Innovate UK

Innovate UK Global Expert Mission Report

AgriFood Technologies in Saudi Arabia

July 2025

Contents

01. Executive Summary

The Kingdom of Saudi Arabia (KSA) faces a number of significant environmental challenges, with a climate, terrain and natural resources that have a huge impact on its agricultural potential and water reserves. Across the food sector in KSA, these challenges greatly restrict domestic production opportunities, meaning an overwhelming reliance on imports and a food security issue in need of a long-term solution.

The nation's response comes through its Vision 2030 strategy published in 2016, an all-encompassing blueprint for economic development and establishing a leading research, innovation and investment approach to tackling the key issues facing KSA, its people, industries and the environment. Within the food sector, a number of new measures have been introduced to help the kingdom become self-sufficient, gain greater security in supply and economic contribution, while also reducing waste and water use. Alongside substantial financial investment and the work of dedicated government departments, key organisations such as the Saudi AgriFood Tech Alliance have been established to take an innovation-led approach to finding novel solutions for the sector.

In support of this national response and the progress made, in March 2024, the UK and KSA signed a Memorandum of Understanding (MOU) to boost research links and collaboration in science and technology between the two countries. The agreement also laid the foundation for deeper cooperation for the UK and KSA that addressed global challenges in food security, water and clean energy. In particular, the MOU highlighted the AgriFood Tech sector as a priority, with a dedicated Deputyship created in the Ministry of Environment, Water and Agriculture (MEWA) to oversee the research and innovation in KSA.

With the UK having a strong focus in this sector covering aquaculture, crops, novel foods and livestock, this GEM sought to understand the opportunity that exists to explore and establish an innovation partnership with KSA. To achieve this, the Global Expert Mission (GEM) delegation attended a number of meetings and site visits across the regions surrounding Riyadh, Jeddah and Tabuk. These visits included leading businesses, crop and livestock farms, research centres and universities, with the aim of understanding the broader AgriFood innovation ecosystem across KSA and where the opportunities may lie for greater UK collaboration.

This information will then inform potential future business-led activity to support UK companies in creating connections in KSA for their solutions, as well as growing the opportunity for activities to take place between the countries to support continued innovation and knowledge sharing. From this GEM, key insights included:

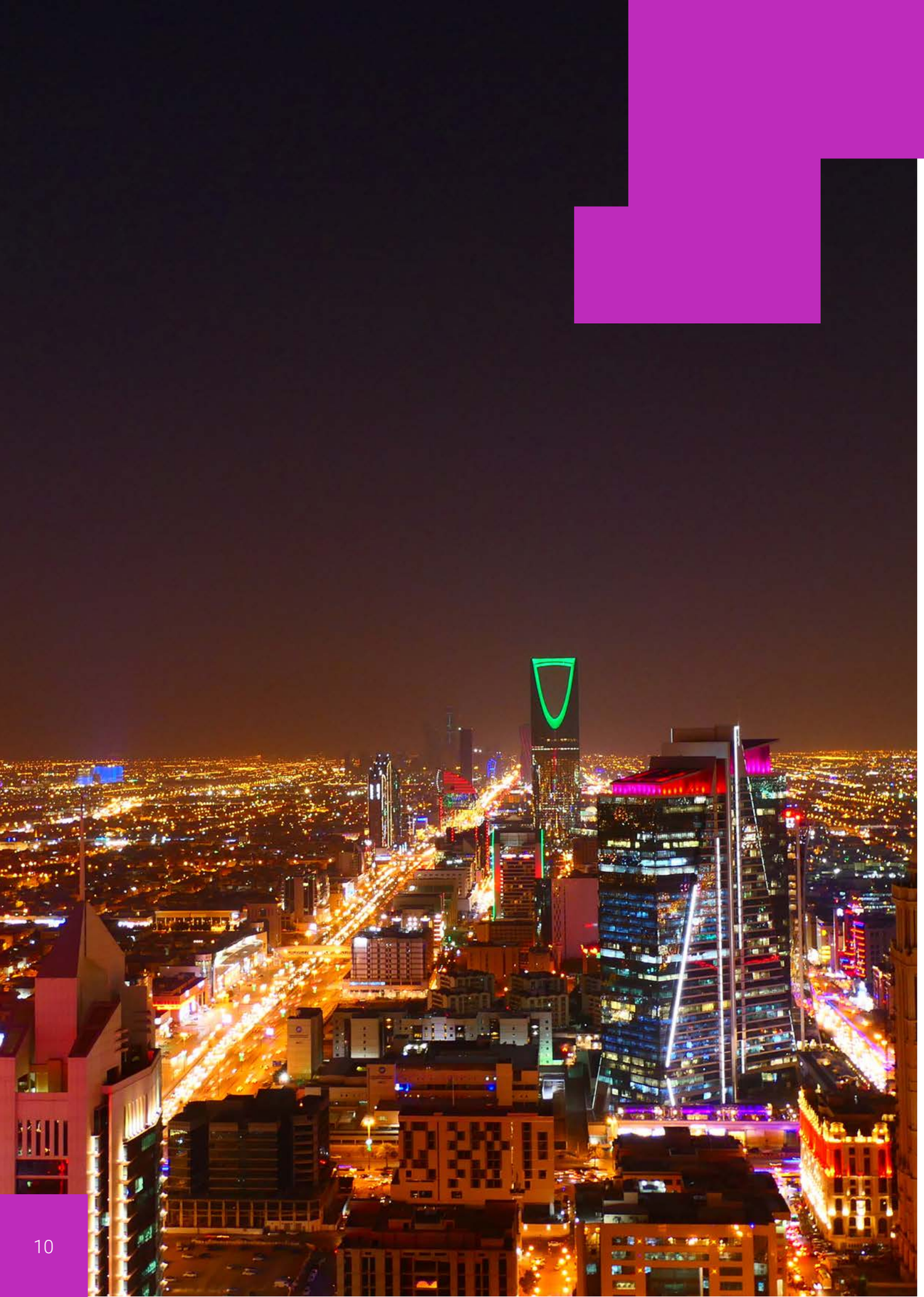
- **Precision Agriculture** – There is a clear demand for greater use of technology and automation in crop farming and growing across KSA. From growing techniques, water use and improved monitoring, to harvesting, picking, sorting and packaging, novel AgriFood Tech solutions have a strong opportunity to support the KSA goals of volume, efficiency and sustainability in fresh produce production.
- **Precision Breeding** – There is a real opportunity for UK knowledge and techniques to support the move towards more resilient crops to suit the KSA climate. Whether simply using UK research and expertise around selecting particular plant varieties known to work best in the region, or enhancing pest and disease resistance, as well as growth potential, through selective genetic breeding, it was evident that real food security results can be achieved in this space with the right support.
- **Livestock technology** – As the poultry and dairy farms of KSA are required to scale to support targets around domestic food volume, there is clear scope for novel technology to support more efficient and sustainable practices. Digital tools for improved animal monitoring, more effective vaccine techniques, and cutting-edge selective breeding technology are all areas highlighted from this mission where existing UK technology and research can make a valuable impact in KSA.

There are also strong potential opportunities to use UK expertise and research across the growing aquaculture space and alternative proteins market as these industries develop further across KSA. It is clear that, although climate and resources make a sustainable food sector complex to achieve, it is precisely in such challenging environments that innovative solutions are most needed and can have the greatest impact.

02. Acronyms

The following are common acronyms used throughout this report:

B2B	Business to Business
B2C	Business to Consumer
DBT	Department for Business and Trade
DSIT	Department for Science, Innovation and Technology
FCDO	Foreign, Commonwealth and Development Office
GBIP	Global Business Innovation Programme
GCC	Gulf Cooperation Council
GEM	Global Expert Mission
IUK	Innovate UK
KSA	Kingdom of Saudi Arabia
MENA	Middle East & North Africa
STN	Science and Technology Network
UKRI	UK Research and Innovation



03. Introduction

Innovate UK, Innovate UK Business Connect and the Global Expert Missions

Innovate UK supports business-led innovation and is part of UK Research and Innovation (UKRI)[1]. UKRI convenes, catalyses and invests in close collaboration with others to build a thriving, inclusive research and innovation system. To this end, Innovate UK helps businesses to identify the commercial potential in new technologies and turn them into new products and services that will generate economic growth and increase productivity. With a strong business focus, Innovate UK drives growth by working with companies to de-risk, enable and support innovation. Innovate UK Business Connect, which is part of the Innovate UK group, exists to connect innovators with new partners and new opportunities beyond their existing thinking – accelerating ambitious ideas into real-world solutions.

As innovation is increasingly a global endeavour and more UK businesses have the ambition to grow and scale globally, it is important to create the right opportunities on which businesses can capitalise. Innovate UK's Global Missions Programme helps further Innovate UK's global strategy (and that of the wider UK Government) by providing the evidence base for where it should invest, and by highlighting the opportunities that exist for UK businesses to build partnerships and collaboration with key economies. To this end, this Global Expert Mission (GEM) is a crucial step to better understanding the KSA market and innovation ecosystem, and to help build key stakeholder relationships in the AgriFood Tech sector.

1 https://www.ukri.org

The objectives of the GEM programme are:

1. **Building International Collaborations**

The expert insights will help inform how Innovate UK can best help UK businesses find and utilise opportunities for innovation partnerships. The GEM creates connections with key organisations and people that will deepen and widen the collaboration with the partner country to the benefit of UK business.

2. **Informing UK businesses and government**

The mission findings and expert insights resulting from the GEM are made available to UK businesses and Government departments, informing them about potential opportunities for innovation in a country of interest and how it can help UK businesses make the most of those opportunities.

3. **Sharing UK Capabilities**

During the GEM visit, the delegation of experts will use the opportunity to share the UK's innovation strengths and experience, and identify where there are synergies between the two countries.

Mission Overview and Objectives

The GEM brought together a team of UK industry experts across the AgriFood Tech space to assess the wider research and innovation ecosystem in KSA and identify areas of synergy and future collaboration. The visit focused on five key technology areas:

- Controlled Environment Agriculture
- Alternative Protein Production
- Aquaculture
- Precision Agriculture and Livestock
- Precision Breeding

In addition to the specific technology areas, the team were tasked to investigate, understand and evaluate the following market and innovation landscape elements:

- The food production system and innovation landscape in KSA across traditional agriculture (arable, horticulture, livestock) and novel food systems (controlled environment agriculture e.g. vertical farming; and alternative proteins, e.g. plant-based, fermentation).
- The market dynamics and trends for alternative proteins and novel foods, and where the synergies are between KSA and UK priorities.
- The priority research and innovation programmes in aquaculture that are helping to shape KSA's ambition in fin-fish production.
- The research, development and innovation investments in AgriFood Tech in KSA, and what the priorities are across innovation agencies, industry and academia.
- The key partner organisations to support UK-KSA collaboration in AgriFood Tech.
- The key geographical hubs, locations and incubators to support future Innovate UK programmes and support for UK businesses.

04. Sector Overview

KSA within the global food challenge

Global food demand is expected to rise significantly in the coming decades, as the world's population heads towards 10bn by 2050. This presents a self-sufficiency issue for countries across the world, as imports at the volume required for many nations become impractical.

Sustainability and stability within a nation's food supply chain depends on many factors, including land, labour and skills, new technology, financial support, and – more commonly in the face of global warming – climate.

While climate change brings different challenges across the globe, regions with particularly arid climates like KSA face substantial issues around their ability to grow crops and rear animals to a scale that would offer a sustainable domestic food sector.

Currently, the biggest agricultural challenges facing KSA remain the long-standing issues of the scarcity of arable land and fresh water, as well as the dependence on food imports and the need for a more robust food supply chain infrastructure.

With a population of 33.2m people in 2023, projected to rise to 37.4m in 2030 and 42.6m by 2040[2] , tackling the challenge of food security and a futureproofed system in KSA is becoming ever more crucial.

2 https://data.who.int/countries/682

The KSA market

As the largest economy in the MENA region, at over $1.1tn, and has been among the fastest growing in the G20 since 2022[3], KSA represents a rapidly changing country that needs its food sector to follow suit to meet evolving demands of consumers.

The sector employs around 350,000 people nationally[4], with numbers expected to grow as domestic production increases. While KSA has been self-sufficient in dairy and egg production in recent years, the growing population has meant a focus on increasing the volume and efficiency of other commodity food products.

Significant market expansion is therefore being seen across a number of areas, including an annual growth of 3.5% in agricultural production and 4.1% in poultry[5] – a sector where self-sufficiency is also a key target in the short term.

Other focus areas for expanding production are in coffee, with the aim to plant 1.2 million trees by 2026[6], and aquaculture as a further protein resource. Here the predicted growth in fish production within KSA is around 500% from its current level, with ambitions to not only create a sustainable and diversified food resource for domestic use, but also to develop an export stream to the wider MENA region that could generate $1bn for the KSA economy.[7]

3 https://saudi-agriculture.com/overview/
4 https://www.zawya.com/en/economy/gcc/saudi-345-800-people-work-in-agricultural-and-fishing-activities-953-are-foreigners-pf69hkns
5 https://saudi-agriculture.com/overview/
6 https://www.mewa.gov.sa/en/MediaCenter/News/Pages/engnews2226.aspx
7 https://saudi-agriculture.com/overview/

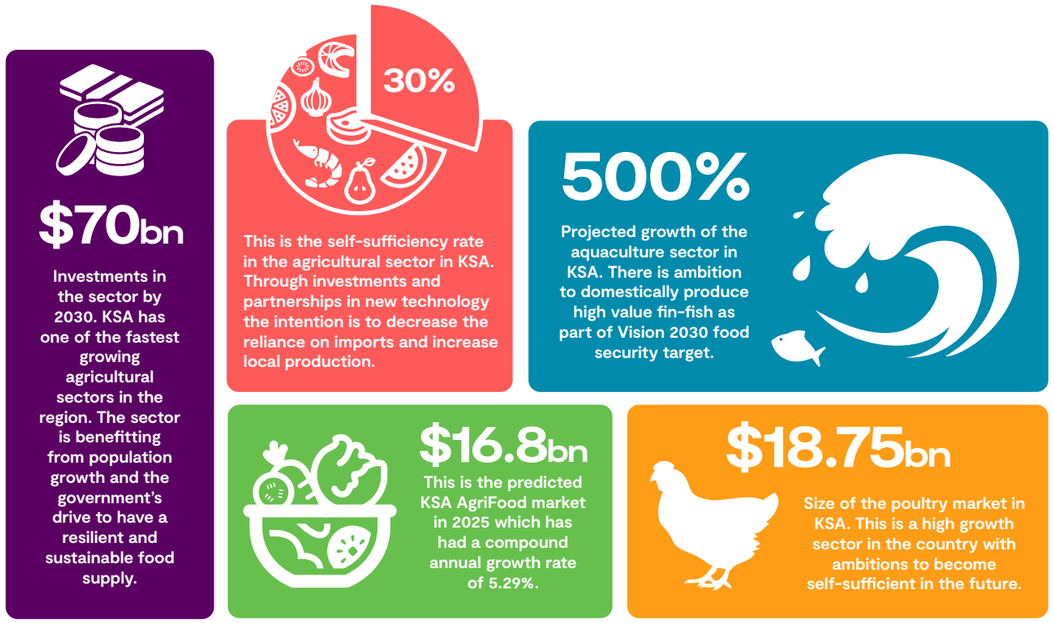


Figure 1. Overview of the KSA AgriFood market highlighting sector investments, market size and expected market growth by 2030.

Drivers for Change – Demographics and Imports

A 2022 census highlighted the country's trend towards a younger demographic, with 63% of Saudi nationals under the age of 30[8]. This presents a potential opportunity for innovation in the food sector, with a younger demographic's preference for trying new food experiences and products. Continued urbanisation in populated areas and a greater influence of Western consumerism on young Saudis have brought signs of change in demand around dietary habits, choice and convenience of food.

This trend has also had an influence on the market for organic produce, which was already worth around $54m in 2022 and is projected to grow by 17% by 2026[9]. A backing for improved farming and growing practices, more environmentally conscious mindsets, and a demand for chemical-free food by younger Saudi consumers has helped drive government policy and investment in this space.

Another catalyst for change within the KSA food system remains the imbalance between domestic production and imported food. With concerns over global food supply uncertainty in light of international trade tariffs and regional conflicts – such as the war in Ukraine – there is a real push within KSA to move to a more sustainable and self-sufficient model.

As of 2024, studies suggest around 80% of food consumed in the Kingdom was imported from overseas[10]. For meat, the USA, Brazil and New Zealand are the main sources, while countries including China, Turkey, Egypt and The Netherlands are common providers of fruit and vegetable imports.

To change the balance towards increased domestically produced food in KSA, several challenges need to be addressed. These include the nascent domestic industries in some sectors, such as aquaculture (fin-fish production), alternative proteins (novel foods) and the need to adopt automation and advanced technologies throughout the food supply chain to enable scalable growth. Additionally, high labour costs in the Kingdom - significantly higher than in many other MENA countries - pose a barrier to expanding local production while maintaining price competitiveness with imported goods.

8 https://www.spa.gov.sa/w1911463
9 https://saudi-agriculture.com/overview/
10 https://www.mfat.govt.nz/en/trade/mfat-market-reports/saudi-arabia-food-security-strategy-february-2024

KSA's Response – Vision 2030

The significant and complex challenges KSA faces in the evolving global food landscape highlight the need for an effective and strategic response from the Kingdom and are a key pillar of the country's Vision 2030 initiative.

The 2030 Vision looks at reshaping and diversifying economic activity, and encompasses all areas of society, the economy and the environmental approach for the Kingdom as it makes great strides towards modernisation, innovation and technological development.

Within this overarching Vision, the food sector plays a key role. It not only contributes more than $19bn to the nation's GDP[11] but also underpins wider efforts for sustainability and self-sufficiency across the country. The substantial environmental and economic pressures placed on the food sector have led the government to place great emphasis on innovation, research and strategic partnerships that will support a drive towards water-efficient farming, climate-resilient supply, new technology development and deployment, and a science and skills-focused shift in an aligned food strategy among growers, farmers and sector stakeholders alike.

The Vision also created a focus on substantial developments in the aquaculture sector and in domestic fish production to help meet food security goals and to increase the role of fish within diets as a sustainable food source. Currently, the aquaculture sector has a self-sufficiency rate of 60% (**figure 2**) and, under the Aquaculture Development Strategic Plan, an ambitious target has been set to increase domestic fish and seafood production from 150MTn at present (see **figure 3** for current local production capacity of fin-fish), to 530MTn by 2030. With a rapidly growing population, coupled with a projected 56% increase in consumption per person by 2030[12], the Strategic Plan aims to reduce the reliance on imports and to replace this with sustainable local seafood instead.

The dairy and livestock sector are playing a key role in KSA food security targets, with ambitions to develop and introduce new technologies to increase productivity particularly in the red meat and poultry sector (**figure 4**) to achieve self-sufficiency and mitigate the reliance of imports. The dairy sector fares much better, however, with KSA actually a net exporter of dairy products (**figure 4**).

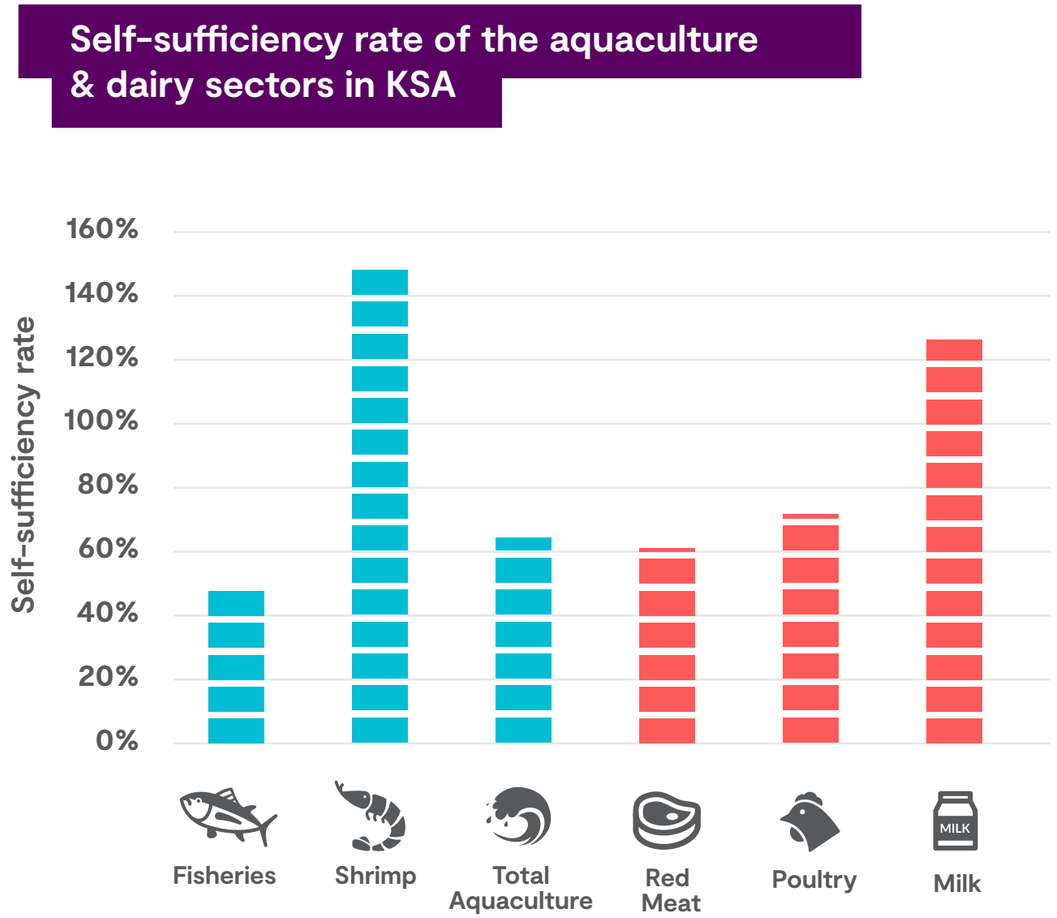


Figure 2. A summary of the self-sufficiency rates across key AgriFood sector in KSA.

11 https://saudi-agriculture.com/overview/

12 KAUST presentation - 'Aquaculture Development Programme' - GEM meeting 5th May 2025

Production capacity of the aquaculture sector in KSA

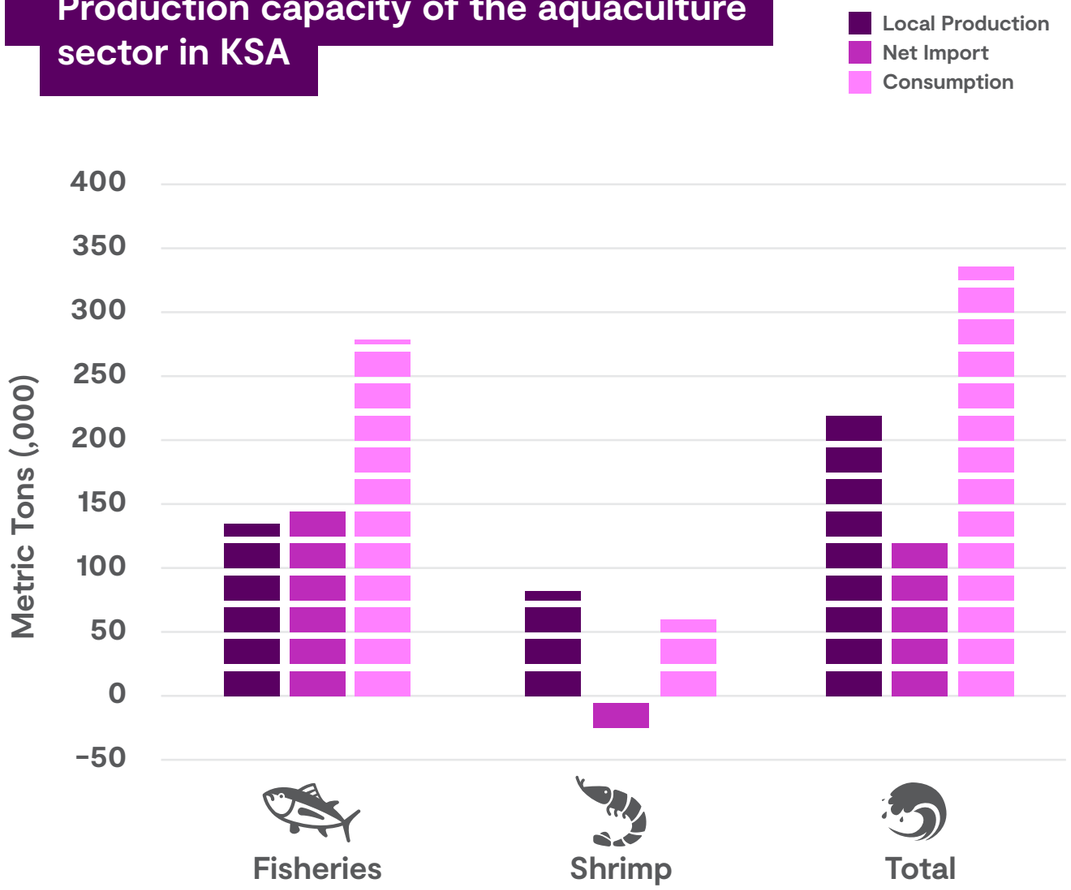


Figure 3. KSA local production capacity, net import and consumption rate in 2023 for the aquaculture sector.

Production capacity of the dairy & livestock sector in KSA

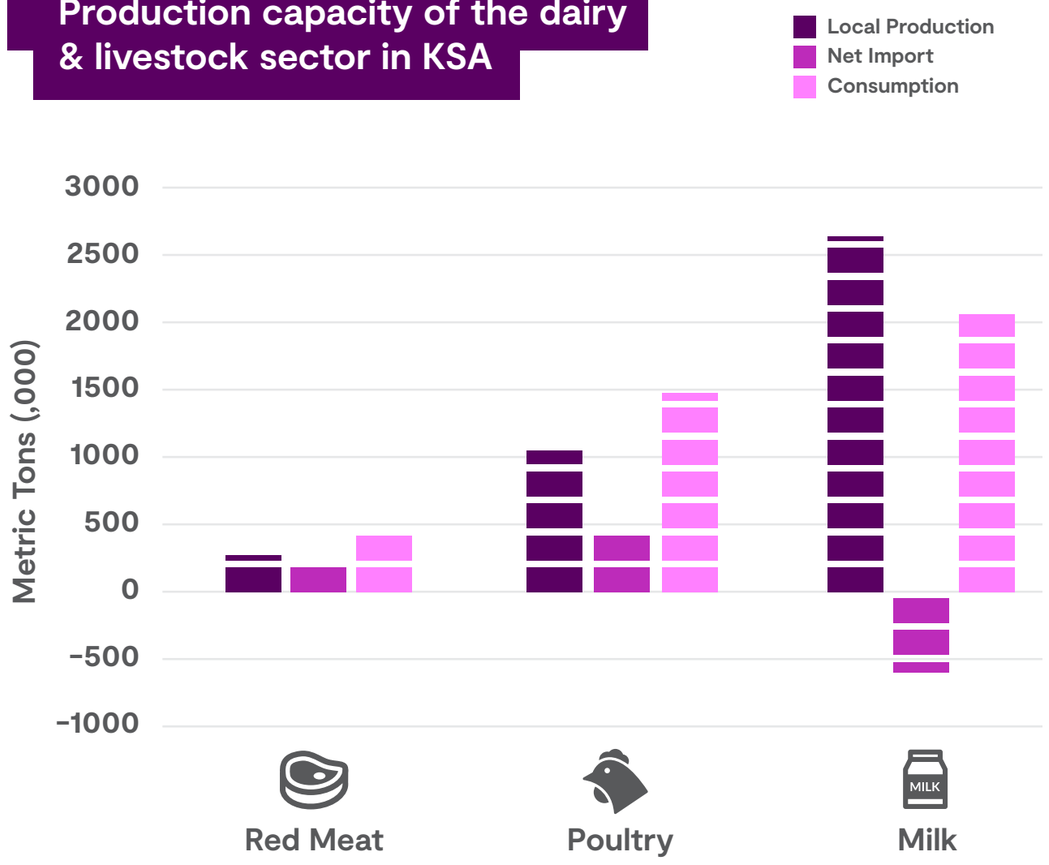


Figure 4. KSA local production capacity, net import and consumption rate in 2023 for the dairy and livestock sector.

05. The Innovation Landscape

Innovation Support

Government Support

Ministry of Environment, Water and Agriculture (MEWA)

MEWA is the primary department responsible for development, sustainability and preservation within KSA around the environment and the Kingdom's natural resources. MEWA also plays a key role in policy development around both water and food security, as well as agricultural priority focus areas. The Ministry works in conjunction with other government-led entities, including the National Centre for Vegetation Cover and the Agricultural Development Fund, to support farmers, growers and technology specialists in a number of ways – from financial loans and funding, to backing for start-ups and entrepreneurs, and the development and deployment of new agricultural technology.

MEWA Strategic RDI Plan

MEWA, alongside other authorities, is responsible for driving technology development and coordinating programmes and initiatives in the AgriFood technology space – including around water security and waste management. MEWA have been able to identify a list of priority technology areas through extensive consultations and workshops engaging with the KSA innovation ecosystem across private and public sector organisations, non-profits, investment funds and technology providers. These areas were assessed based on their impact potential (including their strategic fit to Vision 2030, market demand and global challenges) and ease of implementation (such as their time to market, entry barriers and localisation potential).

A summary of the missions and priority technology areas:

Missions	Objectives		Mission Components	
Mission 2.5 Decrease the withdrawal of non-renewable water by 90% and reduce the cost of water production by 50% by 2035	A	Reduce non-renewable ground water consumption by 90% in agriculture by 2035	A.1	Increase irrigation and water use efficiency
			A.2	Substitute groundwater consumption with alternative sources
			A.3	Develop water efficient species through biotechnology
	B	Reduce cost of water production by 50% by 2035	B.1	Reduce reverse osmosis desalination cost
			B.2	Deploy new desalination methods
			B.3	Enhance water production mix with alternative resources
Mission 2.3 Develop tech in food for sustainable and resilient food systems to achieve more than 50% self-sufficiency by 2040	C	Achieve above 50% self-sufficiency in food by 2040	C.1	Increase production and efficiency of food outputs
			C.2	Increase alternative foods production
			C.3	Reduce food loss and waste

Saudi Agriculture Livestock Investment Company (SALIC)

SALIC is owned by the Public Investment Fund, dedicated to investment in agriculture. Its focus is on supporting the mission for greater national food security through both domestic and international investment activity in the sector. Traditionally investing in areas such as meat, grain and rice, its aim is to help stabilise pricing and provision as part of the wider food strategy, as well as backing commercially ready technology and forging national and international industry partnerships.

Ministry of Investment

Formerly the Saudi Arabian General Investment Authority (SAGIA), the Ministry of Investment oversees foreign investment to KSA, including licensing and promotion of investment opportunities from international partners. While not solely focused on the food industry, but rather the whole landscape of investment, the Ministry has shown an interest in agriculture as part of the Vision 2030 economic development initiatives.

Research and Innovation Activities

Saudi AgriFood Tech Alliance (SAFTA)

With the deployment of AgriFood technologies at its core, SAFTA seeks to bring together a network of expert stakeholders to develop the collaboration and cooperation needed from across KSA in a national effort. The alliance boasts a membership of more than 100 entities across government bodies, private sector companies, academia and research, and not-for-profits. Working together through knowledge sharing and partnership efforts in both research and business, SAFTA aims to inform policy that benefits the KSA food system as a whole.

The National Research and Development Center for Sustainable Agriculture (Estidamah)

Created by MEWA and King Saud University, Estidamah is a key research centre within KSA, focusing on new technologies and research that help meet the country's goals around sustainable agriculture and food system resilience. Across its facilities, including a number of glasshouses, work is underway to research and test new products and techniques that will help mitigate the effects of climate change, increase water-use efficiency, improve crop resilience and promote a more sustainable ecological landscape across KSA.

The Research, Development and Innovation Authority (RDIA)

Since 2021, RDIA has been the main funding agency in KSA that aims to accelerate innovation and create greater collaborations with industry across the KSA ecosystem. Its function is similar to UKRI, by combining grant funding opportunities with efforts to coordinate research and knowledge sharing across the nation's innovation landscape. Within the food space, specifically around AgriFood Tech opportunities, RDIA's priorities continue to be centred around KSA's national need for a sustainable ecosystem in water use, energy and environmental factors.

King Abdulaziz City for Science and Technology (KACST)

As the national scientific research agency for KSA, KACST is responsible for scientific development across a wide range of industries. Home to more than 30 research institutes, along with international partners, the agency has a food-focused research centre dedicated to Advanced Agricultural & Food Technologies. Here, researchers across several laboratories and research stations focus on the development of environmentally friendly technologies that are competitive and able to be deployed within the domestic food sector – with a particular focus on areas including: food safety and nutrition, crop health, animal health, and precision breeding in plants to boost domestic production.

King Abdullah University of Science Technology (KAUST)

Founded in 2009, KAUST is one of the fastest-rising universities globally in research output, geared towards solutions that solve domestic challenges across food and health, energy and the environment, water resources and digital technology. As well as the Centre for Desert Agriculture, which looks at supporting sustainable agriculture in challenging environments, KAUST also has four Centre of Excellence (CoE) specialisms for the nation's priority research areas. One of these, the CoE for Sustainable Food Security, looks to drive innovation around efficiency and sustainability across crops, biosystems, controlled-environment farming, and water-efficient technologies. Through its Core Labs, an integrated research infrastructure and expertise that supports connected research across the food space, as well as the on-site spin out facilities for successful innovation expanding from lab to real-world testing, KAUST is an essential and progressive force for tackling KSA's food security challenges.

Industry-led Innovation[13]

Beyond the central backing from the KSA government and university research centres, there are a number of businesses across the country's AgriFood sector embarking on innovation-led practices and the development of new technology, along with a willingness to engage with international partners and experts to enhance this process.

Green Dunes

A joint venture between Tamimi Markets (a substantial conglomerate of supermarket and food supply chain specialists), Mitsui (the global trading and investment company) and ZERO (the Italian technology-led food manufacturer), Green Dunes is the largest aeroponic farm in the Al-Kharji region.

Created in 2022 and operational in early 2024, Green Dunes' opportunity centres around cutting-edge innovation to showcase the potential for sustainable food production led by novel technology. With a focus on leafy greens and strawberries in the initial stage, Green Dunes is developing its business case around innovation to offer year-round production, pesticide-free growing, significant water reduction of up to 95%, and monitoring technology to maximise yield, plant quality and process efficiency.

To keep innovation progressing, Green Dunes are actively seeking both domestic and international collaboration, with the aim of bringing growers, researchers, technologists and businesses closer together in a more aligned way. As a result, ongoing opportunities exist for international stakeholders in areas such as:

- Crop variety selection and genetic testing
- Novel growing, monitoring and harvesting technologies
- Collaborative research and testing
- Alternative feeds, fertilisers, fermentation and synthetic biology
- Plant quality and shelf-life
- Scaling production and capacity

Mowreq

Situated in Jeddah, Mowreq is a vertical farm company specialising in hydroponics. As a joint venture with the YesHealth group, the company is seeking to develop a network of indoor vertical farms across KSA with a focus on leafy greens, with the intention of expanding into vegetables and berries.

Mowreq has recently opened KSA's largest indoor vertical farm in Riyadh, with a total cultivation area of 20,000 sq. metres - yielding around 2,000 kg per day of leafy greens and vegetables. The company is looking to expand into strawberries and other high-value crops, meaning there is an opportunity for UK institutions to partner with Mowreq on precision breeding programmes to develop crop varieties suited for KSA.

Alwadi

In 50 years since the company's inception in 1975, the Al Wadi Poultry Company has become one of KSA's leading poultry producers with a vertical integration model that sees them manage their business and supply chain from feed to stores.

The company's expansion has seen them scale to substantial levels with around 80 million chickens passing through their slaughterhouses each year. New agreements have also recently been signed for hatcheries rearing 150 million eggs a year across the country, and a feed factory producing 90 tons of feed an hour.

With a history of international partnerships across a range of infrastructure, technologies and feed areas, Al Wadi still presents a strong opportunity for food and technology businesses with novel solutions that can support effective scaling, monitoring systems, research, and concepts to improve practices.

13 There are other key companies across KSA who can play a role in innovation and collaboration. This list represents those engaged on the GEM visit.

TADCO

The Tabuk Agricultural Development Company (TADCO) is one of KSA's leading agricultural companies, producing high-quality fruits, vegetables, olives, wheat and alfalfa. Based in Tabuk, the company plays a key role in the KSA Vision for greater food security and sustainability, with a focus on improving processes throughout their production and supply chains, as well as growing the use of digital technology.

TADCO also have an immediate focus on water use efficiency and soil quality, given their commitment to a variety of crops. The company are keen to work with international investors at present, as part of a wider scope to bring greater efficiency to their labour, sorting and grading, and waste usage processes.

ASTRA

The ASTRA Food Company, part of the ASTRA Group, is an agricultural business with a broader reach. From the fruits, vegetables, flowers, quail and poultry production farms in Tabuk, to the Jeddah-based food commodities trading centre (focused on nuts, pulses, oils, coffee, rice and spices), and the commercial arm that provides retail and wholesale business across the northwest, ASTRA are a key and influential stakeholder in the KSA food system.

ASTRA's move to quail production as a source of high-value protein for the KSA market not only demonstrates their commitment to invest where necessary to achieve diversification from traditional poultry, but also efforts to take greater advantage of the growing national push for domestic production. The biosecurity considerations that accompany bird rearing do also present an opportunity for UK expertise in monitoring technology and other digital solutions.

Almarai

As a multi-national dairy company and the largest food and drink manufacturer and distributor in KSA, Almarai hold a valuable position in domestic production and food security aims under the 2030 Vision. With almost 200,000 cows under their management, Almarai is a leading voice in the KSA livestock sector.

Their scale and influence across KSA and the gulf region means a necessary focus on the security of milk volumes, for which new technology and innovation would need to support to be introduced. While in some areas, such as feed, there is currently little scope for alternatives that may disrupt the consistency of production, Almarai work both internally and with international partners on the use of novel technologies that support animal monitoring, health and analysis. As new solutions develop that bring further advantages in these areas, Almarai represent a strong potential collaborator and customer for digital innovation.

NEOM Topian

Topian, the NEOM food company, has set ambitious targets to transform and redefine how food is produced in KSA, with technology and innovation at its core. Looking to be able to provide year-round fresh food, Topian's investment in state-of-the-art facilities and research into future food opportunities means it will be a key voice in the industry under the 2030 Vision.

Work is currently focused on its large-scale high-tech greenhouse concept at Oxagon and ongoing development of new alternative protein products, as well as sustainable agriculture and aquaculture systems that are both climate resilient and help achieve key targets around water and waste in food production.

Topian's commitment to innovation has already generated international collaboration and significant investment in meeting the underlying aims of food security through new ideas. Topian's continued efforts towards innovation provide ongoing potential for overseas businesses and innovators to partner and engage on new technologies, as well as novel techniques around plant genetics and aquaculture farming.

Innovation Landscape in Saudi Arabia

Tabuk

Tabuk is another key agricultural region for the Kingdom with over 14,500 farms covering more than 270,000 hectares and is home to TADCO and Astra Farms. In recent years it has undergone substantial transformation and has one of the largest infrastructure projects in the world, NEOM and the Red Sea project. Topian (the food arm of NEOM) has invested heavily to develop capabilities in Controlled Environment Agriculture (CEA), novel foods and aquaculture.

Hail

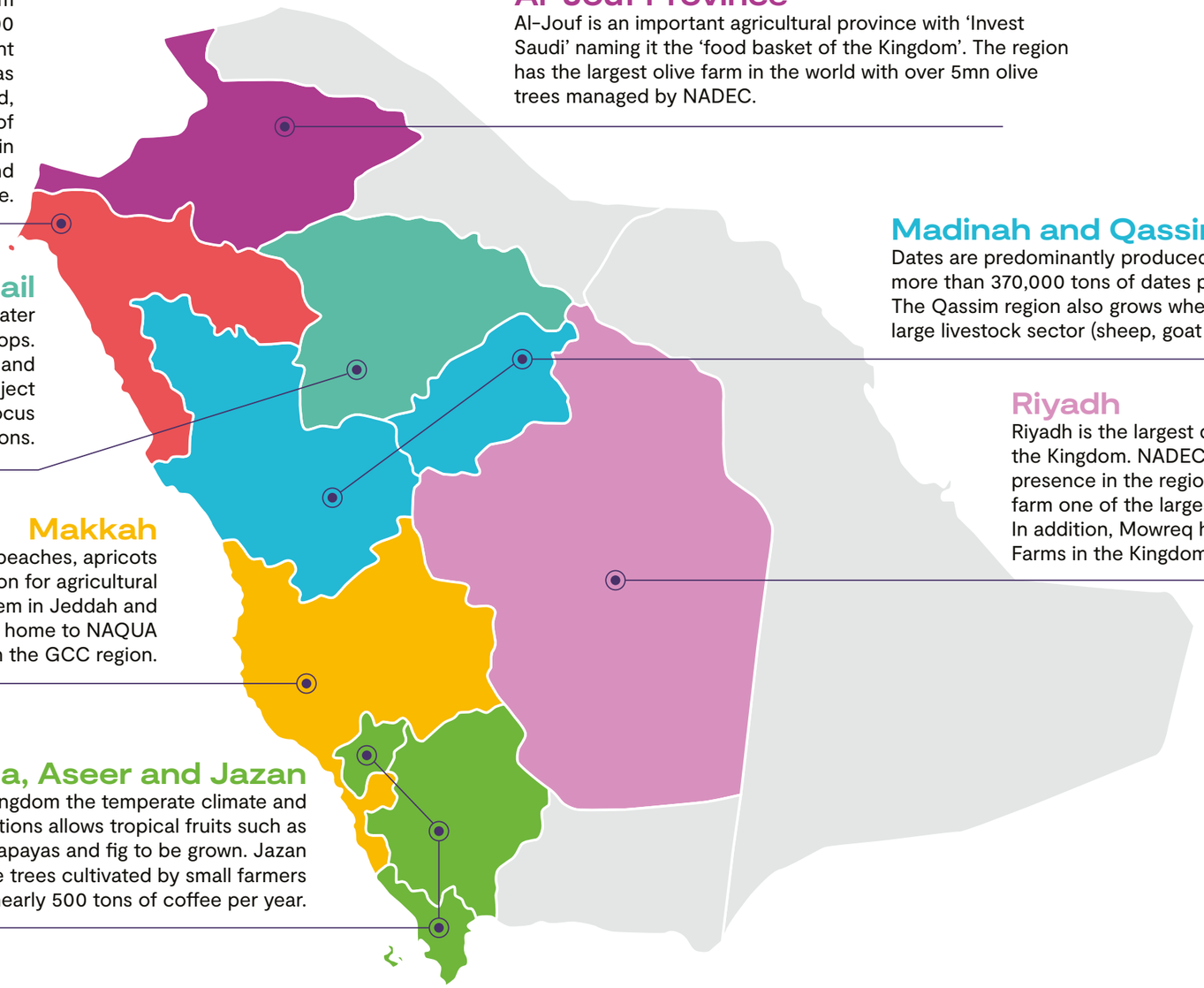
Hail is a key region for agricultural activity due to its water availability, suitable soil and favourable climate for growing crops. The region is a key producer of fruits, vegetables, grains and barley and is home to around 15,000 farms. NADEC's Hail project is located here covering an area of 193mn sq. metres with a focus on cultivating wheat, fodder crops, potatoes and onions.

Makkah

Local produce from Makkah include figs, pears, peaches, apricots and melons. While Makkah is not a key region for agricultural activity there is a vibrant start-up ecosystem in Jeddah and KAUST in developing Agri-Food technology. It is home to NAQUA one of the largest shrimp farm in the GCC region.

Baha, Aseer and Jazan

To the south of the Kingdom the temperate climate and favourable growing conditions allows tropical fruits such as pomegranates, mangoes, papayas and fig to be grown. Jazan has more than 70,000 coffee trees cultivated by small farmers and producing nearly 500 tons of coffee per year.



Al-Jouf Province

Al-Jouf is an important agricultural province with 'Invest Saudi' naming it the 'food basket of the Kingdom'. The region has the largest olive farm in the world with over 5mn olive trees managed by NADEC.

Madinah and Qassim

Dates are predominantly produced in this region with more than 370,000 tons of dates produced annually. The Qassim region also grows wheat and has a relatively large livestock sector (sheep, goat and camel).

Riyadh

Riyadh is the largest date producing province in the Kingdom. NADEC and Almarai both have presence in the region with Almarais Al-Badiah farm one of the largest in the world (35,000 cows). In addition, Mowreq has built the largest Vertical Farms in the Kingdom in Riyadh city.

Figure 5. Key agricultural activity across KSA highlighting regional differences.

Source: Data compiled by Edward Gilbert, Regional Agriculture, Food and Drinks Counsellor - Gulf

KEY POLICY

Memorandum of Understanding - 'UK & Saudi Arabia agreement to strengthen research and development collaboration'[14]

In March 2024, the UK and KSA signed a Memorandum of Understanding (MOU) to develop greater research links between the two nations. Focused on the key topics of food security, clean energy, business opportunities and R&D potential, the MOU represents an agreement to work together to help tackle some of the largest issues facing the global population and economies.

For KSA, the development of science and technology research in these industries is a fundamental part of their 2030 Vision to transform their economy and move towards greater domestic food security. For the UK, the agreement presents a significant opportunity for scientists, researchers and businesses alike to support KSA's progress through cutting-edge innovation, new technologies, and R&D-led business solutions.

14 https://www.gov.uk/government/news/uk-and-saudi-arabia-unveil-joint-plan-to-put-research-links-into-top-gear

KEY POLICY

United Nations Convention to Combat Desertification (UNCCD) – 16th Conference of the Parties (COP16) - December 2024[15]

In an effort to boost steps to tackle the impact of drought both domestically and globally, in December 2024 the KSA government announced the launch of the Riyadh Global Drought Resilience Partnership at the UNCCD conference.

The Partnership will bring together a range of countries and organisations to orchestrate a shift from reactive to proactive responses to drought management and mitigation. Playing a key role in wider water efficiency and food security policies, the Partnership looks to develop a more effective and joined-up approach to drought resilience and reversing the impact of existing challenges.

Initially focusing on areas including grants and funding for novel solutions, insurance and credit, early warning systems, mitigation techniques and vulnerability assessments, the Partnership aims to transform the way drought is tackled and solutions developed. As part of their leading role, KSA will cover the costs of the Partnership office for the first 10 years.

15 https://www.unccdcop16.org/news-room/news-details?lang=en&id=171

06. Collaboration Opportunities

Significant population growth and a rising demand for domestic food production are the key drivers for technology and innovation across the KSA food sector. The goals of self-sufficiency and food security have also created ambitious volume challenges, with KSA aiming to produce 3.4 million tonnes of vegetables[16] and more than 530,000 tonnes of seafood[17] by 2030. Meanwhile, the need to grow crops in harsh climates is a challenge that necessitates both a move to increased greenhouse uses in the absence of sufficient regions of fertile soil, and a national priority push towards innovation that advances water saving technology. Alongside their benefits for mitigating plant diseases, it's estimated that controlled-environment technologies can potentially reduce water consumption by up to 90%[18] for certain crops, and therefore play a key role in driving KSA's agricultural sector forward. Alternative proteins and novel foods (plant-based alternatives) are increasingly playing a key role in not just addressing the Kingdom's food security challenges but also tackling the growing health concerns around diet related non-communicable diseases.

These drivers, which form an integral part of Vision 2030 in KSA, bring opportunities to share best practices and learnings from UK initiatives. The UK is well positioned to provide this support, with previous AgriFood innovation programmes amounting to over £250m since 2019, and the development of new agricultural technologies that could be an effective solution to these challenges. The GEM visit identified a number of collaboration opportunities across the AgriFood sector which can be leveraged through bilateral knowledge exchange, business partnership opportunities and research potential.

16 Ministry of Environment, Water and Agriculture, National Agriculture Strategy, 2020
17 https://www.kaust.edu.sa/en/news/transforming-the-future-of-saudi-aquaculture-through-kaust-s-partnership-with-mewa
18 https://resourceinnovation.org/blog/cea-water-savings-potential-now-validated/

Sector-wide Opportunities

- The Kingdom's Vision 2030 provides a clear and consistent roadmap for the food sector in KSA. As the Kingdom seeks to boost domestic food production, there are opportunities for UK companies in the AgriFood Tech sector to explore how their solutions can support this transformation. By aligning with KSA's strategic direction, businesses can identify potential customers and position themselves to contribute to and benefit from KSA's evolving AgriFood landscape.
- Many of the AgriFood Tech challenges in the 2030 vision relate to areas like food and water security, which aligns to the focus of earlier UK innovation funding programmes like Transforming Food Production (Net-Zero), Farming Innovation Programme (productive, resilient and sustainable agriculture) and Novel Low Emission Food Production Systems (controlled environment agriculture and alternative proteins). As a result, solutions that UK companies and innovators have been developing through these domestic programmes could align well to KSA priorities and ambitions.
- There was a willingness across sectors to engage with UK experts and technology innovators, with a view to explaining their current challenges and to identify solutions. This mindset, seen across multiple site visits and interactions, presents an opportunity for an Innovate UK Global Business Innovation Programme (GBIP) to build connections and create impactful face-to-face meetings among UK and KSA stakeholders. Building introductions and partnerships in this way can also support other activities, like IUK Business Connect Innovation Exchange workshops where UK companies can understand KSA challenges and look to develop potential solutions with stakeholders who have either already engaged with each other, or who know about each other's business and capabilities already.

How SAFTA coordinates AgriFood innovation across KSA

SAFTA is a strategic collaboration within the agricultural and food sectors in KSA, looking to create and drive forward an active network of public and private industry stakeholders in a coordinated effort to bring innovation and transformation to the KSA food ecosystem. By combining government actors together with leading researchers, academics, technologists and private sector companies from KSA and internationally, SAFTA plays an important role in informing future policy and driving technology adoption for the benefit of the sector.

Among its growing membership of 81 organisations, SAFTA focuses on its key pillars of i) Creating an engaged community ii) Developing a knowledge-sharing platform iii) Catalysing joint initiatives for shared opportunities, and iv) Facilitating partnerships for deployment opportunities.

SAFTA's approach to addressing sector-wide challenges stems from the National Strategies that underpin efforts across KSA in areas such as water use, environment and energy, and agricultural technology. This model allows for those members in need of novel solutions to work alongside those who can provide them, both through research and development partnerships and in commercial testing and rollout where possible.

It also plays a key role in raising awareness, education and engagement among members looking at innovation and technology for the first time, or who are looking to scale their business in response to the food security aims set out by the KSA government. It therefore represents a vital tool in creating greater interaction and uptake from the food ecosystem as a whole.

- KAUST provides a wide range of collaborative opportunities across a number of areas, with university research, on-site experts, spin out companies and the Core Labs facilities. These facets all provide an opportunity for UK SMEs through a tailored soft-landing or incubator programme, which would support UK businesses looking to better align their product and to get a market presence in KSA and the wider GCC.

- Many stakeholders within KSA are looking at partnerships that can quickly develop and deploy technology solutions for the KSA market. While the GBIP is one avenue to facilitate B2B connections and partnerships, there may be other suitable interventions such as the Open Innovation and Lead Customer Programme. These are 'leaner' programmes that can be deployed to address specific challenges on a one-to-one partnering basis. Open Innovation involves supporting a business with their key challenges by identifying potential solutions provided by innovators and facilitating partnerships for fast-track pilot testing. Lead Customer programmes focus on funding that supports an overseas customer offering demonstrable deployment of UK innovation in a new market.

Estidamah Innovation Priorities

Estidamah is one of KSA's key research centres, with stations across Riyadh, Jazan and Najran – as well as regional facilities. Its work focuses on the nation's food security challenge and efforts to promote a sustainable landscape across the sector through research and empowering the development of new systems, techniques and efficiencies that tackle issues like water use, biocontrols, agricultural practices and technology development.

In collaboration with government bodies, Estidamah utilises training, consulting, innovation promotion, technology knowledge and research collaboration, both local and international, to achieve their central missions. These missions include: building knowledge of sustainable agriculture; promoting best practices; promoting innovation and the adoption of technologies; building an efficient and effective institution; and supporting a stable and more diverse funding opportunity.

Estidamah's work centres around four programmes, each tackling aspects of the overriding mission and all aligned to KSA's food security goals.

The '**R&D programme'** looks to drive research and launch projects with connected stakeholders, as well as establishing specialised technology research units that can help localise solutions for the KSA market.

The '**technology commercialisation programme**' aims to form effective research partnerships with universities and other knowledge centres, and fund and support the novel ideas of students and researchers, while also providing facilities and backing for start-ups and VCs to incubate their concepts towards testing and market readiness.

The '**knowledge transfer programme**' looks to provide further support through creating digital platforms and knowledge databases to boost collaboration and understanding, as well as offering training and upskilling for farms alongside broader scientific and technical events and forums for the agricultural sector as a whole.

Finally, the '**capability programme**' looks at training and skills development support for companies' existing staff, while also providing support for talent attraction and incentive strategies. It also works with stakeholders around governance, internal processes and regulations, looking to drive efficiency and effectiveness across their business.

Controlled Environment Agriculture

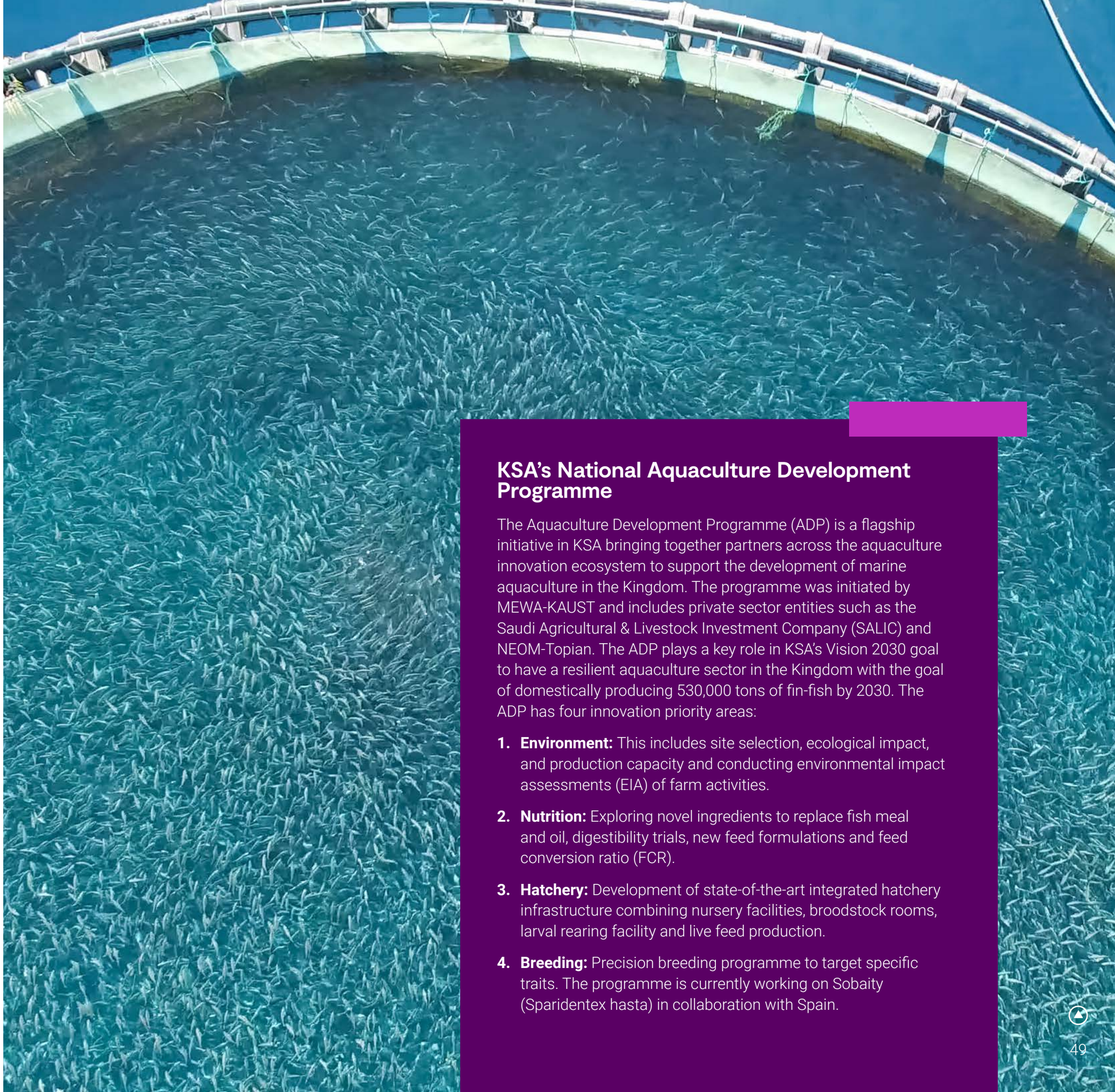
- KSA opportunity in this area would focus around technology support - especially around plant disease detection, seed modification and robotics. There is already research through KAUST ongoing, and UK opportunities at proof-of-concept stage could form part of an incubator approach into workable solutions. There is a willingness to allow early-stage international partners to join potential consortiums or to undertake joint venture initiatives for these solutions.
- Both ASTRA and TADCO displayed an interest in further collaboration, while Green Dunes were keen to engage with UK business through future international and B2B activities. ASTRA and TADCO both faced labour, soil, water, pest and production challenges that could be improved with the right automation and technology-led innovation. Both were keen to understand more about how UK companies could help improve their efficiency and future potential both in terms of crop growing, but also post-harvest quality and sorting, packing and storage.
- Within examples such as NEOM Topian's ambitious glasshouse, there is a willingness to engage in precision robotics for plant harvesting and pruning to help maximise yield and product quality, as well as in genetics and new varieties. In both cases, introductions can be made to UK experts.
- Estidamah represent an encouraging opportunity to connect UK innovation with local KSA farms and the wider ecosystem, as well as a test-bed for on-farm trials. There is an opportunity within a future GBIP for any UK businesses to complete a pitching and networking session hosted by Estidamah at the Saudi Food Show.

Alternative Protein Production

- Among the larger and higher-end supermarkets, particularly Spinneys, a range of plant-based and alternative protein-based food and drinks are available to consumers - although the range can be very limited in other stores. Spinneys, alongside Bidfood, a large wholesaler who operate across the region, are a key player in bringing these products to shelves and could be a useful contact for future business-led missions around bringing products to market and developing appropriate ranges for KSA consumers.
- Topian are becoming active in the market across plant-based milks, snacks and meat replacement products. Manufacture within KSA is planned for the next few years, providing a potential opportunity for UK expertise to help influence which product types are the focus and to be involved in the growing industry through joint ventures in manufacture with Topian.
- In relation to potential growing demand, there is a nascent but clear market opportunity for UK companies in this space. This stems from the growing young population and many affluent KSA nationals returning from education in the US, UK and Europe where there are more alternative protein products that represent better consumer experience. Playing a central role within the sector at this early stage, whether through research, product development, food standards, or market-ready brands, presents a real opportunity for UK alternative protein expertise as the demand grows further in KSA.

Aquaculture

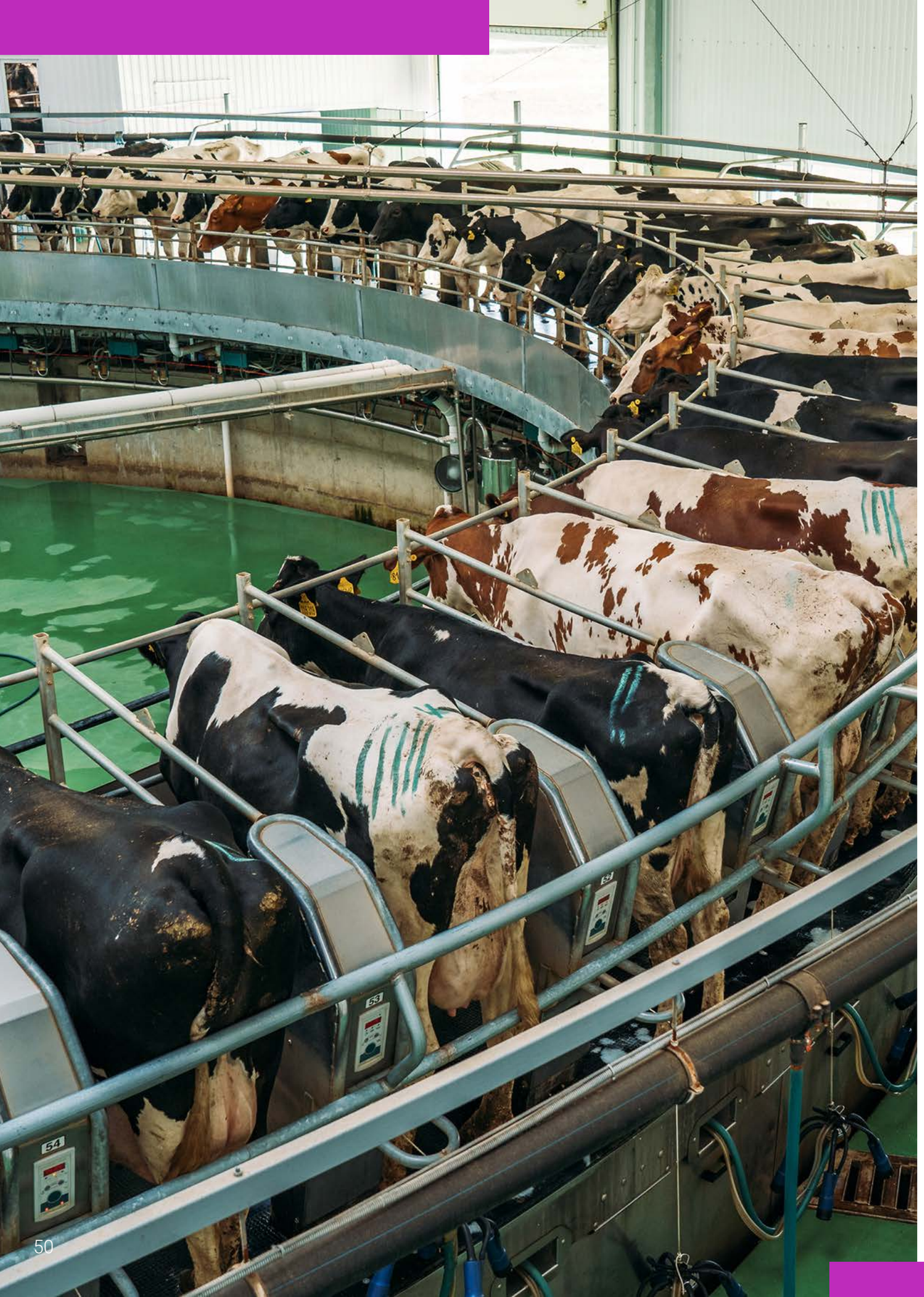
- The aquaculture space in KSA is the fastest growing food sector and there is a demand for international partnerships to co-develop solutions to enable scalable production. There are specific requirements for support around vaccines, feed efficiency, selective breeding, genetics and precision breeding, species development, and fish processing and packaging. There are also opportunities for expertise and innovation from the UK in areas such as micro and macroalgae cultivation and processing, restorative aquaculture, and coastal habitat restoration.
- The current interest in submersible cages and semi-closed floating containment systems for regulating temperature is technically and economically challenging. The need for new technology and innovation that reduces these challenges or reduces the need for these systems represents a real opportunity for UK specialists – particularly in the areas of improving genetics for heat tolerance, disease management and AI monitoring.
- Microalgal work also provides potential for UK researchers and innovators to play a key role in technology improvement and scaling development. B2B opportunities also exist in areas such as processing, biorefinery, strain development and biobanking, using existing UK expertise.



KSA's National Aquaculture Development Programme

The Aquaculture Development Programme (ADP) is a flagship initiative in KSA bringing together partners across the aquaculture innovation ecosystem to support the development of marine aquaculture in the Kingdom. The programme was initiated by MEWA-KAUST and includes private sector entities such as the Saudi Agricultural & Livestock Investment Company (SALIC) and NEOM-Topian. The ADP plays a key role in KSA's Vision 2030 goal to have a resilient aquaculture sector in the Kingdom with the goal of domestically producing 530,000 tons of fin-fish by 2030. The ADP has four innovation priority areas:

1. **Environment:** This includes site selection, ecological impact, and production capacity and conducting environmental impact assessments (EIA) of farm activities.
2. **Nutrition:** Exploring novel ingredients to replace fish meal and oil, digestibility trials, new feed formulations and feed conversion ratio (FCR).
3. **Hatchery:** Development of state-of-the-art integrated hatchery infrastructure combining nursery facilities, broodstock rooms, larval rearing facility and live feed production.
4. **Breeding:** Precision breeding programme to target specific traits. The programme is currently working on Sobaity (Sparidentex hasta) in collaboration with Spain.



Livestock

- Despite differences in livestock farming practices and priorities, there is still potential for UK-led technologies to bring positive impacts to the KSA sector. For a future GBIP or business-led initiative, particular potential lies in the following:
  - UK companies offering fertility/ reproduction technologies for dairy cattle to enhance existing practices. Areas include: IVP, ovum pick up, and semen quality testing.
  - UK-developed precision livestock technology for dairy and poultry production - including sensors, imaging technology, data integration and analytics – to enhance productivity as the KSA challenge of yield vs resources develops.
  - Solutions around the management of health and disease challenges, such as: diagnostics, vaccination, and heat stress management.
- Poultry farming offers opportunity for introducing UK innovation through rapid point-of-care diagnostics testing, given the timescales and work involved in current methods representing a clear business need for improvement. This forms part of a wider potential role for UK expertise to support KSA poultry companies (including Al Wadi) with KPIs and business planning, bird weight-determining vision systems, as well as a technology pathway. A potential knowledge transfer partnership covering wider business development avenues, as well as introducing UK businesses, could be beneficial here.

Precision Breeding

- TADCO showed an insight into the need for precision breeding techniques around pest and disease resistance in crops, as well as wider genetic adaptations and testing. There is an opportunity for collaborative testing and analysis work of current KSA products for their tolerance and durability, in addition to exploring alternative varieties being developed in the UK which could be suitable for the KSA climate.
- NEOM Topian present clear synergies in their ambitions and production methods, with UK expertise in plant genetics and selection. There is an opportunity for closer collaboration with the National Institute of Agricultural Botany (NIAB) and other UK innovators and growers in areas such as soft fruit variety selections for traits that suit growing conditions, integrated pest management and wider precision breeding considerations.
- Similarly, Green Dunes are keen to continue their path of technology-led innovation, and to engage with UK experts to further hone their plant breeding and growing techniques, including variety selection, lighting and environmental conditions, and shelf-life extension. They also provide a wider benefit through their role as a market entry and advisory vehicle for new and overseas businesses in the sector, with end-to-end input from R&D to retail.
- The national strategy for food security will likely lead to a greater demand for low and mid-tech greenhouses across KSA, and with that a greater focus on maximising yield and crop resilience through varieties and crop enhancements to create stability of supply.

07. Barriers to Collboration

While a number of clear and wide-ranging opportunities exist for collaboration between the UK and KSA industries, there are also differences that may create restrictions in some spaces. From day-to-day practices, government priorities, climate-related challenges, and financial needs, the following represent potential barriers to be overcome.

Sector-wide barriers

- There exists a potential misalignment with the current driving forces behind AgriFood innovation between the two nations, with the UK focused more on areas such as environmental sustainability, alternative energy and developing animal rearing practices, whereas KSA's initial focus is currently more towards meeting food security targets - achieved at high volume.
- The availability of cheap labour and diesel energy could hinder the uptake of new automation in KSA in the short term, with the cost of robotics, alternative power and AI technology all potentially prohibitive at farmers' and growers' current business stages.
- There are also broader hurdles that have been seen by the nature of a food industry that is growing quickly from a central government drive. These include new and developing legislation, a different attitude to supporting entrepreneurial approaches, and a fragmented landscape within each part of the industry.

Controlled Environment Agriculture

- The status quo in terms of current production methods, margins and mindsets presents a barrier in itself, where the perceived investment required to pursue new technology is not always an easy sell to make. Where cheap labour and manual techniques currently meet demands in a low-margin environment, the outlay for investing in automation is seen more as a 'nice to have' rather than an urgent requirement in places.
- Where technology is being sought by farmers, the demand is far greater for immediate solutions that can be introduced easily - which could come at the expense of longer-term R&D approaches and the trial and testing of new innovation ideas.
- The continued widespread use of diesel power also potentially hinders the uptake of new UK-led technologies that would require electricity.

Alternative Protein Production

- There is little evidence of consumer engagement or knowledge development around the benefits, opportunities and even products relating to alternative proteins. While alternative proteins is a key pillar in KSA's food security ambition, and with a young Saudi population, there needs to be a joined-up approach or messaging around meat alternatives.
- The drive for food security has meant a focus on dramatically expanding meat and dairy production within the country, which has meant that there is yet to be a real pull for focusing attention, budget and production on alternatives to meat.
- The first iterations of many alternative protein products were considered poor quality and not fully meeting the consumer need. This can have the effect of reinforcing negative perceptions of alternatives to traditional meat products, as well as delaying uptake among interested consumers. Future product iterations will need to ensure they are appealing to consumers, along with meeting other markers such as taste, texture and cost.

Aquaculture

- It appears likely that technologies from outside KSA will need to be localised or adapted to the local conditions, species, requirements and infrastructure. The preference seems to be for 'plug and play' solutions to KSA's industry barriers and problems, which means it's likely that UK innovations will need to already be proven at a commercial scale - with the degree of any requirement for localisation depending both on the technology and the context into which it will be adopted.
- KSA has a focus on open raceways for microalgae production, which is not used in the UK due to differing climate. This limits some of the opportunity for collaboration as alternative UK techniques and supporting expertise may not be as relevant for KSA partners.
- Similarly, one of the most developed aquaculture areas in KSA is in farmed shrimp, an area where the UK has little experience to date. Although some recent funding for UK-based shrimp initiatives has been secured, the industry is too nascent to offer an opportunity to support KSA's own shrimp sector, should this continue to be an area of focus.

Livestock

- The focus on food security and yield has the potential to hinder testing innovation in areas such as alternative feeds for livestock, where the perceived risk of changing feeds (for example, to include insects) and the impact on animals, seems to currently outweigh any potential benefits identified in cost, environmental or circular economy benefits (from food waste).
- Current leading UK technologies would require potentially significant adaptation for the difference in capacity for larger herd/flock size, environmental conditions, day-to-day practices and power sources, in order to work optimally.
- There is a potential reluctance to share data and IP, and to work with external solutions - instead focusing on in-house development - among major players in KSA that could hinder UK businesses' opportunity to collaborate and work on solutions for the KSA market.

Precision Breeding

- KSA already has strong links with the Netherlands in consultancy and innovation in this space, which can prohibit some potential collaboration or partnerships that would clash with these connections. It will be important to identify and focus on specific areas where the UK is strong – such as gene editing and Integrated Pest Managenement (IPM) in order to get a foothold in the sector.
- There are differences in the regulatory landscapes, as well as for the permitted use of chemicals and the scope for GM products that could create a misalignment in processes that hinder effective partnerships in some cases. Some testing of KSA products and methods is harder to undertake (or not permitted) in the UK due to regulatory restrictions.

08. Conclusions

The findings gathered throughout this GEM demonstrate real commitment to innovation across KSA and a willingness to partner on novel solutions and technology to help tackle some of the underlying challenges affecting the sector - and the country more widely.

The government-led Vision 2030 initiative is clearly having a positive impact on the industry and its progress towards sustainability and food security goals. It has helped drive these ambitions and has provided a roadmap through MEWA's mission-led approach to create a more integrated and cohesive innovation ecosystem. Water scarcity, land, climate change and productivity play a key role in KSA's food and water sector. This challenge has led to a more focused and collaborative approach resonating across the research and innovation base as it works to address these shared challenges.

The GEM highlighted recognition across the KSA food sector of UK skills and innovation capability, as well as the UK's approach to driving forward the use of novel technologies that support solutions around scaling, productivity, sustainability, product quality and environmental considerations. Innovations around plant genetics and species identification, as well as precision livestock technology and automation in agriculture, are particular areas where the UK can make a real contribution.

It's clear, however, that a greater understanding of the KSA market – in particular the impact of its climate, culture and resource capabilities – is needed for UK solutions to truly be a success. Adaptations may be needed to existing concepts, innovations and technology, and be able to demonstrate scalability in order to ensure they are appropriate and effective for the KSA sector.

It is abundantly clear that food and water security is critical to KSA's ambitious growth plans in the next decade. While the Kingdom in recent years has invested heavily in mega projects and relied on oil revenue to drive growth, the country has shifted significantly in the last few years to a knowledge-based economy where innovation partnership, knowledge exchange and collaboration have been prioritised. KSA has risen 19 places in the global innovation index since 2020, highlighting the Kingdom's ambition to be an innovation hub in the GCC. New research, technology development and innovation are happening now with other nations competing for partnership with KSA. The UK is in a strong position to engage with key KSA stakeholders to drive innovation and technology deployment in the AgriFood sector. It is therefore important for UK businesses, technologists and researchers to make collaborative strides now, both in knowledge exchange and market-ready solutions, in order to ensure a stronger partnership between the two countries for the longer-term.

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Innovate UK, part of UK Research and Innovation (UKRI), is the UK's innovation agency.

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