a mobile wastewater treatment unit based on AGS technology. It uses bio-engineered, granular clusters of microorganisms that efficiently remove pollutants. These microorganisms soak up multiple types of waste material in a single tank. When paired with a gravity-driven membrane (a high-tech mesh called GDM), the clusters settle quickly, allowing them to be easily removed. Together the combined AGS-GDM system provides a low-cost, decentralized sanitation service for delivering clean water to anyone, anywhere in the Kingdom.

To put this tech to the test, the KAUST team ran a pilot unit for more than six months, treating 140 liters of wastewater per day.

When they compared the pilot unit to a standard wastewater treatment system, it produced results that proved the system's potential. In December 2022, Al-Miyah began running an industrial-sized demo unit capable of serving up to 1,500 people.



smaller land footprint



lower investment costs



lower energy consumption



nitrogen removed



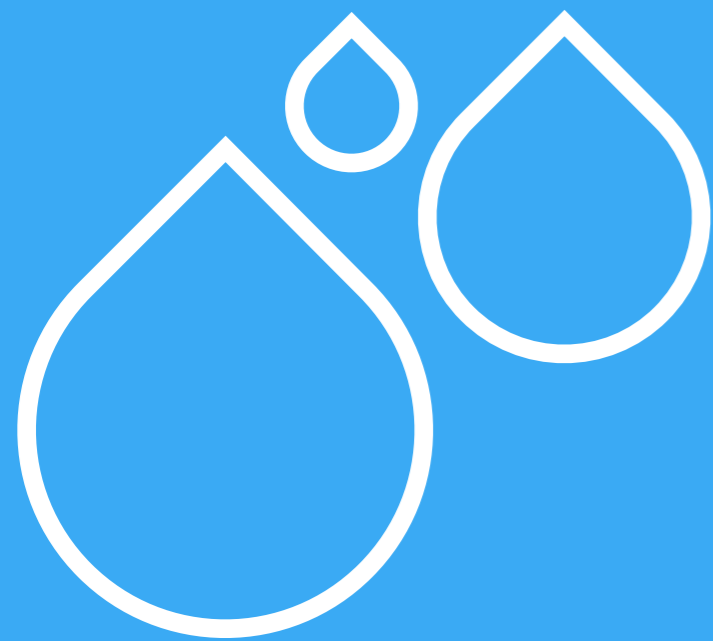
phosphorous removed



energy used in the aeration process

**The next leg of the journey:
helping more communities**

Al-Miyah's mobile unit could be a gamechanger for communities across Saudi Arabia. Mass adoption is in reach. It can fit on a shipping container and be easily installed almost anywhere. It's robust and doesn't need much maintenance. The recycled water is useable for anything you might need non-potable water for, like agriculture, toilet flushing and landscaping.



For areas of the Kingdom that aren't on the main sewer grid, this could mean the end of using thousands of trucks to remove wastewater. This would come with multiple benefits - including lower carbon emissions, less expense, less traffic congestion, better sanitation and far less environmental contamination.

With so much potential for improving people's everyday lives, we're not wasting any time in pushing this tech forward. Our Technology Transfer Office has been supporting Professor Saikaly to develop a strategy to go beyond the pilot and scale as a spinout: Al Miyah Solutions.



Building a culture of entrepreneurship

We support aspiring innovators through the entire journey of entrepreneurship – from teaching them the basics to investing in their startups.

Entrepreneurship isn't just a career – it's a mindset.



Winners of KAUST Ignite gather for a group portrait. The innovation challenge connects participants with students and entrepreneurs from across Saudi to create real solutions to real-world problems.



Growing a thriving economy is a key pillar of Vision 2030. A culture of entrepreneurship will drive us towards that goal. But this doesn't simply mean we want more people to start businesses – it goes deeper than that.

We help people to adopt an entrepreneurial mindset, no matter their profession or background. This means being ambitious and innovative – finding solutions to problems, seeking new skills and creating new opportunities.

Our Entrepreneurship Center (EC) does this in three ways:

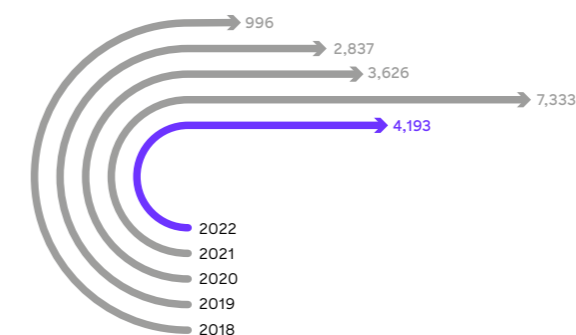
- **Inspire:** We reach out to people across Saudi Arabia and show them the opportunities that can come with an entrepreneurial mindset and a passion for tech.
- **Teach:** With free courses like Entrepreneurship Adventures and Entrepreneurship for All, we teach people the skills they need to be innovators.
- **Accelerate:** We help tech startups thrive through investment and mentoring programs like TAQADAM Accelerator and Destination Deep Tech.

Putting new innovators on the path to impact

A rundown of KAUST Entrepreneurship Center's programs and courses

Innovators trained

In total we have trained 27,496 Innovators over the last 5 years.



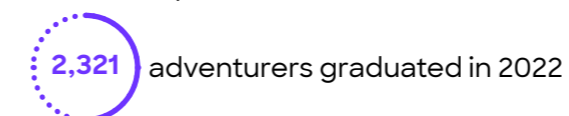
TAQADAM Accelerator

A six-month startup accelerator for entrepreneurs aiming to rapidly grow their business. Through mentorship and targeted learning founders learn how to boost their growth, engage new customers and drive investors.



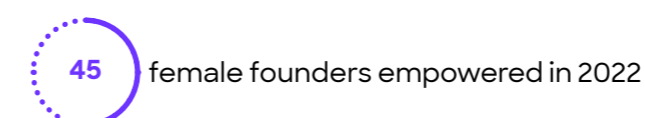
Entrepreneurship Adventures

An eight-week online course that teaches aspiring innovators how to think and work like entrepreneurs. It's free and open to anyone. The 2022 course was the first to be held in-person.



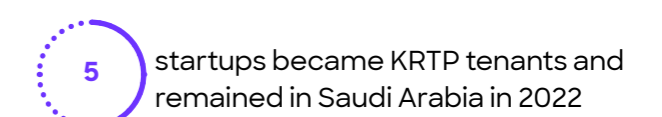
Empowering Women Through Entrepreneurship

An entrepreneurial bootcamp exclusively for female founders – the first of its kind in Saudi Arabia. A collaboration with the University of Texas, Austin and US Consulate Jeddah.



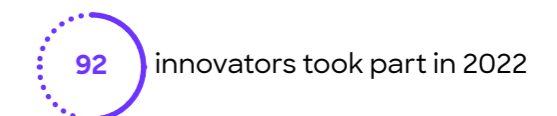
Destination Deep Tech

A landing pad for global deep tech startups looking to relocate to Saudi Arabia. The startups accepted into the program operate from the KAUST Research and Technology Park (KRTP) and connect with the Kingdom's startup ecosystem.



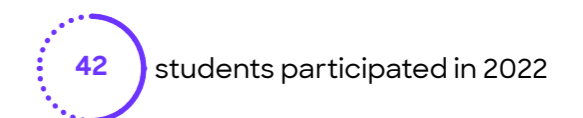
Ignite

An immersive innovation challenge where teams competed over three days to create solutions to challenges by the Ministry of Hajj, Saline Water Conversion Corporation (SWCC) and Saudi Aerospace Engineering Industries (SAEI).



Entrepreneurship for All

A two-week course for KAUST students to gain key entrepreneurial skills, develop new products and leverage opportunities in their future career paths.



An innovator's journey

One Entrepreneurship Center alumni talks about his time with us



“
I'll always be grateful to the KAUST Entrepreneurship Center family.

Faisal Saber,
Co-Founder of SOLOUK

”

My journey with KAUST Entrepreneurship Center (EC) started when I joined the STEAM (now called Ignite) competition in 2018. When I started, I didn't have any idea about how to start a business. I was solving problems as an engineering student, and I learned that to have the complete solution, you need to consider the business requirements.

I attended the TAQADAM showcase 2019 and saw how these founders from various backgrounds and interests worked with the help of EC to create a product that adds value to the community, country and wider world. I decided to join TAQADAM with a group of friends to found a startup called SOLOUK, which specializes in car driving behavior analysis. We joined cohort four and got funded.

While participating in these programs, I gained eye-opening insights and skills. My mindset was shifting towards being an entrepreneur. After a while, KAUST announced Entrepreneurship Adventures – this course helped me sharpen and reflect on what I learned from my startup.

In 2021, I was accepted into Ignite. I realized after the competition that winning the prize didn't matter as much as improving myself and winning people's love and respect. I met people who significantly affected my life. I would describe them as mentors and advisors – they made my life better and opened my eyes.

In 2022, I started my career at one of the world's biggest consultancy firms. I wouldn't be here if I didn't have the experience from these programs. The KAUST EC family didn't forget my participation, and they invited me to be a junior mentor for the next Ignite event – an opportunity that made me realize my growth and added value.

I'll always be grateful to KAUST and the people I met in their programs for helping and pushing me toward being a better version of myself. Finally, I will add that entrepreneurship is a mindset, not only a set of skills.

Startup profile: WhiteHelmet

This TAQADAM graduate has taken big steps in its journey towards revolutionizing the construction industry with AI.



WhiteHelmet was founded in 2017 by Abdullah Almuhanha Abalkhail. His team created a software platform that uses AI to generate 360-degree digital overviews of construction projects. They graduated from our TAQADAM accelerator in 2021, and 2022 proved to be a year of big breakthroughs.

The journey so far: creating the digital from the physical

It’s hard to overstate just how much construction is happening in Saudi Arabia – and how much more will commence in the coming years.

Managing construction sites remotely is difficult. Written reports are often inaccurate, and sending photographs of a site by text message or email is a time-consuming, piecemeal solution.

WhiteHelmet’s platform solves this problem. It takes just one person with a 360-degree camera to create a digital 3D model of an entire site. It’s accessible anywhere in the world, using instant reporting and ‘time machine’ imaging to show a project’s progression on-screen – making remote management much more simple, safe and efficient.

In 2022, WhiteHelmet took home the Global Excellence Award from the PMO Summit – a yearly gathering run by the Project Management Institute of Saudi Arabia, celebrating outstanding work by project managers around the world.

The next leg of the journey: in-Kingdom projects go global

WhiteHelmet landed some major partnerships and projects in 2022. For example, they’ll be involved in the construction of the King Salman Energy Park (SPARK) – a 50km2 industrial park set to house the Kingdom’s energy sector. They also received investment from our own KAUST Innovation Ventures.

WhiteHelmet is also set to begin work with their first international client – and it’s a big one. ACCIONA is a multinational construction company, specializing in renewable energy infrastructure.



A lab technician inspects a new polymer compound for structure and color as part of in-house testing at Pure Polymers, a leading polymer provider in Saudi Arabia.

Boosting small businesses in Saudi

The journey towards making Saudi SMEs more innovative

Small and medium enterprises (SMEs) are crucial to Saudi Arabia's economy. SMEs create economic growth, jobs, exports and innovation. When we help SMEs develop more innovative products, processes and services, everyone in-Kingdom benefits.

Diversifying the Kingdom's economy

As part of Vision 2030, the government plans for SMEs to contribute 35% to the Kingdom's GDP. To enable this, new regulations are being formed, providing SMEs with easier funding access and a bigger share of national procurement and government bids. Our work with SMEs helps them to take advantage of this.



35%

SME's planned contribution to the Kingdom's total GDP

Three ways we help SMEs

There are three main ways we help SMEs to innovate and grow their businesses:

1

Technology:

Demonstrate what types of innovative new technologies are available to them and how they can put them to use.

2

Training:

Offer SME masterclasses in innovation, AI, digital transformation, Internet of Things (IoT) and more.

3

Facilities:

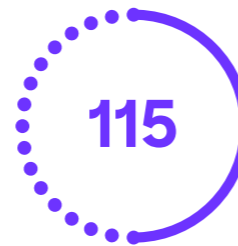
Provide SMEs with access to top-spec business spaces in our KAUST Research and Technology Park (K RTP) – including laboratories, workshops and office space.

Knowledge Partnership Program (KPP)

KPP is a gateway program for industries to access the KAUST Innovation ecosystem. It's built around the new KPP portal, which offers access to industry to post their challenges and request consultations. They can also post internship requests for KAUST master's and doctoral students.



requests since our soft launch in 2021



requests led to further opportunities with KAUST Innovation, KAUST Core Labs and/or our partners' network



applications from
1,926
different SMEs

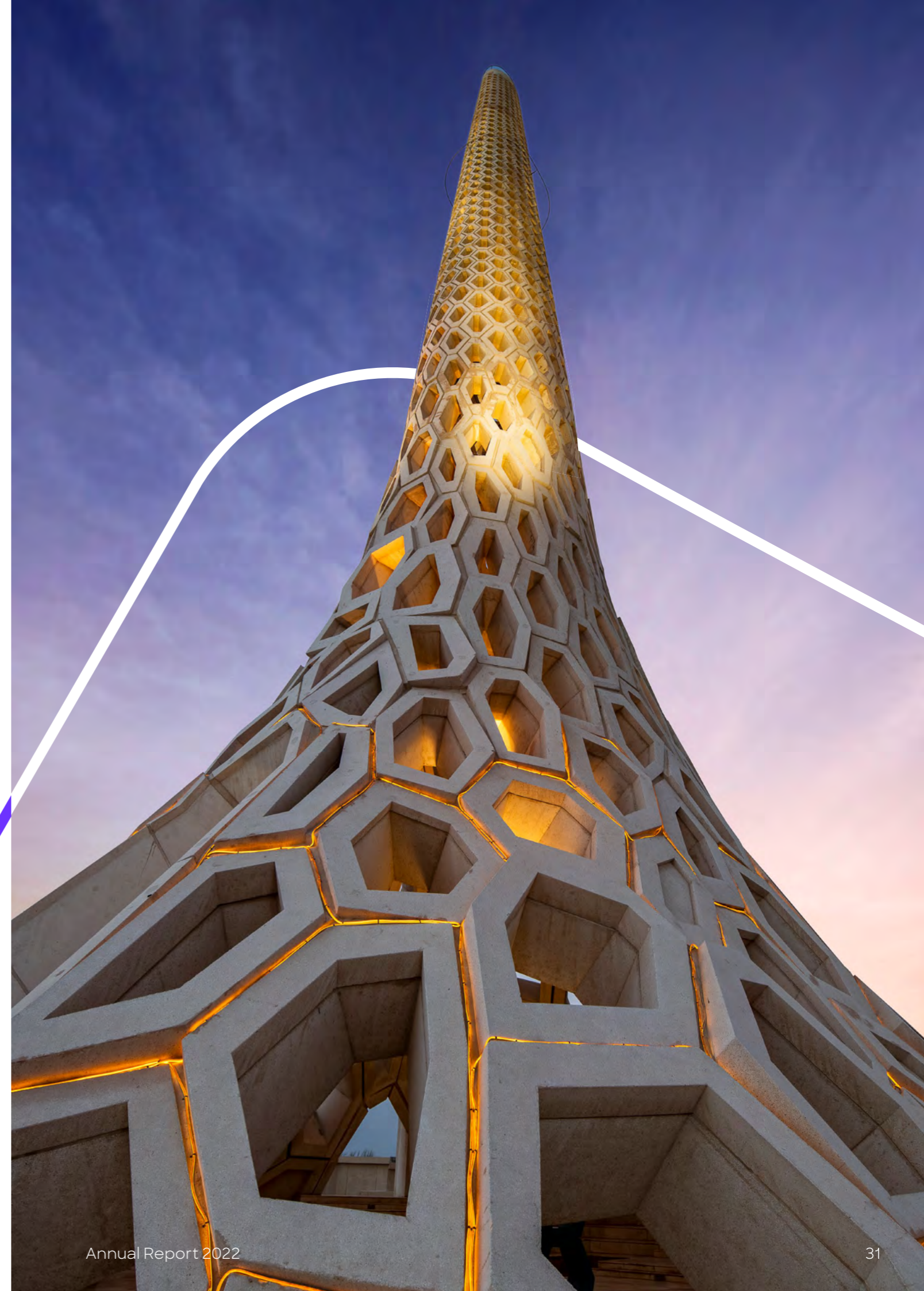


SME staff trained across
77
workshops in 2022

SME Maharat

This program focuses on training and upskilling SMEs' talent. It's organized into three sets of workshops:

- Raqmanna Series (Digitization): Covering digital transformation, artificial intelligence, Internet of things, e-commerce, digital visualization and other emerging technologies.
- Qalab Series (Prototyping and Products Development): Covering prototyping, product development, 3D printing and more.
- Fikra Series (Innovation tools and mindset): Covering innovation, creative thinking, design thinking, intellectual property and other related workshops.





SME profile: Pure Polymers

This SME makes polymer masterbatches - the raw materials needed for all plastic products. Pure Polymers has developed white, black and color masterbatches of such quality that they're already being exported to businesses in 13 different countries across Africa and Asia - from Ghana to Vietnam.

Pure Polymers creates versatile additive masterbatches for specific uses. Need plastics with antimicrobial properties for healthcare equipment? No problem. Want plastics that absorb UV light to help food products last longer? They have these, too.

We're helping Pure Polymers to innovate and grow

We're upskilling the Pure Polymers team with direct training, talent development and intellectual property management.

Pure Polymers is also part of our Knowledge Partnership Program. We're collaborating with them on three long-term projects focused on sustainability and waste management that could shake up the entire industry.

SME profile: iGene

iGene delivers medical research and training for healthcare professionals. A partnership with KAUST is helping to move the needle on innovation.



Pushing medical research forward

iGene specialize in boosting researcher skills in the fields of molecular genetics and cancer cell diseases. As an Innovation Center, iGene can carry out groundbreaking research locally - testing human and animal cells to find treatments for common diseases.

Their progress hasn't gone unrecognized. In 2022 iGene's founder, Dr Burhan Fakhurji, was honored by the president of the UAE Genetic Diseases Association.

We're collaborating with iGene to innovate even further

iGene originally joined the KAUST SME Maharat innovation training program, which introduced techniques for maximizing existing R&D infrastructure and growing their business.

A specialized IoT workshop resulted in the optimization of the freezers that hold their biological samples. Together, we created a solution that controls freezer temperatures and sends alarms and critical data remotely through mobile messages.

iGene is now taking advantage of the laboratory infrastructure at KAUST through their tenancy in the Research & Technology Park.

Shusha Island: A vibrant ecosystem with 300+ coral species, 1,000+ fish species. The coral garden fuels research, luring scientists, researchers, and avid tourists.



Creating sustainable environmental solutions for government and industry

Nature-based solutions are driving future innovations

The era of unsustainable innovation is over – the journey towards solutions that work together with nature is gathering pace.

This view is reflected in our 2022 work on environmental innovations. In particular, our newly-added consultancy arm, KAUST Beacon Development, is working on numerous projects with sustainability at their core.

KAUST Beacon Development is our newly-added environmental consultancy arm to apply unparalleled agriculture and marine expertise to some of the Kingdom’s biggest development projects.

We’re proving it’s possible to farm more fish in-Kingdom, to boost local food security and cut imports. We’re conducting environmental surveys for ambitious NEOM projects, the Ministry of Environment, Water and Agriculture (MEWA) and other Saudi giga projects. We’re using new tech to monitor and protect endangered animals in the Red Sea.

These approaches are vital because the journey doesn’t end in 2030. The gears we set in motion today lay the foundation for our future: a thriving economy, healthy planet and vibrant society.

Launching a new industry: farming algae for food security

We're on a journey to create a thriving industry of algae farmers, producing protein for animal feed in-Kingdom.



Algae is big business. It's a global industry that produces over 32 million tons of macro and microalgae for use in different applications, including feed, food and pharma. Historically, due to the extreme heat and dry conditions, it was thought that algae farming couldn't thrive in the Middle East. We're here to change that.

Cutting animal feed imports

Food security is a core part of Saudi Arabia's Vision 2030. One priority is to produce more fish, white meat and red meat from in-Kingdom farming. over 32 million tons of macro and microalgae for use in different applications, including feed, food and pharma. As it stands, Saudi Arabia imports all its raw materials (protein, lipids and carbohydrates) for animal feed.

Algae makes for very high quality animal feed, due to the due to excellent macromolecules profile. It's efficient, too - soybean and wheat farming, for example, produce roughly 10 to 25 tons per hectare of farmland, per year. Algae outclasses this with roughly 40 tons per hectare, per year, while also having a better protein and amino acid profile.



Algae also has the added benefits of sustainable farming and natural carbon capture.

The Kingdom's goal is to replace 100% of animal feed imports with locally produced microalgae and seaweeds. As well as cutting imports, creating a Saudi-based algae farming industry will create jobs, boost the economy and create new exports.

To prove that it was possible to farm algae in the desert, we teamed up with the Ministry of Environment, Water and Agriculture (MEWA) to invest in groundbreaking algae and aquaculture technology development.



The journey so far: testing and growing algae

The Beacon Development team started out by procuring top-grade algae cultures from an Algae Bank in the United Kingdom. We experimented with different temperature settings to assess the highest temperature environments in which the algae cultures could reproduce.

This conditioning gave the next generation of cultures a slightly higher maximum heat tolerance. We gradually increased the heat with each new generation. We also got the cultures acclimatized to living in saltier waters and higher levels of UV light.

The result? After one year of work, we now have 1,000 square meters of algae ponds containing numerous algae strains that can survive and thrive in the local desert climate using water pumped in from the Red Sea.

The next leg of the journey: expanding an industry

We've already started building phase two of the project: a four-hectare algae plant, which will host 3,300 cubic meters of algae cultures. Based on phase one, we expect this new facility to produce at least 100 tons of algae a year. (To put that in perspective: the entire European Union only produces around 500 tons a year).

We'll also be testing the animal feed on shrimp and poultry, to make sure it packs the nutritional punch we expect it to. Once that's confirmed, we can start using it for animal feed in our own farming and aquaculture projects.

This will all form a technological and financial blueprint for aspiring algae farmers to set up their own private enterprises. In collaboration with the Ministry of Water, Environment and Agriculture, we plan to offer these new businesses the training they need to get started - and access to a national algae bank with over 50 different species to choose from. This, we hope, will lay the groundwork for a thriving new industry.

Protecting Saudi’s endangered sea turtles

We’re helping our native sea turtles along their 20-year journey from hatching to nesting



Sea turtles have lived in our oceans and seas for longer than humans have been on the planet. They’re a vital part of our marine ecosystem. Human activities are endangering sea turtles and it’s important to protect and conserve them.

The Ras Baridi Turtle Conservation Initiative project

Ras Baridi, north of Yanbu, hosts the largest turtle nesting beaches in Saudi Arabia and the Red Sea. Two turtle species nest there:

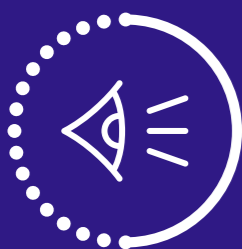
The green sea turtle (endangered)

The hawksbill sea turtle (critically endangered)

These turtles can reach 20 years old before they return to our beaches to nestfacing many obstacles along the way. Rising sea levels mean the nesting beaches are smaller. Fishing nets, boat propellers and plastic pollution are all mortal threats. Even once their offspring hatch on the beaches, light pollution can interfere with their navigation back to the sea. These are the challenges we’ve set out to tackle with this project.

The journey so far: making our seas and beaches safer for sea turtles

What began in 2021 has already reached major milestones.



Two wardens monitor over the beaches during breeding season



Rescued 11 stranded females and returned them safely to the ocean



500kg of trash and marine debris removed so far through weekly beach clean-ups



Helped over 300 disorientated baby turtles find their way to the sea

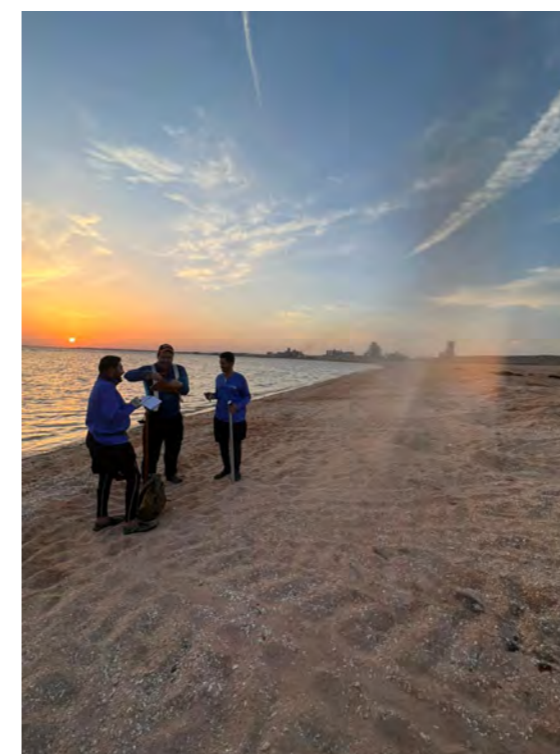
These turtles go all the way up to Egypt and Sudan, but return each year to Ras Baridi to nest. The better we can understand their movements, habits and the dangers they face, the better we can protect them. Data is key.

We're also using drone cameras to see how the turtles behave when they're just offshore. With thermal imaging, we can even keep track of them at night. Over the coming years, all this data collection and analysis will build up our knowledge of how best to protect these turtles.



The next leg of the journey: data collection and research

The future of these turtles will be determined, in no small part, by the Kingdom's conservation action plans. In collaboration with Extreme E and Ba'a Foundation, we're collecting as much data as possible to make these plans as effective as they can be.



In the 2022 breeding season alone, we recorded over 2,000 tracks in the sand from breeding females. We witnessed 282 females laying eggs. We've put flipper tags on 300 females and satellite tags on eight so we can track their movements for up to a year.



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