Gulf Economies

Can Saudi Arabia Feed Its People?

by Yossi Mann

In 2007, almost thirty years after setting out on an ambitious agricultural project, Saudi Arabia announced it would be phasing out government handouts to the agricutural sector, which would end in their entirety in 2016. Outsiders criticized the project from its beginnings, emphasizing the burden it would place on the economy and the damage it would inflict on the country's water assets. Critics were particularly scathing of the decision to subsidize the project and its detrimental effects on the Saudi economy as a whole.

Saudi Arabia managed to avoid dependence on the import of agricultural products such as wheat from the 1980s on. The increase in its wheat exports was spectacular, shooting from a mere 2.4 tons in 1978 to a million tons in 2000, sent mostly to its Persian Gulf neighbors and Asian countries such as Bangladesh.

Nonetheless, Riyadh moved forward with what it saw as its quest to provide both food security for its burgeoning population as well as additonal employment opportunities. An examination of the wheat industry that flourished in the kingdom between 1980 and 2007, its achievements and failures, as well as the influence of the agricultural sector on the local economy and on water resources may prove a cautionary tale, reconfirming the truths behind the law of unintended consequences.

Subsidizing Food Security

Before analyzing the reasoning behind the decision to try to increase the agricultural output of the desert kingdom, it is necessary to get a full picture of what came before that decision and the actual, concrete steps taken to bring it to pass.

The Saudi wheat industry has been concentrated in areas including the Qasim area of the Najd plateau; the outskirts of Riyadh, Qatif, Taif, and Ha'il, and in the southern province of Asir.

Despite a great deal of skepticism, Saudi Arabia managed to avoid dependence on the import of agricultural products such as wheat from the 1980s on. Indeed, Saudi increases in agricultural production were unprecedented, rising from 148,000 tons of wheat in 1981 to 4.1 million tons by 1993. The increase in its wheat exports was even more spectacular, shooting from a mere 2.4 tons in 1978 to a million tons in 2000, mostly to its Persian Gulf neighbors and to other Asian countries such as Bangladesh.

One way in which this was accomplished was by significantly expanding available arable areas. The kingdom had an estimated 67,000 hectare of agricultural land in 1980, which grew to 907,000 hectare by 1993. Similarly, in 1980, the average production per farm was 2.2 tons of wheat per hectare; this grew to 5.19 tons by 2005. Some companies in the country's northern territories even managed to significantly increase production to 8-10 tons per hectare, an amount more or less on a par with production in Eastern and Central Europe.[1]

Over the years, the Saudi wheat industry became concentrated in several areas including the Qasim area of the Najd plateau, the outskirts of Riyadh, the outskirts of Qatif in the eastern province, Taif and its environs in the Northern Province, around the northwestern city of Ha'il and in the southern province of Asir.

Due to better climactic conditions, the Saudi royal family invested greater effort in the northern parts of the country where agricultural companies controlled vast areas that expanded to over 268-380 hectares. In most other parts of the kingdom, the usual amount of land allotted to wheat was more in the 5-10 hectare range.

The explosion in wheat production could not have taken place, however, without government support. In the 1980s, Riyadh granted the agricultural sector incentives such as

1 *Annual Report*, Saudi Arabian Monetary Agency, Riyadh, 2010, p. 389; Safer al-Kahtani, "Optimum Wheat Production in Saudi Arabia," *Journal of King Saud University*, Agricultural Sciences, 1994 (1), pp. 2-3; Vahid Nowshirvani, "The Yellow Brick Road: Self-Sufficiency or Self-Enrichment in Saudi Agriculture?" *Middle East Report*, Mar./Apr. 1987, pp. 1-2; "Saudi Arabia Grain and Feed Annual 2009," *Gain Report*, U.S. Dept. of Agriculture (USDA) Foreign Agricultural Service, Washington, D.C., 2009, p. 7.

subsidies on grain, fertilizer, and irrigation water, and a 45 percent discount on purchasing agricultural machinery. Despite the huge price difference between locally produced wheat ($1,000 per ton) and what was available on world markets ($100 per ton), the Saudi government continued to purchase domestic agricultural produce and to sell it on the local market at artificially lowered prices.

The thriving agricultural sector brought about a significant rise in employment.

This thriving agricultural sector brought about a significant rise in employment. In the mid-1970s, 274,000 people worked in agriculture; those numbers rose to 681,000 by 1992. The boom increased profits for the farming sector though mainly for large landowners.

To increase profits further and to administer their holdings better, the important Saudi trading families and the Saudi princes joined forces with international companies. In the 1980s, for example, Prince Muqrin bin Abdul Aziz, governor of the town of Ha'il, became a partner in the Ha'il Agricultural Development Company, which soon became the biggest agricultural company in the kingdom. Since most of the large agricultural companies were established by the Saudi elites, critics have claimed that the subsidies were essentially granted for the benefit of the same elites.[2] A further consequence of the policy was an increase in wheat smuggling from Yemen and Oman in order to sell it on the Saudi market at a huge profit.[3]

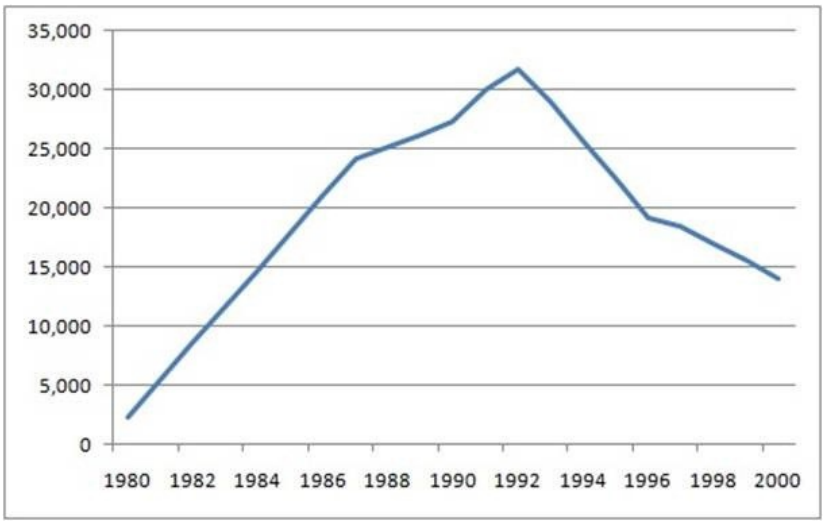
By the 1980s, Saudi government stability had become dependent on those who demanded subsidy guarantees in exchange for domestic stability. The subsidies took an enormous toll on the country's economy, though, eating up an estimated 20 percent of Saudi oil profits between 1980 and 2000. Nor were agricultural subsidies always consistently granted. When food and oil prices dropped, the Saudi government cut down on financial support in order to avoid excess production. Subsidies were at a peak in the beginning of the 1980s when the agricultural industry was just starting out, and government income was particularly high following a decade of oil-induced prosperity. However, low oil prices from 1995-96 made it hard to grant subsidies at the same level as in the preceding years. This, in turn, resulted in a decrease in agricultural production in those years. The royal house looked to avoid too drastic a subsidy cut even when the country was undergoing an economic crisis figuring that once the agricultural sector had been granted assistance, it would find it difficult to function without it. Indeed, the sector's dependence on subsidies was one of the factors behind violent clashes that broke out in the city of Buraida in January 1995 when those who earned their livelihood from agriculture protested against the possibility

2 "Saudi Arabia: Grain and Feed Annual," *Gain Report*, Jan. 2011, p. 3; Gary Vocke, "Wheat Outlook—A Report from the Economic Research Service," USDA, July 2010, pp. 3-24; "Employments in Agriculture," World Bank Data, Washington, D.C., 1981-2001.

3 Sala A. al-Suhaibani, "Mechanization Provisions of Modern Farms in Saudi Arabia," *Journal of King Saud University*, Agricultural Sciences, 1990 (1), pp. 161-3; "Agricultural Machinery, Tractors per 100 sq. km of Arable Land," World Bank Data, 1996-2001; Nowshirvani, "The Yellow Brick Road," pp. 5-7.

of cutbacks. Such guarantees provided a quid pro quo for domestic stability.[4]

Saudi Arabia Water Supply 1980-2000
(in million cubic meters/year)



Source: Walid A. Abderrahman (2001), "Water Demand Management in Saudi Arabia."

The Most Precious Resource

But, the ambitious wheat project also had a negative impact on the country's fragile water supply. The Saudi summer is very hot and arid with temperatures often reaching as high as 120° Fahrenheit (49° Celsius). Average rainfall is 5 inches (130 mm) a year although there has been some occasional flooding in agricultural areas during the "rainy" season. The sporadic rain, soaring temperatures, and high evaporation rates in the eastern areas of the country make it very difficult to establish a viable agricultural economy. For example, an average of 13,173 cubic meters of water is required to irrigate a hectare of wheat in Saudi Arabia as compared to the world average rate of 1,622 cubic meters.[5]

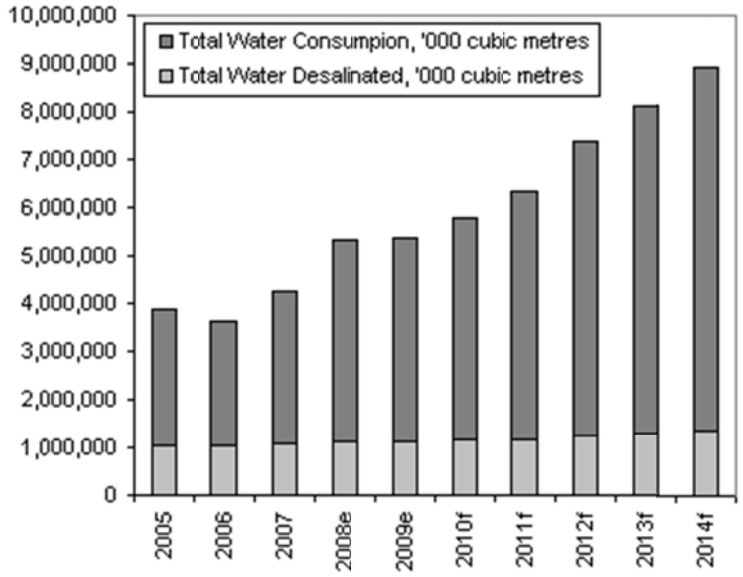
The Saudi water sector only began to be developed in the 1930s. Until then, most of the kingdom's water came from wells that could be found near the main towns. In 1956, sewage water infiltrated many wells, forcing the government to accelerate the ground water pumping rate. In the 1970s, the use of non-renewable water resources was raised even further. A population explosion—from 6.2 million in 1970 to 16.2 million by 1990—led to a sharp increase in demand. Rapid urbanization also took its toll: While 2.7 million out of a population of 7.6 million Saudis lived in cities in 1974, the country's population had risen to 18 million by 1992 with only 3.8 million remaining in villages and peripheral areas.

4 *Omaha World Herald*, Jan. 9, 1995; "Grains World Market and Trade Part One," USDA Foreign Agricultural Service, Dec. 13, 1996.

5 A.A. Leilah and S.A al-Khateeb, "Statistical Analysis of Wheat Yield under Drought Conditions," *Journal of Arid Environments*, May 2005, pp. 483-7; M. M. Mekonnen and A. Y. Hoekstra, "A Global and High-Resolution Assessment of the Green, Blue and Grey Water Footprint of Wheat," *Hydrology and Earth Systems Sciences*, Apr. 22, 2010, pp. 1259-76; Ali M. Subyani, "Geostatistical Study of Annual and Seasonal Mean Rainfall Patterns in Southwest Saudi Arabia," *Hydrological Sciences—Journal-des Sciences Hydrologiques*, Oct. 2004, pp. 803-4.

By the mid-1990s, the agricultural industry was responsible for 92 percent of total water consumption with 48 percent of that going to wheat. The sharp rise in water consumption for agriculture first began to take effect in the 1980s. In 1980, for example, the Saudis were consuming 2 billion cubic meters of water, but a mere three years later, consumption had already reached 7.2 billion cubic meters. This high consumption rate was also due to demographic changes in the kingdom, such as in Mecca, Riyadh, and Abha, and not exclusively as a result of increased agricultural needs.[6]

Saudi Arabia Water Forecasts



Source: Toyobo Company forecast to 2014, published 2007.

By 1993, the government began to realize what a heavy toll the agricultural sector had taken on its water resources. According to the Saudi Ministry of Agriculture, 140 billion cubic meters of water had been pumped from non-renewable water sources between 1980 and 1994, by which time there was significant depletion of drinking water resources in various parts of the kingdom as in the Tebrak area, which is about 95 kilometers from Riyadh and was one of Saudi Arabia's biggest sources of water. In other areas, such as the eastern province, water reservoirs dried up or became unavailable because of bad management, lack of sewage, and excess use of fertilizers, which contain high levels of toxic chemicals. All of these factors caused contamination of the water supply and resulted in a decrease of between 8-15 meters of ground water between 1980 and 1993.[7]

There were 26,000 wells in Saudi Arabia in 1982 and 52,500 by 1990. During this time, there was a marked increase in the use of non-renewable resources from aquifers such as those at Wajid, Saq, Tabuk, Minjur, Biyadh, Wasia, and Umm ar-Radhuma. Some measures were taken to reduce water consumption including the imposition of new water rates in 1994 in order to avoid wastage and excess consumption. Then in 2000, the government decreed that all private home owners and public establishments must install wastewater treatment apparatus.

6 Fahad M. Alkolibi, "Possible Effects of Global Warming on Agriculture and Water Resources in Saudi Arabia: Impacts and Responses," *Climatic Change*, July 2002, pp. 225–36.

7 Mohammed Abdulla al-Saleh, "Declining Groundwater Level of the Minjur Aquifer, Tebrak Area, Saudi Arabia," *The Geographical Journal*, July 1992, pp. 215-9.

These measures notwithstanding, Saudi Arabia continued to rank third in world water consumption at 248.7 liters per capita per day in 1993.[8] As a result, in 2005, the government began using desalinated water rather than water from non-renewable sources. Before then, 11,679 million cubic tons of water had been taken from non-renewable sources per year while only 8,000 million cubic tons of water came from renewable sources. As a result, neighboring countries such as Qatar, Jordan, and Iraq had begun to object to Riyadh's extensive use of shared ground water, which was depleting their own supplies.[9]

Sixty sewage collection disposal plants in the towns of Jeddah, Medina, and Khubar were established to supply 70 percent of the country's water between the early 1990s and the beginning of the twenty-first century. Riyadh also intends to establish forty wastewater treatment plants and to streamline water transportation pipelines. But there is a significant downside to these measures. Desalination plants are energy guzzlers, and depending on them takes a financial toll on governmental revenues accrued from oil and gas exports.[10]

Large agricultural enterprises in Saudi Arabia were established and run by outsiders.

The Roots of a Decision

As far back as 1993, Saudi government officials reported that water resources in the kingdom were dwindling, and yet Riyadh continued to opt for more investment in agriculture. What then were the considerations that motivated the House of Saud to continue subsidizing this project, despite deep financial and environmental losses?[11]

Some have contended that the policy was a misguided course of action derived from a sensible desire to reduce the country's number of foreign workers.[12] Unofficially, estimates are that seven million foreign individuals work in 80 percent of the private sector, making it difficult for native Saudis to find jobs.[13] Dependence on foreign workers has a direct impact on the economy: It is estimated to cause losses of billions of dollars every year because much of the derived income goes into the hands of

8 Ibid; Adil A. Bushnak, "Water Supply and Treatment Trends in Saudi Arabia," Bushnak Water Group, Jeddah, 2001, pp. 12-22.

9 Saleh, "Declining Groundwater Level of the Minjur Aquifer"; Bushnak, "Water Supply and Treatment Trends in Saudi Arabia," pp. 12-22.

10 "The Water Sector of the Kingdom of Saudi Arabia," World Bank/Kingdom of Saudi Arabia, 2007, p. 147; "A Water Sector Assessment Report on the Countries of the Cooperation Council of the Arab States of the Gulf," World Bank, 2005, pp. 2-34.

11 Joseph Mann, "Saudi- Arabia's Economic Needs and the Price of Oil," *Middle East Review of International Affairs*, Dec. 6, 2010, pp. 5-7; Elie Elhadj, "Household Water and Sanitation Services in Saudi Arabia: An Analysis of Economic, Political and Ecological Issues," SOAS Water Research Group, School of Oriental and African Studies and King's College London, May 2004, p. 20.

12 Elie Alhadj, "Saudi Arabia's Agricultural Project: From Dust to Dust," *Middle East Review of International Affairs*, June 2008, pp. 34-5; Manal Soliman Fakeeh, "Saudization as a Solution for Unemployment: The Case of Jeddah Western Region," PhD thesis, University of Glasgow, May 2009, pp. 10-1.

13 "Annual Meeting of Ministers of Finance and Central Bank Governors, October 5, 2013," Gulf Cooperation Council and International Monetary Fund, Riyadh, Oct. 5, 2013, p. 4.

foreigners who then transfer their wages to families outside the kingdom.

However, if recruiting native Saudis to the agricultural sector was a goal of these government subventions, the plan backfired. By the 1980s, most of the field workers were foreigners, and most farms were run by people of Egyptian, Omani, and East Asian origin. In addition, due to the gap between Saudi workers' abilities and industry requirements, more specialized work such as the operation of irrigation systems and advanced equipment were under the control of Westerners. Saudi citizens working in agriculture were mainly limited to positions in marketing and distribution.[14] Similar to the Saudi oil industry (which had been controlled by Western companies until 1980), large agricultural enterprises were established and run by outsiders. For example, Saad-co, a company that was operational in the 1990s, employed 450 workers, of whom 100 were Saudi, 60 American and European, and the rest from Asian countries.[15]

Others have pointed to a desire to diversify sources of revenue for the kingdom as key to the decision to invest so much in the agricultural sector. But an analysis of the contribution of the agricultural sector to the Saudi economy shows it to have consisted of 4.5 percent of the gross national product in 1975, 1.8 percent in 1986, almost 6 percent in 1998, and 4.2 percent in 2002.[16]

Instead, the roots of the Saudi decision must be found elsewhere. Surprisingly, it may be a result of the 1973 global oil crisis, ironically enough triggered by the Saudis' own behavior. The sharp rise in oil prices from that period produced an increase in the cost of agricultural goods from abroad, which in turn, persuaded the government to try to lessen dependence on foreign food sources. The government also feared the creation of an external food cartel that could arise in reaction to the Organization of the Petroleum Exporting Countries (OPEC) oil cartel. Alongside that, the closure of the Suez Canal between 1967 and 1975 raised transportation expenses and provoked fear that food supplies could be further disrupted. Moreover, a number of natural disasters that were detrimental to world wheat production occurred between 1970 and 1976—such as the deadly 1970 Bhola cyclone in east Pakistan as well as severe drought in Australia in 1972—and the Saudi government wanted to ensure that the country would not lack in food sources. With a rise in bread consumption due to the oil-induced economic boom and a 50 percent increase in Hajj pilgrims from 1980 to 1989, the Saudis needed more wheat as well as diversification of their food sources.[17]

14 M.G.H. al-Asmari, "Saudi Labor Force: Challenges and Ambitions," King Abdulaziz University, Jeddah, 2008, p. 24.

15 Richard M. Auty, "The Economic Stimulus from Resource-based Industry in Developing Countries: Saudi Arabia and Bahrain," *Economic Geography*, July 1988, pp. 210-22.

16 Masudul A. Choudhury and Mohammed A. al-Sahlawi, "Oil and Non-oil Sectors in the Saudi Arabian Economy," *OPEC Review*, Sept. 2002, pp. 235-8.

17 E. I. Mousa, I. S. al-Mohizea, and M. A. al-Kanhal, "Chemical Composition and Nutritive Value of Various Breads in Saudi Arabia," Food Science Dept., College of Agriculture, King Saud University, 1990, pp. 259-64; Adbullah I. al-Goosi, "Factors Affecting the Import of Wheat in Saudi Arabia," MA thesis, Michigan State University, 1980, pp. 43-50.

Settling the Nomads

But perhaps the most significant factor behind the royal family's decision to subsidize and expand the agricultural sector lay in domestic, political considerations.

Before the establishment of the modern Saudi kingdom, 70 percent of society in the Arabian Peninsula was of a Bedouin tribal, nomadic nature. In that setting, tribal leaders controlled the lives of their clansmen in ways that were essentially inimical to a centralizing government. To some degree, even after the establishment of the kingdom, these leaders maintained their status for a time through political marriages, control over pasture lands, and acquiring administrative or army posts for their people. But to truly consolidate power, the central government decided it needed to settle these Bedouin nomads in the big cities and in permanent villages, thereby breaking their traditional tribal bonds.

It must be borne in mind that the House of Saud was not the long-time ruler of the peninsula and its members were in fact something of upstarts. Generous subsidies granted to farmers by the government would be suitable compensation for foregoing a previous nomadic life and drawing the beneficiaries of the Saudi largesse closer to the ruling house. A growing agricultural industry appealed to many Bedouin nomads because it meant that they would have access to pasturelands as well as a regular income and would be released from their rigid tribal structure. Indeed, while 25 percent of Saudi citizens were nomads in the 1970s, by 1989, fifteen years after the agricultural project began, only 3.8 percent of the population remained nomadic.[18]

By 1976, there was a wave of government-sponsored development in suburbs surrounding cities where Bedouin began to cultivate their lands, including near Jeddah, Riyadh, Dammam, Ta'if, Abha, and Jizan. Bedouins who have settled in the Ta'if region now make their living as herders and farmers.

Beginning in 1970, the Saudi government established a five-year plan to settle the Bedouin. The government not only granted subsidies to the agricultural sector, it also established authorities whose responsibility was to promote urban settlement. Between 1971 and 1974, for example, the government became increasingly involved in housing matters via the Real Estate Development Fund, which granted convenient loans to young people and to the financially disadvantaged who wanted to purchase homes. In 1975, the

[18] Imman Ansir, "Optimizing the Performance of Environmental Planners and Designers in Saudi Society," *Environment Design Sciences Journal*, 2003, pp. 4-7.

Ministry of Municipal and Rural Affairs was established to assist in the settlement of rural areas. By 1976, there was a wave of government-sponsored development in suburbs surrounding cities where the Bedouin cultivated their lands, including near Jeddah, Riyadh, Dammam, Ta'if, Abha, and Jizan, in which many nomadic families settled.[19]

Large areas of the Saudi desert have been turned into huge wheat fields although the country receives only about four inches of rain a year, one of the lowest rates in the world. The Saudi Grain Silos and Flour Mills Organization, established in 1972, is the government agency in charge of managing the kingdom's wheat program. In 2010, GSFMO expanded Saudi wheat storage capacity and is currently in the process of enlarging its wheat stocks in order to increase the country's strategic reserve.

A fundamental reason behind the determination to grant generous subsidies was the fear that the masses of Bedouins who had left their nomadic lifestyle would not have a steady income, and thus the subsidies aimed at avoiding social unrest amid the newly settled people. The royal family feared that it would lose its legitimacy if it could not provide a social and economic solution to accompany settlement.

Planning for the Future

Riyadh has not, however, entirely abandoned the agricultural sector abroad. In January 2009, King Abdullah announced the establishment of an "Initiative for Saudi Agricultural Investment" aimed both at cutting Saudi agricultural production and investing in countries that had agricultural potential but little financial means. The government announced an aid package worth $800 million for companies that invested in agriculture outside Saudi Arabia, pledging further support for the purchase of tractors and chemicals, the establishment of irrigation systems, and more in these countries. Thus, the government gave $95 million worth of aid to the Hail Agricultural Development Company (HADCO), a Saudi firm which operates in Sudan. The Saudis have also increased wheat imports from Europe, North America, Russia, and Ukraine, and, in 2010, began to expand the port of Jeddah where most of these imported agricultural goods arrive.[20]

[19] Monera Nahedh, "The Sedentarization of a Bedouin Community in Saudi Arabia," PhD thesis, University of Leeds, 1989, pp. 26-40, 219-30.

[20] Carin Smaller and Howard Mann, "A Thirst for Distant Lands: Foreign Investment in Agricultural Land and Water," International Institute for Sustainable Development, Winnipeg, Manitoba, May 2009, p. 24; "Saudi Arabia: Grain and Feed Annual," *Gain Report*, Jan. 2011, pp. 3-4.

Not everyone in Saudi Arabia was happy with King Abdullah's program. Some believed that discontinuing agricultural subsidies would, in the long run, be detrimental to those on society's margins.[21] There were also those who claimed that the cessation of subsidies could expose the kingdom to extreme fluctuations in the world food market[22] and create a balance of power that could cause conflict with agriculture-producing countries—mainly Germany, the United States, and France—which are dependent on OPEC oil exports. On that score, Riyadh joined the World Trade Organization (WTO) in 2005 and as such was obliged to stop subsidizing agriculture and import goods that are cheaper to produce elsewhere.[23] But WTO guidelines allow a country experiencing a food crisis to restrict its agricultural product exports, which could negatively affect the Saudi grain supply should such a crisis arise.

Still others asserted that discontinuing support for agricultural projects could cause a loss of public faith in future government attempts to diversify the Saudi economy.[24] Indeed, the king's pronouncement soon had repercussions: Following the announcement that the subsidies would end, 42 percent of the existing 9,231 Saudi agricultural companies closed down. Many agree that King Abdullah's decision has emphasized that the government attaches more importance to preserving water than to taking care of an agricultural sector that is likely to shrink significantly by 2016.[25]

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Once the fundamental problem of water depletion was fully grasped and the decision made to stop subsidizing domestic wheat production, the Saudi government took concrete measures to both ensure its growing population's food security and develop other avenues to help farmers and land workers.[26] For example, the Saudi Grain Silos and Flour Mills Organization (GSFMO), established in 1972, is the government agency in charge of managing the kingdom's wheat program. In 2010, GSFMO expanded Saudi wheat storage capacity and is currently in the process of enlarging its wheat stocks in order to increase the country's strategic reserve and move it closer to its annual wheat consumption by the end of 2015. It has also announced that there would be an increase in reserves from six to twelve months of consumption by 2016.[27]

21 Jane Harrigan, *The Political Economy of Arab Food Sovereignty* (New York: Palgrave, 2014), p. 70.

22 "Global Food Insecurity and Implications for Saudi Arabia," Chatham House, London, Apr. 29, 2013, p. 2.

23 "Political and Economic Reform in the Kingdom of Saudi Arabia," Institute of Diplomatic Studies, Saudi Arabia Ministry of Foreign Affairs, Riyadh, Mar. 2007, pp. 29-31; "Key Economic Sectors Telecommunications and Media," *The Economist* Intelligence Unit Ltd., in *Saudi Arabia Country Report*, May 2007, pp. 16-8; "Saudi Arabia Oil and Gas Report," ibid., pp. 18-9; Philip S. Khoury and Joseph Kostiner, "Transforming Dualities: Tribe and State Formation in Saudi Arabia," in Joseph Kostiner, *Tribes and State Formation in the Middle East* (Berkeley: University of California Press, 1991), pp. 236-43.

24 Harrigan, *The Political Economy of Arab Food Sovereignty*, pp. 68-70.

25 Ibid; *Chicago Tribune Business News*, Aug. 26, 2010.

26 Thomas W. Lippman, "Saudi Arabia's Quest for 'Food Security,'" *Middle East Policy*, Spring 2010, pp. 90-7.

27 "Global Food Insecurity and Implications for Saudi Arabia," pp. 8-9.

Saudi Arabia has built additional grain silos to store a 12-month reserve to counter the threat of supply disruptions. With the decision to stop domestic grain production in 2016, most of the new silos will be built closer to ports in order to receive imports.

Over the past few years, several new wheat silo projects have been initiated. By December 2015, these storage facilities are slated to yield additional wheat storage capacity of about 3.7 million tons (MT) on top of current GSFMO silos that have a combined storage capacity of 2.8 MT.[28] GSFMO also signed contracts to build five additional storage projects in Mecca, Jazan, Hasa, and Qasim with a combined storage capacity of 790,000 MT, which were to be operational by the end of 2014.[29] Storage silos may not be cheap to build and manage, but they are still much less expensive than growing cereal in such a harsh climate. Annual storage costs for wheat in Saudi Arabia are about $70 million, a minute figure in comparison to the cost of production subsidies, estimated at around $5 billion a year in 1984-2001.[30]

Critics, however, point to the fact that most of Saudi Arabia's current silos were originally designed to receive domestic crops and are thus located inland; of the 2.5 MT of current silo capacity, 90 percent is located in those regions. Silo location has a direct link to cost efficiency as high transportation costs will need to be offset somehow and perhaps shifted to the consumer.[31] With the decision to stop domestic grain production in 2016, most of the new silos will be built closer to ports in order to receive imports.[32] But even with plans to expand silos near Jeddah and Jazan, close to 80 percent of silo capacity will still remain for the time being in the interior of the kingdom. Others maintain that a 12-month reserve is more than is necessary even with the threat of supply disruptions.[33] There is also the difficult task of rotating such a large number of grain stockpiles to and from different locations

28 Hussein Mousa, "Grain and Feed Annual: Saudi Arabia 2014," *Gain Report*, 2014, p. 4-5.

29 Ibid., p. 6-7.

30 Rob Bailey and Robin Willoughby, "Edible Oil: Food Security in the Gulf," Chatham House, London, Nov. 2013, pp. 10-2.

31 "Global Food Insecurity and Implications for Saudi Arabia," pp. 9-10.

32 Danny Hamlick, et al, "Comparing Egypt and Saudi Arabia's Wheat GVC," Minerva Research Initiative, Duke University, Durham, N.C., Apr. 2014, pp. 4-6.

33 "Global Food Insecurity and Implications for Saudi Arabia," pp. 9-10.

as an inability to do so could result in stock spoilage.[34]

While looking to ensure food security for the kingdom, the government has also sought to maintain a stable social fabric that has the potential of fraying in the absence of water subsidies and a dramatic shift in domestic food production goals. It has promoted new water technologies such as drip irrigation systems and enhanced water use efficiency. Saudi agronomists are encouraging farmers to include more sustainable agriculture methods and crops. Different types of xerophytes—plants that are adapted to desert climates—have been introduced with the hope of future commercial potential from their fruits. These crops can offer new ways for farmers in arid areas to earn a living.[35]

Educational and extension programs are a significant part of the Saudi equation. Stressing the importance of these initiatives will raise awareness of the importance of water conservation among growers. Providing farmers with crucial research information[36] will help with the challenges the internal agricultural industry is facing such as low soil fertility and the need for environmental protection.[37] Thus, King Saud University in Riyadh established an agricultural extension center in May 1990. This is the only academic program of its kind in the entire gulf region and offers a degree in agricultural extension and rural development.[38]

To many Saudis, rural areas epitomize a past golden age, and preserving them is seen as a form of protecting a national heritage.

In terms of the social dimensions and the challenges faced there, recent estimates indicate that only about 15 percent of the Saudi population still lives in rural areas. Riyadh feels it is of great importance to keep a balanced ratio of rural to urban population. If such a balance can be reestablished, it will alleviate pressures on the big cities and ease the delivery of essential services to the entire population.[39]

To many Saudis, rural areas epitomize something of a past golden age, and preserving them and their inhabitants is seen as a form of protecting a national heritage. The exodus of farmers to the cities is perceived as a loss, and agricultural education and farm extension programs may stem that loss. Rural industries such as herbal medicine, bee keeping, and sheep and goat rearing can continue with the assistance of modern technology. These initiatives may help make living in rural areas more inviting and economically feasible so that more people return to their ancestral farming communities.[40] In doing so, the Sauds will have made sure not only that the food supply is ensured but that society is secure and balanced as well. These decisions, combined with the Arab upheavals that have cascaded throughout the region since late 2010, gave Riyadh cause to consider its food security, more specifically, the challenge of securing wheat, the main source of

34 Ibid.

35 Mirza B. Baig and Khodran H. al-Zaharani, "Agricultural Extension in the Kingdom of Saudi Arabia: Difficult Present and Demanding Future," Department of Agricultural Extension and Rural Society, College of Food and Agricultural Sciences, King Saud University, n.d., p. 8.

36 Ibid., p. 9.

37 Ibid., p. 10-12.

38 Ibid.

39 "Global Food Insecurity and Implications for Saudi Arabia," p. 6.

40 Baig and Zaharani, "Agricultural Extension in the Kingdom of Saudi Arabia," pp. 11-2.

sustenance for its people. The recent uprisings highlighted the problems for the Saudis that can arise concerning protection of this main food source if the correct measures were not taken and expedited solutions were not devised.[41]

Conclusions

The Saudi attempt to develop its own, internal agricultural industry to ensure food security was considered by many destined to fail from the outset. Indeed, subsidizing the agricultural industry had a devastating effect on the country's water supply as well as a negative impact on the economy as a whole.

Yet, despite the failure to guarantee food security from domestic sources, the project did have positive effects by providing employment for the hundreds of thousands of Bedouins who had abandoned their traditional, itinerant lifestyle because of the country's rapid urbanization. In the long term, the Saudi government was forced to look for other solutions for the food security challenge, notably purchasing lands abroad and creating food stockpiles that could reduce the challenge in any future food crisis.

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41 Raed H. Charafeddine, "The Economic and Financial Impacts of the Arab Awakening," presentation, Belfer Center for Science and International Affairs, Harvard University, Cambridge, Oct. 3, 2011, pp. 5-13.