Food for the Future: Sustainable Agriculture Sector in Egypt, Saudi Arabia and the UAE
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About this Report

This report is the result of a research collaboration between HSBC and EY, aimed at informing and inspiring stakeholders in the agriculture sector to further explore the opportunities of sustainable agriculture practices. The report considers agriculture as the business of cultivating crops for socio-economic purposes and excludes livestock. It provides a snapshot of the agriculture sector in Egypt, the Kingdom of Saudi Arabia (KSA) and the United Arab Emirates (UAE). The report begins by highlighting for each country, the key government priorities, the financial and economic aspects, and the market and technological factors that drive the sector’s development. It also examines some of the key business case themes that support the need for a transition towards more sustainable growth of the sector and the challenges currently hindering this transition. The report concludes by suggesting potential recommendations to help address these challenges and identifies a few good practices emerging from within the region itself, that offer solutions to support the transition to a more sustainable sector.
According to the 2019 Global Agricultural Productivity Report, global productivity is currently only growing at an average annual rate of 1.63%. It will need to increase to at least 1.73% to sustainably produce food, feed, fibre, and bioenergy for the expected 10 billion people by 2050. Whilst good progress has been made in some areas, issues such as deforestation, land use changes, unsustainable agricultural practices and climate change continue to impact the sector’s global development and growth. The impact of these issues is also reflected in the sector’s share of global Gross Domestic Product (GDP). This has shrunk from approximately 8% in 1995 to just 3% in 2018. More worryingly, under a business-as-usual scenario, approximately 8% of the world population (or 650 million people) will then still be undernourished by 2030.

There is a growing need for change in the sector. Some of this change will come from innovative models and sustainable technologies to increase agricultural productivity and scaling these up rapidly and sustainably. Commitments made in 2019 by the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA) to support agriculture and related sectors are a start. This recent programme resulted in investments of USD5.4 billion internationally, and the implementation of 90+ projects to provide agricultural assets and services to 6.7 million farmers. Other changes and more investments will also be needed in the coming years to make a significant difference.

The United Nations Sustainable Development Goals (UN SDGs) have helped by providing a high-level blueprint for the development of the agricultural sector (including SDG 2 – Zero Hunger, SDG 9 – Industry, Innovation and Infrastructure, SDG 13 – Climate Action, and SDG 14 and SDG 15 – Life Below Water and Life on Land). By providing detailed information in each area, and highlighting linkages between them, there is improved understanding of what a better and more sustainable future for all could look like, and more sharing of new developments and best practices in the sector.

For the countries covered by this report, a transition to more sustainable agricultural practices could help to address some of the existing challenges in the region. These are significant, some as a result of geography, some due to human development. Water scarcity, climate change, and land issues have played a significant historic role in determining what and where it is possible to produce food, whilst urbanisation and a growing dependence on food imports have further shaped the local sector. None of these are sustainable in the long term.

There is an opportunity to address this. By focusing simultaneously on the economic benefits to the country and improving the environmental resilience of agricultural practices, stakeholders in agribusinesses can further develop and strengthen local supply chains and meet the expectations of consumers. The technology exists and some early promising case studies in the region are appearing. What is needed now is more holistic engagement on the challenges and opportunities by stakeholders across the region and aligned support for the application and scale up of profitable, carbon-neutral agricultural practices.
Food for the Future: Sustainable Agriculture Sector in Egypt, Saudi Arabia and the UAE
Executive Summary

The continued development and improvement of worldwide agricultural activities is key to addressing global issues such as extreme poverty and shared prosperity. Studies have shown that growth in the agricultural sector are 2-4 times more effective in raising incomes among the poorest communities compared to other sectors. Development of a sustainable and resilient food system is also an investment that allows for the preservation of vital resources while ensuring food security.

For the Middle East and North Africa region, the agricultural sector remains an important part of the region’s economy. For the three countries covered by this report, the contribution to GDP varies from around 3% in KSA to approximately 14% in Egypt. Current agricultural practices are largely traditional, and there is the opportunity to introduce more sustainable farming techniques that would deliver additional economic and environmental benefits as well as protect against the impacts of ever increasing external forces. These include water scarcity, a dependence on international food supply chains, land issues, increasing urbanisation and the effects of physical climate change.

Whilst these are significant challenges, they can for the most part, be addressed if all stakeholders play their part and actions are integrated. Country specific challenges include a lack of appropriate regulatory measures that endorse more sustainable practices, the ease of (and hence growth and increasing dependence on) food imports; rapidly increasing populations; food waste management issues and practices; the system of existing subsidies and incentives that support conventional agricultural practices and related sectors; and an overall lack of incentives for public and private sector investors to invest in sustainable agricultural measures.

By putting farmers first, agribusinesses can lead the development of a more profitable and carbon-neutral agricultural sector. A starting point to make this happen should be government intervention in the form of public policy instrument implementation given that a secure and long-term supply of food is ultimately a public good. With this in place, there is a vision for the ongoing development of the sector, Financial institutions and public investors would then be more likely to deploy additional bespoke, sustainable financial incentive instruments such as blended finance, private adaptation finance, grants and subsidies, equity investments, green bonds, partial credit guarantees etc. Alongside the financial flows, governments should also look to create an enabling business environment for the private sector as part of their strategic national development agendas. This could extend to the establishment of communication channels to highlight opportunities for the private sector to be involved across the agriculture sector supply chain, including the harvest, commercialisation, distribution and marketing stages, and to support the sharing of best practices and information.

The technology needed to underpin such a shift already exists, having been developed and proven in other countries. Techniques such as Controlled Environment Agriculture (CEA) and greenhouse technologies can reliably deliver in less favourable weather and soil conditions. Of course more could be done.

Additional focused support for innovative and sustainable initiatives that are tailored for the region, for example, through increased investment in research and development could help accelerate progress. Supporting technologies for data and information management such as aerial imagery, remote sensors, drones etc. also have an important and exciting role to play, allowing for live data analysis across the agriculture sector value chain, thereby allowing more real-time identification of opportunities and pricing models. To ensure that these are aligned, an overarching framework in the form of a water, food and energy nexus might also be an effective approach to consider the interactions between these resources and technology, as well as the synergies and trade-offs that arise from their management.

It is clear that the necessary elements are available to support a transition to a more sustainable approach to agriculture in the region. There are also a few good practices already emerging within the region itself. A key next step is to further encourage the support of governments, the private sector and local populations to drive this agenda forward in a way that will deliver a lasting positive and sustainable change.
Food for the Future: Sustainable Agriculture Sector in Egypt, Saudi Arabia and the UAE
1. Overview of the Agriculture Sector

As of 2018, the total agriculture value added globally (calculated for 161 countries), i.e. global net annual output of the agriculture sector (including forestry, hunting and fishing, and cultivation of crops and livestock production), was approximately USD2.9 trillion. The contribution of Egypt, KSA and the UAE to this was USD28.16 billion, USD17.50 billion, and USD3.06 billion respectively. Whilst these seem to be big numbers, again as of 2018, the sector’s share of global GDP had shrunk to just 3%, which is one-third of the sector’s GDP contribution from just a few decades ago. This is cause for worry, as under a business-as-usual scenario, this would result in approximately 8% of the world population (or 650 million) still being undernourished by 2030. In addition, the 2019 Global Agricultural Productivity Report also identified that the sector’s productivity was currently only growing at an average annual rate of 1.63%. It will need to increase to at least 1.73% to sustainably produce food, feed, fibre, and bioenergy for the expected 10 billion people by 2050. Action is therefore needed around the world to ensure the continued development and improvement of agricultural activities, not only to ensure that we can feed people, but also as a key driver to address global issues such as extreme poverty and shared prosperity. Growth in the agricultural sector can be 2-4 times more effective in raising incomes among the poorest compared to other sectors. However, issues such as deforestation, land-use changes, unsustainable agricultural practices and climate change continue to impact the sector’s development. These unsustainable practices may threaten the sector’s capacity to feed the world, unless change is introduced.

What is encouraging is that the market for food and agriculture products has the potential to grow and has shown appetite for innovation. The delivery and application of these innovative models and technologies to increase agricultural productivity needs to become more widespread, and there is an urgent need to scale this up rapidly. A shift from more conventional forms of agriculture to more innovative approaches presents numerous investment opportunities, especially for a sector that is the size of the agriculture sector.

The last few years have seen investment from major organisations such as the International Bank for Reconstruction and Development (IBRD) and International Development Association (IDA’s), which together committed USD5.4 billion to support agriculture and related sectors in 2019. This investment has resulted in approximately 94 projects being implemented globally to provide agricultural assets and services to 6.7 million farmers. The funds were used in diverse ways - for example, 3 million farmers adopted improved agricultural technology and, additionally, irrigation and drainage were improved on 730,000 hectares.
of agricultural land. In 2019, approximately 53% of the World Bank’s agricultural investments were directed towards financing climate mitigation and adaptation measures, compared to 28% of the investments four years ago.\textsuperscript{14}

To ensure that wider aspects were addressed, these efforts were, in part, guided by the United Nations Sustainable Development Goals (UN SDGs), which have become a high-level blueprint for the sustainable development of the agricultural sector (including SDG 2 – Zero Hunger, SDG 9 – Industry, Innovation and Infrastructure, SDG 13 – Climate Action, and SDG 14 and SDG 15 – Life Below Water and Life on Land). In parallel, governments have also begun to implement these directions through policy and national strategy. When combined with the necessary financial instruments and changes to the market structure, these changes help to set the conditions within which stakeholders from the agriculture sector can operate and innovate. It is then up to the stakeholders themselves to make the most out of these conditions and innovate towards more sustainable agriculture, improving their competitiveness and tapping into the market with differentiated and resilient business models.

For the Middle East and North Africa region, the agricultural sector remains an important part of the region’s economy. The contribution to national Gross Domestic Product (GDP) varies from around 3% in KSA to approximately 14% in Egypt. With growing food consumption and limited availability of arable land and groundwater reserves (driven in part also by unfavourable local climatic conditions), governments in the region have increased the focus and investment on measures to improve local production conditions.\textsuperscript{15}

This section intends to inform stakeholders in the agriculture sector of the current state of the market in the three countries covered by this report, including policy and financial instruments. This will act as a baseline to present the business case, challenges and opportunities for stakeholders to transition to more sustainable practices, outlined in sections 2, 3 and 4.
1.1. Government priorities

Government visions, policies and strategies largely impact the costs and barriers for industries and their respective stakeholders. Governments also play a role in the development of industries by introducing financing mechanisms to help to overcome existing barriers to risk mitigation. Egypt, KSA and the UAE have each taken their own approach in designing and implementing government policies and regulatory measures to prepare their domestic market for agricultural enterprise.

Some of the challenges faced in the implementation of these measures are described in section 3.

The snapshots below show a more detailed overview of how these three countries have integrated the sector in their strategic directions, as well as the governmental enablers available for stakeholders to take advantage of the growing market.

### United Arab Emirates

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<th>Is the sector considered in government strategies?</th>
<th>What are the existing government enablers?</th>
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<td>The UAE’s first agricultural policy was formulated by UN FAO and other local agricultural organisations and was submitted to the Ministry of Environment and Water in 2015.</td>
<td>Decrees have been issued on the topics of regulation of the importation of palms, rapid alert systems, controlling of imported food for a non-trading purpose, registration of seeds and cultivation of local plants, as well as an accreditation and registration system.</td>
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<tr>
<td>The UAE National Strategy for Food Security 2051 was launched in 2018 with 5 strategic goals aimed at facilitating global food trade, diversifying food import sources and identifying alternative supply schemes.</td>
<td>Emirates Sustainable Agriculture Label is compatible with the United Nations Food and Agricultural Organisation (FAO) Sustainability Assessment of Food and Agriculture (SAFA).</td>
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<td>The Abu Dhabi Agriculture and Food Safety Authority (ADAFSA) was established to take on the roles of the Abu Dhabi Food Control Authority, the Abu Dhabi Farmers’ Services Centre and the Food Security Centre - Abu Dhabi.</td>
<td>In 2014, MOCCAE opened the Agricultural Innovation Centre in Sharjah to promote technological innovations and knowledge sharing.</td>
</tr>
<tr>
<td>The Ministry of Climate Change and Environment (MOCCAE) has announced a priority to increase the use of hydroponic technology.</td>
<td>About half of the 40 existing organic farms have already been certified by Emirates Authority for Standardisation and Metrology (ESMA) and many others are in process, as of 2019.</td>
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<tr>
<td>Dubai Municipality’s initiative ‘Grow Your Food’ aims to reduce agriculture imports and promote food security.</td>
<td>MOCCAE is also focusing on increasing organic farming acreage by 5% annually.</td>
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The agriculture market in KSA was valued at USD9.5 billion in 2018 and is forecast to reach a value of USD12.16 billion in 2024.26

### Country snapshots

#### Kingdom of Saudi Arabia

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<th>Is the sector considered in government strategies?</th>
<th>What are the existing government enablers?</th>
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<td>The Ministry of Water, Electricity, and Agriculture (MEWA) is now primarily responsible for the agricultural policies (previously known as the Ministry of Agriculture).27</td>
<td>The Agricultural Development Fund (ADF) was initiated with SAR20 billion of capital to provide credit facilities. As of 2017, the fund has provided loans with a total value of over SAR48 billion.29</td>
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<td>MEWA developed a strategy for sustainable development of agriculture in KSA up to 2030, with support from UN FAO, and in line with strategic objectives of Saudi Vision 2030.</td>
<td>MEWA plans to partner with the private sector to develop aquaculture projects and advanced farming technologies. For example, the National Shrimp Company, managed by hydro-biologists and marine engineers, has started exporting shrimp to other countries.30</td>
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<tr>
<td>The Sustainable Agricultural Rural Development Programme 2025 aims to support farmers with financial allocations amounting to SAR7.35 billion over a seven year period.</td>
<td>Extension Centres for Integrated Farms (ECIF) are planned to be established by MEWA under the sustainable agriculture strategy 2030 (first centre launched in 2015). These centres focus on the application of scientific research and knowledge through farmer education and the introduction of innovative agricultural technology.30</td>
</tr>
<tr>
<td>MEWA has a target to achieve a 30% reduction (increasing to 50% under discussion) in water usage in the sector by 2030 (vs 2010) by improving irrigation techniques and eliminating water-intensive crops.28</td>
<td>The first National Regulation and Standards for Organic Agriculture were introduced in 2010 by MEWA (earlier known as MOA) to provide guidelines on production, processing, trade and import of organic products.31</td>
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Food for the Future: Sustainable Agriculture Sector in Egypt, Saudi Arabia and the UAE

Country snapshots

Egypt

Is the sector considered in government strategies?

The Government initiated steps towards modernising the agriculture sector in Egypt in 2007 – by converting it into a sector run according to the free market economy as part of the economic liberalisation programme. The FAO 2018-2022 country programming framework for Egypt focuses on three government priority areas: improved agricultural productivity and food security in strategic food commodities, and sustainable use of natural agricultural resources.

What are the existing government enablers?

The Ministry of Water Resources and Irrigation and the Ministry of Agriculture had launched policies in 2009 on improving irrigation methods, avoiding misuse of water supply and recycling the water used for certain crops as irrigation water for other crops. The Ministry of Agriculture and Land Reclamation (MALR) is responsible for agricultural policy implementation and for increasing the amount of arable land through land reclamation programmes.

The Government recently adopted the ‘Sustainable Agricultural Development Strategy towards 2030’ to improve socio-economic conditions based on employment creation, improved efficiency in land and water use to increase yields, income and food security and more participatory governance. The Sustainable Agricultural Development Strategy towards 2030 also aims to modernise Egyptian agriculture, increase food security, improve livelihood of rural inhabitants, increase efficiency in using development resources and in the utilisation of its environmental advantages.

Egypt Rural Agribusiness Strengthening is the initiative by the United States Agency for International Development (USAID) to help farmers in Upper Egypt and the Delta become more self-reliant and grow marketable crops that meet international standards for export.

Agriculture contributes approximately 14.5 % of Egypt’s gross domestic product. The sector employs around 25% of the labour force and 37% of women in the work place, which is equal to the employment contribution of the industrial and construction sectors combined.
1.2. Financial and economic aspects

Stagnation in agricultural productivity, especially in regional economies with fast growing populations, can result in food security concerns that require additional investment in order to be addressed.

However, the likelihood and impact of this food security concern can be reduced by targeting local agricultural investment measures at improving land, developing natural resources and developing human, social and physical capital.40

To date, Egypt, KSA and the UAE have all taken considerable steps to provide financial and economic support for their agricultural sector. Recommendations on how to further improve these financial enablers are explored in section 4.

The following country snapshots outline the financial enablers available to stakeholders in the agriculture sector, as well as some examples of financial instruments being used for agricultural development, as a reference for stakeholders in their process to secure capital.

### Country snapshots

#### United Arab Emirates

The agricultural sector has been identified as one of 13 key sectors eligible for up to 100% foreign ownership. This has encouraged greater involvement and increased investment opportunities by foreign companies. The Abu Dhabi Fund for Development (ADFD) has also invested nearly AED3.2 billion between 1971 and 2018 towards development projects in the agricultural and irrigation sectors.41 The results and success stories from these investments have not yet been published.

#### Financial enablers

- The ‘Ziraai’ programme, launched by the Khalifa Fund for Enterprise Development, provides an interest-free loan of up to AED1 million to each farmer.42
- The UAE’s Office of Food Security’s framework for agriculture finance includes Agtech loan guarantee, supply chain financing, unified agriculture license etc.
- The AgTech initiative launched by Abu Dhabi Investment Office (ADIO) as part of Ghadan 21 (Abu Dhabi’s accelerator programme), is an AED1 billion project to attract global partnerships supporting research and development in agricultural technology.43 40% has been allocated to date.
- One of the six key elements of Abu Dhabi Food Control Authority’s (ADFCA) agricultural policy aims to ensure a fair income for farmers, and has thus launched the Abu Dhabi Farmers’ Services Centre (ADFSC).
- ADFD — a national entity for development aid — has allocated nearly AED3.2 billion for development projects in agricultural and irrigation sectors around the world.44

#### Select examples

- The AgTech packages being launched by Abu Dhabi Investment Office (ADIO) are expected to generate a GDP contribution of over AED1.65 billion and create over 2,900 jobs in the Emirate by 2021.45
- ADOI has made an initial investment of AED367 million to bring four agriculture technology companies - AeroFarms, Masdar Farms, RNZ and RDI to build agri-tech R&D facilities and production centres to explore how arid-climate countries can benefit from these emerging technologies.
- The International Centre for Biosaline Agriculture (ICBA), a non-profit research facility at Dubai’s Zayed University, recently showcased a new generation greenhouse system that could triple crop products of fruits and vegetables while using 90% less water and 50% less energy.46
- An agri-tech start-up called ‘Pure Harvest’ raised USD1.1 million in 2016 from Abu Dhabi-based Shorooq Investments with the aim of cultivating crops in glasshouses to deal with the challenges related to ensuring year-round production.
- Pure Harvest recently secured a multi-stage investment commitment, worth over USD100 million, in April 2020. The investment is committed by Kuwait-based Wafra International Investment, and aims at the development and deployment of advanced controlled-environment agriculture solutions across the region.47
Supported by a range of government programmes over the last three decades, such as the provision of interest-free loans and support services for diversification, KSA’s agriculture development has attracted over USD53 billion in investments annually. Recently the KSA government has been reducing its subsidies on water and fuel, driven partly because of the decline in oil prices over the last few years. With less than 1% of the land in KSA being suitable for farming, and high levels of water stress, the cost of agricultural production has increased substantially. The government is, therefore, now providing subsidies only to those farmers growing crops with low water requirements and adopting efficient farming systems.

KSA’s agricultural industry is expected to demonstrate growth of around 3% Compound Annual Growth Rate (CAGR) over the period 2018-2023, with growth largely dependent on continued government funding under initiatives such as the Sustainable Agricultural Rural Development Programme 2018-2025.

### Kingdom of Saudi Arabia

**Financial enablers**

- Financial support for the environment, water and agriculture sectors worth SAR92 billion was approved in 2017 to help the government meet their goals under the 2030 Economic Plan.
- The Agricultural Development Fund (ADF) has allocated USD800 million in 2018, in the form of soft loans, to SME farmers to support KSA’s sustainable rural development programme.
- Foreign joint-venture partners of Saudi individuals or companies are exempt from paying taxes for a period of up to 10 years, and investment regulations in effect since April 2000 offer further incentives.
- The Saudi Agricultural Bank offers interest-free loans to farmers for machinery, irrigation pumps and agricultural equipment related to livestock and poultry keeping, and fish farming.
- Conferences and events such as the Saudi Agriculture Exhibition are held regularly to attract foreign investments in the Saudi agriculture sector.

**Select examples**

- Saudi Agricultural and Livestock Company (SALIC) and UAE’s Al Dahra company are expected to invest SAR5 billion in the Black Sea region to boost agriculture and ensure food security.
The agriculture and irrigation sector provides livelihoods for 55% of the population, directly employing about 30% of Egypt’s labour force and contributing approximately 13% of the country’s GDP.

Initiatives such as the Sustainable Agriculture Investments and Livelihoods Project (SAIL) were established to improve food security and nutrition in Egypt’s ‘new lands’, increase on- and off-farm incomes, and create overall socio-economic benefits - approximately USD 551,536 over a period of 20 years through improved health benefits due to improved food security and nutrition; approximately USD5.7 million through creation of 806,462 labour days over 20 years; and targeting approximately 40,000 rural households by strengthening smallholder institutions - among other such benefits.68

Country snapshots

Egypt

Financial enablers

The Ministry of Planning, Follow-up and Administrative Reform has announced an increase in investments of LE42.1 billion in 2019-20 in the agriculture sector – an increase of 23% compared to 2018-19.59

The Ministry of Agriculture and Land Reclamation (MALR) supports small-scale farms through the Social Fund for Development established in partnership with the UNDP in 1991.

The USAID announced the Egypt Rural Business Strengthening Project in 2019, an investment of USD37 million to build resilience in Egypt’s agricultural sector.60

Egypt and Germany signed a grant agreement worth LE36 million in the framework of an agricultural quality control project.61

Select examples

The Adaptation for Smallholder Agriculture Programme (ASAP), launched in 2012, enables smallholder farmers to participate in the International Fund for Agricultural Development (IFAD) projects to improve their resilience.62

The Principal Bank for Development and Agricultural Credit (PBDAC) has been issuing crop loans to farmers struggling with transportation costs.63

As of 2017, Egypt’s Agriculture Development Programme approved 248 projects, amounting to a total value of LE278 million, to boost the marketing potentials of the small and medium sized enterprises.64

In 2017, the International Finance Corporation (IFC) announced USD180 million as direct investments in Egypt’s agriculture sector, focusing on latest manufacturing technologies and enhancing employment opportunities, in partnership with Egypt’s private sector.65
1.3. Market and technological aspects

In addition to growing demands for food, the agriculture sector faces challenges such as newly emerging consumer demands for organic products, sustainable retail supply chains and zero-deforestation commitments. A sustainable transformation in the sector is essential to address these challenges, one that considers every step in the value chain, including:

- Manufacturing and distribution of farm supplies;
- Farm production operations;
- Storage, processing, and distribution of farm commodities and products;
- Final disposal and handling at the consumers’ end.

Egypt, KSA and the UAE are all highly reliant on international supply chains and therefore, only have local control over some aspects of the value chain. However, they can play a role in the international dialogue through reviewing and addressing some of the issues related to the other areas of the supply chain and doing more to encourage the development of a more sustainable local agricultural industry.

Stakeholders of the agriculture sector can get involved by identifying, tailoring and testing best practices in the countries’ growing markets, gaining a competitive advantage over more conventional business models. Stakeholders can find more detail on the key obstacles to overcome as part of section 2, as well as innovative ideas to jump ahead of their competitors in the second half of section 4.

The country snapshots below show some of the best practices already under implementation in the countries of focus, as reference and inspiration for new enterprises.
In addition to population increase, the yearly grain and food demand increase is attributable to factors such as a growing tourism sector, planned mega events such as EXPO2020 (now to be conducted in 2021 due to current COVID-19 global situation) and growing government initiatives on improving local food processing and storage capabilities. Currently, the UAE imports 80%-90% of its annual food requirements, posing a major challenge for the country’s food security ambitions. The UAE government has been increasingly investing in research and development programmes that can boost sustainability in agriculture and agri-tech industries. An amount of USD1.5 billion has been committed over the next five years for such initiatives. For example, the Netherlands embassy to the UAE recently announced in May 2020, the set-up of a joint economic committee within the UAE. The aim is to support the UAE in becoming increasingly self-sufficient by boosting local production using Dutch agricultural technologies and attain food security in the post-Covid-19 world.

Sustainable agriculture techniques such as vertical farming and advanced hydroponics are also helping to raise the UAE’s crop producing capacity. Recently, as part of the Abu Dhabi Sustainability Week, MOCCAE supported the establishment of the Climate Innovations Exchange (CLIX) to enable sourcing, funding and commercialisation of climate change solutions and technologies across multiple sectors, including agriculture. The CLIX platform connects entrepreneurs and investors from around the world, to allow exchange of ideas and present innovative investment opportunities. The programme received 1,402 applications from 128 counties in 2020 in categories including Future of Food & Agriculture, Space, and Future of Energy and Mobility.

### Examples of what the government and public-sector is doing

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<td>Encouragement by MOCCAE for the introduction of modern technologies in hydroponic farming including modern fertilisation systems and measuring devices to monitor the acidity and concentrations of nutrient solutions.</td>
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<td>Developments are in progress for 12 vertical farms covering 7,600 square metres of land allocated by MOCCAE.</td>
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<tr>
<td>The UAE Office for Future Food Security’s online Food Research Platform to share latest research findings.</td>
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<tr>
<td>Activities by the Sharjah Foundation to pioneer Entrepreneurs (RUWAD) and Mohammed Bin Rashid Establishment for SME Development to support farmers, beekeepers and fishermen.</td>
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### Examples of what the private sector is doing

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<td>Veggitech, an Agrotech company has identified a solution to address the challenges of traditional farming through its design of “protected hydroponics” and “grow-light-assisted hydroponics”.</td>
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<td>Pure Harvest Smart Farms’ three-hectare farm with a fully climate-controlled greenhouse facility.</td>
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<tr>
<td>Aquaculture, vertical farming, drone use and sensors – four key technologies used under the AgTech initiative.</td>
</tr>
<tr>
<td>A Norway-based company has successfully developed nano-clay soil amendments and completed a pilot which potentially allows for a 50%-65% average reduction in water use (compared to conventional irrigation methods), as well as more efficient fertiliser use and reduced run-off.</td>
</tr>
<tr>
<td>Lulu Group International and Majid Al Futtaim Hypermarkets LLC have been promoting local agricultural products.</td>
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<td>Union Cooperative Association have been endorsing organic product brands and promoting hydroponic products.</td>
</tr>
<tr>
<td>Al Rawafed Agriculture Organic Farm in Abu Dhabi supplies nearly ten tonnes of fresh produce to supermarkets and restaurants daily from its 50-hectare farm.</td>
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The agriculture sector currently only represents 3.4% of the country’s GDP; however, there is a great potential for further development. To date, the Kingdom already has the largest dynamic agricultural projects in Middle East and North Africa related to the date palm, poultry, dairy and aquaculture industries.

The development in the sector has been supported historically through various implicit and explicit incentives. These incentives have been gradually shifting towards more innovative areas such as those mentioned below, in the hope that this will encourage the industry to adopt more resilient and effective methods and technologies, and in so doing become more profitable and sustainable. Areas of focus include funding to support research aimed at developing new crop strains with greater resistance to pests; improved roads linking producers with consumer markets; subsidies on water and electricity tariffs for farmers focusing on growing low-water requiring crops; and commodity boards that agree to purchase grains and cereals at guaranteed prices irrespective of international market prices.

**Examples of what the government and public-sector is doing**

- The UN FAO has a partnership with the Ministry of Environment, Water and Agriculture (MEWA), Saudi Grain Authority and Agricultural Development Fund to establish an effective evidence-based food loss and waste reduction programme and to implement a food security early warning system.

- SABIC collaborated with MEWA in 2008 to fund, build, and operate the Estidamah Agriculture Research Centre that focuses on increasing production to improve food security in KSA.\(^{23}\)

- The Saudi Organic Farming Association (SOFA), established in 2007, organises awareness drives on organic food and engages in market development activities at the national level - one of SOFA’s main services - as well as the provision of information on certification procedures, innovative organic farming methods, legal guidance and marketing opportunities.

**Examples of what the private sector is doing**

- Badir Programme for Technology Incubators and Accelerators, representing King Abdul Aziz City for Science and Technology (KACST), is launching initiatives such as the Agricultural Techniques Hackathon (2019) to develop fresh innovative solutions aimed at transforming the existing food system in KSA and increasing the efficiency and quality of production and higher economic return.

- King Abdullah University for Science and Technology (KAUST) has been conducting research on desert agriculture, genome engineering technologies to manipulate plant growth in adverse conditions, and plant hormones that shape roots based on nutrient availability.\(^{24}\)
The agricultural market was valued at approximately USD2.22 billion in 2018 and is projected to reach a value of USD2.63 billion by 2024. With the country highly dependent on a sector that still predominantly uses conventional farming methods, the government has increasingly been focusing on implementing programmes that will enhance productivity across the entire agriculture value chain and on achieving global standards. In addition, USAID programmes have helped to increase agricultural productivity and raise farmers’ incomes and self-sufficiency; enabling farmers to purchase land, improve farm management techniques, gain access to financial services, and liberalised agro-input markets for fertilisers and seeds.

The government has also been using a market-driven approach to increase economic stability for the farmers and other players in the sector. The ‘Feed the Future - Egypt Food Security and Agribusiness Support’ programme, for instance, increases agriculture-related incomes of 14,000 farmers by strengthening sustainable fruit and vegetable value chains for domestic and export markets; while also working with farmers on production, post-harvest processes, marketing, and nutrition.

### Egypt

#### Country Snapshots:
**Market and technological best practices**

#### Examples of what the government and public-sector is doing

- **The International Fund for Agricultural Development (IFAD) in Egypt supports the settlement of land reclaimed from the desert in Lower (northern) Egypt and provides support for agricultural productivity improvements in the old lands in the Nile valley and Upper Egypt.**

- **The Egypt Network for Integrated Development (ENID) implemented an innovative crop residue recycling pilot project in 2015 in three districts of Qena to stop agricultural burning, reducing its negative impact on the environment and on people’s health.**

- **As part of the Farm-level Irrigation Modernisation Project, the government worked with the World Bank and the French Development Agency from 2011-2017 to use plastic pipes to replace irrigation canals. This has successfully eliminated water loss and increased its distribution by 5%, expecting to increase water efficiency to 75%.**

- **A joint programme was initiated by the Egyptian Food and Agriculture Organisation (FAO) and the Ministry of Agriculture to develop a digital guiding model as part of the 2018-2022 country programme framework.**

- **MALR has been working on a centralised information centre containing data on the food industry in Egypt and forecasting operations for water usage and arable areas, under a programme aiming to develop a digital map of Egypt’s landscapes to monitor areas of urban expansion and rates of desertification.**

#### Examples of what the private sector is doing

- **The International Centre for Agricultural Research in Dry Areas (ICARDA) has led efforts to reduce water over-consumption through mechanisms such as raised-bed farming - a technique that involves digging channels between rows of crops to maximise water distribution and sunlight, effectively saving an average of 4 million cubic metres of water per year.**

- **The Egypt Rural Agribusiness Strengthening activity helps farmers in Upper (southern) Egypt and the Delta become more self-reliant and grow marketable crops that meet international standards for export.**
1.4. Overview of some key technologies for agriculture sector value-chain

Sustainable transition in the agriculture sector faces a number of challenges and barriers due to a number of factors. However, greater collaboration and cooperation between various players in the value chain can help address these challenges and create opportunities to achieve this sustainable transition.

An effective approach would be to use innovative technology to improve the overall agriculture productivity and yield, and meet the increasing food demands, while reducing the negative impact on the environment and the communities. Players in the agriculture sector have been increasingly adopting this approach.

The agriculture sector value-chain and the different activities can be broadly divided across four phases:

**Production:** The process of growing grass, crops, or trees attached to the surface of the land with a commercial value.

**Processing and Storage:** All set of activities engaged exclusively in processing agricultural raw materials to form agriculture products, with the storage phase being a penultimate phase of safely storing and maintaining all process agricultural products before distribution, so as to maintain the quality of the products as per the requirements.

**Distribution:** All set of activities related to the transportation and management of post-harvest and post-processing agricultural commodities. It usually includes transport and distribution of agricultural products by government or independent wholesalers to retailers (although chain retail stores sometimes have their own separate warehouse distribution centres) or directly to end consumers.

**Consumption and End-of-product use:** The final set of activities in terms of an agricultural commodity value chain, wherein the processed and packaged commodity reaches the end-user or consumer. The ‘end-of-product’ use of phase has recently become an increasingly considered phase of the value chain, with a growing market demand for sustainable use of products, waste management, recycling and circular economy approach.

Using technology helps reduce the complexities across each of these phases. This is a key step towards increased sustainable growth and development of this sector. This is especially relevant for the three countries of focus, wherein digitalisation is an important element of all national development plans and agendas.
Some recent innovative agricultural technologies and farming techniques

Production

Controlled Environment Agriculture (CEA)³:
- Conventional hydroponics
- Aeroponics
- Aquaponics

Advanced hydroponics⁴:
- Protected hydroponics
- Grow-light-assisted hydroponics

Urban and modern agriculture practices:
- Seawater Energy and Agriculture System (SEAS)¹
- Climate-controlled glasshouses/greenhouse systems
- Metal-coated netting greenhouses
- Vertical farming
- Smart Irrigation and Growth containers
- Integrated Crop, Livestock and Forestry (ICLF) farming

Genetic modification technologies:
- Genome engineering technologies to manipulate plant growth in adverse conditions
- Genetically Modified Organisms (GMO) and Hybrid crop variety growth techniques
- Plant hormones modification
- CRISPR
- TALEN

Soil-modification technologies:
- Raised-bed farming technique
- Multipurpose soil conditioning
- Super absorbent hydrophilic polymers
- Nanoclay particles

Processing and Storage

Digitalisation for agriculture processing activities:
- Use of drones and lower cost spectral cameras for farm mapping
- Digital mapping of landscapes to monitor areas of urban expansion and rates of desertification
- Microwave sensing
- Robots for harvesting and weed control
- Processing related data analytics and mobile services
- AI, ISOBUS and GPS combination

Use of Artificial intelligence (AI) and Internet of Things (IoT):
- Blockchain farming and distributed ledger technology (DLT)
- Blockchain-based records to allow producers and manufacturers to verify the exact origins of any agricultural product
- Use of Advanced radio frequency identification (RFID) chips for processing and storage

Sustainable storage techniques:
- Solar-powered, off-grid refrigeration units
- Zero energy cool chambers (ZECC)
Consumption and End-of-Product use

Consumption monitoring technologies:
- Food sensors
- Cold chain management facilities
- Real-time monitoring of perishable foods

End-of-consumption product management techniques:
- Crop residue recycling project to stop agricultural burning
- Zero liquid discharge desalination

Product life-cycle management certifications:
- Climate Declaration and other Environmental Product Declarations for production activities of the value chain
- Carbon Trust Carbon Reduction Label
- Climatop certification system – for emission reductions achieved

Digitalisation for improved distribution activities:
- Aerial imagery, remote sensors, drones etc. for real-time data analysis
- Crypto-anchor technology for agriculture
- Near field communication (NFC)

Sustainable techniques and collaborative platforms:
- Solar-powered, off-grid mobile refrigeration units
- Climate Innovations Exchange (CLIX)
- Cold chain management facilities
- Real-time monitoring of perishable foods
- Climate Innovations Exchange (CLIX)
- Cold chain management facilities
- Real-time monitoring of perishable foods

Process-route optimisation:
- End-to-end dynamic routing with real-time rebuilding options
- Predictive fuel consumption and maintenance

Key takeaways from section 1
- The market for agriculture products is large and growing, presenting valuable opportunities for innovative business models.
- Sustainable practices can help make the sector more resilient and cope better with disruption, giving sustainable ventures a competitive advantage.
- In terms of food security and natural resource management, there an incentive for governments to strengthen the enablers for stakeholders to increase production sustainably.

- Special boxes with dedicated compartments for plant growth and water retention (Netherlands-based technology)
- A distributed ledger is a database that is consensually shared and synchronised across multiple sites, institutions, or geographies, accessible by multiple people. Blockchain farming is a digital ledger technology that allows a reliable source about the state of farms, inventories and contracts in agriculture, where the collection of such information is often incredibly costly. The blockchain technology can track the provenance of food and thus helps create trustworthy food supply chains.
- (A platform in the UAE) to enable sourcing, funding and commercialisation for agricultural technologies
- Low-cost storage technology wherein Chambers are constructed with a double brick-wall structure. Cooling takes place via a natural phenomenon known as evaporative cooling, i.e., when air passes over a wet surface, water evaporates into air raising its humidity and same time cooling the bed.
- Technique that shape plant roots based on nutrient availability, water quality and availability etc.
- Tool for editing genomes, alter DNA sequences and modify gene functions
- Transcription activator-like effector nucleas technology that can engineer restriction enzymes that will specifically cut any desired DNA sequence
2. Business case for the transition towards sustainable agriculture

Conventional agricultural practices (i.e., agricultural practices that involve significant amount of synthetic chemicals and energy use) have helped increase the agricultural production over the last few decades to meet the needs of people. However, factors such as ever-increasing population, climate change, and economic instabilities have resulted in pressures on the sector to produce higher yields than ever. Conventional practices can maximise the potential yield of crops, but do so at a major cost to the environment and compromising biodiversity, soil fertility and overall health of the ecosystem. Such conventional environmentally harmful practices will be unable to meet the demands of the rising population in the future. 80

Over the past few decades, new practices, technologies and agricultural techniques have been identified that rely more on natural cycles to ensure plant health and crop performance and improve overall yield. For example, conservation agriculture, a sustainable farming practice, allows increasing organic matter content and moisture-holding capacity of the soil, resulting in the doubling of subsistence crop yields in areas where use of fertilisers is uneconomic and can sustain production in areas with low rainfall. 81

For the Middle East and North Africa region, including the three countries of focus in this report, such sustainable farming techniques can garner both economical and environmental benefits, while addressing challenges such as lack of arable land, water stress situations, climate change and overall harsh weather conditions among others. A clear business case thus exists in the region to support a more sustainable agriculture sector. This section identifies some of the key themes that act as driving forces highlighting the need for such a transformation.

2.1. Water scarcity

The sector is the largest consumer of water globally, with agricultural irrigation accounting for 70% of water use worldwide. 82 In the Middle East and North Africa region, especially in countries such as Egypt, KSA and the UAE, farming systems are still largely designed in a way that makes them unable to cope with periods of water scarcity. There is also a lack of suitable farming technologies that could adjust the cropping systems or patterns in various zones to match water availability and its supply. 83 Traditional farming methods are also a major source of water pollution; with agricultural fertiliser run-off, pesticide use and livestock effluents severely contributing to the pollution of waterways and groundwater. The region is now increasingly focusing on greenhouse cultivation, hydroponics and other emerging technologies in an attempt to reduce the water and fertiliser footprint of the industry. In parallel the sector is also in places, beginning to explore organic farming which is more water, land and labour intensive than conventional farming but less harmful to the environment. Desalination plants in the MENA region produce 48% of the world’s desalinated water, but this is highly energy intensive as it accounts for roughly 90% of the thermal energy used for desalination worldwide, led by the UAE and KSA. 84

The UAE faces several water management challenges, including the scarcity of groundwater reserves, high salinity levels in existing groundwater aquifers, limited re-use of water, and limited collection and treatment of wastewater outside of urban areas. 85 While the agriculture sector accounts for less than 1% of GDP, irrigated agriculture is the primary water consumer with an average of around 60% of total water use, with only about 39% is used for productive agriculture. 86

In KSA, when water pumping started in the late 1970s for farming, the country’s water table beneath the Saudi desert was estimated at 120 cubic miles (500 cubic kilometres). 87 However, by 2008, the country was projected to have used up at least 96 cubic miles (400 cubic kilometres) of its aquifers, and further estimates have suggested that four-fifths of KSA’s ‘fossil’ water has now been depleted. 88 This has resulted in policy changes regulating both the types and extent of agriculture that is now permitted. The depletion of the aquifers also has potential implications on neighbouring GCC countries as they are shared with them.

In Egypt, almost all freshwater supplies are drawn from river Nile and more than 80% of this water is used for agriculture. Scarcity in the availability of freshwater from Nile in recent years has already resulted in cities like Cairo importing approximately half of its food requirements. 89 90

2.2. Disruption in international supply chains

Given the challenges with local agriculture, the region has become highly dependent on international supply chains to deliver all of the food types and quantities that it needs to feed its growing population, posing certain risks associated with potential disruptions in international supply chains. One way to mitigate these risks is to enhance the productivity of local agriculture through sustainable measures. 90 Developing more extensive local food systems can improve the socio-economic welfare of local communities, reduce greenhouse gas emissions (partly as a result of a reduction in the long-distance transportation and storage of food), and reduce the vulnerability of supply chains due to the impacts of weather, as well as market-related issues. 91 Embedding environmental sustainability measures and innovations could also help avoid variability and availability of supplies due to geopolitical risks and future pandemics similar to COVID-19.

Currently, low economic returns from local agriculture discourage farmers and other sector players from upgrading their mechanisms and techniques. There is also a need for specialised guidance and for the adoption of policies supporting local products to reduce the reliance on international supply chains. 92 In most cases, the economics and quality of local agricultural production can be improved through more sustainable and innovative solutions such as advanced greenhouse design, hydroponics, vertical agriculture, netted systems and closed-system greenhouses; whilst being supported by more advanced marketing schemes and facilitated supply chains for local production. 93
2.3. Social impact on local communities

Implementing sustainable, community-supported agriculture practices at a larger scale can bring communities closer together and to stimulate regional economies, while preserving traditional food cultures. This is because, in addition to addressing environmental concerns, sustainable agricultural practices incorporate a wide range of social aspects like human health, labour, democratic participation, resiliency, biological and cultural diversity, equity, and ethical behaviour. Egypt would benefit the most from this, given its greater share of rural communities; followed by KSA and then the UAE. One way of delivering this outcome would be to use community-led initiatives through technical and financial assistance, including training and facilitation services, financial coaching, funding of innovation processes and mechanisms to improve accessibility. These community-led initiatives could include directly tackling resource management, providing information to raise public awareness, inform local and national decision-making and policy processes, and creating multi-stakeholder monitoring committees to facilitate effective management and accountability, among others.

2.4. Land issues and urbanisation

Our historic agricultural practices have resulted in approximately a third of the planet’s land now being classified as severely degraded, with remaining fertile soil being lost at a rate of 24 billion tonnes annually. According to the ‘Global Land Outlook’ study by the United Nations, an urgent shift away from destructively intensive agriculture is recommended. Only about 1.63% of the total land in the Gulf Arab States is suitable for agriculture. There are also some natural forests (roughly 1.5 million hectares), with these mainly clustered in the highlands in the south of KSA, the UAE and Oman. For Egypt, given its geographical location in a severely dry region, wind erosion of top soil is the main cause of land desertification. These areas are characterised by a fragile ecosystem and scarcity of water and vegetation cover, issues and processes such as salinisation of irrigated areas, waterlogging and wind erosion.

Increased urbanisation has also played a destructive role. As cities grow, they drive a change in land use. Studies have shown that urban expansion will result in a 1.8% to 2.4% loss of global croplands by 2030 (with substantial regional disparities). Approximately 84% of projected global production losses are expected to occur in Africa and Asia. In Africa, specifically, a 3% cropland loss is calculated to translate into a 9% crop reduction, most of which is estimated to occur in Egypt and Nigeria. In Egypt, the impact of urban expansion on the agricultural sector is threatening the highly fertile but limited land in the Nile Delta area. With growth in urban areas, the remaining croplands and farmers at the peri-urban interface experience greater competition for water and increased exposure to climate hazards due to factors such as increased loss of water-bodies, cropland conversion, and groundwater extraction. However, if tackled in the right way, urban areas can also contribute to food production. Studies in 2013 identified that urban agriculture practices (practices that include production, distribution and marketing of food and other products within the cores of metropolitan areas and at their edges and outskirts) were responsible for producing approximately 15% to 20% of the global food supply.

Global research and meteorological datasets indicate that, if fully implemented across all cities in the world, urban agriculture could produce as much as 180 million metric tons of food a year i.e., approximately 10% of the global output of legumes, roots and tubers, and vegetable crops. A greater focus on urban agriculture would also allow for greater environmental, economic, and social benefits for those communities.

2.5. Climate change

In the coming years the planet will experience changes in temperature and humidity, water availability, wind and storms, among other aspects, which will impact not only the ability to grow crops, but also aspects such as which crops and how well those crops can grow. Extreme climatic events could also result in the greater proliferation of pests and diseases as well as other changes that are favoured by a warmer climate. To address the significant impacts of climate change on agricultural yields, alternative and more sustainable agricultural practices need to be embraced.

The end result could be the unavailability of certain food items and a sharp rise in food prices, making lower-income households more vulnerable to price shocks.

KSA: Climate change is projected to represent a great threat to crop production for KSA. This is because a temperature increase of 1.5 degree Celsius in the lower latitudes can increase evapotranspiration by 5% to 15%, requiring an increase in the use of water and thereby placing the agriculture sector in the country, which has an already rapidly depleting water table and extreme high temperatures, at high risk. Hence, it is important to develop a sustainable agriculture sector to avoid further resource wastage.

Egypt: According to a World Food Program (WFP) study, Upper Egypt is one of the areas most vulnerable to the impacts of climate change within the region. Furthermore, the WFP forecasts a loss of up to 30% of Upper Egypt’s food production by 2050 owing to risks such as extreme weather and other climate change threats. Hence, improving the efficiency in the use of natural resources is essential for the sector.

Key takeaways from section 2

- Conventional agricultural practices harm the natural resources on which the sector relies and will be unable to meet the food needs of the population in the future.
- There is appetite for systems that optimise the use of water and land, and manage conditions like humidity and temperature, such as smart irrigation, vertical farming and soil management techniques (e.g. hydrophilic polymers).
- There is potential in strengthening production for local consumption, through business models that empower community-led initiatives and leverage sustainable practices.
- Urbanisation can contribute to local agriculture production through urban initiatives, rather than damage the soil or take over available fertile land.
3. Challenges in transitioning to a more sustainable agriculture sector

There is a clear case for the agriculture sector to quickly and comprehensively shift toward more sustainable practices. Whilst some progress has been made across Egypt, KSA and the UAE to date, there is room for significant additional action to be taken. This section describes some of the challenges hindering this transition.

3.1. Lack of effective endorsement through regulatory measures

Egypt, KSA and the UAE have made some investments in more modern techniques and agricultural technologies to address issues related to food security, yet these investments lack a strong regulatory incentive mechanism that can enable effective implementation of these innovations. Some of the incentives currently needed, but which are not regulated consistently and effectively, include localised regulations related to land ownership and access, agricultural insurance, social safety nets for out-of-work farmers, improved access to water and subsidies for renewable energy. Egypt has good potential for more sustainable agricultural practices but it continues to face shortcomings due to weak institutions and infrastructure, unclear direction in agricultural development with frequently changing priorities, and deficiencies in the design of specific intervention policies such as the long-standing universal food consumption subsidies.

Furthermore, Egypt's diminishing pool of resources and growing population also impact the policy choices and political decisions more strongly, especially those related to shaping the country's agriculture sector. Recent regulatory developments such as the 'Sustainable Agricultural Development Strategy towards 2030' also face issues related to a lack of endorsement by the existing laws, deficiencies in enforcement, penalties, compliance and pricing. In the absence of stronger institutional endorsement, unsustainable and inefficient methods and practices such as inefficient use of water and overuse of pesticides and chemical fertilisers will continue to harm the agriculture sector in the long term.

3.2. Ease of food imports

Driven by limited arable land and water resources, and challenges in addressing these effectively, countries in the Middle East and North Africa region are also shifting their agricultural investments and spending abroad. Egypt and Uganda have signed three Memoranda of Understanding (MOUs). These also include agreements related to investments in the agriculture sector wherein both countries cooperate in different fields of agriculture practices and processes. To address KSA government's decision in 2008 to phase out all water-intensive crops including grains by 2016, the Saudi Council of Chambers' Agricultural Investment Committee has...
shifted its investment focus towards agricultural and livestock projects in Ukraine, Brazil, Argentina, Canada and Sudan. The UAE government also signed a deal with Uganda in 2019 to establish a 2,500-hectare agricultural free zone to enhance food security in the UAE.

While these investments allow countries to reach an agricultural capacity that could not be achieved domestically and help to deliver on food security concerns, it is not a complete solution as it is still potentially exposed to climate change and other local factors, and the produce still needs to be transported back for local consumption. As of 2019, food-related transport emissions comprise 6% of food’s total emissions globally, whilst the overall food supply chain emissions (i.e., transport, packaging and retail) account for 18% of the total food-related emissions.

A report by the Gulf Research Centre has indicated that such investments potentially risk being detrimental to local landowners, especially in developing countries, if issues such as the inclusion of local owners in decision-making and land allocation and land rights are not planned effectively. In addition, certain countries with existing high risks of radicalism, political instabilities and other internal conflicts can threaten the agricultural investments as well. Another point of concern is the high cost of purchasing overseas produce, which has grown substantially over the years in the three countries of focus.

The UAE currently imports about 80%-90% of its food requirements, KSA imports approximately 80% of its food requirements and Egypt imports approximately 40% of its food and agricultural products.

Once established, it is highly likely for an ever-growing reliance on food imports to set in, particularly as growing local populations, income levels, changes in lifestyles and consumption patterns drive new demands. Overcoming the notion that this approach is cheaper, more secure and more varied is a key challenge to delivering on a transition to a sustainable agriculture sector.

3.3. Rising population

Whilst a significant challenge to agricultural self-sufficiency in the region continues to be the geographical location and the scarcity of renewable water resources; another major challenge is the ever-increasing population. This exerts ever-growing pressure on the agriculture sector and on its ability to narrow the production and demand gap. According to a study by Alpen Capital on the GCC food industry, the UAE’s population is projected to reach approximately 11.5 million by 2025. To feed this population, food imports are expected to grow from AED13.9 billion in 2011 to AED30.8 billion by the end of 2020, presenting a major challenge for both the national economy and food security. In Egypt, the population is estimated to increase to 123 million by 2030 and then onwards to 174 million by 2050, aggravating the challenge of delivering adequate agricultural resources. In KSA, from a population of 29 million in 2015, the population is expected to increase by 77% by 2050.

The KSA government has already identified that this rate of population growth will outpace the current rate of food and water production and availability; and has called for an increased dependence on food imports.
If managed effectively, a rising population could be aligned with the opportunity to promote investments and drive innovation in community-based agriculture, sustainable technologies, storage and processing infrastructure among others. This poses an opportunity for both governments and the private sector to adapt their practices and business models to serve a wider population more effectively.

3.4. Geographical and climatic conditions

For countries such as KSA and the UAE, the inherent aridity of their difficult-to-farm regions limits both the amount of agriculture that is possible and the natural productivity of the land, curbing immediate desires to become more self-sufficient. The sandy soils in these regions are mainly infertile due to a lack of organic matter and clay content, and rainfall being infrequent. In addition, the saline composition of the soil, extreme porosity, high insolation of soil surfaces and lack of organic matter in soil resulting in natural fertilizer run-off, require farmers to supplement the soil with fertilizers, additives and chemicals, which then leach into groundwater over time. High evapotranspiration rates and sandy soil textures result in water losses, required to be compensated through increasing irrigation rates. These are achieved through drip irrigation and desalination processes that can sometimes be expensive as well as energy-intensive. An estimated 90% of farms on the UAE’s east coast suffer water supply deficiencies. Out of the approximate 5,272 wells on east coast farms, 23% are either dry or the water is tainted in some way, e.g., being too saline and unusable. Irrigation water in these farms is usually obtained from farm or home wells, desalination plants and running water from the municipality. However, this is usually uneconomic for the small volume of farm crops produced.

3.5. Food waste management

The wastage of imported and locally grown food is a key issue for all three countries. Whichever way it is measured, wastage quantities are significantly higher than those found in the United States and European countries; with hotels and restaurants being one of the biggest waste generating sources. The average annual amount of food waste is estimated at 427 kg per person in KSA, 197 kg per person in the UAE and 73 kg per person in Egypt, compared with the 95-115 kg average per person in Europe and North America.

Both individual and commercial behaviors contribute to this. According to a recent survey, about 78% of home food purchased in KSA is discarded by residents each week to make room for new groceries. With food items and groceries highly subsidized and abundantly available to all, residents take food for granted. At a commercial level, despite the various awareness drives and initiatives, there is a lack of government-driven laws and regulations in the hospitality, food retail and residential sectors to ensure that organizations and individuals work towards the issue of managing food waste in the three countries.

From an economic sustainability standpoint, food waste can erode a major portion of national revenues for countries, creating unnecessary demand for surplus food that can then increase a dependence on imports. For example, another recent survey indicated a food wastage of approximately SAR70 million per day in KSA at the household level – equivalent to 8 million meals per day or disposing of 1.65 million tonnes of food to landfills from domestic kitchens annually.
Untreated food waste also contributes to climate change due to the production and emission of a significant amount of methane from anaerobic decomposition. A key challenge in accepting and overcoming this situation is the inability to successfully mitigate long established unsustainable lifestyle attributes in the region. Furthermore, business models that take advantage of food waste, such as composting facilities, are still scarce and often expensive.

3.6. Government subsidies and incentives for conventional agriculture

To encourage local production, agriculture sector subsidies and government financial aids are common across all three countries of focus. Subsidies and financial aid provided to conventional agriculture has, in many cases, distorted the normal economic business cases and have been a key reason for a delay in the uptake of more sustainable practices.

The KSA government effectively offers almost-zero tariff energy to farmers along with the establishment of commodity boards that agree to purchase grains and cereals at guaranteed prices irrespective of international market prices. These government intervention in setting prices have led to market distortions, investments in less efficient power and water infrastructure, and high (and often unnecessary) domestic consumption of resources.

Government initiatives such as King Abdullah Initiative for Agricultural Investment Abroad, incentivise investments in other countries and in doing so, reduce the motivation for local investors to invest in sustainable practices and technologies within the Kingdom.

In Egypt, both the manufacture and distribution of domestically produced fertilisers are subsidised by the General Authority for Agricultural Stabilisation Fund (GAASF), which transfers funds obtained from the Ministry of Finance to fertiliser factories and Principal Bank for Development and Agricultural Credit (PBDAC). Furthermore, cotton producers are also subsidised with respect to the cost of chemical materials and the costs of their application. Owing to direct government intervention in agricultural prices and because of some crops being more heavily taxed than others, farmers reallocate land, labour and other inputs primarily based on economic benefits without much consideration of the environmental impacts of the enterprise.

The UAE government has also announced an annual farm assistance programme through the MOCCAE, wherein UAE growers will be provided with critical farming implements and seeds, as well as fertilisers and pesticides at discounts of up to 50%.

The challenges highlighted in this section provide an overview of the existing policy and regulatory, financial incentives and market and technology level barriers to a sustainable agriculture sector transition in the three countries of focus. The next section aims to identify a set of potential solutions and recommendations, applicable to these countries, to enable this transition.

Key takeaways from section 3

- The COVID-19 pandemic offers an opportunity for governments to strengthen local production programmes, shifting resources away from conventional practices, reducing dependence on imports and involving a growing population in the economy.

- Business models that are backed by community-led initiatives have a competitive advantage because they are supported by stronger socio-environmental systems.

- Local geographic and climatic conditions make conventional agriculture expensive, presenting an opportunity for new business models that optimise natural resources.

- There is room for food waste management enterprises, especially when combined with other activities (e.g. composting and waste-to-energy). These would benefit from related regulation.
The three countries of focus in this report have shown awareness and taken steps to develop their agriculture sector and improve their food security. A number of challenges still hold back a full-scale and long-term transition to a more sustainable approach to agriculture. In the short term, a number of steps can be taken that can help improve the resilience and sustainability of agriculture in the region.139

4. Recommendations to accelerate the transition

Experience from other parts of the world has indicated that sustainable agricultural systems can be both economically, environmentally and socially viable, and contribute positively to local livelihoods. But without appropriate national or regional policy support, they are likely to remain localised at best in its extent, and at worst simply wither away, edged out by more dominant existing practices. The outcomes and success of actions by non-government stakeholders is largely dependent on the effectiveness of public policy instruments. It is recognised that a secure and long-term supply of food is ultimately a public good and so it requires government intervention. Considering the individual challenges faced by each of the three countries, this report puts forward the following suggestions:

4.1. Public policy instruments

Review and revise the current supply chain framework to increase the role of local producers

Establish and promote the co-operatives to improve the seller power of local farmers

Tailor the existing and planned incentives to focus more on sustainability aspects such as (i) reduction in greenhouse gas emissions i.e. electricity and water usage, transportation fuel use etc., (ii) use of locally appropriate crops and farming methods, (iii) research and development to identify more locally appropriate agricultural practices

Introduce regulations to encourage the use of local production over imports

Establish food quality assurance mechanisms to ensure adequate quality of local production

4.2. Nexus approach

While the three governments have to-date implemented a few policy mechanisms and strategies focusing on the transition towards more sustainable agriculture, the agriculture sector and the governments continue to engage and address the challenges largely in a ‘siloed’ fashion.

Nexus approach for Egypt141

Egypt’s INDC (Intended Nationally Determined Contributions as per the United Nations Framework Convention on Climate Change (UNFCCC) lists adaptation and mitigation activities strictly separated, but nexus analyses for Egypt show that more water and energy-smart agricultural planning is urgently needed to meet the growing challenges of climate change and other pressures.

Agriculture takes the major share of water allocation in Egypt, at about 85%. But agriculture also has a lower priority of water allocation than domestic water uses and water for industry. Therefore, the main ‘nexus solution’ for Egypt lies in producing more food with less water, i.e. an increase in water productivity through innovation. This also has energy implications; more intensive agriculture will require more energy. Recognising this implication, the government already prescribes the use of solar energy only, for new land developments.
A number of other countries have realised that the concept of a water, food and energy nexus can be a more effective approach to review the needs of the sector whilst also considering the synergies and trade-offs that arise from the management of these three resources.

Solutions proposed should take into account the outcomes of such an integrated model, also allowing for a range of scenarios and estimates to be modelled. For example, it would improve the quality of the recommendations if a range of factors and performance measurement metrics were taken into account, such as, the relative importance of agriculture in national economies to the existing degree of intensification of agricultural production, the constraints and opportunities that are determined by the availability of agricultural resources, and the needs of individuals in communities.\textsuperscript{140}

\subsection*{4.3. Bespoke financial instruments and incentives}

Globally, banks and other private financial institutions are launching unique instruments to support a rapidly growing and economically exciting sustainable agriculture sector. Financial institutions and public investors in the Middle East and North Africa region could consider customising sustainable financial incentive packages, which could help achieve food security while delivering attractive financial returns and improving the sustainability across the whole value chain.

For example, the Global Index Insurance Facility (GIIF), managed by the World Bank and funded by the European Union, Germany, Japan and the Netherlands; offers index-based insurance. The institution offers insurance against shared risks when external factors exceed certain thresholds, like unusually high temperatures, low rainfall, or disease outbreaks. Other emerging financial instruments include grants and subsidies, equity investments, green bonds, partial credit guarantees by non-governmental organisations or banks to compensate for lack of collateral by farmers, as well as off-take agreements wherein buyers commit to purchase future production. More instruments and products are emerging as the issue of agricultural resilience rises on the global agenda.

Blended finance, i.e., enabling the development of financial instruments that are a mix of several such instruments, can also help to increase investor confidence. The World Food Program, for example, launched the Food Security Climate Resilience (FoodSECuRE) Facility in 2015 – a multilateral, multi-year, replenishable fund that focuses on reinforcing community resilience during and after climate-related incidents as well as before the occurrence of such disasters using forecasting techniques and methodologies. One of its medium-term goals includes the establishment of fully operational FoodSECuRE facilities in at least five countries - Guatemala, Niger, Philippines, Sudan, and Zimbabwe - by the end of 2020. This will also include developing and testing early action plans, implementing a monitoring framework, as well as a cost-benefit analysis team and an accessible country contingency fund.\textsuperscript{142}

Private adaptation finance is another area that presents a significant opportunity to mobilise climate action and finance in the agriculture sector. Private financial institutions, banks and investors can consider investing substantially in adaptation techniques and new technologies and capitalise on new business opportunities.

Leading banks are promoting and financing Integrated Crop, Livestock and Forestry (ICLF) farming among its clients, allowing farmers to restore underutilised or degraded arable land and increasing their profitability. Impact investment can also allow investors to fund agricultural projects with social and environmental benefits – for example, Root Capital as an impact investor had deployed over USD1.1 billion in credit to 659 businesses by 2017, who collectively source from over 1.2 million smallholder farmers.\textsuperscript{143}

Another key financial instrument is Export Credit Agency (ECA) Financing. ECAs are usually a private or quasi-governmental institutions that act as intermediaries between national governments and exporters to issue export insurance solutions and financing guarantees, thereby reducing the uncertainties related to export activities and international trade. For example, Dutch ECAs support their agri-tech sector in selling advanced sustainable farming products to other countries. With the reduced risk guarantee brought by ECAs, local financial institutions and banks are then willing to provide loans to local farmers or agri-businesses to purchase such assets and technologies.

These activities highlight the interest and focus of investors in the agriculture sector. What is needed now is for this experience to be shared more widely, the number of participating organisations to increase substantially, and for the quantum of investments to be scaled up significantly in the short term.

\subsection*{4.4. Increased private-sector involvement}

According to the FAO, the governance of the food and agriculture sector is also increasingly transforming globally, largely through new technological, knowledge-based, financial and managerial resources and innovation. The private sector has been instrumental in driving many of these transformations.\textsuperscript{144} Creating an enabling and supporting environment for the private sector to be involved should

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**Financing programme for sustainably commodities**

Backed by the UK government and the UN, Sustainable Investment Management (SIM)manages a financing programme for sustainable commodities supported by green bonds, aimed at supporting Brazilian farmers and avoiding the clearing of the country’s grasslands. SIM will arrange USD1 billion in green bonds over the next four years, which is expected to result in the production of 180 million tonnes of responsible soy and corn. The first USD300 million bond issuance is planned for the planting season of 2020.
also be an important strategic consideration for all the three countries of focus. In an ideal world, private sector organisations should be considered for involvement right from the planning and design phases of policies and specific projects, thereby allowing strengthened partnerships and more effective investments.

Communication channels should be established more widely to highlight opportunities for the private sector to be involved across the agriculture sector supply chain such as the harvest, commercialisation, distribution and marketing stages. Demonstrating the commercial viability of adaptation strategies is another recommended approach to attract the private sector. Public funds could be used to conduct feasibility assessments and pilot projects can be implemented for new tools and technologies to assess viability, monitoring and evaluation of adaptation projects. This should be set within the context of longer term government plans and visions for the country.

4.5. Innovative practices

The region’s governments have begun to selectively identify and invest in potential sustainable technological interventions to address the food security concerns and enable the transition to a more local and sustainable agriculture sector. These efforts are currently limited to a few sustainable agriculture technologies such as vertical farming, aquaponics and hydroponics.

Case-study:

**Emirates Airline (Emirates) building an AED147 million vertical farming factory in Dubai**

Emirates is in the process of building the world’s largest vertical farming facility in Dubai, in a USD40 million (AED147 million) partnership with Crop One, a California-based firm. The facility will be a 130,000 square feet facility near the Dubai Airport and at full productivity will produce 2,700kg of herbicide-free and pesticide free leafy greens every day.

The facility is predicted to use 99% less water than outdoor fields with only 0.003% of the space. It will produce the equivalent of 900 acres of farmland. Fresh vegetables will not need to be imported from abroad and will have a very short trip to customers at the airport.

The construction of the farm began in November 2018 and the first products are aimed to be delivered to Emirates Flight Catering’s customers, including 105 airlines and 25 airport lounges.

UAE’s Majid Al Futtaim’s commitment to support local agriculture supply chains

Majid Al Futtaim (MAF) in the UAE recently renewed its commitment related to a local agriculture supply chain. MOCCA and MAF renewed their Memorandum of Understanding (MoU) to promote and retail locally grown agricultural products across all Carrefour stores, operated by MAF, in the UAE. Furthermore, MAF Retail hand-picks a selection of local suppliers following stringent safety and hygiene audits and reviews the businesses of all suppliers every six months, including organising awareness trainings related to market needs. MAF aims to support local sustainable agricultural production through this partnership, in addition to encouraging local farmers to adopt the latest cultivation techniques and providing them with agricultural input subsidies.
Whilst helpful, the introduction of broader conservation agriculture techniques, equipment and strategies that make better use of labour, soil and water resources is of the highest importance in the region and has the potential to have more of an impact. There exist a range of proven techniques with applicability to the region from other dry areas of the world. They involve zero or minimum soil disturbance, careful monitoring of soil and water relationships, development of rational options for long-term cropping choices and patterns, involvement of farmers’ groups in decision-making processes, and development of technologies that are geared specifically to women producers and processors.

An emerging technology in the Middle East and North Africa region that has recently been gaining traction is the use of synthetic materials to improve the physical properties of soil by improving water and nutrient retention capabilities. Super absorbent hydrophilic polymers can absorb more than 200% of their weight in water, nutrients, and other aqueous chemicals. As the soil dries, the polymer hydrogels passively release the absorbed components into their surroundings. These polymers can absorb and store water usually lost to evaporation or groundwater, thereby reducing the volume and frequency of irrigation up to 50%.

Techniques such as Controlled Environment Agriculture (CEA) can support agriculture in countries with less favourable weather and soil conditions. CEA is the growing of crops while controlling certain aspects of the environment to reduce pests or disease, increase efficiencies, be more sustainable, increase yield or save costs. Solutions like greenhouses, which is a type of CEA, have been in commercial use around the world for decades.

Another approach to technological advancement in the region’s agriculture sector is the adaptation of solutions such as Genetically Modified Organisms (GMO) and hybrid crop variety growth to improve the resilience of existing plant varieties. New technologies like CRISPR (tool for editing genomes, alter DNA sequences and modify gene functions) and TALEN (transcription activator-like effector nuclease technology that can engineer restriction enzymes that will specifically cut any desired DNA sequence) could also be researched further.

Case-study:
Solar-powered, off-grid refrigeration units

Using renewable energy as a source of power can be an innovative way to reduce the refrigeration costs for storage while also reducing environmental impacts, overcoming the high cost and high energy requirements of conventional fridges. A start-up in Nigeria, ‘Cold Hubs’, is developing an off-grid storage warehouse for perishable food crops. The unit uses roof-mounted solar panels that store energy in high-capacity batteries which feed an inverter, enabling 24-hour refrigeration inside the cold room. This innovation can increase shelf life from 2 to 21 days. The company targets nutrient loss and food waste in rural farming regions of developing countries. In order to make the service affordable and attractive for farmers, the company offers a flexible pay-as-you-store subscription model.
4.6. Data and information management across the supply chain

Technologies such as aerial imagery, remote sensors, drones, etc. now allow for the management of data and information for real-time data analysis across the agriculture sector value chain, thereby allowing identification of opportunities and pricing models. Supported by some on-ground data input, they can also be effective in identifying crop interventions and predicting final yields. Such data analytics, through mechanisms such as big data, Internet of Things (IoT) and cloud computing, can help pin-point to the exact issue across any specific element of the supply chain and formulate predictive algorithms that can alert even before a problem occurs. The adoption of analytics in agriculture has been increasing consistently; its market size is expected to grow from USD585 million in 2018 to approximately USD1.23 billion by 2023.152

Global programmes such as the World Food Program have also been promoting forecast-based techniques that allow the preempting of disasters with early interventions and responses, thereby encouraging increased investments in the sector by reducing the possibility of risks impacting final yields.

The use of blockchain technology can help increase transparency across the agriculture sector value chain, help farmers retain a bigger share of their crop value, facilitate timely digital payments and increase access to financing. Blockchain based records can also allow producers and manufacturers to verify the exact origins of any agricultural product, thereby also meeting increasing consumer demands for organic and fair-trade products etc.153 Examples of this already exist for some products such as cotton, bananas and tuna fish.

Smart irrigation is a recent sustainable technology suitable for arid climates such as those in Egypt, KSA and the UAE. It allows real-time measurements of soil conditions through satellites or soil-probe sensors, combined with weather forecasts and data analysis, to regulate the amount of water delivered to crops, water dosing, and overall crop health status. Smart irrigation platforms have demonstrated water savings ranging from 30% to 50%, and yield increases ranging from 11% to 30% compared to fields without irrigation management systems.

This is an exciting and growing area of research and application with defined economic and social benefits. Further developments are likely in the near future with the potential to increasingly transform the sector.

4.7. Further investments in agriculture-based research and development

A key recommendation for countries such as Egypt, KSA and the UAE is the need to increase the focus on identifying innovative and sustainable practices from similar environments. In the short-term, the three countries can consider investing in research related to application of globally existing sustainable technologies by tailoring and testing them for further deployment in conditions specific to the three countries. For example, members of the Federal National Council in the UAE recently highlighted the need for initiatives to increase agricultural research funds.154

A fundamental re-orientation is needed to involve producers as partners in the development of research and extension programmes. High priority should be given to research on the development and testing of more sustainable and integrated farming systems through greater diversification, integrated pest management, integrated soil and water management, development of salinity tolerant crop and fodder varieties, seed selection, land management and storage. Focus should also be on improving the genetic diversity of crops; as the region is currently largely dependent on very few species of plants.

Countries such as Singapore, that have slightly similar agricultural production conditions, have incentivised research in the sector by creating enabling environments that attract innovators in the field. Government agencies regularly collaborate with other stakeholders through various platforms. This has resulted in agro companies investing locally into R&D in these fields, such as the rice research laboratory set up by Bayer CropScience.155 Norway, despite having limited agricultural research budgets, have implemented measures such as combining three major state agro-research institutes into one and mandating focus on agricultural efficiency and optimisation research among other more localised issues.

4.8. Life-cycle assessment framework to manage greenhouse gas emissions

It is likely that the Middle East and North Africa region as a whole will in future continue to rely heavily on food imports, and as a result, the agriculture sector life-cycle will not just be confined within the countries of jurisdiction. There is also a national responsibility to begin to manage the greenhouse gas emissions across all the sector’s activities. i.e., starting from the countries of production, stretching to food transportation, consumption and waste disposal.

A life-cycle assessment (LCA) framework can be used to determine the areas of greatest impact and opportunity for change and support the development of greenhouse gas reduction strategies. Managing the impacts can be especially difficult when dealing with those related to employees, retail operations, on-farm energy production, value-added agricultural practices, agri-transport etc. A recommended approach is to split these processes into modules to simplify the analysis and treat each process as an individual system, while also developing complementary systems at the country level that can be joined up.156

Agricultural institutions and other organisations that form part of the agriculture sector supply chain in Egypt, KSA and the UAE can consider embedding practices such as the alignment with ‘ISO 14044 on Environmental Management – Life-Cycle Assessment’ requirements and guidelines for determining impacts across the value chain. Decision-making authorities in the three countries could consider implementing regulations around sector-related certification and labelling schemes, as a means of differentiating processes or products across the value chain based on specified performance levels, can also prove beneficial in terms of encouraging businesses to capitalise on emerging markets for environmentally sensitive products and practices. Life-cycle based environment footprint certification initiatives could include:

- certification based on a third-party verified LCA of production activities (such as Climate Declaration and other Environmental Product Declarations);
- certification based on demonstrated level of emissions reduction for a given reporting interval (e.g., the Carbon Trust Carbon Reduction Label);
- certification based on demonstrated lower environmental impacts than a product category benchmark (for example, the Climatop certification system requires a minimum of 20% lower emissions than the benchmark).157
Combined with a food labelling and awareness programme, all of this would also help to provide the consumer with additional and reliable information. Currently a lack of awareness, and a lack of trust in the information being provided, is holding back cultural changes needed to successfully address some of the challenges highlighted earlier in the report.

With regards to greenhouse gas emissions during the transport of food imports, governments could develop and implement regulatory schemes and policies. Existing trade policies should be updated and complemented with targeted environmental measures to ensure trade benefits in terms of economic growth and climate change mitigation, while also including measures that allow potential trade-related environmental externalities to be addressed.

These import policy updates can be developed in a manner that allows internalising of environmental costs through price and market mechanisms. These mechanisms could include internal taxes on greenhouse gas emissions and emission trading schemes; subsidies for the use of sustainable measures for import and trade practices; and regulations and standards to promote the use of climate-friendly goods and technologies for imports, among others.158

Key takeaways from section 4
- Stakeholders can leverage the benefits of sustainable and innovative practices to leapfrog existing challenges and tap the growing local markets. For example, testing or developing advanced technologies in the local environment could give businesses a competitive edge.
- The private sector should strive to participate in the development of policy and financial instruments, to voice its needs and highlight the benefits of supporting its activities (e.g. appetite for sustainable finance).
- Adopting integrated frameworks to approach agricultural development (e.g. LCA and water:energy:food nexus) could help organisations in the public and private sector flag inefficiencies and find better ways to operate.
5. Conclusion

The market for agriculture products is large and growing, both globally and in the region. Although conventional practices can increase yields – and have done so in the past – this increase often means harming the natural resources on which the agriculture sector relies. And, if estimations are correct, the highest potential yield from conventional practices will still be unable to meet the food needs of the population in the future.

Sustainable practices can play a part to address these key concerns by optimising the resources that currently limit yield: water, energy, chemical agro-inputs, land, and soil quality. These practices tend to rely more heavily on natural cycles, while carefully controlling aspects like temperature and soil humidity, to ensure plant health and crop performance, and improve overall yield. They can help make the sector more resilient and cope better with disruption, giving sustainable agriculture ventures a competitive advantage. Also, adopting integrated frameworks (e.g. LCA and water:energy:food nexus) could help stakeholders find synergies and inefficiencies and, consequently, identify ways to operate better. With ever-increasing demands on the sector, there are ongoing opportunities for new and more innovative practices and business models.

The COVID-19 pandemic clearly highlighted for every country that there is an immediate need and opportunity to strengthen the production of food for local consumption through business models that empower local community-led initiatives and leverage sustainable practices. This is another important part of the solution. As governments look to the future and consider food security and natural resource management, there are compelling reasons for them to strengthen the enablers for stakeholders to increase local production sustainably and to empower the local communities. The pandemic offers an opportunity to shift national resources away from conventional agriculture practices (i.e., water and energy intensive, adapted to the international market, heavily reliant on fossil fuels for production and transportation) and into community-led, more sustainable initiatives. The report also highlighted a few trends that might help private sector stakeholders in the region pivot towards more sustainable agriculture in the countries of analysis. First, community-led business models could have a competitive advantage because they are supported by stronger socio-environmental systems, making them more resilient in an uncertain economic climate. Also, the local geographic and climatic conditions will likely make conventional agriculture increasingly expensive (and in some cases impossible) in the near future, making sustainable agriculture and innovative techniques more attractive ventures. Finally, there is also great potential in encouraging better food waste management by consumers that would reduce the initial demand for food. This would need to be taken forward by both the private and the public sector.

The final part of the solution needs to be the recognition that the full range of stakeholders in the agriculture sector all have a key role to play (and need to work together) in driving the adoption of innovative and sustainable practices. Whilst, financial and regulatory enablers are also essential, establishing stronger communication channels with the private sector players is key for government and financial institutions to achieve their respective goals. For the public sector, the input of businesses would clarify the next steps to strengthen the sector while, at the same time, with a better understanding of the government’s aims and priorities, businesses could align their investments and activities to support their delivery. The financial sector would then be able to develop the necessary financial instruments that could boost sustainable agriculture while also attracting new investments.

As we look forward, it is clear that the agriculture sector is an essential part of the economy and the social fabric of all the countries analysed in this report. The sector has always been heavily reliant on the local environmental conditions of the ecosystem in which it operates, and changes to these conditions are threatening the continued viability of traditional approaches and practices. There is an opportunity to help the sector transition to a sustainable way of operating that would bring benefits to all stakeholders. However, there is not much time left and the current pandemic crisis provides an opportunity for us to reset our business-as-usual approach and introduce greater resiliency in the system. If this is embraced and taken forward, achieving a more sustainable agriculture sector would help governments secure socio-economic development and food security, would protect the long-term operations of the private sector, and would safeguard the health and livelihood of the communities.
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