

# Advancing food security in the UAE

Policy Paper



مبادرات محمد بن راشد آل مكتوم العالمية  
Mohammed Bin Rashid  
Al Maktoum Global Initiatives

كلية محمد بن راشد  
للإدارة الحكومية  
MOHAMMED BIN RASHID  
SCHOOL OF GOVERNMENT







**Advancing  
food security  
in the UAE**





# STRENGTHENING RESILIENCE: ADVANCING FOOD SECURITY IN THE UAE

POLICY PAPER

## ABSTRACT

The UAE has one of the world's most comprehensive plans to address food security, but much can be done to improve its resilience and sustainability. The UAE is considered food secure due to its economic and political stability. As a desert country, lacking in water and arable land, the UAE is facing considerable food security challenges of its own. With a growing population, and rising consumption needs, the UAE must tackle this challenge head on. Indeed, the UAE has recently appointed a new Minister of State for Food Security, signaling a renewed focus on this strategic policy area. This policy paper aims to draw conclusions and recommendations on how to enhance the policy, regulatory and governmental frameworks to effectively address food security.

**Tara Fischbach**

January, 2018



# Introduction

Despite the rapid economic and technological advances that the world has seen over the last two decades, there remains 793 million undernourished people in the world<sup>1</sup>. This constitutes a significant decline from previous decades where it stood at 1.01 billion in 1990–92<sup>2</sup>. However, this number remains high and is likely to increase if food production and distribution channels are severely impacted by climate change or conflict. Food security is a major concern for many countries, either because they are unable to produce enough food to feed their populations or because regional or global economic, political, or environmental crises have the ability to significantly impact their food supplies.

The Middle East and North Africa (MENA) region in particular faces unique challenges resulting from the scarcity of freshwater resources, regional conflicts, and rising temperatures, among others. According to the UN Food and Agriculture Organization (FAO), the region's shrinking freshwater resources are being negatively impacted by climate change and will have a heavy bearing on the region's food availability and stability. While undernourishment has decreased worldwide, conflict has caused the number of undernourished people in the MENA region to increase<sup>3</sup>. The region, which gets the majority of its food energy from cereals, cannot produce enough cereals to meet its needs and is currently the world's largest net importer of cereals<sup>4</sup>.

While the United Arab Emirates (UAE), is considered food secure due largely to its economic and political stability, it still must address food security challenges resulting from water scarcity, climate change, hot climate, and regional instability. Long-term food security and self-sufficiency are key strategic goals for the UAE government. For example, the Ruler of Dubai, H.H. Sheikh Mohammed Bin Rashid has recently appointed a new Minister of State for Food Security, signaling a renewed focus on this strategic policy area<sup>5</sup>. This policy paper will: (1) Introduce the concept of food security as it is defined by the international community; (2) Discuss in detail the UAE's food security strengths and challenges; (3) Introduce best practices for addressing food security gained by benchmarking policies from countries with similar challenges, and (4) Assess the UAE's current approaches to ensure food security, and (5) suggest recommendations for improvement.

- 
1. "How Close Are We to #ZeroHunger?" FAO, Food and Agriculture Organization of the United Nations, 2017, [www.fao.org/hunger/key-messages/en/](http://www.fao.org/hunger/key-messages/en/).
  2. "How Close Are We to #ZeroHunger?" FAO, Food and Agriculture Organization of the United Nations, 2017, [www.fao.org/hunger/key-messages/en/](http://www.fao.org/hunger/key-messages/en/).
  3. Iqbal, Farrukh. "Is MENA's Undernourishment Getting Worse?" The World Bank, 20 Oct. 2014, [www.blogs.worldbank.org/futuredevelopment/mena-s-undernourishment-getting-worse](http://www.blogs.worldbank.org/futuredevelopment/mena-s-undernourishment-getting-worse).
  4. Magnan, Nicholas, and Marc Sadler. Grain Import Dependency in the MENA Region: Risk Management Options. International Food Policy Research Institute, World Bank, 2011, [www.agriskmanagementforum.org/doc/grain-import-dependency-mena-region-risk-management-options](http://www.agriskmanagementforum.org/doc/grain-import-dependency-mena-region-risk-management-options).
  5. The Cabinet." United Arab Emirates, The Cabinet, The Government of Dubai, 2017, [uaecabinet.ae/en/details/cabinet-members/her-excellency-mariam-bint-mohammed-saeed-hareb-al-mehairi](http://uaecabinet.ae/en/details/cabinet-members/her-excellency-mariam-bint-mohammed-saeed-hareb-al-mehairi).

# What is Food Security?

Food security is defined by the Committee on World Food Security as availability, access, stability and utilization of a country's food system<sup>6</sup>. According to the standard FAO definition, agreed at the 1996 World Food Summit, people can only be considered food secure when sufficient food is available; can be accessed easily; is well utilized (that is, food consumption converts into improved nutritional outcomes); and that all these three dimensions remain stable over time<sup>7</sup>. This means that for a country to be food secure, it would need to fulfill the following criteria:

- Food availability: for a country to fulfill the food availability criterion it would need to have sufficient amounts of quality food on consistent basis, supplied through imports and/or domestic production;
- Food access: sufficient access to food is found when a country's people have the resources, economic, social and political enabling environment, to acquire appropriate nutritious food either through "purchase, home production, barter, gifts, borrowing or food aid"<sup>8</sup>;
- Food utilization: to fulfill the food utilization criterion, food availability and access must result in a healthier diet, sanitary and safe food, and overall well-being<sup>9</sup>;
- Food stability: for a country to ensure food stability it should be able to provide food at all times, whether at the national or individual levels. This includes resilience against unforeseen risks or shocks (economic, political, or climate-driven, whether cyclical and seasonal). Essentially, food security comprises the availability and access dimensions.

Food security requires a functioning and sustainable food system, which encompasses: (1) the production of food; (2) the distribution of food; (3) how people acquire food; (4) the consumption of food and finally; and (5) the disposal of food waste<sup>10</sup>. Virtually every aspect of a country's economy and politics impacts this interconnected system. Variables impacting food security can be broadly classified into two categories: (a) those that impact the production and supplementation of food, and (b) those that impact a country's ability to respond to shocks and crises<sup>11</sup>. In a nutshell, there are different approaches to achieving food security, but all must include strategies that address both categories.

---

6. Trade Reforms and Food Security: Conceptualizing The Linkages. Food and Agriculture Organization of the United Nations, 2003, <ftp://ftp.fao.org/docrep/fao/005/y4671e/y4671e00.pdf>

7. Trade Reforms and Food Security: Conceptualizing The Linkages. Food and Agriculture Organization of the United Nations, 2003, <ftp://ftp.fao.org/docrep/fao/005/y4671e/y4671e00.pdf>

8. "What Is Food Security?" WFP, United Nations World Food Programme, [www.wfp.org/node/359289](http://www.wfp.org/node/359289).

9. Food Security. Food and Agriculture Organization of the United Nations, 2006, Food Security, [www.fao.org/forestry/13128-0e6f36f27e0091055bec28e8e830f46b3.pdf](http://www.fao.org/forestry/13128-0e6f36f27e0091055bec28e8e830f46b3.pdf).

10. "What Is Food Security?" Resilience, Resilience, 9 Jan. 2015, [www.resilience.org/stories/2015-01-09/what-is-food-security/](http://www.resilience.org/stories/2015-01-09/what-is-food-security/).

11. Trade Reforms and Food Security: Conceptualizing The Linkages. Food and Agriculture Organization of the United Nations, 2003, <ftp://ftp.fao.org/docrep/fao/005/y4671e/y4671e00.pdf>



## The UAE's Context

Due to the limited supply of arable land, water, and a heavy reliance on imported food, food security has become a key policy priority for the UAE<sup>12</sup>. Despite importing about 80-90% of its food supplies, the UAE is considered food secure due to its capacity to purchase food on the international market even if at higher costs<sup>13</sup>. However, food security remains a concern, particularly on a long-term basis, due to supply challenges for production and importation<sup>14</sup>. The importance of focusing on food security policies became clear in 2007 when rising global food prices caused the UAE to struggle to secure basic commodities<sup>15</sup>. In the UAE, food prices are on the rise and will only increase with the implementation of the Value-added Tax (VAT) in 2018<sup>16</sup>.

The UAE has made substantial investments towards its food security and it benefits from a number of key strengths that have made it food secure. Strong diplomatic and trade relations, easy access to trade markets, and well-functioning trade ports have enabled easy access to food supplies through food import strategies. However, the UAE also faces a number of challenges that threaten its food security that will likely persist in the future. The UAE's most glaring challenge, that differentiates it from many food-secure countries in the world, is its climate. As a desert, the UAE has a very limited amount of arable land, suffers from extreme weather in the summer time, and sees very little rain fall. This climate poses a huge challenge not just for domestic food production, but also for food storage. Water supply is extremely limited and a reliance on desalination makes agricultural production difficult. The following sections will detail the UAE's food security strengths, challenges, opportunities and threats.

As a result of its inability to produce its own food, the UAE relies on imports. Its highly developed logistics infrastructure makes importing food effective and efficient. However, the lack of sufficient economic diversification from heavy reliance on petroleum means that the UAE finances its food imports primarily through fossil fuel revenues, leaving the country vulnerable to fluctuations in trade between food and oil<sup>17</sup>. Food imports are also expensive and lead to a need for food subsidies in order to keep food affordable. The higher food prices related to such supply complications do not directly

---

12. Wam, "Food security tops UAE's priorities, says Abu Dhabi Crown Prince". Emirates 247 News. Feb 7, 2017, [www.emirates247.com/news/emirates/food-security-tops-uae-s-priorities-says-abu-dhabi-crown-prince-2017-02-07-1.647735](http://www.emirates247.com/news/emirates/food-security-tops-uae-s-priorities-says-abu-dhabi-crown-prince-2017-02-07-1.647735)

13. Malek, Caline. "UAE's first agricultural policy to benefit farming sustainability and profitability". The National. Dec 4, 2015, from [www.thenational.ae/uae/environment/uaes-first-agricultural-policy-to-benefit-farming-sustainability-and-profitability](http://www.thenational.ae/uae/environment/uaes-first-agricultural-policy-to-benefit-farming-sustainability-and-profitability)

14. Chatham House, "Edible Oil: Food Security in the Gulf". Chatham House. 1 Nov, 2013, [www.chathamhouse.org/publications/papers/view/195281](http://www.chathamhouse.org/publications/papers/view/195281)

15. "Abu Dhabi Taking Action on Food Security." Oxford Business Group, Oxford Business Group, 19 May 2016, [www.oxfordbusinessgroup.com/analysis/securing-supply-food-security-issue-and-government-and-private-sector-are-deploying-strategies](http://www.oxfordbusinessgroup.com/analysis/securing-supply-food-security-issue-and-government-and-private-sector-are-deploying-strategies).

16. Deulgaonkar, Parag. "GCC food import bill to hit \$53.1bn in 2020" - Alpen Capital". Arabian Business. 23 Feb, 2017, [www.arabianbusiness.com/gcc-food-import-bill-hit-53-1bn-in-2020-alpen-capital-664599.html](http://www.arabianbusiness.com/gcc-food-import-bill-hit-53-1bn-in-2020-alpen-capital-664599.html)

17. Chatham House, "Edible Oil: Food Security in the Gulf". Chatham House. 1 Nov, 2013, [www.chathamhouse.org/publications/papers/view/195281](http://www.chathamhouse.org/publications/papers/view/195281)

threaten the UAE as it is currently able to finance the risks, but any shocks to the UAE's economy would immediately affect food availability and affordability. Rising domestic food prices may pose a political risk if the population finds itself unwilling or unable to pay the prices. A rising cost of living means that food may become unaffordable for portions of the population if subsidies were ever lifted.

These issues are aggravated by a rise in demand for food and by eating preferences that are highly diverse and globalized. Food consumption in the UAE is growing due to the influx of tourists, and to overall population growth. Food consumption in the Gulf Cooperation Council (GCC) as a whole is expected to expand at a compound annual growth rate (CAGR) of 4.2% "from an estimated 48.1 million MT (metric tons) in 2016 to 59.2 million MT in 2021"<sup>18</sup>. Rising income has led to changing and increasingly globalized diets as well as to sedentary lifestyles that have resulted in a rise in "lifestyle diseases" such as diabetes and obesity<sup>19</sup>.

To address these challenges and threats, the UAE depends heavily on its strengths, namely its economic and political stability, stable currency and high Gross Domestic Product (GDP). Strong diplomatic and trade relations have underpinned its food security strategies, and access to capital and low tariffs and barriers to trade have facilitated this process effectively. Strong regulatory frameworks and access to human capital positions the UAE to enhance its food security through strategic, sustainable, and forward-thinking policies that efficiently and effectively utilize its comparative advantages<sup>20</sup> as evident in the analysis below:

---

18. Alpen Capital, "GCC Food Industry". Alpen Capital. 22 Feb, 2017. [www.alpencapital.com/downloads/reports/2017/GCC-Food-Industry-Report-February-2017.pdf](http://www.alpencapital.com/downloads/reports/2017/GCC-Food-Industry-Report-February-2017.pdf)

19. Bell, Jennifer. "The State of the UAE's Health: 2016." GulfNews, GulfNews, 24 Jan, 2016, [gulfnews.com/gn-focus/special-reports/health/the-state-of-the-uae-s-health-2016-1.1658937](http://gulfnews.com/gn-focus/special-reports/health/the-state-of-the-uae-s-health-2016-1.1658937).

20. By comparative advantage I mean the ability of the country to carry out a particular economic activity related to food security (such as making a specific product) more efficiently than another activity by utilizing key strengths and resources it possesses.

Table 1: UAE's Food Security Strengths, Weaknesses, Opportunities and Threats (SWOT)

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> <li>• Economic stability;</li> <li>• Political stability;</li> <li>• Strong diplomatic relations;</li> <li>• High GDP;</li> <li>• Strong trade relations with diversified partners;</li> <li>• Good infrastructure including Ports' infrastructure;</li> <li>• Logistical hub and Transport hub<sup>21</sup>.</li> <li>• Positive global standing;</li> <li>• Strong regulatory frameworks;</li> <li>• Access to labor and highly-qualified human resources;</li> <li>• Access to capital;</li> <li>• Low tariffs and barriers to trade;</li> <li>• Stable currency;</li> <li>• An abundant and inexpensive energy supply.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of arable land;</li> <li>• Water scarcity;</li> <li>• Hot climate;</li> <li>• Insufficient investment in agricultural research;</li> <li>• Fossil-fuel based economy;</li> <li>• High levels of food waste and over-consumption<sup>22</sup>; and</li> <li>• Dependency on desalination.</li> </ul>
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> <li>• Gateway to 1.5 Billion African and Middle East markets;</li> <li>• Huge export market;</li> <li>• Economic diversification;</li> <li>• New agricultural technologies;</li> <li>• Growing innovation sector;</li> <li>• Investments in STEM infrastructure and education;</li> <li>• Well established universities;</li> <li>• Expo 2020;</li> <li>• Access to global labor markets;</li> <li>• Growing entrepreneurship sector;</li> <li>• Green initiatives and strategy;</li> <li>• Public Private Partnerships;</li> <li>• Disruptive technologies; and</li> <li>• Emiratization in the STEM/Innovation sector.</li> </ul>	<ul style="list-style-type: none"> <li>• Insufficient data for research and planning;</li> <li>• High dependence on global and regional markets;</li> <li>• Insufficient science, technology, engineering and mathematics (STEM) workforce<sup>23</sup>;</li> <li>• Heavy government subsidies for utilities and agriculture; and</li> <li>• Food consumption in the UAE is currently growing at 12% each year and it is predicted that the value of food imports will increase from US\$3 billion in 2011 to US\$8.4 billion by 2020 to meet this demand<sup>24</sup>;</li> <li>• The UAE's current population of 9.34 million people is projected to reach close to 11.5 million people by 2025. This will place increased pressure on the country's already strained food and water resources<sup>25</sup>; and</li> <li>• Rising cost of living in key emirates.</li> </ul>

21. "United Arab Emirates Staying Afloat in The Waves." Country Report: Risk Analyses by EH Economic Research, Euler Hermes, [www.eulerhermes.com/economic-research/country-reports/Pages/United-Arab-Emirates.aspx](http://www.eulerhermes.com/economic-research/country-reports/Pages/United-Arab-Emirates.aspx).

22. Power, Lauren. "Scarcity and Abundance: UAE Food and Water Security", Future Directions, November 25, 2014. <http://www.futuredirections.org.au/publication/scarcity-and-abundance-uae-food-and-water-security/>

23. Melanie Swan, "Education minister targets skills gap", The National, March 13, 2017. <http://www.thenational.ae/uae/uae-minister-of-higher-education-targets-skills-gap>

24. Swan, Melanie. "Education minister targets skills gap", The National, March 13, 2017. <http://www.thenational.ae/uae/uae-minister-of-higher-education-targets-skills-gap>

25. Lauren Power, "Scarcity and Abundance: UAE Food and Water Security", Future Directions, November 25, 2014. <http://www.futuredirections.org.au/publication/scarcity-and-abundance-uae-food-and-water-security/>

Evidence-based and effectively developed policies can help the UAE mitigate the core challenges it faces, namely overcoming its climate, land, and water constraints. Research and development is the basis of any effective food security strategy, and will help propel the UAE further on its path to economic diversification and growth of innovation sectors. Opportunities abound for investment in new agricultural technologies, green initiatives, science, technology, engineering and mathematics (STEM) infrastructure, and budding entrepreneurship. These strategies would also be aligned with developments currently underway, such as Expo 2020 innovation themes,<sup>26</sup> and the UAE’s Vision 2021<sup>27</sup>.

Security issues in general, both domestic and foreign, are a major cause for concern. Instability impacting regional trade partners has already been a source of supply insecurity. The threat of regional maritime chokeholds on trade routes, such as the Suez Canal and Strait of Hormuz adds to food insecurity. Climate change and the global water shortages will only exacerbate these difficulties, and the UAE’s disadvantageous climate will be doubly impacted.

The slow diversification of the UAE’s economy means it is beholden to fluctuating fuel prices, and the changing prices of food as a result. Global food shortages and embargoes have already impacted the country, and food security strategies must develop national resilience to these threats. The long-term development of the UAE in terms of a growing population, changing societal expectations, growing tourism sector, and rising incomes have contributed to an increasing demand on food. However, the growing reliance on technology and digitization has placed the UAE in a unique position to capitalize on this phenomenon. Disruptive technologies and innovations in transport and green technology will pave the way for the future, and are intricately tied to food security as the below Food Security Political, Economic, Social, Technological and Environmental Analysis (PESTE) indicates:

Table 2. Food Security PESTE

Political	<ul style="list-style-type: none"> <li>• Regional instabilities;</li> <li>• Global political crisis;</li> <li>• Unpredictable global political landscape; and</li> <li>• Refugee crisis.</li> </ul>
Economic	<ul style="list-style-type: none"> <li>• Global financial crisis;</li> <li>• Fluctuating fuel prices;</li> <li>• Global food shortage and price spikes;</li> <li>• Speculative flows (stock market, real estate, etc.); and</li> <li>• Growing global innovation sector.</li> </ul>

26. “Expo Live.” Expo 2020 Dubai UAE, [www.expo2020dubai.ae/expo-live/expo-live](http://www.expo2020dubai.ae/expo-live/expo-live).

27. “UAE Vision.” Vision 2021, Dubai Government, [www.vision2021.ae/en/our-vision](http://www.vision2021.ae/en/our-vision).

Social	<ul style="list-style-type: none"> <li>• Globalized food preferences;</li> <li>• Rising purchase power in developing nations;</li> <li>• Health consciousness;</li> <li>• Global population growth;</li> <li>• Rising education levels;</li> <li>• Regional youth bulge;</li> <li>• Decline of traditional agriculture; and</li> <li>• Urbanization.</li> </ul>
Technological	<ul style="list-style-type: none"> <li>• Global rise in digitization;</li> <li>• Developing disruptive technologies;</li> <li>• Growth in green technologies;</li> <li>• Improved green agro;</li> <li>• Innovations in transportation; and</li> <li>• Growth of Big Data.</li> </ul>
Environmental	<ul style="list-style-type: none"> <li>• Climate change; and</li> <li>• Global water crisis.</li> </ul>

# Food Security Policy Benchmarks

The degree of any country's food security is a combination of its natural endowments and its forward-thinking strategies. Even countries that are able to be self-sufficient require strategies that will enable them to withstand acute crises or threats. Any successful food security strategy must incorporate policies that focus on multipronged approaches such as, self-sufficiency, trade, resilience, and sustainability. According to the Food Security Index (FSI), the five most food secure countries in the world are the United States, Ireland, United States, the United Kingdom, Singapore and Australia. The UAE is ranked number 33<sup>28</sup>. While the United States, Ireland, and Australia have well developed agricultural sectors and an enabling climate, Singapore presents an outlying case. Similar to the UAE, Singapore has limited agricultural land, is reliant on imports, and has insufficient domestic agricultural production. For these reasons, Singapore presents an interesting comparative case for the UAE. In between these two food security models is Norway, which aims to maintain 50% of its needs through domestic production and the rest through imports<sup>29</sup>. A comparison of these countries' policies may give us insights into best practices that can improve the UAE's food security strategies and policies. In this benchmark, we will be comparing countries' policies using a framework that focuses on the policies' impact on the availability, stability, and sustainability of food supplies in the hope that this can shed light on mechanisms to address the UAE's food security challenges.

---

28. "The Global Food Security Index." Food Security Index, Economist Intelligence Unit, 2017, [foodsecurityindex.eiu.com/](http://foodsecurityindex.eiu.com/).

29. Trauger, Amy. Food Sovereignty in International Context: Discourse, Politics and Practice of Place. Routledge, 2015.

# Food Policies in Norway, Singapore and the UAE

The benchmark in the Table below will compare the UAE, Norway and Singapore’s overall food strategies, domestic production policies, high technology agriculture policies, research and development policies, import policies, foreign investment strategies, subsidization policies, stockpiling strategies, and food loss strategies.

Table 3. Food Policies in Norway, Singapore, and the UAE<sup>30</sup>

Policies	Norway	Singapore	UAE
Food stockpiling	X	✓	✓
Food price subsidies	✓	✓	✓
Food waste strategy	-	✓	✓
Food loss strategy	-	✓	-
Food source diversification	X	✓	✓
Developing as a trade and export hub	X	✓	✓
High-import tariffs	✓	X	X
Investing in agriculture abroad	X	✓	✓
Government funding for Research and Development (R&D)	✓	✓	✓
Incentivizing research through Public-Private Partnerships (PPPs)	X	✓	✓
Enabling legal and regulatory frameworks	X	✓	✓
R&D infrastructure	✓	✓	✓
Alternative agriculture	X	✓	✓
PPP for technological development	✓	✓	✓
Funding for agricultural technology (Agro- tech) use by farmers	✓	✓	✓
Local production goals	✓	✓	✓
Financing for farmers	✓	✓	✓
PPPs for technological development	-	✓	✓
Risk Management strategies	✓	✓	✓
Holistic Food security strategy	✓	✓	X

30. “The Global Food Security Index.” Food Security Index, Economist Intelligence Unit, 2017, foodsecurityindex.eiu.com/.

When comparing the UAE, Norway, and Singapore it is important to note that all countries are highly developed, score high on development indices, and have high GDP per capita. Not only that, they are all wealthy nations where food is affordable. The FSI ranks Singapore as the fourth most food secure country in the world, Norway ranks 13<sup>th</sup> and the UAE rank is 33<sup>rd</sup><sup>31</sup>.

## A. Holistic Food Security Strategy

As the Table indicates, it is clear that the three countries fare comparably well on the indices measured. The UAE lags behind in high imports tariffs, and in the absence of a holistic food security strategy. It shares the first aspect with Singapore, but not the latter where both Singapore and Norway have a holistic food security strategy in place. When comparing the food security strategies of Singapore, Norway and the UAE, we see some marked differences. Singapore focuses on increasing food resilience as their main food security strategy while Norway on the other hand, focuses on increasing self-sufficiency.

Singapore has recognized that food self-sufficiency will never be a complete strategy and is not structurally possible, and thus has focused instead on improving its food resilience<sup>32</sup>. Singapore is food secure because it is enhancing its limited agricultural sector, focusing on sustainable growth, diversifying its imports, and offsetting threats to its food system. Within this context, local production is continuously enhanced, with a focus on utilizing technological advancement and increased efficiency. It has outlined its Food Security Roadmap which centers mainly on diversifying food sources and optimizing local production<sup>33</sup>.

Norway on the other hand, has focused on enhancing self-sufficiency. It is food secure because it combines domestic production with imports, and employs strategies that support its agricultural sector. It has focused its strategies on maintaining self-sufficiency by emphasizing domestic production, including supportive policies to ensure it is preserved for national use and to limit foreign competition through extremely high import tariffs, and market interventions.

While Norway and Singapore emphasize different policies in their food security strategies, both countries have clear and holistic strategies that utilize each country's strengths and address weaknesses and threats. In Singapore, in particular, all aspects of the country's food system, and the relevant stakeholders, follow a unified national vision for the country's food security.

To compare these policies, and their impact on the key criteria making up food security: availability, access, stability, quality as well as sustainability. Each section will include a small table highlighting this.

Policy	Availability	Access	Stability	Quality	Sustainability
Holistic Food security strategy	✓	✓	✓	-	✓

31. "The Global Food Security Index." Food Security Index, Economist Intelligence Unit, 2017, [foodsecurityindex.eiu.com/](http://foodsecurityindex.eiu.com/).

32. Tortajada, Cecilia, and Thinesh Kumar S/O Paramasilvam. "Singapore's Impressive Food Security." The Diplomat, The Diplomat, 6 Sept. 2015, [thediplomat.com/2015/09/singapores-impressive-food-security/](http://thediplomat.com/2015/09/singapores-impressive-food-security/).

33. Tortajada, Cecilia, and Thinesh Kumar S/O Paramasilvam. "Singapore's Impressive Food Security." The Diplomat, The Diplomat, 6 Sept. 2015, [thediplomat.com/2015/09/singapores-impressive-food-security/](http://thediplomat.com/2015/09/singapores-impressive-food-security/).



## B. Domestic Production

This section will compare Norway and Singapore's domestic production policies with a concerted focus on Singapore because, like the UAE, it has limited arable land and water resources to support a sufficient agricultural sector. Singapore has catapulted itself into one of the most food secure nations through a targeted domestic production strategy and increasing food supply resilience. Norway on the other hand, has focused on improving the productivity of its limited agricultural land, using supportive economic strategies as a backup.

Increasing self-sufficiency through domestic production has long been the cornerstone of food security strategies worldwide, helping to achieve food availability. According to FSI, Norway ranks 4<sup>th</sup> in the world in terms of food availability, Singapore ranks 16<sup>th</sup> and the UAE 51<sup>st</sup><sup>34</sup>. To offset threats of crisis or supply challenges, self-sufficiency has been Norway's main strategy since the Second World War. Norway's agricultural industry is very small with a 1.5% share of its GDP, and suffers from high production costs due to structural issues and a challenging production environment<sup>35</sup>. The focus has been on maintaining productivity, traditional farming communities, and competitiveness through market interventions. Norway has only 3% arable land, and 30% of this can be used for grain and produce<sup>36</sup>. Production in the country is reliant on improved efficiency and yield due to pesticide use although they face shortcomings in relation to the supply for produce. All these factors make Norway a high-cost agricultural producer and the government heavily intervenes to keep the sector competitive with tariffs and subsidies that exceed those of the European Union (EU)<sup>37</sup>. Despite this, in terms of sufficiency of food supply (which measures the availability of food in the food supply chain and levels of food aid), Norway scores highest among the three countries standing at 90.1%<sup>38</sup>. This strategy resulted in 50% self-sufficiency varying from one year to the next<sup>39</sup>. The sector meets the majority national requirements for meat and dairy, and around 60% of grain and potato demand. The rest is supplemented through imports.

To mitigate supply disruptions and serve as a platform for innovative agriculture, Singapore has focused on improving its limited agricultural sector. Despite being the fourth most food secure country in the world, Singapore scored low in terms of average food supply at 65.7%<sup>40</sup>. The FSI scores its sufficiency of supply at 75 out of 100. This is largely due to its limited agricultural land, and reliance on imports. At present less than 1% of its land area is used for agriculture and local production only covers 10% of Singapore's food supply. In order to combat this, it has made its agricultural land more efficient and found alternative methods to secure food supply. It did this by developing the Food Security Roadmap focusing on food resilience strategies.

---

34. "The Global Food Security Index." Food Security Index, Economist Intelligence Unit, 2017, [foodsecurityindex.eiu.com/](http://foodsecurityindex.eiu.com/).

35. "Norway - Food Imports (% of Merchandise Imports)." Trading Economics, [tradingeconomics.com/norway/food-imports-percent-of-merchandise-imports-wb-data.html](http://tradingeconomics.com/norway/food-imports-percent-of-merchandise-imports-wb-data.html).

36. "Family Farming: The Key to Food Production in Norway." TINE.no, [www.tine.no/english/about-tine/family-farming-the-key-to-food-production-in-norway](http://www.tine.no/english/about-tine/family-farming-the-key-to-food-production-in-norway).

37. "Norway - Agricultural Sectors." Export.gov, 23 Feb. 2017, [www.export.gov/article?id=Norway-Agricultural-Sectors](http://www.export.gov/article?id=Norway-Agricultural-Sectors).

38. Sufficiency of supply (A composite indicator that measures the availability of food through the food supply in kcal/capita/day and levels of food aid)

39. Flaten, Dr. Ola, and Dr. Shuji Hisano. "Security Policy in a Food Importing Country: The Case of Norway." ResearchGate, Jan. 2001, [www.researchgate.net/publication/228462163\\_Food\\_Security\\_Policy\\_in\\_a\\_Food\\_Importing\\_Country\\_The\\_Case\\_of\\_Norway](http://www.researchgate.net/publication/228462163_Food_Security_Policy_in_a_Food_Importing_Country_The_Case_of_Norway).

40. "Norway - Agricultural Sectors." Export.gov, 23 Feb. 2017, [www.export.gov/article?id=Norway-Agricultural-Sectors](http://www.export.gov/article?id=Norway-Agricultural-Sectors).

The threat of a global food crisis drove the Singaporean government, in consultation with various stakeholders, to initiate a study to analyze the resilience of its food system. The result was a strategy that highlights sustainable development and takes into consideration the industrialization of agricultural lands. To maximize its potential, Singapore enhanced local production by focusing on targeted support and enhanced efficiency in the agriculture sector through investments in agricultural research and development for modern farming techniques (these will be discussed in another section).

The Food Security Roadmap identifies three key staple foods for priority investments: leafy vegetables, hen-shell eggs, and fish. The government set specific production targets for these foods which it aimed to achieve within five years. As such, many research and development efforts have focused on increasing production of these key foods. The production of three key foods offers a fallback in times of supply disruption by offering a limited supply buffer and boosting resilience. The Agriculture Food and Veterinary Agency (AVA) established the Food Fund to increase self-sufficiency primarily through the development of seed banks, farming systems and post-harvest processes, fish farms, and poultry waste treatment systems<sup>41</sup>. These efforts have required Public Private Partnerships (PPPs) and collaboration with foreign companies to develop technologies that address production shortfalls and structural issues like Singapore’s climate and terrain. This fund has benefited around 60% of key local food farms<sup>42</sup>.

To support these initiatives, the Inter-Ministry Committee on Food Security (IMCFS) was formed to formulate strategies to mitigate risks and vulnerabilities. Its location in the Prime Minister’s Office guarantees access and strategic authority. Action required to combat food security risks must be cross-cutting, and the agency helps facilitate efficient and smooth multi-agency response.

By focusing resources on enhancing its limited agricultural land, and providing a limited amount of local food as backup for crisis situations, Singapore has enhanced its food resilience. This was done through careful government planning, inter-governmental collaboration and coordination, support for applied research, and public private partnerships.

Policies	Availability	Access	Stability	Quality	Sustainability
Local production goals	✓	✓	✓	✓	✓
Financing for farmers	✓	✓	✓	-	✓
PPPs for tech development	✓	✓	✓	✓	✓
Risk Management strategies	✓	✓	✓	-	✓

41. Teng, Paul, and Margarita Escaler. “The Case for Urban Food Security: A Singapore Perspective.” NTS Perspectives Is. No.4, (31 Dec. 2010). RSIS. Web.

42. A Case Study of Singapore’s Smart Governance of Food. Center for Livable Cities Singapore, 2015, [www.clc.gov.sg/documents/books/smart\\_food\\_governance\\_paper-sg\\_case\\_study\\_final\\_sept%2028\\_3.pdf](http://www.clc.gov.sg/documents/books/smart_food_governance_paper-sg_case_study_final_sept%2028_3.pdf).

### C. High Technology Agriculture

A major part of Singapore’s Food Security Roadmap is increasing yield in the agricultural sector through technological innovations. A part of Singapore’s strategy has been funding new farming techniques, such as hydroponics, that have resulted in a 30% increase in local vegetable productions over ten years<sup>43</sup>. The AVA has made agro technology parks a major part of this sector. The Agro technology Programme includes Agro technology Parks (modern farms), and works to develop Agro technology and Agro-biotechnology, and encourage investments in the Agro-industry<sup>44</sup>. These advancements, like highly sophisticated greenhouses and vertical farming, are maintained by the Agriculture Productivity Fund to help support farmers enhance production<sup>45</sup>. An example of such an intervention is when a local farm received support for robotic cleaners, while another received funds for technological upgrades that eased manpower demands and increased yields. The government recently set aside long lease farm land for high-tech farming.

These policies have helped Singapore maximize what little agricultural potential it has, and provide sufficient supply of the three designated staple foods. Indeed, Singapore has pioneered hydroponic<sup>46</sup> and aeroponic<sup>47</sup> technologies which have proven to be commercially successful while maximizing limited water and land resources. The AVA supported vertical farming innovations for leafy vegetables in collaboration with the private sector by conducting research on water pulley systems. This low-energy system could promise increased yields of upwards of 10% and is one of the first commercial vertical farms in the world<sup>48</sup>.

Policies	Availability	Access	Stability	Quality	Sustainability
Alternative agriculture	✓	✓	✓	✓	✓
PPP for technological development	✓	✓	✓	✓	✓
Funding for agro tech use by farmers	✓	✓	✓	✓	✓

43. Tortajada, Cecilia, and Thinesh Kumar S/O Paramasilvam. “Singapore’s Impressive Food Security.” The Diplomat, The Diplomat, 6 Sept. 2015, thediplomat.com/2015/09/singapores-impressive-food-security/.

44. “Food.” AVA, Agri-Food and Veterinary Authority of Singapore, 20 June 2017, www.ava.gov.sg/explore-by-sections/food.

45. Singapore’s Food Security. AVA, www.agrifood.net/images/cfs43/CFS43%20Side-event%20background%20document%20-%20Lessons%20from%20Singapore.pdf.

46. The growing of plants in a soil-less medium, usually in a liquid based mineral and nutrient solution

47. The soil-less growing of plants in air or mist environments

48. A Case Study of Singapore’s Smart Governance of Food. Center for Livable Cities Singapore, 2015, www.clc.gov.sg/documents/books/smart\_food\_governance\_paper-sg\_case\_study\_final\_sept%2028\_3.pdf.

## D. Research and Development

Norway has a limited agricultural research budget and has combined the three major state agro research institutes into one. Its mandate focuses on agricultural efficiency and optimization research among other more localized issues<sup>49</sup>. In terms of R&D, the FSI gives both Norway and the UAE a 0 score while Singapore receives a score of 13<sup>50</sup>. This is because the country has placed a high premium on this sector and has driven research by creating specialized funds and institutions, and incentivized private sector research. The AVA has a Post-Harvest Technology Center that researches food waste reduction. The AVA also carries out significant applied research that tackles food waste throughout the supply chain to help reduce post-harvest losses and develop best practices for distribution and handling of food<sup>51</sup>.

Singapore incentivizes research by creating enabling environments that attract innovators in the field. Government agencies regularly collaborate with other stakeholders through various platforms in R&D. Policies have helped create a pro-enterprise tax and financial environment, excellent R&D infrastructure and strong intellectual property regulations. This has resulted in agro companies investing in R&D in these fields. One such example is the rice research laboratory set up by Bayer CropScience<sup>52</sup>.

By aggressively pursuing R&D and facilitating it amongst its stakeholders, Singapore was able to develop and employ new agro technologies, increase productivity and efficiency of its limited land, and contribute to increasing its food resilience and security.

Policies	Availability	Access	Stability	Quality	Sustainability
Government funding for R&D	✓	✓	✓	✓	✓
Incentivizing research through PPPs	✓	✓	✓	✓	✓
Enabling legal, regulatory frameworks	✓	-	✓	✓	✓
R&D infrastructure	✓	✓	-	✓	✓

49. "Streamlining Norway's Agricultural Research Institutes." NIBIO, Norwegian Institute for Bioeconomy Research, 2 Sept. 2014, [www.skogoglandskap.no/en/news/streamlining\\_norways\\_agricultural\\_research\\_institutes/newsitem](http://www.skogoglandskap.no/en/news/streamlining_norways_agricultural_research_institutes/newsitem).

50. "The Global Food Security Index." Food Security Index, Economist Intelligence Unit, 2017, [foodsecurityindex.eiu.com/](http://foodsecurityindex.eiu.com/).

51. Teng, Paul, and Margarita Escaler. "The Case for Urban Food Security: A Singapore Perspective." NTS Perspectives Is. No.4, (31 Dec. 2010). RSIS. Web.

52. A Case Study of Singapore's Smart Governance of Food. Center for Livable Cities Singapore, 2015, [www.clc.gov.sg/documents/books/smart\\_food\\_governance\\_paper-sg\\_case\\_study\\_final\\_sept%2028\\_3.pdf](http://www.clc.gov.sg/documents/books/smart_food_governance_paper-sg_case_study_final_sept%2028_3.pdf).

## E. Import Policies

All three countries under study rely on food imports to varying degrees. Norway imports more than half its food needs and food imports (% of merchandise imports) were reported at 9.50% in 2015<sup>53</sup>, among the highest imports shares within the Organization for Economic Co-operation and Development (OECD) countries. To support its agricultural sector, Norway imposes high tariffs on goods that compete with its products in order to limit their entry to the market<sup>54</sup>. Additionally, it exempts over one third of agricultural goods from import tariffs except ‘sensitive goods’ such as dairy, meat, cereals, and certain produce, which are protected by high tariffs<sup>55</sup>. This has made Norwegian agriculture artificially competitive in the local market, with the exception of fish, of which it is a net exporter. Thus, Norway has been effective in providing food where it is lacking, and supporting local production where sufficient.

Although it imports about 90% of its food, Singapore is ranked fourth most food secure in the world by the FSI<sup>56</sup>. It has an open market and established strong relationships with trade partners that have come to place great importance on Singapore’s food retail market. Indeed, it has increased its food resilience despite high reliance on imports by diversifying its import sources, and this has become its core strategy to ensure food security. This is the cornerstone of the Food Security Roadmap, and Singapore currently imports food from 170 countries, up from 160 countries in 2007<sup>57</sup>. This has helped it mitigate supply disruptions by providing alternative sources for almost all foods on the market. This was tested when Malaysia banned the export of five species of fish in 2013, which did not impact Singapore’s fish supply as it had 100 other species of fish in the market<sup>58</sup>. Not only that, Singapore maintains low agricultural tariffs in order to better facilitate trade, and as such it scores 100 in this area on the FSI<sup>59</sup>.

Singapore has succeeded at diversifying imports by enhancing its role as a trading hub, and building extensive public private partnerships. Government agencies engage the private sector through regular business meetings that focus on finding new food sources. The government agencies act as agro-trade coordinators through meetings and foreign sourcing trips in collaboration with industry members. In an accreditation trip to Indonesia for example, the AVA included participants from seafood industries and major supermarket retailers. The trip resulted in import contracts for 30 metric tons of fish<sup>60</sup>.

---

53. “Norway - Food Imports (% of Merchandise Imports).” Trading Economics, [tradingeconomics.com/norway/food-imports-percent-of-merchandise-imports-wb-data.html](http://tradingeconomics.com/norway/food-imports-percent-of-merchandise-imports-wb-data.html).

54. “Norway - Agricultural Sectors.” Export.gov, 23 Feb. 2017, [www.export.gov/article?id=Norway-Agricultural-Sectors](http://www.export.gov/article?id=Norway-Agricultural-Sectors).

55. Import from Developing Countries. Norwegian Ministry of Foreign Affairs, 2010, [www.regjeringen.no/globalassets/upload/UD/Vedlegg/Handelspolitikk/121029\\_Import\\_from\\_developing\\_countries\\_WEB\\_v2.pdf](http://www.regjeringen.no/globalassets/upload/UD/Vedlegg/Handelspolitikk/121029_Import_from_developing_countries_WEB_v2.pdf).

56. “Singapore.” Global Food Security Index, Economist Intelligence Unit, 2017, [foodsecurityindex.eiu.com/Country/Details#Singapore](http://foodsecurityindex.eiu.com/Country/Details#Singapore).

57. Ming En, Siau. “The Big Read: Far from people’s minds, but food security a looming issue”, Today, 26 May. 2017, [m.todayonline.com/singapore/big-read-far-peoples-minds-food-security-looming-issue](http://m.todayonline.com/singapore/big-read-far-peoples-minds-food-security-looming-issue)

58. A Case Study of Singapore’s Smart Governance of Food. Center for Livable Cities Singapore, 2015, [www.clc.gov.sg/documents/books/smart\\_food\\_governance\\_paper-sg\\_case\\_study\\_final\\_sept%2028\\_3.pdf](http://www.clc.gov.sg/documents/books/smart_food_governance_paper-sg_case_study_final_sept%2028_3.pdf).

59. “Singapore.” Global Food Security Index, Economist Intelligence Unit, 2017, [foodsecurityindex.eiu.com/Country/Details#Singapore](http://foodsecurityindex.eiu.com/Country/Details#Singapore).

60. A Case Study of Singapore’s Smart Governance of Food. Center for Livable Cities Singapore, 2015, [www.clc.gov.sg/documents/books/smart\\_food\\_governance\\_paper-sg\\_case\\_study\\_final\\_sept%2028\\_3.pdf](http://www.clc.gov.sg/documents/books/smart_food_governance_paper-sg_case_study_final_sept%2028_3.pdf).

Being a trade hub contributes heavily to food-source diversification and Singapore has become a vital market for re-exporting food. Around 20-25% of imported food in Singapore is re-exported abroad<sup>61</sup>. Its location as a trading hub has aided these efforts. Crisis could impact a variety of staple food products and so, diversification has been key to offsetting these disruptive threats.

Policies	Availability	Access	Stability	Quality	Sustainability
Food source diversification	✓	-	✓	✓	✓
Developing as a trade and export hub	-	-	-	✓	-
Import tariffs	X	X	X	-	X

## F. Foreign Investment Strategies

As a supplemental strategy, Singapore invests in agricultural operations abroad which helps secure food from these sources and provides right of purchase in times of crisis<sup>62</sup>. An example of this is the Singapore-Jilin Food zone. This zone was established in cooperation with China and operates as a Foot and Mouth Disease-Free Zone for pork. Contract farming is responsible for 5% of produce consumed in Singapore, up from half of that amount in three years' time.

Contract farming enables price, quality, and supply control. Investments in agriculture abroad allow local farmers to overcome land constraints and get access to new markets. They also allow them to export produce back to Singapore<sup>63</sup>. This policy has not been followed by Norway, which chooses to support foreign agriculture only as part of its commitment to global development goals.

Foreign investment strategies have been effective to some degree, but do not increase the stability and sustainability of supply. This is because these investments are often carried out in developing countries that do not have the legal systems and protections that can ensure steady supply for contractors. Not only that, these governments lack the financial and agricultural experience to carry out such large scale projects. It remains a risky investment, and as such investing in developed agricultural industries is preferable, even if costly<sup>64</sup>.

Policies	Availability	Access	Stability	Quality	Sustainability
Investing in agriculture abroad	✓	-	X	✓	X

61. Tortajada, Cecilia, and Thinesh Kumar S/O Paramasilvam. "Singapore's Impressive Food Security." The Diplomat, The Diplomat, 6 Sept. 2015, thediplomat.com/2015/09/singapores-impressive-food-security/.

62. A Case Study of Singapore's Smart Governance of Food. Center for Livable Cities Singapore, 2015, www.clc.gov.sg/documents/books/smart\_food\_governance\_paper-sg\_case\_study\_final\_sept%2028\_3.pdf.

63. Ming En, Siau. "The Big Read: Far from people's minds, but food security a looming issue", Today, 26 May. 2017, m.todayonline.com/singapore/big-read-far-peoples-minds-food-security-looming-issue

64. Detrie, Megan. "Food security a growing concern for the UAE" The National, 4 Nov. 2010, thenational.ae/lifestyle/food/food-security-a-growing-concern-for-the-uae-1.562078

## G. Subsidization Policy

Overall, food is most affordable in Singapore, followed by the UAE then Norway. Norway has offset the high costs of its agricultural produce using tariffs and subsidies. The country has a high GDP per capita and does not intervene with price controls to a high degree.

Singapore and the UAE are considered the 2<sup>nd</sup> and 4<sup>th</sup> countries in terms of food affordability due to being “high-income countries with small populations and well-funded public sectors—all factors that directly benefit food affordability”<sup>65</sup>. In Singapore, aid and assistance is also offered to underprivileged families,<sup>66</sup> helping to increase the overall earning power of families along all income levels in the country. Direct government intervention through subsidies has resulted in highly affordable food through various programs, particularly in relation to market hawker food prices. The government also utilized PPPs to maintain affordable food prices. One such example is hiring social enterprises to work as managing agents, providing raw materials for hawkers in bulk at discounted prices<sup>67</sup>.

Governments subsidize food when food costs are unfeasible. Subsidization is ineffective at addressing the structural issues causing food to be expensive, and governments should work hard to realign their policies towards that goal. For the short to medium term span, subsidies can improve access and stability of food, but they are not sustainable.

Policies	Availability	Access	Stability	Quality	Sustainability
Food price subsidies	✓	✓	✓	✓	X

## H. Stockpiling

Stockpiling can help alleviate the worst-case scenario by focusing on strategic storage plans in an import-reliant country. Because it is a short-term strategy, stockpiling does not improve the long-term sustainability, stability, or availability of food. Stockpiling is reliant on resource intensive infrastructural investments and is inherently limited. Stockpiling strategies are costly, and are vulnerable to price disruptions relating to production inputs, land availability, capital availability, and import policies of trade partners, and losses from spoilage amongst others. If all countries were to follow this strategy, it would have an opposite effect by increasing global price volatility<sup>68</sup>.

65. “The Global Food Security Index.” Food Security Index, Economist Intelligence Unit, 2017, [foodsecurityindex.eiu.com/](http://foodsecurityindex.eiu.com/).

66. Ming En, Siau. “The Big Read: Far from people’s minds, but food security a looming issue”, Today, 26 May. 2017, [m.todayonline.com/singapore/big-read-far-peoples-minds-food-security-looming-issue](http://m.todayonline.com/singapore/big-read-far-peoples-minds-food-security-looming-issue)

67. AR, “Government looking at ways to keep hawker food affordable: Vivian Balakrishnan”, Channel News Asia, 18 Aug. 2015, [channelnewsasia.com/news/singapore/government-looking-at-ways-to-keep-hawker-food-affordable-vivian-8222582](http://channelnewsasia.com/news/singapore/government-looking-at-ways-to-keep-hawker-food-affordable-vivian-8222582)

68. Caballero-Anthony, Mely, et al. Public Stockpiling and Food Security. RSIS, 2015, NTS Center, [www.rsis.edu.sg/wp-content/uploads/2015/06/PB150603\\_Public-Stockpiling.pdf](http://www.rsis.edu.sg/wp-content/uploads/2015/06/PB150603_Public-Stockpiling.pdf).



In terms of agricultural infrastructure, Singapore score 100, and Norway scores 90, while the UAE scores 80 on the FSI. This indicator measures the ability to store and transport produce to markets, which includes storage facilities and road and port infrastructure. Stockpiling is a policy undertaken in Singapore to increase price stability and supplies when there is a short term food shortage. Only Singapore has shown a steady incline in its agricultural infrastructure score in the last 5 years, highlighting the country’s investments in the sector. Such storage has a time limit and is considered short term; for example, rice importers are required to keep stockpiles in government warehouses for two months at a time. In Norway on the other hand, National stockpiling was considered a short-term compensation for risks related to import reliance and so, national stockholding ended in 2003.

Policies	Availability	Access	Stability	Quality	Sustainability
Food stockpiling	✓	-	✓	-	X

## I. Strategies to Combat Food Loss

Norway does not have a clear stand-alone food waste strategy, but rather, it is a big part of its “National Waste Management and Prevention Plan: From Waste to Resources” launched in 2013. The plan addresses the issue through government cooperation with stakeholders via negotiated agreements that tackle food waste through waste prevention along the food chain<sup>69</sup>.

In Singapore, food waste increased by 50% in the last 10 years and is expected to increase. Food waste is about 10% of Singapore’s total waste, and only 13% of it is recycled. The rest of it is used in the Waste-to-energy plans for incineration<sup>70</sup>. Food loss and waste have been important factors in increasing the efficiency and sustainability of Singapore’s food system, helping ensure that more quality food is available and resources are not being wasted.

Singapore has implemented many strategies to reduce food loss along the import supply chain by encouraging innovation. Several government agencies work to reduce food waste or recycle byproducts. The AVA and others partner with retailers to identify food loss along the supply chain. To incentivize innovation in managing food loss, the government has set up the 3R fund to co-sponsor such initiatives.

69. Hanssen, Ole Jørgen, and Silvia Gaiani. Norway – Country Report on National Food Waste Policy. EU Fusions, [www.eu-fusions.org/phocadownload/country-report/NORWAY%2023.02.16.pdf](http://www.eu-fusions.org/phocadownload/country-report/NORWAY%2023.02.16.pdf).

70. “Food Waste Management.” National Environment Agency, Singapore Government, [www.nea.gov.sg/energy-waste/3rs/food-waste-management](http://www.nea.gov.sg/energy-waste/3rs/food-waste-management).



The AVA also established the Post-Harvest Technology Center that undertakes research on how technology can be used to recycle, reduce and recover food waste. Other initiatives include improving packaging, advancing cold chain technologies, and enhancing post-harvest protocols<sup>71</sup>. Through these initiatives, food waste was reduced by 12% from 2010 to 2015 (kg per head of population)<sup>72</sup>.

Food loss strategies are extremely effective at improving efficiency and productivity of food systems. When they address food loss at all points of the supply chain they improve resource utilization, and maximize return on investment. Any food security strategy should include food loss policies, particularly when an over reliance on imports is assured due to domestic production limitations.

Policies	Availability	Access	Stability	Quality	Sustainability
Food waste strategy	✓	✓	✓	-	✓
Food loss strategy	✓	-	-	-	✓

71. A Case Study of Singapore's Smart Governance of Food. Center for Livable Cities Singapore, 2015, [www.clc.gov.sg/documents/books/smart\\_food\\_governance\\_paper-sg\\_case\\_study\\_final\\_sept%2028\\_3.pdf](http://www.clc.gov.sg/documents/books/smart_food_governance_paper-sg_case_study_final_sept%2028_3.pdf).

72. Stensgård, Aina Elstad, and Ole Jørgen Hanssen. Food Waste in Norway 2010-2015. 16th ed., vol. 17, Ostfoldforskning, European Commission, [ec.europa.eu/food/sites/food/files/safety/docs/fw\\_lib\\_format-rapport-2016-eng.pdf](http://ec.europa.eu/food/sites/food/files/safety/docs/fw_lib_format-rapport-2016-eng.pdf).

# Current Approaches to Food Security in the UAE

The UAE is food secure due to a focus on open trade and imports, foreign agricultural investments, and increasing development of a small agricultural sector. The UAE has been able to offset many of its structural challenges with investments in infrastructure, market interventions, and subsidies. The UAE has a comprehensive plan to support food and water security, but much can be done to improve its sustainability. The government established the Food Security Center in 2010 to draft and implement a food security strategy which is detailed below<sup>73</sup>. The UAE is working to boost the resilience of its food supply and it has succeeded in increasing it through a variety of approaches such as strengthening trade relations, and investing in technology and research. Leadership has called for developing vital partnerships between national establishments, launching investment projects, encouraging research on new agricultural technologies and techniques and adopting best practices for sustainable food security<sup>74</sup>.

Due to a similarity in circumstance, the UAE has implemented many of the same policies and strategies as Singapore but has not had the same successes. This is largely due to the degree to which it has implemented particular strategies. In the following sections the UAE's food security policies will be compared to the policies benchmarked in the previous section. The section will highlight to what degree these policies are being implemented in the UAE, and to what degree they are effective in achieving desired strategic goals.

## A. Food Security Strategy

Structurally, the UAE is only able to provide a small portion of its food consumption needs due to the nature of its climate, land and water resources. The UAE focuses on supporting the production of various non-staple vegetables that supply a very small amount of the country's needs. To maximize productivity, the government outlined a National Policy for Food in 2015 and has focused on improving food security with broad policy outlines. Productivity of the sector is enhanced by providing subsidies, technical and financial assistance for farmers, and collaboration with the private sector.

The FSI gave the UAE a score of 82.9 for its sufficiency of supply. However, the country has not done well at managing agricultural volatility, which scored at 0%, a failing grade (under 25). The ten key crops produced in the country (cucumbers, tomatoes, capsicums, eggplant, cabbage, and potatoes are

---

73. Gueganic, Pierre. "Understanding UAE Food Security Strategy & Potential Investment Opportunities Related.", LinkedIn, 9 Jun. 2015, [linkedin.com/pulse/understanding-uae-food-security-strategy-potential-related-gueganic](https://www.linkedin.com/pulse/understanding-uae-food-security-strategy-potential-related-gueganic)

74. WAM. "Food Security Tops UAE's Priorities, Says Abu Dhabi Crown Prince." Emirates 24|7 News, Emirates 24|7, 7 Feb. 2017, [www.emirates247.com/news/emirates/food-security-tops-uae-s-priorities-says-abu-dhabi-crown-prince-2017-02-07-1.647735](http://www.emirates247.com/news/emirates/food-security-tops-uae-s-priorities-says-abu-dhabi-crown-prince-2017-02-07-1.647735).

some) are incapable of supporting the population<sup>75</sup>. Low rainfall, heat, and highly salinized water and soil make the country almost incapable of growing wheat and rice, the food staples of the region. As such, following the self-sufficiency approach, like Norway, is unfeasible. The UAE has instead focused on developing a small agricultural sector that provides some of its produce needs, and a small dairy and meat industry.

The UAE's first agricultural policy was formulated in 2015 with support from FAO and other organizations and works to improve the agro-food system. The National Policy for Food and Agriculture outlines the policy direction for the coming fifteen years focusing on increasing productivity, efficiency and sustainability of the agricultural sector.

## B. Domestic Production

Traditional agriculture has always been a limited part of the UAE's economy due to the country's inhospitable climate and land. In the modern age, advancements in technology and increasing investment has resulted in a meagre agricultural sector in the country, which is not sufficient to meet the food requirements for the country. The government has invested in increasing self-sufficiency by supporting technology required to improve water and land management. Modernizing irrigation systems and shifting to the production of water efficient crops has been undertaken to improve the efficiency and productivity of the sector. These measures are expensive however, and extraction of groundwater, even within water efficient systems, is unfeasible and unsustainable in the UAE.

Enhancing the productivity of the agricultural sector has included support for farms and farmers, particularly through subsidies, funding and training. The Abu Dhabi Farmers Services Center (ADFSC) helps farmers meet production costs even if sales decrease. It also provides training on agricultural best practices. The center plans crop growth cycles for the season and allows farmers to submit expressions of interest for which crops they would prefer to grow. This allows the center to organize production according to market demand and preapproved criteria. While this policy has helped local production, farmers are faced with shorter growing seasons, depleting water sources, and rising costs-with limited returns.

This approach has been effective at improving productivity of the agricultural sector to the degree that it covers some of the market demand for these goods. It has been effective at improving irrigation methods and improving yields through government interventions. As such, these policies have improved the situation marginally but have been unable to address the critical structural challenges. This policy relies on the UAE's ability to spend on the sector due to its high GDP, and its ability to address structural issues has made it successful only to the degree that it has achieved improved

---

75. Radan, Silvia. "Abu Dhabi Farmers Gear up for next Agricultural Season." Khaleej Times, 20 July 2015, [www.khaleejtimes.com/nation/general/abu-dhabi-farmers-gear-up-for-next-agricultural-season](http://www.khaleejtimes.com/nation/general/abu-dhabi-farmers-gear-up-for-next-agricultural-season).

productivity and efficiency over the traditional methods employed previously.

Investing in local agriculture has helped improve food security, but since it is not possible at the level of sufficiency required, other measures need to be taken. The strategies currently implemented have not had the widespread success of the Singaporean model. The core issue here is that the solution to improving the sector requires significant natural resources that are unavailable, and technology that has not been sufficiently developed. This policy is based on the UAE's ability to subsidize a sector with limited returns, a consequence of its fossil fuel based economy. The policy also does not account for population growth, consumption growth, inflation and increasing pressures from water scarcity and rising temperatures. This makes the policy unsustainable; support for this sector is uninsulated from market fluctuations in oil prices, and therefore subsidies. Fuel price shifts and rising governmental costs in other areas may limit support in the future.

The structure of this agricultural system does not address the major climate and environmental issues facing the UAE. The small amount of agricultural produce requires an unsustainable flow of resources, particularly water which absorbs 34% of the groundwater supply<sup>76</sup>. By using 60% of the nation's water and providing less than 1% to GDP, agricultural production in the UAE needs to be transformed in order to remain a prudent investment and a viable long term solution<sup>77</sup>.

With rising temperatures, limited arable land, and decreasing water resources, alternative agriculture is the future of food production in the UAE, and it is poised to take advantage of this momentum by investing heavily in this area. Addressing structural limitations can only be done through innovation and technology, and the UAE can build on its strengths as a human capital and investment hub to facilitate this process, namely through research and development.

The current policy does not effectively utilize developing agricultural and disruptive technologies like Big Data and robotics. The UAE's focus on developing high tech industries, innovation sectors, and state-of-the-art infrastructure provides a missed opportunity in terms of agriculture. A focus on green strategies and entrepreneurship can make the UAE a knowledge and innovation hub in the area of innovative agriculture. The UAE must utilize its vast capital, and its strategic location as a major financial hub with access to human capital to attract researchers and developers. While this strategy may be a long term commitment, it has great potential returns, and the UAE must invest more in this approach.

### C. High Tech Agriculture

The UAE government has made some strides in supporting high tech agriculture. Traditional agriculture is no longer feasible for the UAE, and strategies must focus on improving yield and efficiency by utilizing

---

76. "Abu Dhabi seeks to ensure food security with increased investment". (12 Oct, 2016). Oxford Business Group, Zawya. [WWW.ZAWYA.COM/MENA/EN/STORY/ABU\\_DHABI\\_SEEKS\\_TO\\_ENSURE\\_FOOD\\_SECURITY\\_WITH\\_INCREASED\\_INVESTMENT-ZAWYA20161012081457/](http://WWW.ZAWYA.COM/MENA/EN/STORY/ABU_DHABI_SEEKS_TO_ENSURE_FOOD_SECURITY_WITH_INCREASED_INVESTMENT-ZAWYA20161012081457/)

77. Ali, Nusrat. "New Japanese Farming Methods Target UAE's Agricultural Sector." Gulf Business, Gulf Business, 10 Apr. 2014, [gulfbusiness.com/japanese-film-farming-boosts-uaes-agriculture/](http://gulfbusiness.com/japanese-film-farming-boosts-uaes-agriculture/)

and pioneering new technological advancements in agriculture. This strategy is implemented mainly through PPPs, where the industry is incentivized to support government efforts to improve productivity and efficiency implemented through specialized government institutions, and increasing R&D.

The UAE has followed a similar approach to Singapore by investing in new farming techniques like soilless farming and hydroponics, new greenhouse techniques and dry agro<sup>78</sup>. The Abu Dhabi Farmers' Services Centre is one government agency working on supporting the shift to modern agricultural methods<sup>75</sup>. The Ministry of Climate Change and Environment has several programs that assist farmers with quality seeds, lab tests, greenhouses, and R&D services in an effort to aid this shift<sup>80</sup>. The private sector is also tackling this issue, and Pure Harvest is establishing the first high tech commercial greenhouse in the nation, with a focus on year-round tomato production. The technology used in this greenhouse is resource efficient to maintain high productivity year round<sup>81</sup>.

Like Singapore, vertical farming is another option for the UAE, as it is water efficient and can be large scale (urban farms) or small scale (home farming). Although some private sector groups are trying to work with real estate developers to create home-based vertical gardens, this method has not taken a hold in the Emirates as it does not adequately address the extremely hot climate and water deficiency. Hydroponics, in particular, presents an alternative to water heavy agricultural methods, as it saves up to 70% more water and results in longer growing periods. Its use in the UAE has increased from 50 hydroponic projects in 2009 to around 1000 in 2017. At present, there is a demand for subsidized prices for hydroponics and fertilizers that could enhance production.

This strategy has been marginally effective in that it has resulted in the implementation of various high tech agricultural projects. However, none have been commercially viable as of now and have not resulted in significant market deployment. Development and use of these technologies is still limited, and not viable for large scale production required to aid food security.

This policy successfully utilizes the UAE's openness to trade to improve PPPs. Inexpensive oil and high GDP have allowed for more investment in the agro tech sector. However, while technology like hydroponics can decrease the need for water resources significantly, it still does not solve the UAE's climate challenges as such projects require unsustainable cooling systems. This means that the UAE, with its unique climate challenges, must invest in technological developments that will directly address its specific needs. A major challenge to the deployment and development of such technologies is high costs, low awareness and lack of incentives.

---

78. Chelali, Tarik. "Food security is this region's urgent priority." *The National*, 8 Jan. 2017, [www.thenational.ae/opinion/comment/food-security-is-this-regions-urgent-priority](http://www.thenational.ae/opinion/comment/food-security-is-this-regions-urgent-priority)

79. Malek, Caline. "Sustainable Farming Ideas Spread across UAE." *The National*, The National, 21 Aug. 2013, [www.thenational.ae/uae/sustainable-farming-ideas-spread-across-uae-1.471460](http://www.thenational.ae/uae/sustainable-farming-ideas-spread-across-uae-1.471460).

80. Salama, Samir. "Hydroponics, organic farming top food security strategy." *Gulf News*, 14 Mar. 2017, [www.gulfnews.com/news/uae/government/hydroponics-organic-farming-top-food-security-strategy-1.1993738](http://www.gulfnews.com/news/uae/government/hydroponics-organic-farming-top-food-security-strategy-1.1993738)

81. Chesters, Crystal. "Pure Harvest to Launch High-Tech Farm in UAE Following \$1.1mn Investment." *Catering News Middle East*, Dec. 2016, [www.hotelnewsme.com/catering-news-me/pure-harvest-launch-high-tech-farm-uae-following-1-1mn-investment/](http://www.hotelnewsme.com/catering-news-me/pure-harvest-launch-high-tech-farm-uae-following-1-1mn-investment/)

These technologies may take significant time, resources, and manpower to produce and perfect, but they represent the only real hope for the agro industry in the UAE. This will include shifting the mentality of people and farmers away from traditional agriculture. Agriculture must be thought of as a modern and technological sector rather than a cultural sector, and a key component for securing the future of the country. Not only that, the skills and capacities of farmers need to be updated through education and training which must include the skills to utilize new technologies.

#### D. Research and Development

The UAE is pursuing research and development initiatives that would improve agro productivity by establishing various governmental institutions and tasking them with working on agricultural research, often in collaboration with the private sector. The UAE has worked to develop national frameworks that encourage public private partnerships, particularly when it comes to scientific research<sup>82</sup>. Research in the UAE has focused on finding alternative technologies, growing methods, and even substitute crops. While this strategy has been effective in advancing research on the sector, it is still in its nascent stages and has not provided the largescale breakthroughs needed to address challenges.

The International Centre for Biosaline Agriculture was established to conduct research, and has established trial greenhouses and supported research and training programs for farmers in the region<sup>79</sup>. The Agricultural Innovation Centre was also launched in Sharjah, which works in tandem with international centers specializing in agro tech research<sup>83</sup>. This center was opened to support the National Innovation Strategy and is currently studying various technologies that can help overcome the UAE's structural challenges, like greenhouses that are cooled by absorbing water from plants growing inside them, instead of fans<sup>84</sup>.

A key research stream in the UAE has focused on identifying and developing resilient strains of high value crops. The Abu Dhabi Food Control Authority (ADFCA) has carried out several studies to determine which crops can be grown locally, including wheat, a staple product<sup>85</sup>. This research was focused on improving food security given climate constraints and was undertaken in collaboration with international research centers<sup>86</sup>. Previous efforts to produce wheat have failed due to high temperatures and water scarcity, but this research is focused on discovering strains that can survive the UAE's harsh climate<sup>87</sup>.

---

82. Chelali, Tarik. "Food security is this region's urgent priority." *The National*, 8 Jan. 2017, [www.thenational.ae/opinion/comment/food-security-is-this-regions-urgent-priority](http://www.thenational.ae/opinion/comment/food-security-is-this-regions-urgent-priority)

83. Malek, Caline. "Sustainable Farming Ideas Spread across UAE." *The National*, *The National*, 21 Aug. 2013, [www.thenational.ae/uae/sustainable-farming-ideas-spread-across-uae-1.471460](http://www.thenational.ae/uae/sustainable-farming-ideas-spread-across-uae-1.471460).

84. Zriqat, Thaer. "Water takes farming to cutting edge." *The National*, *The National*, 17 Dec. 2014, [www.thenational.ae/uae/environment/water-takes-farming-to-cutting-edge-1.452578](http://www.thenational.ae/uae/environment/water-takes-farming-to-cutting-edge-1.452578)

85. "ADFCA Launches Wheat Research as Part of Food Security Initiatives", 29 Jan. 2013, [www.adfca.ae/English/MediaCenter/News/Archived%20News/WheatResearch.aspx](http://www.adfca.ae/English/MediaCenter/News/Archived%20News/WheatResearch.aspx)

86. "ADFCA Launches Wheat Research as Part of Food Security Initiatives", 29 Jan. 2013, [www.adfca.ae/English/MediaCenter/News/Archived%20News/WheatResearch.aspx](http://www.adfca.ae/English/MediaCenter/News/Archived%20News/WheatResearch.aspx)

87. Malek, Caline. "Sustainable Farming Ideas Spread across UAE." *The National*, *The National*, 21 Aug. 2013, [www.thenational.ae/uae/sustainable-farming-ideas-spread-across-uae-1.471460](http://www.thenational.ae/uae/sustainable-farming-ideas-spread-across-uae-1.471460).

The Authority has also carried out research trials testing the adaptability and resilience of 103 crops to the local climate conditions.

The country has experimented with the cultivation of quinoa, launching research trials to study the crop's productivity<sup>88</sup>. Quinoa is an economical, lucrative, and resilient crop that can grow in areas with hot climates and requires little water to be productive. Research trials on salt-tolerant quinoa have produced high yields. The Ministry of Climate Change and Environment stressed the importance of such research, stating that "quinoa has immense potential if given the correct research and investment as a potential way of growing local food that is nutritious and environmentally friendly"<sup>89</sup>. The crop is expected to be on the ground in five years. Challenges to this research include limited availability of scientific and genetic materials, lack of awareness about alternative crops like quinoa, and the challenge of making these crops desirable and affordable<sup>90</sup>. Convincing the public to eat the crop is another challenge, but with growing health consciousness this may be feasible.

With limited trials and deployments, the country has not taken noticeable advantage of its wealth in diplomatic partnerships, capital, and existing infrastructure to develop this sector. R&D is the premier solution to the UAE's food security challenges, and poor investment in this area is a major threat to the country's development. Developing this sector can become a key part of the UAE's economic diversification efforts, taking advantage of existing high tech developments like Big Data, Smart city infrastructure, 3D printing and robotics. All of these sectors are strategic components of the country's vision, and agro research can be pioneered alongside them.

Research in these areas could help significantly increase feasibility and resilience of the agricultural sector in the UAE, improving its stability and sustainability. Agricultural innovations can also help address the impact of climate change and growing populations. This strategy must be given more support, particularly in that it would require large scale investments, and the infrastructure and experience which is currently missing<sup>91</sup>.

This policy must be continued and supported; incentivizing research in this area is likely to produce significant results. Although there has been a big focus on PPP and on encouraging the private sector to invest in agricultural business, as of now it appears that the most R&D being done is through the public sector, especially through international projects. Being a center for agricultural innovation will not only benefit the UAE directly, but will also increase foreign investments and strategic partnerships with countries that can potentially benefit from successful projects.

---

88. Crompton, Paul. "UAE ministry keen on Quinoa as future of food." Gulf News, Gulf News, 6 Dec. 2016, [gulfnews.com/news/uae/health/uae-ministry-keen-on-quinoa-as-future-of-food-1.1941054](http://gulfnews.com/news/uae/health/uae-ministry-keen-on-quinoa-as-future-of-food-1.1941054)

89. Al Wasmī, Naser. "Quinoa 'could be the solution to feeding UAE's population.'" The National, The National, 6 Dec. 2016, [www.thenational.ae/uae/environment/quinoa-could-be-the-solution-to-feeding-uae-s-population-1.173078](http://www.thenational.ae/uae/environment/quinoa-could-be-the-solution-to-feeding-uae-s-population-1.173078)

90. Al Wasmī, Naser. "Quinoa 'could be the solution to feeding UAE's population.'" The National, The National, 6 Dec. 2016, [www.thenational.ae/uae/environment/quinoa-could-be-the-solution-to-feeding-uae-s-population-1.173078](http://www.thenational.ae/uae/environment/quinoa-could-be-the-solution-to-feeding-uae-s-population-1.173078)

91. Malek, Caline. "Sustainable Farming Ideas Spread across UAE." The National, The National, 21 Aug. 2013, [www.thenational.ae/uae/sustainable-farming-ideas-spread-across-uae-1.471460](http://www.thenational.ae/uae/sustainable-farming-ideas-spread-across-uae-1.471460).



## E. Import Policies

As a result of its inability to produce sufficient food, the UAE has become an import reliant country. Imports are expected to rise from USD \$100 billion in 2014 to over USD \$400 billion in the next ten years<sup>92</sup>. This leaves them vulnerable to price fluctuations and supply threats. To improve the availability of food, the UAE maintains low import tariffs to facilitate trade. This policy is implemented through the development of the UAE as a transport and trade hub, investment in infrastructure, and diversification of import sources. The UAE has an open trade regime with low tariffs which means that food supply is available and the gap between production and consumption is controlled. Most agricultural products, including staples like wheat, barley and rice, are exempt from import duties<sup>93</sup>.

The government encourages open trade and works to establish the nation as a regional trade hub. The Emirate of Dubai, in particular, acts as a hub for goods due its state of the art infrastructure, free trade zones, and pro-business rules and regulations. The UAE has also worked to establish itself as a food processing hub, becoming a center for importing and processing raw food that is then re-exported to foreign countries, and the United Nations (UN) has identified the country as a key 'potential regional food hub'<sup>94</sup>.

At the moment around 70% of food imports are re-exported from the UAE, and increasing the scale and success of this operation could make the UAE a more strategic hub for global food trade<sup>95</sup>. The UAE is one of the world's greatest rice re-exporters, representing 90% of the world's re-exports in 2010<sup>96</sup>. Dubai Wholesale City (DWC) are working to enhance PPP by working with key stakeholders in the food trade in order to increase food security and stability. The DWC will be the world's largest wholesale hub, aiming to support economic diversification efforts away from fossil fuel and aid the UAE to become a wholesale platform. It will also help increase strategic stock levels<sup>97</sup>.

However, as an import reliant country, the UAE needs to diversify its food sources in the same vein of Singapore. Food re-exporting helps diversify sources of import, and it facilitates the maintenance of key stockpiles. Diversifying import sources helps achieve all metrics of food security, particularly by increasing stability, availability, and resilience. Import diversification is a part of the UAE Ministry of Climate Change and Environment's food diversification policy framework, which they work on with FAO<sup>98</sup>. Recent events put this policy to the test. The 2017 ban on imports from five regional trade partners due to high pesticide use caused an increase in food prices, as produce had to be resourced. Since then, the government has worked on several fronts to enhance local food security yet there is the need to help mitigate the risks related to global shortages or supply chain problems.

- 
92. Bitar, Zaher. "UAE's Food Imports to Rise to \$400b in 10 Years." GulfNews, 31 Mar. 2015, [gulfnews.com/business/sectors/investment/uae-s-food-imports-to-rise-to-400b-in-10-years-1.1482864](http://gulfnews.com/business/sectors/investment/uae-s-food-imports-to-rise-to-400b-in-10-years-1.1482864).
  93. Zghoul, Fayrouz. 2017 Grain and Feed in the United Arab Emirates (UAE). vol. 8, UAE, USDA Foreign Agriculture Service, GAIN, 2017, [gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual\\_Dubai\\_United%20Arab%20Emirates\\_4-24-2017.pdf](http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual_Dubai_United%20Arab%20Emirates_4-24-2017.pdf)
  94. Power, Lauren. Scarcity and Abundance: UAE Food and Water Security. Future Directions International, 2014, [Scarcity\\_and\\_Abundance: UAE Food and Water Security, futuredirections.org.au/wp-content/uploads/2014/11/FDI\\_Strategic\\_Analysis\\_Paper\\_-\\_UAE\\_Scarcity\\_and\\_Abundance.pdf](http://Scarcity_and_Abundance: UAE Food and Water Security, futuredirections.org.au/wp-content/uploads/2014/11/FDI_Strategic_Analysis_Paper_-_UAE_Scarcity_and_Abundance.pdf).
  95. Abdul Kader, Binsal. "Food processing sector supports UAE's food security; officials say". Gulf News. Gulf News. 20 Mar, 2017. [www.gulfnews.com/news/uae/environment/food-processing-sector-supports-uae-s-food-security-officials-say-1.1997356](http://www.gulfnews.com/news/uae/environment/food-processing-sector-supports-uae-s-food-security-officials-say-1.1997356)
  96. Lowe, Aya. "Ensuring Food Security of the UAE." GulfNews, 19 Feb. 2012, [gulfnews.com/business/sectors/features/ensuring-food-security-of-the-uae-1.982693](http://gulfnews.com/business/sectors/features/ensuring-food-security-of-the-uae-1.982693).
  97. Chesters, Crystal. "Dubai Wholesale City to Support UAE Food Security." Hotel News ME, 29 Sept. 2016, [www.hotelnewsme.com/fb/dubai-wholesale-city-support-uae-food-security/](http://www.hotelnewsme.com/fb/dubai-wholesale-city-support-uae-food-security/).
  98. Aldroubi, Mina. "Abu Dhabi Heralds Waste-Reduction Success." The National, 16 July 2017, [www.thenational.ae/uae/abu-dhabi-heralds-waste-reduction-success-1.609430](http://www.thenational.ae/uae/abu-dhabi-heralds-waste-reduction-success-1.609430).



The import policy has been successful in the UAE due largely to the country's strong trade relations, infrastructure, and regulatory frameworks. It has also been effective at increasing the availability of food and the stability of supply. It has not been as effective at improving resilience of this supply and its sustainability. This is because the UAE must continue to expand import sources, especially by focusing on maintaining its position as a trade hub. Continuous improvement and expansion of trade infrastructure must be undertaken to ensure the growth of this sector. This will contribute to economic diversification efforts and to food source diversification. While diversification is currently underway, more can be done to enhance the strategies employed.

## F. Foreign Investment Strategies

To improve the resilience of its food supply, the UAE invests in foreign agricultural sectors as part of its broad food security strategy. This is mainly implemented through contract farming and the acquisition of agricultural enterprises abroad.

In response to the 2007-2008 food price crisis, the UAE began to buy or lease land abroad, mainly in east Africa, in order to sidestep embargoes placed by traditional exporters<sup>99</sup>. This was done to ensure supply in crisis situations and increase food supply by giving access to food production bases. This was implemented through support for private agribusinesses and direct government contracts.

More recently, in 2017 the Pegasus Agriculture Group established Pegasus Food Futures in the UAE, a new fund that works to increase food security and reduce import reliance by investing in new technology and food manufacturing, supply chain transparency, and R&D. The fund will first focus on establishing growing operations in the MENA region and in established agricultural sectors like Europe and North America. The fund is already working with private and public sector entities on a global indoor research and production hub<sup>100</sup>.

Land acquisition has faced criticism; in impoverished countries, export oriented projects inspired local hostility. Weak infrastructure, political instability, and poor security further endangered these projects and in response, the UAE shifted its strategy to more developed countries like Australia and Eastern Europe. It became clear that land acquisition in foreign countries with weak governance is not a strategic move, but investing in existing agricultural operations with key trade partners like the USA or Australia is<sup>101</sup>.

These policies have relied on the UAE's comparative wealth and good diplomatic standing, but they do not address the core structural issues the country faces, like import reliance. The policy has been marginally effective at improving food supply, and largely ineffective at improving the sustainability and resilience of the food system. The strategy is also unsustainable as countries can ban exports at any time in response to crisis. The solution to this challenge is found in food-source diversification and the establishment of protected farm operations in countries with strong legal and regulatory frameworks.

---

99. Gornall, Jonathan "Inside the UAE's quest for food security and why the West is wrong about land acquisitions". The National. Jan 21, 2016. [www.thenational.ae/arts-life/the-review/inside-the-uaes-quest-for-food-security-and-why-the-west-is-wrong-about-land-acquisitions#full](http://www.thenational.ae/arts-life/the-review/inside-the-uaes-quest-for-food-security-and-why-the-west-is-wrong-about-land-acquisitions#full)

100. Whitehead, Richard. "Dubai Hydroponics Investor Launches Global Food Security Fund." Food Navigator Asia, 16 May 2017, [www.foodnavigator-asia.com/Business/Dubai-hydroponics-investor-launches-global-food-security-fund](http://www.foodnavigator-asia.com/Business/Dubai-hydroponics-investor-launches-global-food-security-fund).

101. Bailey, Rob, and Robin Willoughby. Edible Oil: Food Security in the Gulf. BP ed., ERR, Chatham House, 2013, [www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy%20Environment%20and%20Development/bp1113edibleoil.pdf](http://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy%20Environment%20and%20Development/bp1113edibleoil.pdf).

## G. Subsidization Policy

In order to ensure affordability, the UAE heavily subsidizes food. Due to the heavy investment required to ensure food supply, food in the UAE would be completely unaffordable if market interventions were not employed. This policy has been effective at achieving its purpose, but it does not increase the resilience and sustainability of the food system.

Food subsidies have been characterized as inefficient by some economists. Economists have stressed that the deregulation of petroleum prices would help channel capital away from subsidies and towards productive investments, and spending on infrastructure, healthcare, and education. This move would boost economic growth and stimulate foreign direct investment<sup>102</sup>. Farming in the country is also highly subsidized. The ADFSC offers farmers a 'Minimum Price Guarantee (MPG)' to protect them from market price fluctuations. The center only takes commissions when market prices are higher than the MPG<sup>103</sup>. This means the industry would all but collapse if government support was removed.

Mainly, the capital wealth of the UAE mitigates price risks. Government measures like subsidy spending and food price control insulated consumers from global price shocks by fixed pricing of staple foods. Biofuel policies only exacerbate the situation as long term food security is tied to oil prices. On the long term scale, the ability of the country to manage price risks will rely on effective economic diversification<sup>104</sup>.

## H. Stockpiling

Stockpiling of food is a policy that aims to ensure stability and availability of food in the market. In the UAE, this policy is implemented through various government strategies, and PPPs. This is implemented first and foremost through the work of government institutions. The UAE has established the Abu Dhabi Food Security Center which is tasked with developing strategies and emergency plans, managing emergency reserves and building up stocks of main commodities<sup>105</sup>.

There have been various efforts to maintain stockpiles but none are at the level required to meet crisis situation shortages. The UAE maintains a six month supply of barley, rice, wheat and around four months of corn stocks<sup>106</sup>. In 2016, a storage terminal called Etihad Mills opened in the Fujairah Free Zone to support food security efforts. It holds strategic supplies of wheat, rice, and corn and is still in the testing phase<sup>107</sup>.

---

102. Haider, Haseeb. "Subsidy Reforms to Spur Development in UAE." Khaleej Times, 22 Jul. 2015, [www.khaleejtimes.com/business/energy/subsidy-reforms-to-spur-development-in-uae](http://www.khaleejtimes.com/business/energy/subsidy-reforms-to-spur-development-in-uae).

103. Wam. "Abu Dhabi Farmers to Harvest 31,050 Tonnes of Produce." Khaleej Times, 14 Jul. 2015, [www.khaleejtimes.com/nation/general/abu-dhabi-farmers-to-harvest-31050-tonnes-of-produce](http://www.khaleejtimes.com/nation/general/abu-dhabi-farmers-to-harvest-31050-tonnes-of-produce)

104. Bailey, Rob, and Robin Willoughby. Edible Oil: Food Security in the Gulf. BP ed., ERR, Chatham House, 2013, [www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy%20Environment%20and%20Development/bp1113edibleoil.pdf](http://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy%20Environment%20and%20Development/bp1113edibleoil.pdf).

105. Bailey, Rob. "Food Security Issue for GCC Is Linked to Supply, Not Prices". The National, The National, 11 Nov. 2011, [www.thenational.ae/thenationalconversation/comment/food-security-issue-for-gcc-is-linked-to-supply-not-prices](http://www.thenational.ae/thenationalconversation/comment/food-security-issue-for-gcc-is-linked-to-supply-not-prices).

106. Zghoul, Fayrouz. 2017 Grain and Feed in the United Arab Emirates (UAE). vol. 8, UAE, USDA Foreign Agriculture Service, GAIN, 2017, [gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual\\_Dubai\\_United%20Arab%20Emirates\\_4-24-2017.pdf](http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual_Dubai_United%20Arab%20Emirates_4-24-2017.pdf)

107. Zghoul, Fayrouz. 2017 Grain and Feed in the United Arab Emirates (UAE). vol. 8, UAE, USDA Foreign Agriculture Service, GAIN, 2017, [gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual\\_Dubai\\_United%20Arab%20Emirates\\_4-24-2017.pdf](http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual_Dubai_United%20Arab%20Emirates_4-24-2017.pdf)

As discussed previously, stockpiling does not improve sustainability of food supply overall, but it can effectively address short term supply risks and price fluctuations. In general, however, the UAE's harsh climate makes the requirements for sustaining storage facilities too great to be sustainable as a long term strategy. The resources required to cool such facilities and maintain optimum storage conditions is unfeasible. Stockpiling requires effective management and storage infrastructure, both of which are costly and resource intensive and will add to the cost of food supplies. Accepting this strategy as a contingency plan required for maintaining prices and emergency supplies is possible on a short term basis. Yet, it does not present a solution to solving critical structural issues and aiding in long term food security plans.

## I. Strategies to Combat Food Loss

Addressing food loss is a key part of improving efficiency and sustainability of a food system. It improves food security by ensuring that resources are effectively managed, and available food is appropriately utilized. Addressing food loss would make the food system of the UAE more efficient and sustainable. It would also increase access and availability of products. Despite having a high rate of food waste, the UAE does not have an overall strategy to address food loss despite the fact that the government has made some efforts to address the issue although they remain limited in scale or impact.

In 2013, the UAE had one of the highest rates of food waste globally, with 19% of landfill rubbish comprised of discarded food. In 2016, it was reported that it wastes around \$4 billion worth of food every year<sup>108</sup>. The UAE government has attempted to reduce its rate of food loss, particularly within the hospitality and tourism sector, and this work has been a core part of its collaboration with FAO. As such, the government has set a goal of recycling 75% of food waste by 2021<sup>109</sup>.

The current approach has been ineffective at addressing food loss at any point in the supply chain. Improvements would require significant investment in research, infrastructure, and a whole sale remodeling of several industries to improve efficiency. The hospitality industry, in particular, is a major food waste source, and challenging existing operational models will be difficult and disruptive to a key industry. The government has also not put enough effort into systematically studying and addressing food loss, and with rising temperatures, production, storage, supply and distribution of food will only become more challenging.

At the minimum level, more needs to be done to raise awareness of food loss and recycling in all sectors of society. Much more could be done in terms of food loss, from composting, recycling. The government could also capitalize effectively on the existing strong infrastructure and growth of the green sector and it can do more to empower society and the private sector to innovate in this area.

---

108. Baldwin, Derek. "Food Worth \$4b Going to UAE Landfill." GulfNews, GulfNews, 23 Aug. 2016, [www.gulfnews.com/news/uae/environment/food-worth-4b-going-to-uae-landfill-1.1883853](http://www.gulfnews.com/news/uae/environment/food-worth-4b-going-to-uae-landfill-1.1883853)

109. Malek, Caline. "Sustainable Farming Ideas Spread across UAE." The National, The National, 21 Aug. 2013, [www.thenational.ae/uae/sustainable-farming-ideas-spread-across-uae-1.471460](http://www.thenational.ae/uae/sustainable-farming-ideas-spread-across-uae-1.471460).

## Conclusion

To improve its food security, the UAE has employed strategies focusing on domestic production, high tech agriculture policies, research and development policies, import policies, foreign investment strategies, subsidization policies, stockpiling strategies, and food loss strategies, among others. These strategies contributed to addressing issues of food security self-sufficiency, trade, resilience, and sustainability in various degrees. Although the UAE is categorized as food secure, more needs to be done to improve food security in light of changing climates, resource depletion, and regional instability.

The UAE has employed policies that have proven successful, such as its food import policy. This policy, in particular, can be described as mature and complex and capitalizes on the UAE's pre-existing strengths. However, other policies have not been as successful due to the absence of holistic strategic goals that involve all major stakeholders. The mammoth climate challenges that the UAE faces makes finding solutions to food security challenges particularly difficult. Food policies in the UAE need to be long term and done in collaboration with all relevant stakeholders in the public and private sectors and in conjunction with environmental and green initiatives. Current policies have not yet been effective at overcoming the core challenges facing the UAE nor have they maximized its strengths. Many of the policies would be unfeasible if climate change and resource scarcity continue to have negative impacts on the country. Global economic crises that might impact the UAE's economy and ability to spend at these unsustainable levels would bring an end to nearly every strategy.

In response, the UAE has made attempts to diversify its economy away from fossil fuels and towards innovation sectors of the future. Vigorous investments in its infrastructural advancements, in new technologies and innovations are critical. These strategies must be intrinsically linked to its food security policy. Additionally, heavy investment in, and enabling of, research and development initiatives is the cornerstone of an effective food security for the UAE. The core challenges facing the country have not been effectively resolved, only mitigated in the short term. Without research and development, the UAE's food security strategies will lack real resilience and sustainability.

The UAE's efforts in developing a focused and overarching food security strategy have been inadequate. Without clear strategic goals underpinning policies, all plans will have limited long term impact. The UAE should outline a focused strategic goal from which all policies, tools, and implementation mechanisms will flow. This will improve efficiency, productivity, sustainability and effectiveness of food security strategies by maximizing return on investment. A holistic, adaptable, and inclusionary strategy involving all stakeholders must be developed and implemented. This holistic strategy will focus heavily on cooperation with the private sector and industry, and on collaboration with research institutions.

# Policy Recommendations

## Short Term (quick-wins)

- The UAE would benefit from launching a large scale national food-waste awareness campaign that details the degree to which the UAE suffers from food loss due to waste. This campaign should be deployed in schools and universities, government offices, and public spaces. The campaign can also encourage the public to come up with creative solutions to reduce food waste in their homes, schools and organizations.
- Developing a substantial scholarships for Emirati students at leading agricultural research institutes around the world would be highly beneficial. This will ensure that the UAE is investing in, and developing, a workforce able to aid in its research and development efforts and import expertise and knowledge from abroad.
- To increase the amount of information available on the UAE's food system, it is important to ramp up efforts to collect data and to make it transparent and available to researchers and entrepreneurs looking to improve efficiency and address challenges. The UAE can utilize existing Big Data and Internet of Things technology to collect data relating to the UAE's food system. For example, this kind of initiative can help to discover the UAE's major food-waste sources, food consumption patterns, and inefficiencies in the supply chain. This initiative can be easily integrated into Dubai and Abu Dhabi's Smart City strategies.
- More needs to be done to bolster the resilience, efficiency, and range of the agricultural sector through targeted investments. PPPs increase competitiveness of the agro sector by making it less reliant on government support. The government could play a facilitating role, allowing the private sector to enhance diversification, commercialization, and efficiency<sup>110</sup>.
- The UAE can allocate funds and infrastructure resources specifically for local universities to incentivize researchers to mobilize resources toward food security research. Major food and agro laboratories would also attract international talent and investment to the country and facilitate international research collaboration.

## Medium Term

- The UAE must develop a holistic and targeted food security strategy that outlines specific goals for each point in the supply chain and engages all relevant stakeholders. Engaging all stakeholders will ensure that the strategies and initiatives of individual organizations are aligned with the UAE's

---

110. Al Shariqi, Rashid Mohamed. "UAE's Farming Reforms." Khaleej Times, 22 Feb. 2012, [www.khaleejtimes.com/editorials-columns/uae-s-farming-reforms](http://www.khaleejtimes.com/editorials-columns/uae-s-farming-reforms).

overall food security strategy, and that their experience and knowledge are well utilized. Engaging the private and academic sectors will encourage private sector organizations to invest in the technology and projects that will be most useful for achieving national goals. This strategy should then be made public and available to researchers and entrepreneurs. The public too should be engaged in the strategy whereby they are identified as a key partner responsible for sustainable food consumption and waste management on the individual and household level. This will make clear that food security is the result of well-coordinated actions initiated across multiple levels from government organizations to the private sector to the community.

- To generate meaningful research, there must be sustained and strategic support for research centers. Government partnerships with universities, the private sector, and the industry will be most productive when applied towards strategic and focused long term national strategies. The UAE needs to continue to incentivize research into increasing productivity of this limited sector, particularly through the use of new technologies. This would capitalize on the growing innovation and tech sectors to help achieve these goals. This must be done in conjunction with strengthening the UAE's Intellectual Property laws and regulations.
- Significant resources must be invested in educating and training youth and professionals in the STEM fields and research methods most relevant to these developing sectors. Reliance on foreign human capital and expertise is unsustainable and ineffective. Local knowledge can be utilized effectively if combined with well-developed skills, leading to holistic strategies and approaches to solving the UAE's pressing challenges. This can be done by incentivizing young people to enter green technology and agro fields in the university, providing scholarships, and emphasizing the importance of these sectors for the survival and future of the UAE. Other initiatives can include partnering with current agro tech companies to develop rigorous training and internship programs in which students and young professionals may learn about the sector and acquire fundamental skills.
- The UAE should invest in the development of an agricultural innovation sector that will become a global knowledge hub, in the vein of Silicon Valley. This will give the UAE a competitive economic advantage. By offering capital, awards, and research facilities the government can achieve maximum impact in a limited time frame. The UAE is already poised to take advantage of this momentum due to its ongoing investments in budding disruptive technologies. A largescale strategy would be more effective.
- In conjunction with these strategies, it is important to provide training for farmers in high tech agriculture and methods. Involving farmers in the research process yields more effective results and will increase buy-in and adoption of high tech agro. Farmers should also be made aware of their role in increasing food security and the importance of their contributions to the country's future.

## Long Term

- The UAE's food security strategy should identify key staple foods that will have priority in terms of



resource and technology allocation. By focusing food production strategies on a few staple foods, the UAE can maximize productivity, and sustainability of the agricultural sector. By focusing on 3-5 foods that are culturally acceptable, cheap, nutritious, and easily produced in the country, the UAE could maximize returns on investment and improve efficiency of the sector. This would move precious resources away from the non-essential agro goods currently offered, and invest them in staple foods that can sustain the country. Research needs to be done to identify the key foods that will be resilient, sufficient and efficient to produce. These foods could be quinoa, potatoes, and fish, for example. All three of these foods are locally available, locally sustainable, and could form the bedrock of a holistic food security strategy. By redirecting existing operations and mechanisms, like farm subsidies, towards this goal, the UAE government can incentivize their production. This process requires resources and effort to produce research on how to cultivate these crops, including how to overcome limitations with seed strains, and structural challenges. Existing farm operations would have to be modernized and advanced, and farmers would have to undergo significant training and skills' advancement.

- To improve productivity of the sector the UAE government must continue to provide incentives to research in high tech and alternative agriculture, with a particular focus on the staple foods that are strategically chosen. The government can do this by enhancing public private partnerships and encouraging the private sector to conduct continuous research in this area. By subsidizing research and offering the UAE as a laboratory for proprietary technology, the country can benefit directly from the results. The local population must be trained to become experts in this area, achieving the country's strategic vision for Emiratization and STEM development. The UAE can become the leading knowledge hub in this sector, a strategy that effectively addresses its challenges and channels them into a long term opportunity.
- The UAE's import diversification strategy is already very strong but can be strengthened by employing PPPs more effectively. The government can prioritize PPPs and work closely with retailers and industry leaders to increase source countries for all foods. This can be implemented through sourcing trips, industry meetings and collaboration, and mutually advantageous business development.
- A critical approach would be to strengthen regional cooperation and build on comparative advantages. Support for regional agriculture can help improve the resilience of the UAE's supply, by ensuring low cost high quality produce. The UAE can identify regional partners with hospitable climates, and stable political and economic systems and who are interested in increasing their agriculture production. With sustainable planning and knowledge and resource sharing this could be a good model. Investing in alternative port and railway infrastructures would ease political risks in the region. Yet this would be particularly effective if it focused on creating a regional model for import and trade. A good example of this is China's belt and road initiative which aims to enhance trade with its strategic partners along the route boosting economic growth and trade<sup>111</sup>.

---

111. Darby, Megan. "China's Xi Promises Green 'Belt and Road' Investment Strategy." Climate Home - Climate Change News, Climate Home, 15 May 2017, [www.climatechangenews.com/2017/05/15/chinas-xi-promises-green-belt-road-investment-strategy/](http://www.climatechangenews.com/2017/05/15/chinas-xi-promises-green-belt-road-investment-strategy/).

## References

A Case Study of Singapore's Smart Governance of Food. Center for Livable Cities Singapore, 2015, [www.clc.gov.sg/documents/books/smart\\_food\\_governance\\_paper-sg\\_case\\_study\\_final\\_sept%2028\\_3.pdf](http://www.clc.gov.sg/documents/books/smart_food_governance_paper-sg_case_study_final_sept%2028_3.pdf).

Bailey, Rob, and Robin Willoughby. Edible Oil: Food Security in the Gulf. BP ed., ERR, Chatham House, 2013, [www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy%2C%20Environment%20and%20Development/bp1113edibleoil.pdf](http://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy%2C%20Environment%20and%20Development/bp1113edibleoil.pdf).

Caballero-Anthony, Mely, et al. Public Stockpiling and Food Security. RSIS, 2015, NTS Center, [www.rsis.edu.sg/wp-content/uploads/2015/06/PB150603\\_Public-Stockpiling.pdf](http://www.rsis.edu.sg/wp-content/uploads/2015/06/PB150603_Public-Stockpiling.pdf).

Flaten, Dr. Ola, and Dr. Shuji Hisano. "Security Policy in a Food Importing Country: The Case of Norway." ResearchGate, Jan. 2001, [researchgate.net/publication/228462163\\_Food\\_Security\\_Policy\\_in\\_a\\_Food\\_Importing\\_Country\\_The\\_Case\\_of\\_Norway](https://www.researchgate.net/publication/228462163_Food_Security_Policy_in_a_Food_Importing_Country_The_Case_of_Norway).

"Food". AVA, Agri-Food and Veterinary Authority of Singapore, 20 June 2017, [www.ava.gov.sg/explore-by-sections/food](http://www.ava.gov.sg/explore-by-sections/food).

Food Security. Food and Agriculture Organization of the United Nations, 2006, Food Security, [www.fao.org/forestry/13128-0e6f36f27e0091055bec28ebe830f46b3.pdf](http://www.fao.org/forestry/13128-0e6f36f27e0091055bec28ebe830f46b3.pdf).

Hanssen, Ole Jørgen, and Silvia Gaiani. Norway – Country Report on National Food Waste Policy. EU Fusions, [www.eu-fusions.org/phocadownload/country-report/NORWAY%2023.02.16.pdf](http://www.eu-fusions.org/phocadownload/country-report/NORWAY%2023.02.16.pdf).

Import from Developing Countries. Norwegian Ministry of Foreign Affairs, 2010, [www.regjeringen.no/globalassets/upload/UD/Vedlegg/Handelspolitikk/121029\\_Import\\_from\\_developing\\_countries\\_WEB\\_v2.pdf](http://www.regjeringen.no/globalassets/upload/UD/Vedlegg/Handelspolitikk/121029_Import_from_developing_countries_WEB_v2.pdf).

Magnan, Nicholas, and Marc Sadler. Grain Import Dependency in the MENA Region: Risk Management Options. International Food Policy Research Institute, World Bank, 2011, [www.agriskmanagementforum.org/doc/grain-import-dependency-mena-region-risk-management-options](http://www.agriskmanagementforum.org/doc/grain-import-dependency-mena-region-risk-management-options).

Power, Lauren. "Scarcity and Abundance: UAE Food and Water Security", Future Directions, November 25, 2014. <http://www.futuredirections.org.au/publication/scarcity-and-abundance-uae-food-and-water-security/>



Singapore's Food Security. AVA, [www.agrifood.net/images/cfs43/CFS43%20Side-event%20background%20document%20-%20Lessons%20from%20Singapore.pdf](http://www.agrifood.net/images/cfs43/CFS43%20Side-event%20background%20document%20-%20Lessons%20from%20Singapore.pdf).

Teng, Paul, and Margarita Escaler. "The Case for Urban Food Security: A Singapore Perspective." NTS Perspectives Is. No.4, (31 Dec. 2010). RSIS. Web.

Trade Reforms and Food Security: Conceptualizing The Linkages. Food and Agriculture Organization of the United Nations, 2003, <ftp://ftp.fao.org/docrep/fao/005/y4671e/y4671e00.pdf>

Trauger, Amy. Food Sovereignty in International Context: Discourse, Politics and Practice of Place. Routledge, 2015.

"The Global Food Security Index." Food Security Index, Economist Intelligence Unit, 2017, [foodsecurityindex.eiu.com/](http://foodsecurityindex.eiu.com/).

"What Is Food Security?" WFP, United Nations World Food Programme, [www.wfp.org/node/359289](http://www.wfp.org/node/359289).

## Authors and Citation

This Working Paper was Authored by:

**Tara Fischbach**

Associate Researcher,

Mohammed Bin Rashid School of Government, Dubai, United Arab Emirates.

The views expressed in this report are those of the author and do not necessarily reflect those of the trustees, officers and other staff of the Mohammed Bin Rashid School of Government (MBRSG) and its associated entities and initiatives.

## Acknowledgements

The author wishes to express personal appreciation to the following individuals for their input to the different stages of producing this paper and for providing essential input and assistance into the report and its related materials:

**H.E. Mariam Saeed Hareb Al Muhairi, the Minister of State for Future Food Security**

Sarah El Shaer

Engy Osman

Ghaith Yagan

# Copyright Information

Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License

Readers are free to copy, re-distribute, transmit and adapt the work, on the following conditions: You must attribute ownership of the work to the Mohammed Bin Rashid School of Government; you must not use the work for commercial purposes; and, if you share, alter, transform or build upon the work, you must distribute the resulting work only under the same or similar conditions. These conditions may be waived if you obtain written permission from the Mohammed Bin Rashid School of Government. Where the work or any of its elements is in the public domain under applicable law, that status is in no way affected by the license. For further copyright information, please visit the website: [www.mbrsg.ac.ae](http://www.mbrsg.ac.ae) or contact the author.



# The Mohammed Bin Rashid School of Government



كلية محمد بن راشد  
للإدارة الحكومية  
MOHAMMED BIN RASHID  
SCHOOL OF GOVERNMENT

The Mohammed Bin Rashid School of Government (formerly Dubai School of Government) is a research and teaching institution focusing on public policy in the Arab world. Established in 2005 under the patronage of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the United Arab Emirates and Ruler of Dubai, in cooperation with the Harvard Kennedy School, MBRSG aims to promote good governance through enhancing the region's capacity for effective public policy.

Toward this goal, the Mohammed Bin Rashid School of Government also collaborates with regional and global institutions in delivering its research and training programs. In addition, the School organizes policy forums and international conferences to facilitate the exchange of ideas and promote critical debate on public policy in the Arab world. The School is committed to the creation of knowledge, the dissemination of best practice and the training of policy makers in the Arab world. To achieve this mission, the School is developing strong capabilities to support research and teaching programs, including:

- Applied research in public policy and management;
- Master's degrees in public policy and public administration;
- Executive education for senior officials and executives; and,
- Knowledge forums for scholars and policy makers.

## The Sustainable development research group at the MBRSG

The Sustainable development research group at the Mohammed bin Rashid School of Government (MBRSG) produces interdisciplinary research area focusing on sustainable development in all of its facets – economic, social and environmental, while paying special attention to the impact of market, policy and institutional actions on each of these spheres. Within economics, sustainable economic policies are explored, especially within the context of the oil-rich GCC and the impact of these policies on economic growth and equality as well as on the environment. Issues related to social sustainability and environmental sustainability are examined within the global context of environmental treaties and development goals and the local context of energy, infrastructure and climate regulations and policies. Finally, social sustainability is explored through the lens of development and long term social stability including equal and broad infrastructure and social development.







كلية محمد بن راشد  
للإدارة الحكومية  
MOHAMMED BIN RASHID  
SCHOOL OF GOVERNMENT

**Mohammed Bin Rashid School of Government**  
Convention Tower, Level 13, P.O. Box 72229, Dubai, UAE  
Tel: +971 4 329 3290 - Fax: +971 4 329 3291  
www.mbrsg.ae - info@mbrsg.ae

