

Food for the Future:

Sustainable Agriculture Sector in
Egypt, Saudi Arabia and the UAE

Executive Report



In collaboration with



Foreword

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 2050.¹ 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 2030.²

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.³ 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.⁴

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.



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.

1. Overview of the Agriculture Sector

A snapshot of the sector



Global agricultural productivity growth is increasing at an average annual rate of 1.63%, as of 2019. Feeding a world of 10 billion people by 2050 will require a 70% increase in current food production levels.⁵



For each 1°C increase in average global temperature, the global mean crop yields of rice, maize and wheat are projected to decrease by 3-10%; a 5-10% decrease in fishing catch size in tropical marine ecosystems is expected in the long term.⁶



Climate change impacts such as rising temperatures, changes in precipitation and sea levels are also expected to affect the ability to raise crops and livestock, as well as operate fisheries and aquaculture.



Agricultural activities currently account for around a quarter of global greenhouse gas emissions and 68% of global freshwater withdrawals and consumption.⁷

As of 2018, the global net annual output of the agriculture sector (calculated for 161 countries and 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.⁸ 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 2030.⁹ 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 2050.¹⁰

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.¹¹ Growth in the agricultural sector can be 2-4 times more effective in raising incomes among the poorest compared to other sectors.¹²

However, issues such as deforestation, land-use changes, unsustainable agricultural practices and climate change continue to impact the sector's development.¹³ 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.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.¹⁵




The snapshots in this section intend to inform stakeholders in the sector of the current state of the market in the three countries of focus, including policy and financial instruments.

Key takeaways - Market overview

- The agriculture market 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.

1. Government priorities

Government visions, policies and strategies largely impact the costs and barriers for industries and their respective stakeholders.¹⁶ Governments also play a role in the development of industries by introducing financing mechanisms to help to overcome existing barriers to risk mitigation.¹⁷ The snapshots below show a more detailed overview of how Egypt, Saudi Arabia and the UAE have integrated the sector in their strategic directions, as well as the governmental enablers available for stakeholders to take advantage of the growing market.

 <p>UAE</p> <ul style="list-style-type: none"> UAE National Strategy for Food Security 2051 (2018) - 5 strategic goals to facilitate global food trade, diversify food import sources and identify alternative supply schemes.¹⁸ Ministry of Climate Change and Environment - MOCCA - increased use of hydroponic technology¹⁹ and increase organic farming acreage by 5% annually. New regulation - accreditation and registration systems, palm imports, rapid alert systems, food imports for non-trading purposes, registration of seeds and cultivation of local plants. Agricultural Innovation Centre (Sharjah, 2014) - technological innovation and knowledge sharing.²⁰ 	 <p>KSA</p> <ul style="list-style-type: none"> Strategy for Sustainable Development of Agriculture Up to 2030 (Ministry of Water, Electricity and Agriculture - MEWA)²¹ Target to reduce agriculture water usage by 30% by 2030 by improving irrigation and eliminating water-intensive crops. A target of 50% is under discussion (MEWA).²² The Sustainable Agricultural Rural Development Programme 2025 has offered farmers SAR7.35 billion in financial support over a seven year period. Since 2017, the Agricultural Development Fund (ADF) has offered loans for over SAR48 billion.²³ 	 <p>Egypt</p> <ul style="list-style-type: none"> Ministry of Water Resources and Irrigation and the Ministry of Agriculture launched policies on irrigation methods, misuse of water supply and water recycling (2009).²⁴ Sustainable Agricultural Development Strategy towards 2030 - employment, land and water use efficiency, and yields, modernisation of the sector, food security, rural livelihood and better use of resources.²⁵ Intergovernmental initiatives - FAO 2018-2022 framework on agricultural productivity, food security and sustainable use of resources,²⁶ Rural Agribusiness Strengthening initiative (USAID) to improve rural self-reliance and increase the growing of export crops.²⁷
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2. Financial and economic aspects

Stagnation in agricultural productivity, especially in regional economies with fast growing populations, can result in food security concerns. However, their likelihood and impact can be reduced through local agricultural investment to improve land, develop natural resources and develop human, social and physical capital.²⁸ The country snapshots below 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.

 <p>UAE</p> <ul style="list-style-type: none"> Agriculture - one of 13 key sectors eligible for up to 100% foreign ownership. The Abu Dhabi Fund for Development (ADFD) - ~AED3.2 billion (1971-2018) towards development projects in agriculture and irrigation.²⁹ Enablers - interest-free <AED1 million loans for farmers (Khalifa Fund),³⁰ AED1 billion initiative for agricultural R&D (Abu Dhabi Investment Office),³¹ services like Agtech loan guarantees and supply chain financing (UAE Office of Food Security), AED3.2 billion for international agriculture and irrigation development (ADFD).³² 	 <p>KSA</p> <ul style="list-style-type: none"> Government programmes - interest-free loans and support services for diversification.³³ Subsidies on water and fuel have been reduced, giving priority to low-water crops and efficient farming systems.³⁴ Foreign investment incentives - Tax exemptions for joint-venture partners,³⁵ regular events such as the Saudi Agriculture Exhibition.³⁶ Enablers - USD800 million in soft-loans for sustainable agriculture to SME farmers (ADF),³⁷ interest-free loans for equipment (Saudi Agricultural Bank),³⁸ SAR5 billion investment in food security (SALIC and Al Dahra).³⁹ 	 <p>Egypt</p> <ul style="list-style-type: none"> Sustainable Agriculture Investments and Livelihoods Project (SAIL) - increase of on- and off-farm incomes, for food security and overall economic development.⁴⁰ Ministry of Planning, Follow-up and Administrative Reform - LE42.1 billion in investments (2019-2020), a 23% increase against 2018-2019.⁴¹ Social Fund for Development - support for small-scale farms (Ministry of Agriculture and Land Reclamation (MALR) and the UNDP, 1991). Intergovernmental support - USD37 million for resilience (USAID Egypt Rural Business Strengthening project),⁴² LE36 million in a grant agreement with Germany for quality control.⁴³
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3. Market and technological aspects

In addition to growing demands for food,⁴⁴ the agriculture sector faces challenges such as newly emerging consumer demands for organic products, sustainable retail supply chains and zero-deforestation commitments.⁴⁵ Considering the whole value chain is essential, from farm supplies manufacturing to end-of-life. The private sector can test best practices in the countries' growing markets, jumping ahead of competitors. The snapshots below show some of the best practices already under implementation.

 <p>UAE</p> <ul style="list-style-type: none"> Increasing investment in R&D for sustainable agriculture and agri-tech (USD1.5 billion over five years)^{46,47,48} Innovation - 7,600 m² of vertical farms under development,⁴⁹ AgTech initiatives like aquaculture, drone use, sensors, protected hydroponics, grow-light-assisted hydroponics, nano-clay soil and climate-controlled greenhouses. Enablers - Support for farmers, beekeepers and fishermen through the Sharjah Foundation for pioneering Entrepreneurs (RUWAD) and the Mohammed Bin Rashid Establishment for SME Development. 	 <p>KSA</p> <ul style="list-style-type: none"> Increased funding for R&D on new crop strains with greater resistance to pests and lower water requirements. Innovation - food loss and waste reduction programme and food security early warning systems (UN FAO, MEWA, Saudi Grain Authority and Agricultural Development Fund), Estidamah Agriculture Research Centre (MEWA and SABIC),⁵⁰ Badir Programme for Technology Incubators and Accelerators; research on desert agriculture, genome engineering, and plant hormones (KAUST).⁵¹ 	 <p>Egypt</p> <ul style="list-style-type: none"> Focus on productivity across the value chain and global standards. Innovation - crop residue recycling (ENID),⁵² Farm-level Irrigation Modernisation Project,⁵³ implementation of mechanisms such as raised-bed farming (ICARDA) and digital guiding models (UN FAO and Ministry of Agriculture). Enablers - programme to increase agricultural productivity and raise farmers' incomes, including access to financial services (USAID),⁵⁴ 'Feed the Future Egypt Food Security and Agribusiness Support' programme for 14,000 farmers to strengthen sustainable agriculture.
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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 challenges hindering this transition.

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,⁵⁵ but 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.⁵⁶

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.⁵⁷

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 Memorandums of Understanding (MOUs). These also include agreements related to investments in the agriculture sector wherein both countries co-operate in different fields of agriculture practices and processes.⁵⁸ 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.^{59,60} 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.⁶¹

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.⁶² 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.⁶³ The UAE currently imports about 80%-90% of its food requirements,⁶⁴ KSA imports approximately 80%⁶⁵ of its food requirements and Egypt imports approximately 40% of its food and agricultural products.⁶⁶

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. 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 2020,⁶⁷ 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.⁶⁸ 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.⁶⁹

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.⁷⁰ 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.⁷¹

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 fertiliser run-off, require farmers to supplement the soil with fertilisers, 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.⁷² 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.⁷³

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.⁷⁴ The average annual amount of food waste is estimated at 427 kg per person in KSA, 197 kg per person in the UAE⁷⁵ and 73 kg per person in Egypt,⁷⁶ compared with the 95-115 kg average per person in Europe and North America.⁷⁷

Both individual and commercial behaviours 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.⁷⁸ With food items and groceries highly subsidised 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 organisations 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.⁷⁹

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.

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.⁸⁰ 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.⁸¹

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. Government intervention in prices and differentiated taxing, causes farmers to reallocate land, labour and other inputs primarily based on economic benefits rather than the environmental impacts of the enterprise.⁸²

The UAE government has also announced an annual farm assistance programme through the MOCCA, wherein UAE growers will be provided with critical farming implements and seeds, as well as fertilisers and pesticides at discounts of up to 50%.⁸³

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 - Challenges and opportunities






- The COVID-19 pandemic is an opportunity to strengthen local production: **shift resources away from conventional practices, reduce dependence on imports and involve a wider population in the economy.**
- Local conditions make conventional agriculture expensive, making room for **business models that optimise water and land, and manage conditions like temperature.**
- Production for local consumption can grow through business models that **empower community-led initiatives and leverage sustainable practices.**
- **Food waste management enterprises are attractive,** especially when combined with activities like compost or waste-to-energy).

Recommendations to accelerate the transition

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.⁸⁴

1. Public policy instruments

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:

-  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

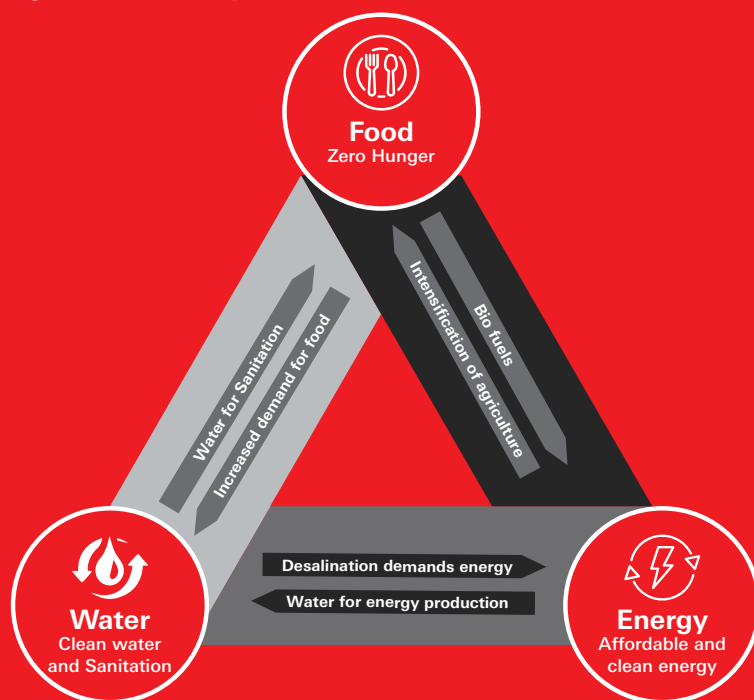
2. Nexus approach

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 Egypt⁸⁶

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.⁸⁵

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.⁸⁷

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.⁸⁸

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.

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.⁸⁹ Creating an enabling and supporting environment for the private sector to be involved should 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.

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.

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.⁹⁰ These efforts are currently limited to a few sustainable agriculture technologies such as vertical farming,⁹¹ aquaponics and hydroponics.

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.⁹⁴ 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.⁹⁵

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 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 2023.⁹⁶

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.⁹⁷ Examples of this already exist for products like cotton, bananas and tuna fish.

Case-study:

Case-study: Emirates Airlines building an AED147 million vertical farming factory in Dubai⁹²

Emirates Airlines 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.⁹³

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.

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.⁹⁸

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.⁹⁹ 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.

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.¹⁰⁰

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:

- third-party verified LCA of production activities (such as Climate Declaration and other Environmental Product Declarations);
- demonstrated emissions reduction for a given reporting interval (e.g., the Carbon Trust Carbon Reduction Label);
- demonstrated lower environmental impacts than a product category benchmark (for example, the Climatop certification system requires a 20% emissions reduction over the benchmark).¹⁰¹

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 help internalise environmental costs through price and market mechanisms such as 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.¹⁰²

Key takeaways - Recommendations

- **The benefits of sustainable and innovative practices can be leveraged** to tap the growing local markets, giving 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 operate better**.

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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86. Water-food-energy nexus (<https://edepot.wur.nl/424551>)
87. Financing Sustainable Agriculture (<https://globalwa.org/issue-brief/financing-sustainable-agriculture/>)
88. Unlocking climate finance for agriculture through innovative financing mechanisms (<https://ccafs.cgiar.org/blog/unlocking-climate-finance-agriculture-through-innovative-financing-mechanisms#.XjWSzmgzY2w>)
89. UN FAO Private Sector (<http://www.fao.org/partnerships/private-sector/en/>)
90. Sustainable Agriculture for Arid Climates (<https://masdar.ae/-/media/corporate/downloads/about-us/masdar-annual-sustainability-reports/masdar-journal.pdf?la=en&hash=7F1368BF80A7210575EA21541C42B8D7220A7551>)
91. Vertical farming is the practice of growing produce in vertically stacked layers. The practice can use soil, hydroponic or aeroponic growing methods. Vertical farms attempt to produce food in challenging environments, like where arable land is rare or unavailable.
92. Emirates to build Dh147m vertical farming factory near Dubai airport to produce food for passengers (<https://www.thenation-al.ae/uae/environment/emirates-to-build-dh147m-vertical-farming-factory-near-dubai-airport-to-produce-food-for-passengers-1.744383>)
93. November construction start for Emirates' vertical farm in Dubai (<https://www.constructionweekonline.com/article-50434-november-construction-start-for-emirates-vertical-farm-in-dubai>)
94. Use of genetic material that has been transferred from one external organism to the plant, in order to induce certain favourable traits
95. Pocket K No. 4: GM Crops and the Environment (<https://www.isaaa.org/resources/publications/pocketk/4/default.asp>)
96. Big Data and Agriculture: A Complete Guide (<https://www.talend.com/resources/big-data-agriculture/>)
97. Financing Sustainable Agriculture (<https://globalwa.org/issue-brief/financing-sustainable-agriculture/>)
98. UAE farmers to get seeds, fertilisers to boost harvest (<https://gulfnews.com/uae/environment/uae-farmers-to-get-seeds-fertilisers-to-boost-harvest-1.2072089>)
99. Advancing food security in the UAE (<https://www.mbrsg.ae/getattachment/859ddec7-f5ed-48dd-99dd-4e1b8f326112/Advancing-food-security-in-the-UAE.aspx>)
100. Conducting an Agricultural Life Cycle Assessment: Challenges and Perspectives (<https://www.hindawi.com/journals/tswj/2013/472431/>)
101. Life Cycle Assessment In Agriculture ([https://www1.agric.gov.ab.ca/\\$Department/deptdocs.nsf/all/sag15417/\\$FILE/LifeCycle-Assessment.pdf](https://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/sag15417/$FILE/LifeCycle-Assessment.pdf))
102. Trade, food security and climate change: conceptual linkages and policy implications (<http://www.fao.org/3/CA2370EN/ca2370en.pdf>)

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