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FOOD SECURITY AS A PRELUDE TO SUSTAINABILITY: A CASE STUDY IN THE AGRICULTURAL SECTOR, ITS IMPACTS ON THE AL KHARJ COMMUNITY IN THE KINGDOM OF SAUDI ARABIA*

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Abstract. Food security is an absolute necessity for human wellbeing. Food insecurity could adversely affect national security and sustainability. As food security is reliant on agriculture, self-sufficient agricultural industry is the basis of the economic strength of any nation. The current food supply in the Kingdom of Saudi Arabia (KSA) from the available domestic sources is far below the required domestic demand. The country meets its food requirements through imports, which is as high as 80%. The present study investigated the problems faced by the agriculture sector in Al Kharj region. The data for the study has been collected through field visits in farms in Al-Kharj. The study has succeeded in identifying the problems faced by the farmers of the region, and has made some suggestions. Though the study is conducted in one region of the country, it has applicability in the entire Gulf region, as the problems faced by them are same and similar in nature. It is expected that the study will act as a trigger for further research.

Keywords: agriculture; sustainability; food sustainability; Saudi Arabia

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1. Introduction

Food security and sustainability are closely related topics, and the two have been subjected to studies in multitudes of dimensions (Sulphey, 2017; Sulphey & Safeer, 2017; Sulphey & AlKahtani, 2017; Tireuov, Mizanbekova, Kalykova & Nurmanbekova, 2018). For any country, food security is paramount to human wellbeing and is akin to national security and sustainability (Tvaronavičienė, 2018). Food security is totally reliant on agriculture. Self-sufficient agricultural industry is considered as the very basis of the economic strength of any nation (Akhmetova & Suleimenova, 2018). Threats to food security will undermine the very foundation of any country (Skrypnyk, Tkachuk, Andruschenko & Bukin, 2018). It is estimated that the present food supply in the Kingdom of Saudi Arabia (KSA) from the available domestic sources is far below the supply daily domestic demand. This occurs due to limitations in the kingdom with respect to a host of aspects including availability of cultivatable land and water.

KSA is unique with respect to many aspects (Sulphey, AlKahtani & Syed, 2018). With an approximate area of 2,149,690 square km is the largest country in Arabia, with an estimated population of over 30 million (Ministry of Economy and Planning, 2014). The country has only 1.6% of the total land mass as arable and the per capita arable land are very low at 0.11 ha (World Bank, 2018). Globally this is one among the lowest. In the past few decades Saudi Arabia has undergone remarkable social and economic development. The harsh extreme climatic conditions of the country are not conducive to farming. Despite this, the country has time and again initiated a large number of agricultural schemes and programs with a benign objective of ensuring food security and to have inclusive development of the society (Bailey & Willoughby, 2013). A few schemes initiated in the recent past include agricultural expertise, credit schemes, farmers' responsive plans, free agricultural land distribution, intensive extension programs, etc. These schemes have helped in enhancing substantially the yield of fruits, vegetables, flowers, cereals and a host of veterinary products including cattle and poultry feed (Fiaz, Noor & Aldosri, 2016).

The various schemes and programs adopted by the Government enabled the country to export food surplus in the early 2000s (FAO, 2009). However, the realization that the existing scarce water resources in the region need to be provided the due consideration, prompted the Kingdom to rollback the intensive agricultural production program. This decision was taken as intensive agriculture resulted in disproportionate use of non-renewable natural resources (Al-Subaiee, Yoder & Thomson, 2005). As a result of this the contribution of agriculture to GDP in KSA, towards the end of the decade decreased to 4.7% (from 5.2%). However, the country succeeded in maintaining stability in the volume of production due to enhanced productivity (Ministry of Agriculture, 2008).

The country has been categorized as "water stressed", and is considered to face acute water shortage by the year 2050 (Falkenmark, Rockstrom & Karlberg, 2009). According to Baig & Straquadine (2014) the non-renewable aquifers of the country is being depleted at a rapid pace as a result of adoption of un-sustainable farming practices. This situation points towards the definite need for self-sufficiency in food production. Due to the unique situation prevalent in Saudi Arabia, sustainable food security can be attained only through the adoption of modern agricultural technologies that are capable of improving productivity (Fiaz, et al, 2016).

The kingdom has 3850 cubic meters per year available groundwater, whereas, the surface water is 1300 cubic meters per year, which is variable and depends on annual rainfall. The kingdom's estimated total renewable water resources are about 500 km³, 340 km³ of which is economically feasible to extract. It is estimated that the kingdom is consuming an average of 24 billion cubic meter of water pa. According to Al-Hussayen (2007) agriculture sector uses that lion's share of this with 88%, followed by municipalities with 9%. The industrial sector consumes around 3%. The demand for municipal water is increasing exponentially due to the increasing

migration from rural areas, in addition to the average population growth of 3% (Ministry of Economy and Planning, 2005). The growth trend shows that in the near future, the available water resources will be incapable of meeting the rising demand. It is estimated that the available water from all sources (both non-conventional as well as conventional) will not be capable of meeting the demand gap of about 11.5 billion cubic meters per annum (Fiaz, et al, 2016). As stated earlier, despite depleting the non-renewable aquifers as a result of un-sustainable farming practices, (Baig and Straquadine, 2014), the country is meeting over 80% of its food requirements from imports (Baig, Al-Zahrani, Schneider, Straquadine & Mourad, 2018), creating further burden on the foreign exchange resources (as food is made available by the Government to the Saudi population at substantially subsidised rates).

Another problem plaguing the country is and adversely affecting food security is the large scale wastage. The Barilla Center for Food and Nutrition (2106) ranked Saudi Arabia among the top 25 countries that waste food. They have put the per capita annual wastage at a whopping 427 kg. The present study indents to find out the impediments to food security in the Kingdom of Saudi Arabia. The problems faced by the kingdom in agriculture are unique in nature. Coupled with it is the socio-economic and cultural factors of the country.

2. Review of Literature

Availability of food is essential for any society to thrive. Food availability is defined as “sufficient quantities of food of appropriate quality, supplied through domestic production or imports, including food aid”. In a broader level this availability is measured as the Average Dietary Energy Supply Adequacy (ADESA), which is expressed in terms of the ratio of “dietary energy supply” to the energy that is required from the diet. The concept of food security has been defined based on a number of dimensions and factors. Many definitions are available about food security.

Defining the concept

Food security is an extremely complex subject that involves a broad spectrum of disciplines like agriculture, economics, sociology, culture, engineering, entrepreneurship, environment, politics, human physiology, etc. The FAO (2009) states that food security occurs only “when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (p.8). Though there are multitudes of definitions for food security, the most widely accepted one is that which has been provided by FAO (2010). According to them, food security is:

“a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”

In ordinary parlance food security is considered as the condition when all members of a society have both physical and economic access to either “buy, produce, obtain or consume sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life”. From the available definitions and literature, food security can be considered to be based on three aspects that are presented in Table 1.

Table 1. Basic Aspects of Food Security

No	Aspect	Description
1	Availability	<ul style="list-style-type: none"> The physical presence of the food (this can be grown or, produced locally, or made available through transfer in the form of aid or import).
2	Access	<ul style="list-style-type: none"> This involves the accessibility of the available food to the individuals. Access is said to occur only when all the members of the society have the required resources/money to have the required foods that provides them with a nutritious diet. Access is based on the income levels of the members in the respective societies

		<ul style="list-style-type: none"> • It is also based on the societal, institutional and market rights to which an individual is entitled. • Insecurities in the societies like conflicts, strife, uprisings, etc. could hamper the aspect of access. • Access could also be hampered for people with low income due to the collapse of possible protective safety net institutions.
3	Utilization	<ul style="list-style-type: none"> • This is the way members of the society use the available food. • Utilization of food is dependent of a host of factors like quality, production and storage, nutritional utility, health status of the consumer, etc. • Utilization could be affected due to diseases, improper sanitation, inadequate nutritional knowledge, cultural issues, demographics of the members, etc.

Food safety initiatives help in the reduction of food borne diseases among populations (Havas & Salman, 2011). According to Wakabi (2006) food insecurity in any economy would result in malnutrition and case the resultant exacerbation of health. It is also considered to suppress the immune system and make the population highly prone to diseases. Wolfe, Daszak, Kilpatrick & Burk (2005) is also of the opinion that food insecurity resulting from problems associated with access and availability would force populations to go in for alternate food sources, which could possibly expose them to diseases not known hitherto.

Rising urbanization has also been identified as an impediment to food security. The vulnerability of urban population to food insecurity and related complications was evident during 2007 and 2008 due to astronomical rise in the oil prices (Satterthwaite, Mcgranahan & Tacoli, 2010). This problem has strong applicability in KSA as the kingdom is 80% urban. Further, any potential issues at the Strait of Hormuz could also be detrimental to the interests of Saudi Arabia (Efron, Fromm, Gelfeld, Nataraj, & Sova (2018). A fair review of the existing literature shows that no studies have been undertaken in the dimension proposed by the researchers. The present study attempts to address this gap in literature.

3. Methodology

Qualitative case study research has been identified to address the proposed questions in the present work. Case study is often identified more as a research strategy than a method (Eriksson & Kovalainen, 2008). However, it has the capability to produce substantial quantitative data, though it may not result in generalizations based n statistical tools or quantitative and deductive findings (Ghuri & Gronhaug, 2005). It definitely is an ideal tool to conduct investigations about the complex cross relationships that may occur across various domains/environments like human, organization, society, etc. (Sulphey, in print). This method has the added qualification of having the required dexterity of being connected harmoniously to “interpretative, ethnographic and field-research studies” (Eriksson & Kovalainen, 2008). Yin (2003) has identified the steps required to conduct a successful qualitative case study, which was closely followed in the present study.

For having a better understanding of the problem under study, and have the views of farmers of diverse nature, the researchers classified the farms into small, medium and large. The first two types of farm have been included in the purview of the study. Since large farms have multitude of advantages like availability of immense resources at their disposal and their problems are altogether different in nature, they have been excluded from the purview of the study. The study was limited to small and medium farms in the Al-Kharj governorate.

The researchers have conducted filed visits in and around the Governorate of Al-Kharj and collected the required data from various stake holders like farm owners, government officials, farm managers/workers, etc. The researchers have used a form of unstructured interview to collect the required data for the study. The information so received was assimilated and discussed with experts in the field to arrive at the findings. Adoption of this

approach has helped the present researchers in successfully arriving at a thorough and holistic understanding of the issue under study. Though the study was conducted at the Al-Kharj Governorate of Saudi Arabia, the findings have wide application and relevance to the entire gulf regions, as all the countries in the region face same or similar problems.

4. Findings of the study

As stated in the earlier sections, the findings of the study were based on the data collected from the field researches. It was observed that most famers (both small and medium) were focusing on cash crops like leafy vegetables, tuber crops and certain other exotic vegetables that fetched high returns. Grains and cereals cultivation was observed to be cultivated only at a bare minimal rate. This indeed does not auger well as this may cause the country to import the entire chunk of its requirement. All farmers, irrespective of the size, were particular in cultivating date palms, as it is considered part of the culture in Saudi Arabia. However, it was found to be limited to certain parts of the farm land, as date palms provided only single harvest in a year. While medium farmers involved in poultry and dairy farming; the small farmers involved in poultry. These farming practices adopted by them helped in enhancing the fertility of the soil and aided in better yields.

All the farmers identified water availability as a major issue facing the farming industry. Since the country has dry and arid climate availability of water is a major challenge. Further, there is also the issue of falling water levels due to overexploitation and failing rain falls. Though the medium size farmers had their own irrigation wells and system, the high cost of electricity worked to their disadvantage. Most small farmers used the treated water supplied by the municipal authorities, though some of them had their own wells.

For a better understanding of the problems and the prospects, the findings of the study are presented in Table 2, based on the size of the farms.

Table 2. Findings based on the field visits

Size of farm	Problems	Prospects
Small	<ul style="list-style-type: none"> • Water availability for irrigation purpose • Availability of required seasonal labour • High costs for inputs like seeds, fertilizers, pesticides, etc. • Extension facility from the concerned departments • Timely requirement of funds for various purposes • Pest attacks • Drastic climatic variations • Marketing issues • Drastic price variations 	<ul style="list-style-type: none"> • Lower levels of investment requirements • High level of possibility of mobility between and among crops cultivated • Advantages of intercropping possibilities • Labour problem is not acute, due to lesser requirement •
Medium	<ul style="list-style-type: none"> • Water availability for irrigation and other associated purposes • High costs for inputs like seeds, fertilizers, pesticides, etc. • Higher levels of investments for infrastructure • High cost for expert labour • High electricity consumption and cost • Paucity of timely extension support from various departments • Marketing issues • Multiple pest attacks 	<ul style="list-style-type: none"> • Proper professional and scientific management of resources • Branding possibilities for products • Availability of experts in finance/ accounting, marketing, grading, etc. • Better acceptability by the vendors • Advantages due to economies of size • Advantages of multiple cropping • Availability of round-the-clock supervision and labour • Buying agreements will departmental stores and hyper pest markets

	<ul style="list-style-type: none"> • Drastic climatic variations • Drastic price variations for the products and associated marketing issues • High credit periods by vendors 	
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Another problem faced by Saudi Arabia is the alarming rate at which the country is getting urbanized. An early estimation done in 2014 found that approximately 83% of the country’s population reside in urban areas. Further, it was found to be increasing at the rate of 2% annually. At this rate, in the near future KSA will be fully urban in nature, directly affecting water availability, agriculture, the social fabric, etc. As another direct fall out of urbanization, the youth (even children of farmers) were found to be reluctant to involve in the vocation of agriculture. These aspects are bound to have its adverse repercussions in the near future, and need to be addressed urgently.

5. Suggestions

It is essential to make the country secure in terms of food availability. Towards this, the nations should utilize all resources available at its disposal. It should, on a priority basis, take all required steps to minimize the economic and social cost associated with food production. A national movement is also required to tackle food wastages. Towards this, there is an urgent need to formulate a national policy that integrates all possible solutions that makes a seamless supply of food products, while ensuring its nutritional status.

Though Saudi Arabia has a number of geo-climatic limitations and problems, agriculture definitely has immense potential for contributing towards sustainable food security. Towards this the agricultural industry need to make required investments in technology that is capable of promoting a “market-oriented agriculture” that enhance productivity so as to derive the maximum possible income from each unit of water used. The system should be such that it is can bring in better incentives to farmers, and save as well as generate foreign exchange earnings. In order to attain this, there is the requirement of careful analysis and identification of the right mixture of crops and trade-offs (Table 3).

The suggestions based on the findings of the study are presented in Table 3.

Table 3. Suggestions

No	Suggestions	Details
1	Developing of sustainable and resilient agriculture	<ul style="list-style-type: none"> • To make the agriculture sustainable, problems associated with soil quality and climate change need to be addressed with top priority. • This requires a holistic approach that comprehensively takes into consideration aspects related to: <ul style="list-style-type: none"> ○ Land management ○ Water management ○ Crop management ○ Economies of size (financial management) ○ Information management
2	Research and extension activities to boost productivity	<ul style="list-style-type: none"> • Productivity needs to be provided the top priority, as the availability of arable land is a big issue. • There is a definite requirement for research and extension activities towards enhancement of productivity. • Extension activities of various institutions including research organizations, universities, and government bodies need to be streamlined, networked, and organised in a seamless manner. • The various research bodies (both private and public) need to be networked so as to have knowledge and experience sharing.
3	Adoption of latest farming	<ul style="list-style-type: none"> • For productivity enhancement, all famers need to be sensitized to adapt

	technologies	<p>modern farming techniques</p> <ul style="list-style-type: none"> • Incentivizing and appropriate rewarding of technology adoption by progressive farmers. • Appropriate policy frameworks towards adoption of latest farming technology will act as a “push factor” in this direction.
4	Multi-cropping	<ul style="list-style-type: none"> • Multiple drought resistant crops could act as a cushion against recurrent losses for the farmers. • This will act as a hedge against crop losses and help in maintain the fertility of the soil.
5	Supportive institutional framework	<ul style="list-style-type: none"> • The financial institutions need to be sensitized and appropriate schemes devised for making available timely and easy accessible seasonal finance. • Adequate focus should be provided to small, marginal and medium farmers, which could act as a “pull factor” in favour of them.
6	Price stabilization mechanisms	<ul style="list-style-type: none"> • Due to various contingencies farmers have to face wide fluctuations in prices. • An institutional early warning and price stabilization mechanism need to be in place so that price variations do not take the farmers by surprise. • Availability of adequate and appropriate storage facilities could be a major step in this direction. • Financial support for small farmers, including subsidization would go a long way in the direction of food security.
7	Water efficiency	<ul style="list-style-type: none"> • The region being water stressed, water efficiency need to be given top priority. • Crops that require lesser amount of water need to be identified and prioritized, than those which require larger quantities. • Water efficient techniques and technologies need to be made available to all farmers irrespective of type and size. • Wastage of water need to be reduced considerably and could even be made an offence. • A policy framework and a popular movement towards water conservations need to be in place, as presently this resource is taken for granted by the farmers.
8	Efficiency throughout the supply chain	<ul style="list-style-type: none"> • There is need for efficient storage facilities of various agricultural produces. • Efficient supply chain could go a long way in substantial reduction of post harvest losses, which currently is at disproportionately higher levels. • This will also solve the problem of availability and accessibility of required food for all the sections of the society, irrespective of their location and demography.

6. Conclusion

Maintenance of sustainable food security is a universal concern. This requires robust policies that take into consideration diverse views, feedback and opinion from various stakeholders. This will help in boosting and accelerating agriculture. The present work was an attempt to understand the prevailing status of agricultural prospects in Al Kharj. The study has been confined to small and medium farms located in Al Kharj. This could be a limitation as large corporate farms have not been brought under the purview of the study. However, since the researchers, have provided due consideration to all the problems faced by the small and medium firms, the limitation would not be of significance. However, further researchers could attempt to explore the possibility of identifying the problems of large corporate farm houses, in addition to involving other stakeholders. Since the *Vision 2030* is focusing on enhancing the non-oil sector growth, there are immense possibilities and opportunities for farmers and other prominent stakeholders to collaborate in reforming agricultural practices and policies. There is a definite need to enhance productivity of agriculture in the kingdom. Partnering with global experts in agriculture will give the country open up the floodgates of avenues in this field. It is expected that the present work will act as a trigger in motivating further studies in this challenging area.

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