

# Food Security in the Gulf Cooperation Council Countries: Challenges and Prospects

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**Abstract** Food insecurity concerns are as old as humanity. Food security exists when all population, at all times, has access to sufficient, safe and nutritious food. It is built on four pillars, namely food availability, food access, food utilisation, and stability. While it is widely admitted that food security increases with economic development, also rich countries in the Near East and North Africa (NENA) region, such as the Gulf Cooperation Council (GCC) countries, face specific challenges. Therefore, this review paper analyses the state, determinants and perspectives of food security in GCC region. Historically, food security was not an issue for the GCC states. In fact, GCC states are capital rich and have no foreign exchange limitation for food import. Consequently, due to their robust fiscal position resulting in high buying power, these countries, have been less vulnerable to price risk than other food importers; and able to bridge the shortfall in domestic production. As a result, in 2018, the six GCC members have been ranked as the most food secure in the Arab world and among the most food secure countries in the world. However, in the wake of the 2007–2008 global food crisis, food security became an ongoing challenge. The crisis exposed the high dependence of GCC countries on imports, limits of import-based food policies and the need to increase the local production. However, agriculture is limited by several natural conditions, such as scarce water resources and poor soils, and aquifers have been heavily exploited above the average natural recharge. Further, potentially, more critical to GCC food security is availability risk, which arises when an import-dependent country is not able to obtain food, even if it has sufficient funds to purchase it. The paper makes the case for promoting a productive and sustainable agriculture, with high resources use efficiency, to increase food security in the GCC.

**Keywords:** food security, water security, food self-sufficiency, sustainable agriculture, GCC

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## 1. Introduction

The great challenge for the coming decades will be the task of increasing food production to ensure food security for a world population of 7.6 billion people, and expected to be 9 billion by 2050. Achieving a world without hunger and malnutrition is one of the aims of the 2030 Agenda for Sustainable Development. In fact, ensuring access to safe, nutritious and sufficient food for all (Target 2.1) and eliminating all forms of malnutrition (Target 2.2) are prominent targets of the second Sustainable Development Goal (SDG) of the 2030 Agenda (i.e. End hunger, achieve food security and improved nutrition and promote sustainable agriculture). Moreover, the achievement of SDG2 depends on and contributes to the attainment of many other goals of the 2030 Agenda and sustainable development as a whole [2].

Food security concept has evolved and been expanded over recent decades [3-8] with a change of focus from increasing food production to improving food access.

Indeed, it is increasingly recognised that attaining food security is more complicated than just producing more food, as the fundamental issue concerns access to nutritious and safe food [9-13]. The 1996 World Food Summit definition of food security is still widely used [14]. It was officially reaffirmed in the 2009 Declaration of the World Summit on Food Security [15,16], with the addition of social access to food: “Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” [15]. Food security is built on four pillars [4,17,18,19]: *food availability* (i.e. sufficient quantities of food available on a consistent basis); *food access* (i.e. having sufficient resources to obtain appropriate and nutritious foods); *food use/utilisation* (i.e. appropriate food use based on knowledge of basic nutrition and care); and *stability* in food availability, access and utilization [20].

A recent report on the *State of Food Security and Nutrition in the World* [2] shows that the number of undernourished people has been growing and was

estimated to nearly 821 million in 2017 (17 million more than in 2016), so around one out of every nine people in the world. The situation is worsening in South America and most of Africa. Conflicts and climate change are among the key drivers behind the recent uptick in global hunger. Indeed, climate change threatens to erode and reverse gains made in ending hunger and malnutrition. Moreover, food insecurity contributes to overweight and obesity and the three burdens of malnutrition (undernutrition, overweight/obesity and micronutrient deficiencies) coexist in many countries.

Food insecurity and malnutrition are still relevant issues in the Near East and North Africa (NENA) region [21]. In their discussion paper on “Food Security and Economic Development in the Middle East and North Africa”, Breisinger et al. [22] put that “...the region’s longstanding challenges persist; yet taking immediate action is more urgent in light of the recent, global food, fuel, and financial crisis and projected severe impacts of climate change”. While it is widely admitted that food insecurity decreases with economic development, also rich countries in the region such as the Gulf Cooperation Council – GCC – countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates - UAE) face specific challenges for achieving long-term, sustainable food security. Therefore, the present review paper analyses the state, determinants and perspectives of food security in GCC not only in a changing climate but also unstable global geopolitical context.

The Gulf Cooperation Council (GCC) is a group of six Arab Middle East countries bordering the Gulf, covering an area of 2,672,700 sq.km and with a total population of approximately 56.65 million and combined GDP of US\$1.537trn in 2018. Enormous hydrocarbons reserves (30% of the proven oil reserves and 22.2% of the proven natural gas reserves of the world) compared with a modest national populations, have made the region one of the wealthiest in the world. Oil, natural gas revenues and petrochemical industries still form the main part of the national income and government revenues in GCC countries. GCC countries face numerous environmental challenges and will have to reconcile the many conflicting priorities from economic diversification, water scarcity, food security, desertification, environmental protection, and conservation to the impacts of climate change [23].

This paper is based mainly on secondary data from written documents, governmental reports, websites, newspapers articles, and reports from different sources such as the FAO; UNEP; United Nations System High Level Task Force on Global Food Security (UN-HLTF); IFAD; OECD, WFP; associated with a review of peer-reviewed scientific literature dealing with food production, food security and agricultural production in the GCC countries.

## 2. Food Security in GCC: A Critical Political Issue

Historically, food security was not an issue for the GCC states. In fact, GCC states are capital rich and have no foreign exchange limitation for food import [24]. Consequently, due to their robust fiscal position resulting in high buying power, these countries, have been less

vulnerable to price risk (i.e., the risk that food is available for import but the importing country may not be able to afford to purchase a sufficient amount for its residents) than other food importers; and able to bridge the shortfall in domestic production [25]. As a result, in 2018, the six GCC members have been ranked as the most food secure in the Arab world and among the most food secure countries in the world in the Global Food Security Index [26]<sup>1</sup> (Table 1).

**Table 1. Ranking of the GCC countries in the Global Food security Index, 2018**

Country	Global Rank	Rank in the Arab world
Qatar	22	1
Kuwait	28	2
Oman	29	3
UAE	31	4
Saudi Arabia	32	5
Bahrain	41	6

Source: The Economist Intelligence Unit [26].

However, GCC countries are food secure but not food self-sufficient. It is therefore clear that food security “does not equal self-sufficiency” [22]. Despite their wealth and affluence, these countries lack control over their food sources and are highly dependent on imports—thus lack food sovereignty [27].

In fact, in the wake of the 2007–2008 global food crisis, food security became an ongoing challenge. Food security assumes particular political significance in the GCC for numerous reasons [28]. As highlighted by Lippman [29] “no product or commodity carries the immediacy or political sensitivity of food”. Since the GCC countries rely heavily on food imports, which make them vulnerable to price and supply shocks, the stability and the availability dimensions of food security are critical issues. Three elements contribute to food availability: domestic food production, distribution, and food import [30]. Assessing food availability determines food security. This assessment is particularly important for GCC countries, which are highly dependent on food imports. Nevertheless, a country that has low self-sufficiency and is highly dependent on food imports can still be food secure as long as it is able to finance its food imports [27]. The 2007–2008 global food crisis has exposed the high dependence of GCC states on imports and the lack of clear food security policies. The food crisis of 2007–2008 raised awareness of the supply and price risks associated with a dependence on the world market [31].

As a matter of fact, the 2007–2008 food price crisis had acted as a wake-up call for the GCC countries regarding their vulnerability to food price and it will continue to have an impact over the next decade. During the 2007–08 global food price crisis over 30 countries imposed export restrictions like Argentina, Russia, India, and Vietnam [28]. This had an immense psychological impact. “Gulf countries now face the specter that someday they might

<sup>1</sup> The Global Food Security Index considers the core issues of affordability, availability, and quality across a set of 113 countries.

not be able to secure enough food imports at any price even if their pockets are lined with petrodollars. This has reinforced the impression that food security is too important to be left to markets.” [32]. The region as a whole lacks adequate control over, and access to, its food sources and this dependency on external supply channels has been locally articulated as a lack of food sovereignty [27]. The perception of Gulf countries is that their food security is threatened [32]. Further, the main consequence of the 2007–2008 global food crisis is inflation. The increase in food prices after the 2007–2008 global food crisis has put significant inflationary pressure on the GCC economies with consumer prices reaching double digits during 2008–09 [33]. Food price rises in the GCC thus contribute significantly to overall inflation. As a result of the food crisis, the GCC have witnessed an accelerated inflation rates for three years (2005–2007). About one third of GCC inflation during this period is imported due to high food prices [34]. This inflation threatens the political stability of the region. In fact, food inflation can be the source of significant social unrest, as it hits lower income groups especially hard because they have to spend a relatively high share of their disposable income on food [35]. Record-high world food prices triggered protest and violent rioting in 48 countries in 2007/08 [36]. Riots of this sort have not been reported in the Gulf, but there has been criticism [37]. In addition, access to affordable food is an important part of the social contract in the GCC countries [32]. Higher prices could lead to a greater demand for a say in politics if the government should fail to mitigate the impact of food price inflation [35]. For example, in a rare sign of political opposition, in 2007, a group of Saudi Arabia Muslim clerics has issued a rare warning to the ruling government that it must take action to curb rising inflation and warned that inflation could “have a negative impact on all levels, causing theft, cheating, armed robbery and resentment between rich and poor.”<sup>2</sup> In fact, GCC populations are not uniformly wealthy: the poorest 10 per cent or so may spend 30–50 per cent of their income on food – a rate more typical of a developing country [37]. Reports indicate around 20 per cent of the population in Saudi Arabia live on less than \$12,000 a year [38]. Price risk constitutes a major threat to the food security of these households, especially in smaller Gulf States such as Qatar and Kuwait, where the blue collar expatriate workforce forms a majority of the population and this could develop into a serious issue [35].

In the future, growing population, rising income levels and change in consumption habits result in continuing growth in consumption levels in the GCC countries. Per capita consumption in the region is low compared to that in developed economies and is expected to increase at a relatively higher rate [33]. In 2018, the total population of the GCC region was 56.65 million from 41.7 million in 2010 and 25.8 million in 2005 and is likely to increase further in future. Meanwhile, GCC food import demand is forecast to hit \$53.1 billion by 2020, up from US\$28.4 billion in 2011 (Table 2) [39].

Table 2. GCC food import (USD billion)

	2011	2015	2020 (estimate)
<b>Bahrain</b>	0.8	1.1	1.6
<b>Kuwait</b>	2.5	3.6	5.3
<b>Oman</b>	2.1	3.3	4.8
<b>Qatar</b>	1.3	2.1	3.3
<b>Saudi Arabia</b>	17.9	24.5	35.2
<b>UAE</b>	3.8	5.5	8.4
<b>GCC Total</b>	<b>28.4</b>	<b>36.4</b>	<b>53.1</b>

Source: The Economist Intelligence Unit [39].

### 3. Food Production in GCC: Limiting Natural Factors

Historically, food production was limited and based mostly on fishing, Bedouin animal husbandry, date farming and small-scale vegetable production. Since the GCC are located in one of the world’s most arid regions, where the climate is classified as a hot desert climate (BWh) under the Köppen climate classification [40], domestic food production has been constrained by unfavorable agro-ecological conditions, such as scarce water resources, high temperatures and poor soils.

Actually, only 19.5% of the total land area of the GCC region, is agricultural land<sup>3</sup> (cropland and pastures), while only 1% is arable (cropland) (Table 3) [41], which is much lower than the global average of 10.6%<sup>4</sup> and lower than some countries: 16.6% in the USA, 24.9 % in the United Kingdom, 12.7% in China and 52.6% in India. Furthermore, with progressive salinization and desertification processes in the entire GCC region, the amount of arable land is projected to decrease even further [42].

Table 3. Indicators of land and water resources in the GCC

	Agricultural land, % of total land area (2014)	Arable land, % of total land area (2016)	Renewable internal freshwater resources (billion m <sup>3</sup> )	Annual freshwater withdrawals (billion m <sup>3</sup> )
<b>Bahrain</b>	11	2.1	0.0040	0.3574
<b>Kuwait</b>	9	0.4	0.0	0.9
<b>Oman</b>	5	0.2	1.40	1.32
<b>Qatar</b>	6	1.2	0.06	0.44
<b>Saudi Arabia</b>	81	1.6	2	24
<b>UAE</b>	5	0.6	0.15	4.00
<b>GCC average</b>	<b>19.5</b>	<b>1%</b>		

Source: OECD and FAO [41].

<sup>3</sup> Agricultural land refers to the share of land area that is arable, under permanent crops, and under permanent pastures. Land under permanent crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest. Arable land refers to land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow.

<sup>4</sup> <http://www.fao.org/faoterm/viewentry/en/?entryId=162552>.

<sup>5</sup> <https://data.worldbank.org/indicator/AG.LND.ARBL.ZS>

<sup>2</sup> <https://www.telegraph.co.uk/finance/economics/2821312/Clerics-tell-Saudi-rulers-to-curb-inflation.html>

In addition, the majority of soils in the GCC countries are fragile, sandy, poorly developed; and low in organic matter and water retention capacity [43,44,45] (Box 1), and over 95 per cent of land on the Arabian peninsula is subject to some form of desertification [28].

#### Box 1. Soil types in Kuwait

Soils in Kuwait are sandy and poorly developed, low in organic matter and water retention capacity, high level of salts and poor soil forming reaction. Aridisols (70.8 %) and Entisols (29.2 %) are the main soil orders of Kuwait [43]. The top horizon of the soil has sandy or sandy loam texture since these soils are developed mostly from whitish calcareous sandstones or gravelly sand that is cemented with lime. A hard pan layer locally known as “gatch” is found at various depths, which restricts root penetration and deep-water percolation leading to the formation of local water tables. Filtration rate of the desert soil is normally very high ranging from 15 to 100 cm h<sup>-1</sup> [44,45].

However, the main issue regarding agriculture in the GCC is water. Food and water are inextricably linked [46]. Water security is often framed as a component or subset of food security [47,48,49]. Due to the hot climate, coupled with low rainfall and high evaporation rates<sup>5</sup> (greater than 3,000 mm/year), water is an extremely scarce resource in the GCC. Further, surface water is almost nonexistent [40]. The GCC region is the poorest region in the world in water resources, in absolute and per capita terms, mainly caused by the region’s arid climate and the high population growth [50]. With regards to rainfall, in 2014, all of the GCC countries were listed among the 15 countries receiving the least amount of rainfall globally [21]. In fact, the GCC have one of the lowest per capita freshwater availability in the world<sup>6</sup>, estimated in 2017, at 82.55 m<sup>3</sup> compared to a world average of about 6,500 m<sup>3</sup>. All the GCC countries are considered in absolute water scarcity situation, defined as less than 500 m<sup>3</sup> per capita per annum of renewable water resources (Table 4)<sup>7</sup>.

**Table 4. Total Renewable Water Resources per Capita in GCC Countries in 2017**

	2007	2012	2017
<b>Bahrain</b>	112	89.23	77.7
<b>Kuwait</b>	7.99	5.889	4.83
<b>Oman</b>	525.7	404	302
<b>Qatar</b>	48.74	27.49	21.98
<b>Saudi Arabia</b>	95.04	82.51	72.86
<b>UAE</b>	24.82	16.85	15.96

Source: Aquastat<sup>8</sup>.

5 In the GCC, the annual precipitation (P) is less than two thirds of the potential evapotranspiration-PET (evaporation from soil plus transpiration by plants) [24].

6 Total per-capita internally available renewable water is defined as “the sum of internal renewable water resources and external actual renewable water resources”.

7 To provide water for their populations despite low levels of freshwater resources, GCC countries rely on desalination. Desalination provides the majority of potable water (more than 70%), and a large percentage of total water usage including industry, irrigation, municipal drinking water, and other uses [25].

8 <http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en>.

As a result, this lack of freshwater is an obvious constraint to development of conventional agriculture in this region [51] and GCC states do not have a comparative advantage in field crop production. High maximum temperatures limit yields for many crops, while rainfall is well below that required for rain-fed cereal production [28] (e.g. wheat requires around 600–650 mm per year in hot climates) [52].

In the future, in the GCC, the climate change through rise in temperature, decline in rainfall and increase in evapotranspiration will further affect agriculture and food production in an already exceedingly dry area [24]. Climate change projections expect the entire region to become hotter and drier in the future, with a reduction of precipitation [53] (Table 5). The analysis cautions that the dual drivers of climate change and population growth will combine to put further stress on scarce water resources and affect food security [42]. For example, climate change is expected to reduce frequencies of winter low temperatures, which affect production of certain traditional fruit trees in ancient cropping systems, mostly in the high-mountain region in Oman [54].

**Table 5. Climate change impact on farming systems in the GCC region**

Farming system	Exposure: Expected climate change-related events	Sensitivity: Likely impact on farming systems
Irrigated	Increased temperatures Reduced supply of surface irrigation water Dwindling of groundwater recharge	More water stress Increased demand for irrigation and water transfer Reduced yields when temperatures are too high Salinisation due to reduced leaching Reduction in cropping intensity
Pastoral	Increase in aridity Greater risk of drought Reduced water for livestock and fodder	A very vulnerable system, where desertification may reduce carrying capacity significantly Non-farm activities, exit from farming

Source: Bucchignani et al. [53].

## 4. Food Production in GCC: Unsuccessful Past Experiences

Since the 1970 and following the US threat of a food embargo against OPEC countries in response to the first oil price shock [28], GCC states adopted several policies to increase the local food production to realize the highest possible level of self-sufficiency. Despite some success to increase food production, especially in the case of Saudi Arabia, those policies result on serious environmental damages (Box 2). Due to low rainfall, attempts to increase local production was based on irrigation and have resulted in heavy depletion of the non-renewable water resources. Since the 1970, GCC governments provided generous subsidies to ensure future food supplies [39], resulting in expansion of food production. Artificially cheap water has enabled the development of water-intensive crops (E.g. wheat in Saudi Arabia) in a region that has no natural advantage in producing these crops [55,56,57].

**Box 2. Rangeland deterioration in Saudi Arabia**

Today, rangelands throughout Saudi Arabia are declining in both condition and productivity. The political, economic and cultural evolution which have occurred in Saudi Arabia over the last half of the 20th century have upset the balance between the nomadic people and the desert environment. For centuries, the nomadic people have developed a sustainable use through regulations to control rangeland use (Hema system). However, in 1953 the government abolished the old nomadic hema system leading to open access to all rangelands, thus uncontrolled livestock grazing [55]. In the 1970, the Saudi government gave agriculture a high priority in order to increase the local food production to realize self-sufficiency. From the mid-1970s into the 1990s, Saudi agriculture was booming, reaching its peak of production in 1993 [56]. From 1980 to 1985, the agricultural sector grew at an astonishing rate, at an average of eight percent annually [55]. Using oil revenues, the government established generous subsidies and interest-free credit to facilitate this growth. Lands were distributed free to citizens to cultivate [57]. Within twenty years, farmland went from 150000 hectares in 1975 to over 1.6 million hectares in 1995. To meet the enormous demand for red meat, the government instituted a program of financial incentives for sheep and camel producers. This program encouraged flocks expansion and the total population of sheep in the country increased by many folds, which put pressure on rangelands. In 1980, the government replaced the financial incentive program by a grain subsidy program. Likewise, high subsidies for feed grain resulted in livestock population densities many times higher than the carrying capacity of the land. Rangeland conversion into agriculture area or farmland is another cause of the present poor status of the rangelands [55].

Further, agriculture is based mostly on open field irrigation methods with a low water use efficiency (WUE)<sup>9</sup> resulting in high losses from evaporation. The average efficiency ratio in the GCC is 54.80% compared to 76.46% in Egypt and 71.69% in Tunisia (Table 6).

**Table 6. Irrigation efficiency ratio in the GCC in 2014**

	Irrigation Water Requirement, Million m <sup>3</sup> /Yr	Water Withdrawal for Agriculture, Million m <sup>3</sup> /Yr	Efficiency Ratio (%)
<b>Bahrain</b>	40	159	25.16
<b>Kuwait</b>	119	492	24.19
<b>Oman</b>	721	1,168	61.73
<b>Qatar</b>	76	262	29.01
<b>Saudi Arabia</b>	11,599	20,830	55.68
<b>UAE</b>	1,815	3,312	54.80
<b>GCC average</b>	14,370	26,223	54.80

Source: Sadik [50].

Immense pressure has been exerted on the scarce water resources, including non-renewable fossil groundwater, as reflected in the high rates of water withdrawals for agriculture, averaging about 630 percent of total renewable water resources in GCC countries, reaching about 2,460

percent in Kuwait [50]. In average, in the GCC, 85% of water is used for agriculture. According to FAO [58], countries are in a critical condition if they use more than 40 percent of their renewable water resources for agriculture and could be defined as water-stressed if they extract more than 20 percent of these resources. Based on this definition GCC countries could be defined as water-stressed, because their current abstraction rates from their renewable water resources for agriculture greatly overshoot the defined limits (Table 7).

**Table 7. Pressure on water resources: water withdrawal and use in agriculture**

	Total Water Withdrawals (Million <sup>3</sup> )	Agriculture share of total withdrawals * (%)	Agriculture share of total renewable water resources (%)
<b>Bahrain</b>	357.4	44.54	137.2
<b>Kuwait</b>	913.2	53.87	2460
<b>Oman</b>	1321	88.42	83.43
<b>Qatar</b>	444	59.01	451.7
<b>Saudi Arabia</b>	23670	88	867.91
<b>UAE</b>	3998	82.84	2208
<b>GCC average</b>	30703.6	85.41	629.15

Source: Sadik [50].

Since 85% the water used in irrigation is groundwater, aquifers have been heavily exploited above the average natural recharge, thus increasing water and soil salinity. For instance, in 2016, in Qatar, the groundwater consumption rate (319 million m<sup>3</sup>/year) was higher than the recharge rate from natural renewable resources (217 million m<sup>3</sup>/year), which represents a yearly depletion rate of 102 million m<sup>3</sup>/year [59]. Using groundwater resources beyond their natural replenishment rates is rapidly depleting aquifer reserves, that had taken millions of years to accumulate and degrading water quality due to seawater intrusion [60], which is a common issue in the GCC region. In many cases, overexploitation of the limited natural resources (water and land) has hazardous effects due mostly to inadequate policies and interventions [61,62] (Box 3).

**Box 3. The socio-economic and environmental cost of Dammam aquifer overexploitation in Bahrain**

Groundwater in the Dammam aquifer is the only natural source of freshwater in Bahrain. Since the early 1970, rapid population growth urbanization and expansion of irrigated agriculture, boosted water demand. As a result, the Dammam aquifer has been heavily exploited above the average natural recharge, thus increasing water salinity due to seawater intrusion. In addition, this overexploitation increased soil salinity and results on socio-economic and environments problems. As groundwater used for irrigation has become more saline, soil become less productive, which have eventually lead to a loss of cultivable land and forced the abandonment of traditional agricultural areas. Cultivated area dropped from about 65 square kilometers to 41 square kilometers in the late 1970s. Groundwater depletion has also damaged wetlands and biodiversity. The drying of all natural springs and their surrounding environments has destroyed wildlife habitats, eliminated animal species and compromised the ecosystem and its tourism investment potential [60,61,62].

<sup>9</sup> The ratio between effective water use and actual water withdrawal. It characterizes, in a specific process, how effective is the use of water.

Meanwhile, agriculture water consumption is disproportionate to the value created by the sector. Despite the government support to increase local agriculture production through financial assistance and subsidies, the contribution of agriculture to total economic added-value or the Gross Domestic Product (GDP) is quite negligible, around 0.8% on average (less than 1 % in Bahrain, Qatar, Kuwait and UAE; 1.3 % and 1.9 % in Oman and Saudi Arabia respectively) [63]; e.g. in Qatar, the agricultural sector consumes 40% of total water resources and the production meets only 10% of the national food demand. In addition, the agricultural sector contribution to GDP is only 0.13% and it employs 1.3% of the labor force [64].

## 5. Food Security in GCC: Limits and Drawbacks of Import-based Food Policies

In order to bridge the gap between food production and food consumption, the GCC states rely heavily on food imports. These countries remain largely net importers of food, especially with respect to cereals, the main staple food commodity in the region (Table 8).

**Table 8. Food self-sufficiency ratio in GCC countries**

	Total Food (%)		Cereals (%)	
	2005	2012	2005	2014
<b>Bahrain</b>	12.96	14.6	0.00	0.00
<b>Kuwait</b>	28.38	15.6	3.88	3.84
<b>Oman</b>	45.21	32.5	1.17	2.30
<b>Qatar</b>	12.18	9.6	3.12	0.42
<b>Saudi Arabia</b>	44.52	30.1	26.75	4.58
<b>UAE</b>	21.13	21.2	0.85	2.05
<b>GCC average</b>	<b>37.40</b>	<b>26.5</b>	<b>20.25</b>	<b>2.19%</b>

Source: Compiled by the authors from FAOSTAT data.

Even food products made locally rely heavily on foreign imports. In fact, in certain cases – the growing dairy industry in Saudi Arabia, for example – it is not clear that domestic production reduces a country's dependence on food imports, since animal feed must be imported [25]. GCC food security rests on international trade, leaving countries exposed to price risk (relating to volatility of import prices) and supply risk (relating to import disruption) [28]. Furthermore, the future of food supply in this region is challenged by several factors. Firstly, the impacts of climate change could significantly affect agriculture production through yield reductions [65]. Climate change will also lead to an increase in the frequency and severity of extreme weather events such as droughts, floods and heat-waves, increasing the risk of yield shocks in key producer countries and concomitant price spikes [66]. For example, the International Centre for Tropical Agriculture (CIAT) projects that crop yields will fall by more than 10% for a quarter of major crops by 2030 and decline at similar rates for more than half of crops beyond 2050<sup>10</sup>. Willenbockel [66] estimates a potential short-term price increase of up to 33% for wheat, 140% for corn and 26% for rice in response to

climate-related yield shocks in 2030. As a result, agricultural commodity prices are expected to remain volatile in the future, which could result in export restrictions and speculation [67].

Secondly, in the future, international markets are expected to remain tight and thin as production growth lags demand and stock-to-use ratios struggle to recover, leaving global supply vulnerable to destabilizing weather events such as droughts or heat-waves in key producer regions. Volatility will be further amplified by biofuel mandates, which limit exports of food commodities, create inelastic demand and depress stock-to-use ratios further [28]. “Expert opinion suggests that this will continue to be the case as the factors that led to elevated costs in the first place have not been adequately dealt with. Bio-fuel production programs continue to be encouraged in major grain-producing countries; global grain reserves have not been sufficiently enhanced in the intervening years; and food supplies have not kept pace with the increasing demands arising out of higher per capita incomes and changing consumption patterns in certain parts of the developing world.” [27]. Consequently, observers uniformly agree that given its heavy reliance on external food supplies, the GCC and the Middle East in general are particularly susceptible to fluctuations in both price and availability of global food stocks [27]. GCC countries are highly vulnerable to fluctuations in international commodity markets and supply risks, such as the one that occurred in 2007-2008, because they are highly dependent on food imports.

*In fact, potentially more critical to GCC food security is availability risk, which arises when an import-dependent country is not able to obtain food, even if it has sufficient funds to purchase it [25]. “A number of Gulf countries were on the market for food at a time when prices had gone up, and some exporting countries had put up export bans, especially for rice—creating a nervousness that even if they could afford it, they couldn't get it.” [39].*

### Box 4. The GCC, strategic choke points [28]

#### Transiting Suez Canal

7.5 million tons of wheat and coarse grains are shipped from North America, South America and Europe, and 4.6 million tons from the Black Sea. This represents 81% of total imports of these commodities to the GCC.

#### Transiting Bab Al Mandab

5.8 million tons of imports of wheat and coarse grains from North America, South America, Europe and the Black Sea are shipped on from Suez to Kuwait, UAE, Qatar, Bahrain, Oman and eastern ports in Saudi Arabia. This represents 39% of total imports of these commodities to the GCC.

#### Transiting Strait of Hormuz

5.2 million tons of wheat and coarse grains from North America, South America, Europe and the Black Sea are shipped on through the Strait of Hormuz to Kuwait, the UAE, Qatar, Bahrain and eastern ports in Saudi Arabia. This represents 35% of total imports of these commodities to the GCC.

2.5 million tons of rice from South and Southeast Asia (81% of total rice imports).

0.7 million tons of wheat from Australia.

<sup>10</sup> <https://ciat.cgiar.org/what-we-do/climate-smart-agriculture/>

**Box 5. Dealing with Disruption: The Qatar Blockade**

In June 2017, Saudi Arabia, the UAE, Bahrain, and Egypt cut off diplomatic relations with Qatar and impose an air, sea, and land blockade. Prior to the blockade, Saudi Arabia and UAE accounted for 27.4% of Qatar's total value of food products. Meanwhile, about 80% of Qatar's food imports passed through a neighboring country, with 40% coming through the Saudi border and 60% of dairy products imported by Qatar coming from Saudi Arabia and the UAE. In response to the blockade, Qatar has adopted a range of strategies to ensure its food security: arranging alternative trading routes and food supply chain with new partners, most notably Iran, Oman, Turkey and Pakistan; and upgrading its ports to prepare for additional shipping with the expanding of the new Hamad port. The blockade showed the limits of import-based food policies and the need to increase the local production in Qatar. Since then the Qatari agriculture sector has been under growing pressure to increase the local food production and to realize the highest possible level of self-sufficiency.

Thirdly, one particularly salient factor contributing to availability risk for the GCC is the fact that the majority of food imports passes through one of three maritime chokepoints [25,28] (Box 4), especially for strategic commodity such as wheat. In fact, GCC states are among the most exposed to potential food security risks caused by maritime chokepoints. Import routes are particularly vulnerable to disruption or closure in the event of instability within the wider Middle East and North Africa (MENA) region [28] (Box 5).

Furthermore, in recent years, in response to international sanctions, Iran has periodically threatened to close the Strait of Hormuz. Any conflict in the Hormuz Strait will disrupt food shipments and would have a devastating impact on GCC's food security particularly for states that are entirely reliant on ports within the Persian Gulf: Bahrain, Kuwait and Qatar [28]. While 80% or more of wheat imports to five of the six GCC countries passed through at least one chokepoint, the likelihood of availability risk differs substantially across the countries. With access to both the Red Sea and the Arabian Gulf, Oman, Saudi Arabia, and the UAE are less vulnerable to import food disruption in case of conflict in Hormuz Strait than Bahrain, Kuwait, and Qatar. Bahrain, Kuwait, and Qatar are the most vulnerable GCC countries to a chokepoint disruption. About 80% of Qatar's wheat imports and nearly all of Bahrain's and Kuwait's passed through the Strait of Hormuz, and there are no alternative maritime routes from the Arabian Sea to the Arabian Gulf [25,28].

## 6. Achieving Food Security in GCC States: A Combination of Strategies is Needed

According to FAO [68] "A food security strategy that relies on a combination of increased productivity and general openness to trade will be more effective than a strategy that relies primarily on the closure of borders." In fact, faced with a high potential for import disruptions, the GCC may find it helpful to focus on four different sets of strategies.

### 6.1. Foreign Agro-investments

After the 2007-2008 food crises, GCC countries pursued a strategy of purchasing or leasing farmland abroad with the aim of exporting at least some of the crops produced there back to the purchasing country [25] in order to ensure privileged bilateral access to food production [32]. Since then, these countries acquired lands in Africa and Australia, among other places, invest in existing agricultural business and export the produce back to the purchasing country, so that it can maintain control over the food supply chain. Today, GCC countries are the biggest regional investors in agricultural land abroad [25]. However, these investments are risky. Many of the land deals have been in parts of Africa already suffering from food insecurity. From the point of view of the land-owned country, exporting crops could worsen existing food insecurity and poverty, and may cause political unrest. Given persistent undernourishment for many in Africa, public perception and tolerance of foreign landholders on the continent may deteriorate, especially as African food imports themselves increase [25]. To preempt such criticism, Qatar for example, has put foreign agro-projects on hold until land rights issues have been sorted out in a mutually beneficial way. State-owned Hassad Food announced that it would aim to invest in existing agro-companies rather than acquire land rights and building up farming operations from scratch. The Arab Authority for Agricultural Investment and Development chose a similar approach when launching a \$2 billion fund in October 2009 [32]. Another obstacle is the growing resistance of local populations to the agro deals, due to food and water shortages of local residents, the transfer of the lands into a commodity aimed at serving foreigners and the loss of lands that belonged to the farmers' families for generations. What is considered as legitimate land acquisitions and agro-investments by the investors is perceived as illegal land grabbing by the locals and as a sort of neo-colonialism [69]. In most parts of sub-Saharan Africa, acquiring sizeable farms has proved very difficult and controversial, in particular when the investment leads to community displacement from productive land [70].

In addition, the countries targeted for investment face many challenges, among them underdeveloped infrastructure, corruption, political instability, as has been the case with Sudan, and a lack of skilled labor [32]. Owing to the generally poor agricultural infrastructure in many target destinations, and because few support services can be provided by local sub-contractors, the investor has to establish the entire system required for successful farm operation: e.g. farm machinery cannot be rented, expatriate staff has to be recruited because management for large farm operations cannot be hired locally, and processing facilities have to be established [70]. For example, in Ethiopia, investors have encountered difficulty transporting agricultural machinery and skilled labor to the most remote areas of the landlocked country<sup>11</sup>. As a result, numerous foreign agricultural land acquisitions have not been as successful as predicted. For example, in Ethiopia, only 35 per cent of the leased land has been developed and the Ethiopian government has cancelled seven leases after

11 <https://ig.ft.com/sites/land-rush-investment/ethiopia/>

investors failed to deliver on their promises<sup>12</sup>. In addition, the food commodity crash in the second half of 2008 reduced the urgency for agricultural investments [32]. Further, challenges exist even in countries and regions that are food secure such as California [71] (Box 6).

#### Box 6. Almarai agro-investment in California

In 2015, Saudi Arabia's Almarai Co, the largest dairy company in the Gulf, bought 1,700 acres (688 hectares) of land in Blythe (California) to supply its business with alfalfa hay. Almarai, which already owns land in Arizona, said the purchase was part of efforts to secure high-quality hay from outside Saudi Arabia, in line with Saudi government policy. In fact, Saudi Arabia is phasing out the growing of crops and fodder because of the strain such cultivation places on scarce water resources. The cultivation of green fodder will end in 2019. Each month, Almarai loads the alfalfa on to hulking metal shipping containers destined to arrive 24 days later.

Today, the company owns 15,000 acres – 16% of the entire irrigated valley. However, the land is part of a region that has senior rights to Colorado River water. The 1877 water claim, now owned by the Palo Verde Irrigation District, ensures that Blythe has “unquantified water rights for beneficial use”. The Palo Verde Irrigation District is not allowed to sell the water to farmers. Blythe farmers are thus only charged to cover the water district's overhead – \$77 an acre a year. In Blythe, no matter how much he uses, a farmer gets his water for a cheap, flat rate. Some local stakeholders have raised concerns that these rights will allow Almarai to cultivate thirsty crops there despite periodic droughts in California. When Almarai first began purchasing land in the western US, in 2015, environmentalists, and many average citizens, were outraged. “Saudi Hay Farm in Arizona Tests State's Supply of Groundwater,” said an NPR article in November of 2015. “Saudi Arabia is Outsourcing its Drought to California,” wrote Gizmodo [71].

Finally, another issue related to foreign agro-investments, is that they do not guarantee food security in times of crisis. In case of food crises, there is the risk that the host country may renege on a contract or restrict exports. While the WTO outlaws curbs on industrial exports, it allows for agricultural export restrictions in the case of domestic food security concerns. It would be hardly conceivable to enforce delivery of food items from distressed countries [32].

## 6.2. Stockpiling

Recognizing the unreliability of imports and in order to be less susceptible to price fluctuations, since 2007-2008, GCC states invested in strategic reserves to ensure supplies for domestic consumption. Stockpiling can provide GCC governments with a degree of insurance against price and supply risks [28]. In fact, stockpiling can strengthen purchasing power by signaling to sellers that countries have alternative sources of supply, militating against price gouging [28]. While stockpiling is a more efficient strategy than the pursuit of an alleged

self-sufficiency, it involves many potential risks [42]. Firstly, stockpiling is expensive due to the risk of spoilage [25], particularly due to post-harvest insect pests and grain pathogens and the need to cycle the stock periodically. Secondly, ensuring safe grain storage requires technologies that leave no residues on the stored grain that may harm the consumer and demand environmental conditions such as low temperature and low oxygen, which will make it energy intensive in the climates of the GCC states [42]. Given the difficulties of domestic production, stockpiling will likely remain an important strategy for GCC countries in the future. Oman, for example, announced in 2018 plans to develop an agricultural bulk terminal in Salalah with a storage capacity of 60,000 tons of grain reserves, and handling equipment capable of handling 15,000 MT of grain per day; designed to serve as a trading hub for the region and to store grain for the country<sup>13</sup>.

## 6.3. Innovation in Agriculture: Towards Sustainable Food Production

The third set of strategies – which will become critical if multiple trade routes are simultaneously disrupted – is to increase the potential for domestic production [25]. However, as explained above, past GCC experience to increase local food production resulted in serious environmental damages and heavy drainage of the non-renewable water resources with little productive results. Consequently, there is, hence, a need for a transition towards sustainable food systems that ensure food and nutrition security [72,73]. In fact, in arid and semi-arid countries, such as the Gulf region, where natural resources are scarce, there is a need for strategies to produce more food with less land and water. GCC's agriculture is based on traditional irrigation methods with a low use efficiency and aquifers have been heavily exploited above the average natural recharge. In this context, new technologies and innovative practices such as hydroponics, greenhouses, modern irrigation systems (e.g. drip irrigation), and appropriate crops that would suit the local climatic conditions, can be used to increase the productivity and the sustainability of agriculture systems [74,75], within a positive enabling environment supported by efficient policies [76]. Hence, water shortage in GCC countries requires developing new technologies and methods of irrigation that can be helpful to utilize this precious input in an effective way [77]. In addition, there is also a need to carry out practices of irrigation water management to achieve high water use efficiency and to increase the productivity of existing water resources and also to produce more food with less water [78]. This necessitates innovative and sustainable research and an appropriate transfer of technologies [79]. Further, another issue related to agriculture innovation is the adoption and integration of new technologies (cf. innovations) into agricultural production. Low adoption rates of new and potentially beneficial agricultural technologies in many countries continues to contribute to food insecurity and low agricultural productivity [80]. Another solution related to water is to increase the use of wastewater. Many GCC

12 <https://ig.ft.com/sites/land-rush-investment/ethiopia/>

13 <https://www.omanobserver.om/new-agriculture-bulk-facility-set-up-in-salalah/>.

countries use treated wastewater to irrigate certain types of crops. While Kuwait and Saudi Arabia reuse about 50% of their total wastewater, Bahrain and Qatar only reuse about 10-15%. Public perception and stigma represent a considerable hurdle in expanding the use of this strategy [25].

#### 6.4. Reducing Food Waste

Ironically, another issue related to food security in the GCC is food waste. The Gulf Cooperation Countries (GCC) do stand out as among the world's top food wasters [81]. On an average, GCC countries waste a third of the food imported, and the UAE is estimated to lose billions of dirhams through food waste each year. On a per capita basis, Saudi Arabia wastes the most food annually, at 427 kg per person 14., while the UAE ranks 22<sup>nd</sup> out of 25 with wastage of 196.6 kg, compared with 95-115/person in Europe and North America [82]. Though prices for the food commodities are on the rise in the international markets yet the GCC governments provides food items to the consumers at highly subsidized rates. Since the prices for the food items are not very high, therefore, GCC citizens take food items for granted [81].

### 7. Conclusion

GCC – countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) face specific challenges for achieving long-term, sustainable food security. Food security is a holistic concept that involves economic, social, cultural, environmental and political aspects. However, food security is still a misunderstood operational concept in the public policy in the GCC [27] [42]. The contemporary discourse is still characterized by a broad emphasis on the supply-side, reflecting the global perception from the 1970's [42]. There is, hence, a need for a transition towards sustainable food systems that ensure food and nutrition security through a mix of strategies and policies that address all the four dimensions of food security (availability, access, utilization, stability).

There is also a need for transition towards a sustainable local food production. In this context, new technologies and innovative practices, that would suit the local climatic and soil conditions, can be used, to increase the productivity and the sustainability of agriculture systems. However, the paucity of current research on the dynamics and characteristics of innovation and technologies adoption within the agriculture sector in GCC and its link to food security and sustainability leaves a major and worrying gap in the knowledge base needed to form effective policies. Further, studies detailing the factors that influence the interactions between the different stakeholders and what does this imply for knowledge production and exchange, and consequently innovation, are lacking. There is a need for research to identify the main obstacles and the factors that influence innovation, technologies adoption, knowledge sharing and cooperation within the agriculture sector in the GCC. Furthermore, the food crisis of 2007-2008 and the need to increase the local

food production is an opportunity for a systemic and holistic approach of innovation that considers the several aspects of food production, including agricultural production, economic development, environmental sustainability, and institutions, taking into account at the same time all the elements, their interconnections and related effects. A more system-oriented understanding of how innovation occurs is critical to promoting dynamism in agriculture and, ultimately, to enhancing agri-food productivity and sustainability in GCC countries.

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