Prospects for improving food availability through increased agricultural production and productivity

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1. Introduction

Food security is of great concern to Arab countries. They have been pursuing a target of higher food self-sufficiency rate, but achieving this goal remained beyond reach. With limited cultivable land and scarce water resources, Arab countries did not use their agricultural endowments effectively and efficiently which threatened agricultural sustainability.

The 2030 Agenda for Sustainable Development was finalized during the United Nations Sustainable Development Summit in September 2015. The core component of the Agenda is the Sustainable Development Goals (SDGs), 17 cross-cutting goals which will guide global action and investment for sustainable development over the next 15 years.

Arab countries need to address a series of challenges they face in order to achieve sustainable development including aridity, limited cultivable land, scarce water resources and serious implications of climate change. Weak policies, insufficient investment in science and technology and agricultural development in the past have contributed to the impoverished state of agricultural resources and to their inefficient use and low productivity. Population growth, rising demand for food, degradation of natural resources, and conversion of farmland to urban uses, pose further challenges to the enhancement of food availability in the Arab region.

2. Structure and objectives

The objective of the current paper is to discuss prospects for improving food availability through increased agricultural production and productivity in the Arab World by assessing Sustainable Development Goals target 2.3 and 2.4. Target 2.3 states: “By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment”. Target 2.4 emphasizes that “By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality”.

3. Target 2.3: Productivity and income of small food producers

The Inter-agency and Expert Group on Sustainable Development Goal Indicators (IAEG-SDGs) worked on the formulation of two indicators that are directly linked to SDG target 2.3. The first

indicator (2.3.1) is defined as "Volume of production per labor unit by classes of farming/pastoral/forestry enterprise size" while the second indicator (2.3.2) concerned the "Average income of small-scale food producers, by sex and indigenous status".

A. Composition and scale of small food producers

Currently, there is still no agreed international definition of a "small scale food producer". Therefore, assessing target 2.3 that deals with small-scale food producers in particular, and not agriculture in general, through proposed indicators is still not feasible.

Considering such fact, the Food and Agricultural Organization (FAO) suggested that it would be necessary for an indicator on productivity and incomes to measure performance for the two lowest quintiles of countries' farm size distributions. With this method, it should be possible to compute the value of food production per hectare as a measure of productivity. It should also be possible to compute the value of agricultural production per labor unit as a measure of farm labor productivity, which, in absence of data on net farm incomes, may be used as a rough proxy for smallholders' incomes (FAO, 2015). Accordingly, FAO Statistics, in collaboration with IFAD and the World Bank, are working towards the establishment of a harmonized program of Agricultural and Rural Integrated Surveys (AGRIS) that could form the basis for the collection of data on this, as well as on several other SDG indicators for the agricultural sector. Preliminary data are currently available for nine countries in the world, but none from the Arab region as yet.

The present paper aims to assess the current level of productivity and income of small food producers in Arab countries and region through existing database of FAOSTAT and the World Bank as provided for all agricultural producers.

B. Current level of productivity and income of food producers in Arab countries and region

A key to food security in Arab countries is to improve the productivity and sustainability of agriculture. Arab countries have devoted a considerable portion of their agricultural resources to the production of cereals, in line with the importance of these commodities to food security in terms of domestic supply and cost of imports (FAO, 2002). Particularly, taking wheat as an example, we can see that its productivity more than doubled between 1961 and 2014 in the Arab region (Figure 1).

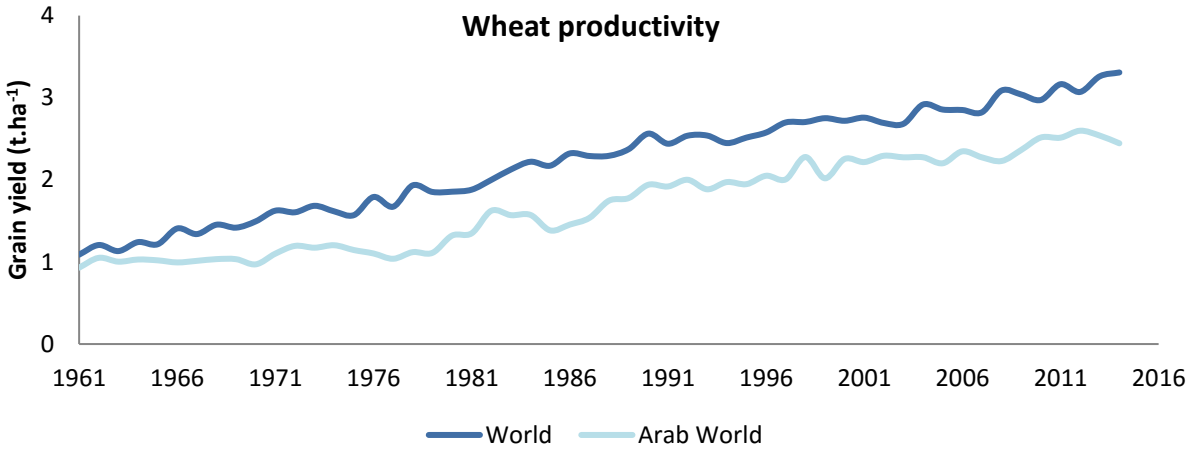

Figure 1. Wheat productivity in the Arab World
Source: FAOSTAT database

However, despite productivity growth, wheat yields in the region are below the global average, indicating that there is still considerable space for improvement for both small and larger-scale farmers in the region, particularly in those countries where yields are still very low. Figure 2 presents clearly that most of Arab countries have an average wheat yield between 1990 and 2014 below the World average of 2.8 $t.ha^{-1}$ except Egypt, Saudi Arabia, Oman and the United Arab Emirates. In fact, only Egypt showed an average yield exceeding 6 $t.ha^{-1}$ followed by Saudi Arabia with an average yield between 4 and 6 $t.ha^{-1}$.

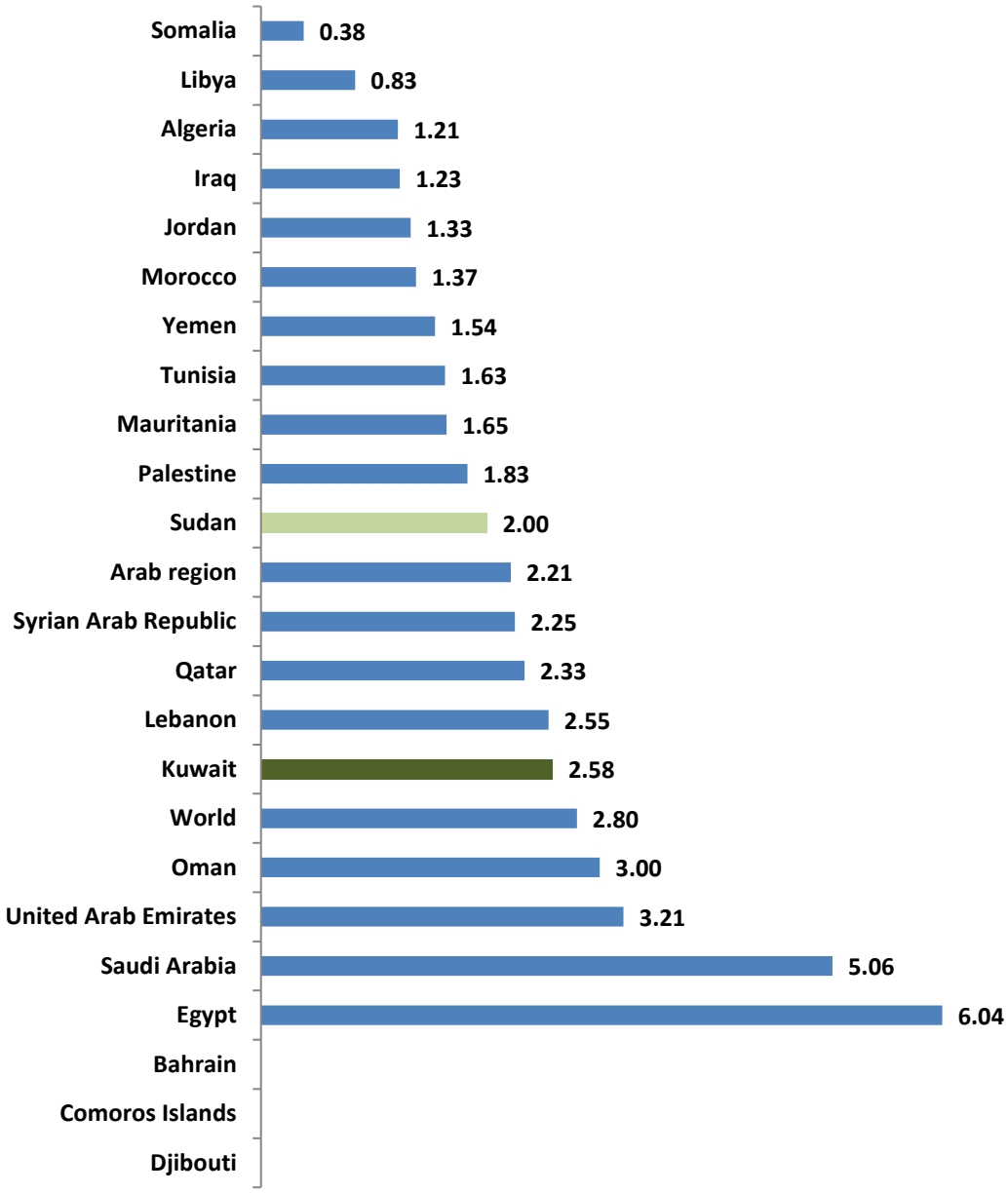

Figure 2. Average wheat yield in ton ha^{-1} (1990-2014)

Source: FAOSTAT database

C. Assessment of the main factors that influence achieving target 2.3

I. Equal access to land

In the Arab region, it is becoming increasingly difficult to produce food because land for agriculture is becoming scarcer. There is a growing preoccupation that agricultural land is being lost to non-agricultural uses in a period where Arab population is growing rapidly. Particularly,

the arable land per person declined by 70 percent from 0.48 ha in 1961 to 0.14 ha in 2013 as shown in Figure 3. In fact, the long-term land productivity potential is being undermined by the ever more intensive use of land in production through multiple cropping, reduced fallow periods, and excessive use of agrochemicals and spread of monocultures perceived as leading to land degradation.

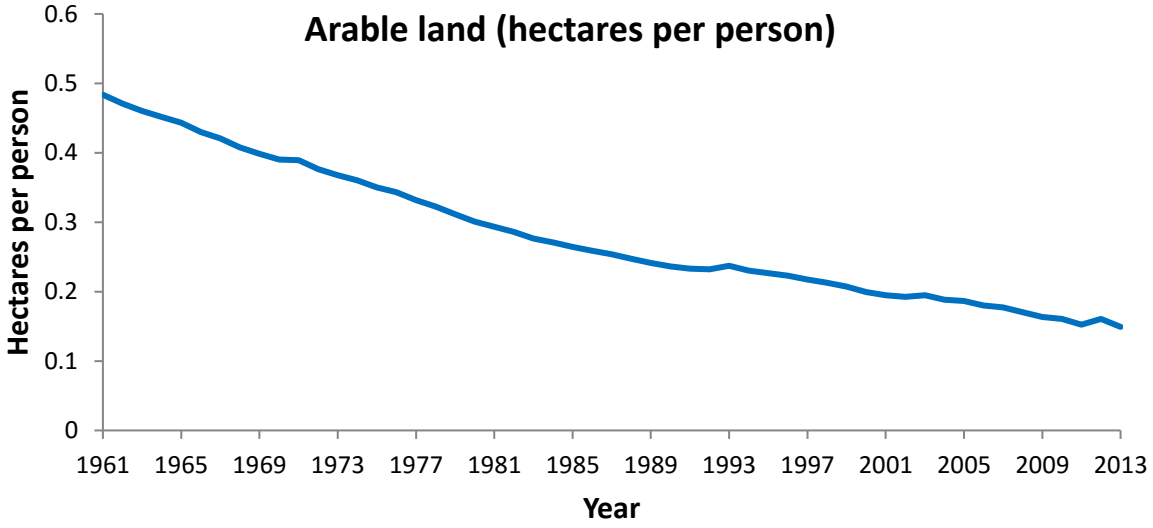

Figure 3. Arable land in the Arab region

Source: World Bank Development Indicators

In addition, women make essential contributions to agriculture; yet across many countries of the region, women consistently have tenure rights that are often less secured. Their reduced access to land, other productive resources and inputs remain serious obstacles for agricultural productivity improvement and food security of the region. Apart from equal access to land ownership between men and women, the issue of land ownership and tenure system in the region continue to be a bigger hindrance in terms of land development and agricultural productivity in the longer run. Table 1 gives an idea about the female employment in agriculture for Arab countries. According to the World Bank, still there are no women employed in agriculture in some countries while the highest female employment in agriculture is in Egypt, Iraq, Morocco and Sudan with 42.9%, 50.7%, 59.9%, 60.7% of the total female employment respectively.

Table 1. Female employment in agriculture in Arab countries

Source: World Bank Development Indicators

	Employment in agriculture, female (%)
Qatar (2013)	0.0
Bahrein (2010)	0.0
Kuwait (2014)	0.0
United Arab Emirates (2009)	0.1
Saudi Arabia (2013)	0.2

Oman (2010)	0.5
Jordan (2014)	0.5
Algeria (2011)	2.9
Syrian Arab Republic (2011)	12.3
Tunisia (1989)	22.7
Yemen (2010)	28.0
Egypt (2013)	42.9
Iraq (2008)	50.7
Morocco (2012)	59.9
Sudan (2011)	60.7

The numbers between brackets refer to the year of statistics

II. Equal access to other production resources (energy, water, fertilizers, certified seeds,)

Arab countries are exposed to high variability of agricultural productivity arising mainly from difficulty of access or management of farming inputs (irrigation, seeds, fertilizers, pesticides, and mechanization), agricultural practices and technologies. The total area equipped for irrigation between 1990 and 2014 and the fertilizer consumption in kg per hectare of arable land for the different Arab countries are shown in Figures 4 and 5, respectively. For example, irrigation in Egypt covers nearly 100 percent of the cultivated area, while in Sudan irrigation is limited to less than 10 percent of the cultivated area (AOAD, 2012). Fertilizer use in Sudan did not exceed an average of 13 kg/ha in 2013, compared to about 615 kg/ha in Egypt and 6500 kg/ha in Qatar. In addition, the average fertilizer use in the Arab region was 135 kg/ha in 2013 while the World average was 78 kg/ha in 2013.

There is a clear need to boost agricultural productivity in Arab countries through equal access to production resources such as irrigation technologies, high-yielding seed varieties, chemical fertilizers, pesticides and other inputs for the enhancement of food security in the region. However, such production inputs should be used without compromising the long-term sustainability of agriculture that is currently threatened by human pressure and mismanagement, climate change, soil degradation, groundwater depletion, and environmental contamination.

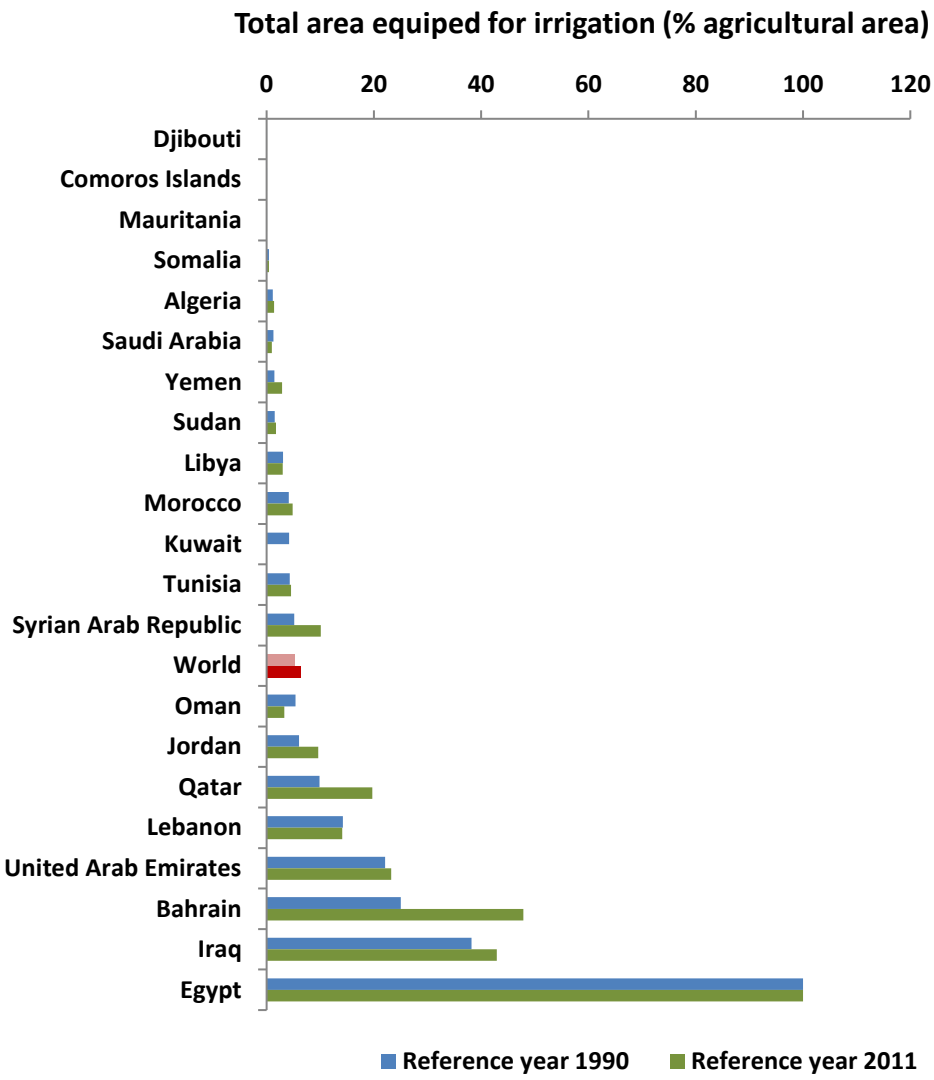

Figure 4. Total area equipped for irrigation in the Arab countries

Source: FAOSTAT database.

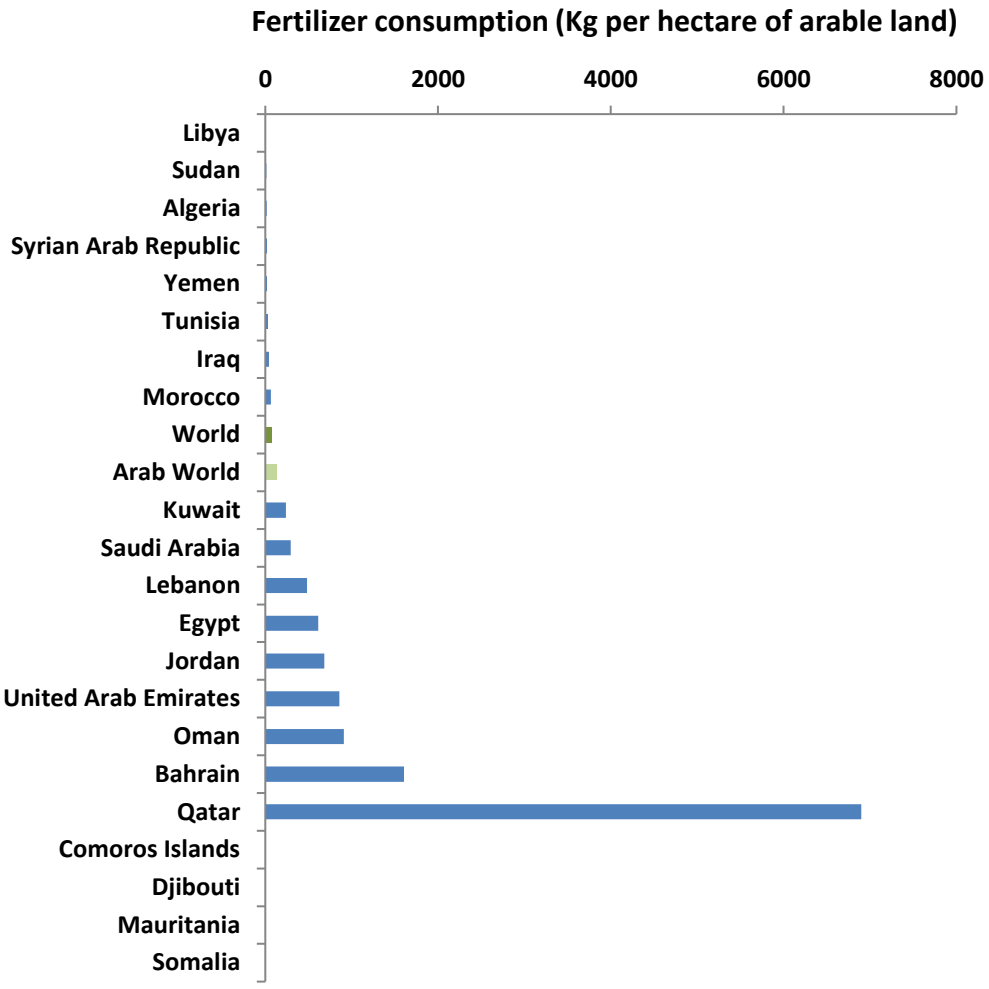

Figure 5. Fertilizer consumption rates in the Arab countries

Source: FAOSTAT database (year 2013).

III. Equal access to knowledge and financial services

Knowledge and financial services are a matter of concern in Arab countries. Particularly, extension systems in those countries have not been fully effective, leading to slow dissemination of available technologies. This is due to many factors including inadequate funding, which needs to be addressed at the local, national and regional levels. Simultaneously, policy makers need to consider rural financial services (credit, insurance, etc.) that could encourage resource-poor, risk-averse farmers to adopt new technologies. In addition, other solutions might be explored, such as opening the research and extension systems to more providers, and creating partnerships between governmental institutions, universities, research centers, non-governmental organizations and private firms.

IV. Equal access to markets and opportunities for value addition

Growth of the food marketing sector offers new opportunities for smallholder farmers by broadening their choice of input suppliers and of outlets for produce, as well as increasing their access to credit and training. However, access to both input and output markets has proved problematic for many smallholders. Small farmers access to markets can be improved through better organization and greater cooperation, which may involve not only farmers but also a larger number of stakeholders, including agricultural support service providers, NGOs, researchers, universities, local government and international donors.

V. Access to non-farm employment

The traditional image of farm households in Arab countries has been almost exclusively on farming with little rural non-farm activities. Nevertheless, there is mounting evidence that rural non-farm activity income (i.e. income derived in this sector from wage-paying activities and self-employment in commerce, manufacturing and other services) is an important resource for farm and other rural households (Maystadt et al., 2014). There are several reasons why the promotion of rural non-farm activity can be of great interest to Arab countries. Particularly, the evidence shows that rural non-farm income is an important factor in household economies and therefore also in food security, since it allows greater economic access to food. Finally, both non-farm and farm employment are of great importance for smallholder farmers for a prosperous, satisfying lifestyle and a descent standard of living. Feasible agriculture adopting best farming practices that conserve the sustainability of land and water resources as well as agricultural production systems allow reaching such lifestyle.

4. Target 2.4: Ensure sustainable food production systems and implement resilient agricultural practices

The Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs) proposed an indicator for the assessment of SDG target 2.4. The indicator was defined as “Proportion of agricultural area under productive and sustainable agriculture”. The numerator captures the three dimensions of sustainable production: environmental, economic and social. The measurement instrument that is farm surveys, will give countries the flexibility to identify issues related to sustainability that are most relevant to priorities and challenges within these three dimensions. Land under productive and sustainable agriculture will be those farms that satisfy indicators selected across all three dimensions. Data related to the proposed indicator are still not available. FAO, in collaboration with IFAD and the World Bank, are working towards the establishment of a harmonized and cost-effective program of Agricultural and Rural Integrated Surveys (AGRIS) that could form the basis for the collection of data on indicator 2.4. Through this program, methodological guidelines on how to conduct enterprise surveys in agriculture will be developed and provided to countries, together with technical support in the implementation of the farm surveys.

This paper will assess the current level of national and regional food production in Arab region through existing data of FAOSTAT and the World Bank databases.

A. Current level of food production

In most Arab countries, domestic agricultural production is insufficient. The gap between production and demand is likely to increase due to climate change and other factors. Most of Arab countries are classified as food deficit but there are large differences in access to food among the 22 countries of the Arab League (Haddad et al., 2011). Arab countries import more than half the food they consume and are therefore highly vulnerable to swings in commodity prices (FAO, 2008). This vulnerability could increase in the coming years as a result of high population growth and loss of productive soils by urban expansion, low agricultural productivity, degradation of arable lands and continued dependence on global commodities markets.

Cereal production, particularly wheat in the Arab region is mainly produced by six countries: Algeria, Egypt, Iraq, Morocco, Sudan and Syria. The wheat production for 2014 is illustrated in Figure 6. In fact, Egypt, Iraq and Morocco produced more than 4 million tonnes of wheat in 2014, while more than ten countries produced less than 0.5 million tonnes. For example, Saudi Arabia has a low production despite its high wheat productivity. However, Saudi Arabia implemented the 2007 Government decree to completely terminate wheat cultivation by the end of the 2016. The measure reflected strong concern over the depletion of local groundwater reserves which were used to irrigate wheat production (FAO/GIEWS, 2017).

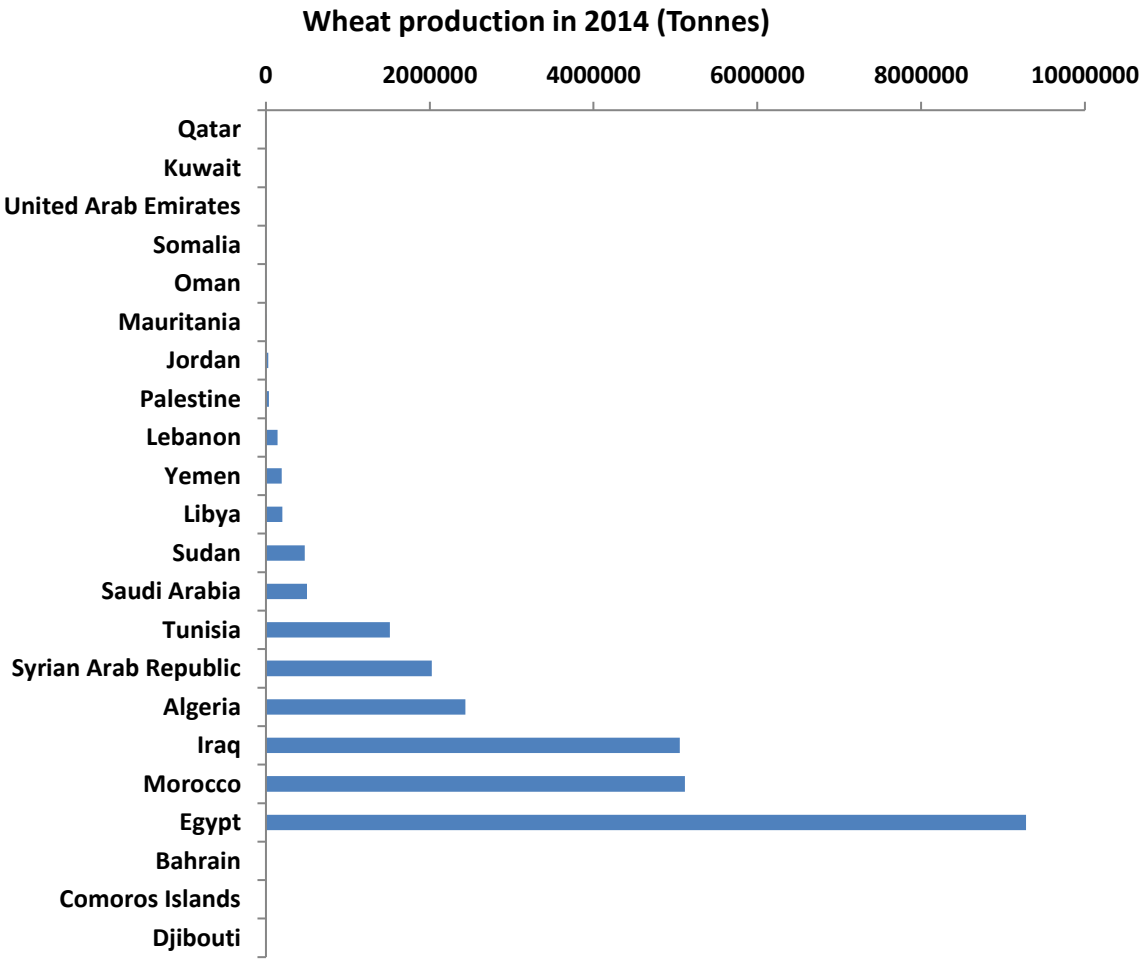

Figure 6. Wheat production in 2014 in the Arab region

Source: FAOSTAT database.

The increase in wheat production in Arab countries was attained through expanding the cultivated area by about 30 percent over the period 1961-2014 (Figure 7 and 8) and particularly through increased productivity. Contrasting differences in wheat production in terms of harvested area and productivity do exist. For example, Egypt with a share of about 13 percent of the cereal area had a share of about 35 percent of total cereal production in 2014. GCC countries, with a share of about 1.2 percent of the cereal area contributed a share of about 3.3 percent to cereal production in the region.

Demand for food in Arab countries has been met in large part through imports. If this trend of food imports continues, in the absence of enhancing the food self-sufficiency ratio, and an Arab population projected to reach 619 million in 2050, the future cost of food imports will increase rapidly (AOAD, 2012).

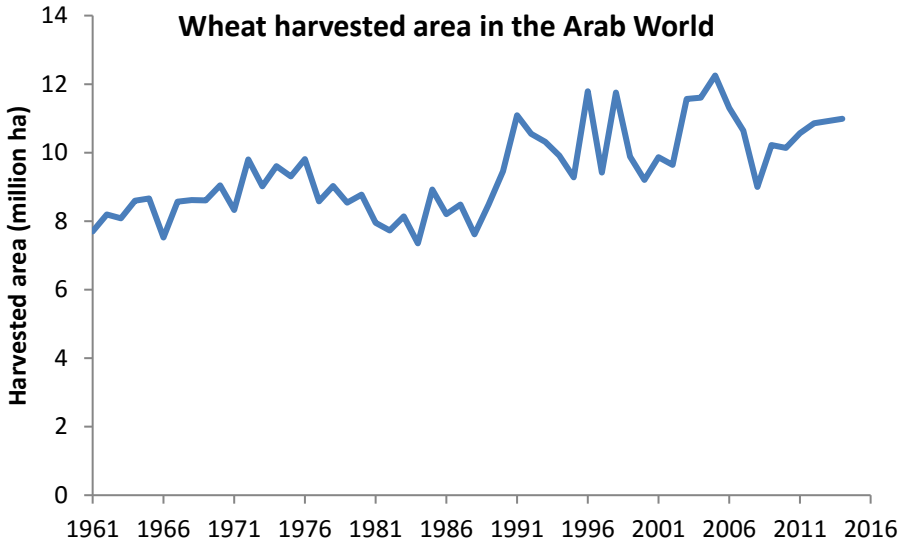

Figure 7. Wheat harvested area in the Arab World

Source: FAOSTAT database.

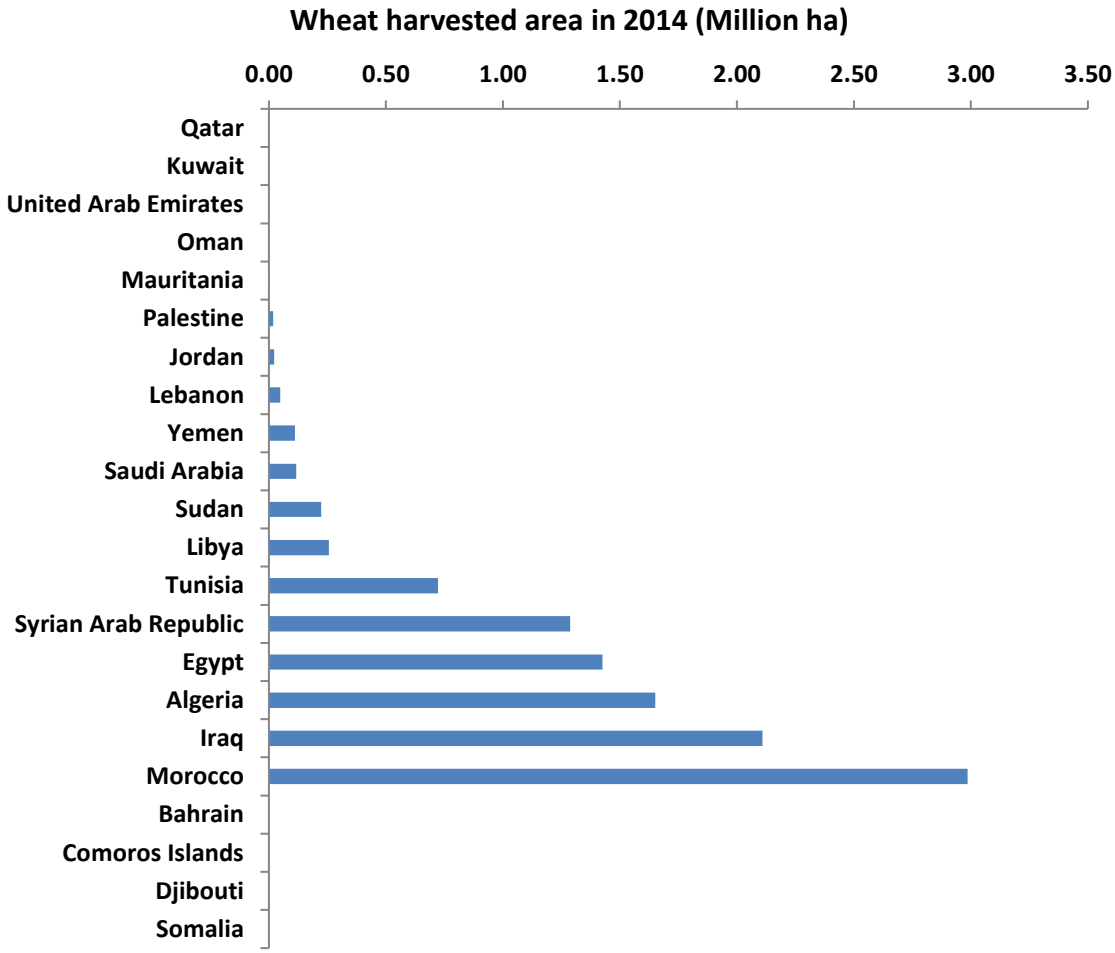

Figure 8. Wheat harvested area in 2014 in the Arab region
Source: FAOSTAT database.

B. Assessment of the main factors that influence achieving target 2.4

Food production in the Arab region is constrained by limited land and scarce water resources. It is likely to be further compromised by climate change. The Arab region is the poorest region in the world in water resources mainly caused by the region's arid climate. Renewable internal freshwater resource per capita varies widely among Arab countries (Table 2).

Table 2. Renewable internal freshwater resources per capita in the Arab countries for 1962, 1992 and 2014.

	Renewable internal freshwater resources per capita (cubic meters)		
	1962	**1992**	**2014**
Algeria	962	414	289
Bahrain	23	8	3
Comoros Islands	6155	2726	1558
Djibouti	3185	478	342
Egypt	63	31	20
Iraq	4587	1906	998
Jordan	708	182	92
Kuwait	0	0	0
Lebanon	2493	1701	855
Libya	456	152	112
Mauritania	440	187	101
Morocco	2214	1121	855
Oman	2419	707	330
Qatar	997	114	26
Saudi Arabia	550	138	78
Somalia	2087	953	570
Sudan	..	..	102
Syrian Arab Republic	1456	541	380
Tunisia	964	494	381
United Arab Emirates	1336	74	17
Yemen	393	159	80

Source: World Bank database.

Projected population growth in the Arab countries will lead to greater pressures on water resources, with a drop in regional per capita average and a rise in the number of countries facing absolute water scarcity (UN, 2012). According to FAO, 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 abstract more than 20 percent of these resources (FAO,

2002). Based on this definition, most Arab countries are either in critical water condition, or are water stressed. Table 3 provides a clear indication about the annual freshwater withdrawals for agriculture as compared to the total annual withdrawals for the different countries. In addition, the annual freshwater withdrawals for agriculture for the different Arab countries in 2014 are illustrated in Figure 9.

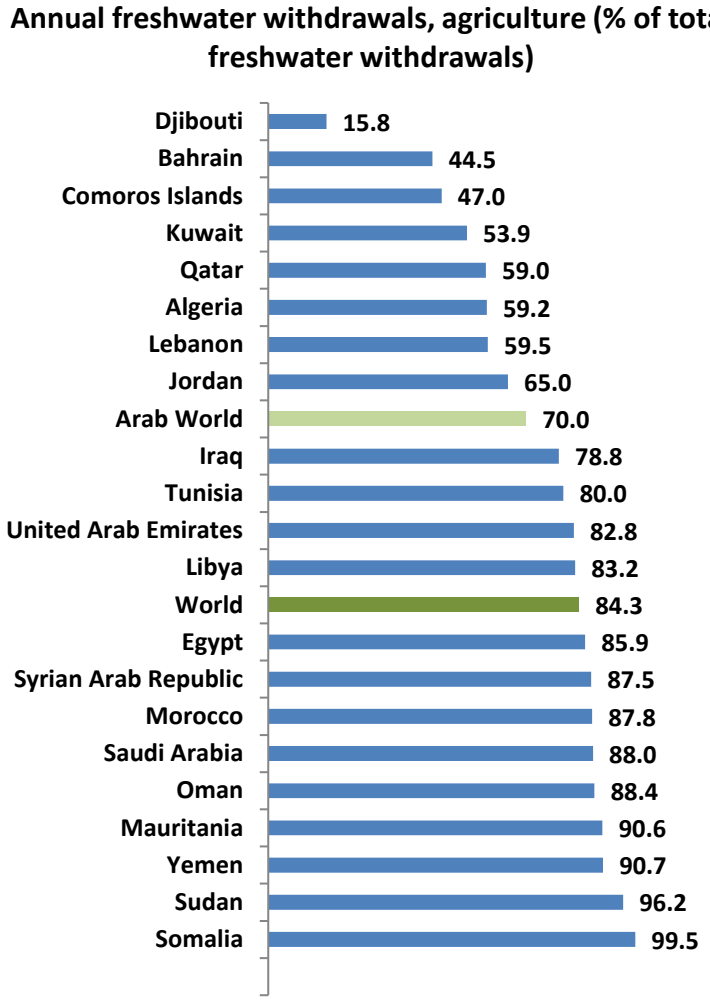

Figure 9. Annual freshwater withdrawals, agriculture for the Arab countries in 2014
Source: World Bank Development Indicators

The impact of climate change on food security in the Arab region is predicted to manifest itself mainly through decline in agricultural yields which adversely affect rural incomes (Verner, 2013). Furthermore, rainfed crop yields are expected to fluctuate increasingly over time with a declining trend, decreasing by an overall average of 20 percent in the region (WB, FAO and IFAD, 2009). The challenge for Arab countries is how to produce more food from existing cropland and water resources, in a changing climate. The linkage between climate change and

food security needs to be recognized and addressed as agriculture is predicated to be seriously threatened by a changing climate.

Table 3. Annual freshwater withdrawals for agriculture as compared to the total annual freshwater withdrawals in the different Arab countries

	Annual freshwater withdrawals, agriculture (% of total freshwater withdrawal)	Annual freshwater withdrawals, total (% of internal resources)
	Reference year 2014	
Djibouti	16	6
Bahrain	45	8935
Comoros Islands	47	1
Kuwait	54	
Qatar	59	793
Algeria	59	75
Lebanon	60	27
Jordan	65	138
Iraq	79	188
Tunisia	80	79
United Arab Emirates	83	2665
Libya	83	833
Egypt	86	4333
Syrian Arab Republic	88	235
Morocco	88	36
Saudi Arabia	88	986
Oman	88	94
Mauritania	91	338
Yemen	91	170
Sudan	96	673
Somalia	99	55
Arab World	70	226
World	84	9

Source: World Bank Development Indicators

C. Assessment of the main factors that define sustainable and resilient agriculture

I. Crop, soil conservation and fertility management

Sustainable and resilient agriculture should be tackled through improved varieties of wheat, barley and food legumes (chickpea, lentil and faba bean) in Arab countries (ICARDA, 2009). Most improved varieties are targeted to rainfed systems, and have high and stable grain and

straw yields, high levels of resistance to important prevailing insects and diseases, and high drought tolerance.

Furthermore, conservation agriculture, a combination of reduced or zero tillage, mulch retention, crop rotations and cover crops, offers multiple benefits for farmers in the Arab region. Such soil conservation practices control soil erosion and improve soil fertility. Results from research stations as well as farmer' fields have shown increases in crop water availability, productivity, soil organic matter and nutrient availability, and pest control, together with savings in labor and fuel costs (Bashour et al., 2016). Considering that the area under conservation agriculture is still even low in the whole World with an average of 0.22%, there is growing interest in testing and disseminating these conservation agriculture methods, particularly for dry areas such as the Arab region (Table 4).

Table 4. Area under conservation agriculture in selected Arab countries

	Conservation agriculture area: >30% ground cover (% of Agricultural area)
Lebanon	0.19 (2011)
Morocco	0.01 (2008)
Sudan	0.01 (2008)
Syrian Arab Republic	0.13 (2011)
Tunisia	0.08 (2008)
World	0.22 (2011)

Source: World Bank Development Indicators

The numbers between brackets refer to the year of statistics

Soil degradation can lead to sharp declines in yield, through a combination of various factors such as nutrient depletion, loss of organic matter, reduced rainfall infiltration and plant water uptake (Henao and Baanante, 2006). Substantial yield improvements can be obtained with the application of appropriate fertilizers. However, the main problem in the use of fertilizers in the Arab countries is the imbalanced application of nutrients.

The use of legumes in crop rotations can improve soil fertility, in addition to 'technology packages' that combine fertilizer application with supplemental irrigation. For example, experiments in nitrogen-deficient Mediterranean soils showed substantial increases in wheat yields and water productivity with a combination of supplemental irrigation and 50–100 kg/ha of nitrogen (Oweis, 1997).

II. Water management

Considering the severe water scarcity in Arab countries, water management in agriculture is crucial for the development of irrigated agriculture. In fact, the related Arab authorities such as

the Ministries of Agriculture and the Ministries of Irrigation are actively encouraging irrigation management and modernization. Improving irrigation efficiency to produce more crops with less water is an option of significant importance for enhancing food security in Arab countries. It is primarily enhanced through the adoption of appropriate irrigation method, good selection of crop type, irrigation scheduling, and suitable source of water (AFED, 2010).

Particularly, efficiency of surface irrigation technique must be improved because it is predominantly used in more than 90% of irrigated agricultural land in the MENA regions (AFED, 2010). Sprinkler irrigation systems, very common in Saudi Arabia, must be designed to enable a uniform application of water (FAO, 2008). Localized irrigation such as trickle and drip need to be promoted in Arab region. For example, in Jordan, the adoption of modern irrigation systems (micro-irrigation) is increasing and has reached about 60% in the Jordanian River Valley and about 85% in the highlands (Shatanawi et al., 2005). In Morocco, an important conversion program from surface to drip irrigation has been launched and promoted by the Moroccan authorities (Feltz and Vanclooster, 2013). With the implementation of drip systems, fertigation became an important tool to achieve sound irrigation and fertilization in Lebanon (Darwish et al., 2006).

More importantly, improving irrigation efficiency, coupled with best farming practices and agricultural inputs, boosts water productivity. Given that water is not the only factor in the production of crops, including other inputs as well as energy consumption associated with water delivery and other processes in food production, the benefits of water use efficiency and water productivity can be far more than water savings. Other benefits include reduction of energy costs, lower cost of crop production, less greenhouse emissions, and more price competitive crops. Therefore, the interdependencies between water, energy and food security form a nexus that advocates a coherent policy approach across different sectors to ensure the efficient use of the scarce resources devoted to food production.

The use of appropriate irrigation schedule, water harvesting techniques and supplemental irrigation can more than double water productivity and yields when combined with other sustainable and resilient agricultural practices such as soil fertility management and improved varieties.

Research results from ICARDA and other institutions, as well as harvests from farmers' fields, illustrate the substantial increases in yields in response to the application of relatively small amounts of supplemental irrigation. The optimal quantity of supplemental irrigation needed depends on rainfall, and has been determined for various conditions. The optimal is about 75 mm in areas with 500 mm annual rainfall, and 250 mm in areas with 250 mm rainfall (Oweis and Hachum, 2009). For example, rainfed wheat yields in West Asia and North Africa are

typically 0.5 to 1.5 t/ha; however, experimental fields and on-farm demonstrations have achieved double and triple this yield level (Oweis and Hachum, 2009). This success can be replicated on a wider scale with a combination of water harvesting, supplemental irrigation, improved water-use efficiency, high-yielding varieties and improved crop management. Heng et al. (2007) demonstrated that, in Jordan, supplemental irrigation at sowing time significantly improved average wheat grain yield, particularly when 40 kg N ha^{-1} was applied. In Lebanon, supplemental irrigation can also increase significantly barley yield (Yau et al., 2011). In Morocco, applying limited supplemental irrigation at the beginning of the season and at flowering and grain filling would double biomass production and water productivity of cereals compared to conventional approaches. Finally, In Jordan, Syria and parts of North Africa, research on water-harvesting through micro-catchment management has shown to raise water productivity of open field crops (Solh and Van Ginkel, 2014).

III. Adoption of traditional, indigenous knowledge and practices

Among the diverse knowledge sources and learning forms that farmers use, Darnhofer et al. (2016) have pointed to the particular role of farmers' experiential learning and networking in increasing the resilience of family farms. Rural Arab communities have been greatly endowed with 'special' knowledge with which agricultural activities were carried out. Notwithstanding, people fail to realize the efficacy of the 'special' knowledge that is indigenous knowledge in the enhancement of sustainable development. This indigenous knowledge should be properly mainstreamed into development projects for the enhancement of agriculture and food security practices to better cope with adverse climatic conditions in Arab region. Knowledge networking that facilitate exchange of lessons learned and successes, joint learning and the generation of new more integrated solutions, are crucial if agriculture is to become sustainable and resilient.

5. Policies for enhancing agricultural production and productivity

Agriculture in the Arab countries has been subject to distortive policies and poor agricultural practices, leading to undermining its long-term sustainability. It is clear that there is a need to reinforce extension programs and to develop more effective, participatory approaches to encourage farmers to use existing proven technologies for enhancing agricultural productivity and production. Arab countries must support policies based on incentives for the promotion of best farming practices such as adoption of no-till seeders, modern irrigation systems and water saving technologies to encourage farmers for a more efficient agriculture. The adoption of seed support policy is needed in order to ensure farmers' access to quality seeds of varieties that meet their production, consumption and marketing conditions. Access implies affordability and availability of a range of appropriate varieties. Policies that reward farmers who farm sustainably are to be encouraged. Support is growing for the use of payments for environmental services as part of the enabling policy environment for sustainable agricultural

and rural development. Adopting an incentive policy for smallholders farmers as a source of livelihoods in the rural areas is therefore a major concern for agricultural and rural development.

In addition, the concept of virtual water constitutes an option for water-scarce countries to counter food security issues by importing water-intensive food products, and using their limited internal water resources for the production of high-value and less water-intensive commodities. In this regard, the virtual water concept as a policy tool for addressing the water-food nexus gains relevancy and importance. This is related to international trade policies in agricultural products and the impact of the policy on agricultural development and the livelihoods of the farming communities in food importing countries.

Experience shows that Arab agriculture suffered heavy damages due to lack of coordination policies in respect of production and exploitation of land and water resources, in addition to weak coordination of trade policies (AOAD and LAS, 2007). To be effective, intra-regional cooperation in food security requires an approach based on the harmonization of national agricultural strategies and policies, implementation of agricultural practices, regulations, measures and incentives conducive to the efficient use of resources with special attention to the improvement of the management of national and shared regional water resources. Arab countries have over the past decades expressed their willingness to promote Arab cooperation to advance regional food security. Nevertheless, over the past decades agricultural economic policies were designed at country level in the Arab region, while narrowly taking into consideration the Pan-Arab dimension. While availability of food is only one pillar of food security, facilitation of intra-regional agricultural trade through reduction or elimination of trade barriers, improved marketing information, and provision of infrastructure for communication and transport are of critical importance for accessibility to food.

6. Institutional and economic/financial capacities for enhancing productivity and sustainable agriculture

Weak institutional capacity and functioning is a common constraint on agriculture in Arab countries, and limits the effectiveness of policies at the local level. Institutions should have two basic functions: to ensure the necessary quantity and quality of key resources, inputs, knowledge and finance, and to ensure that small farmers have access to those resources. In the following, institutions should have influence on the functioning of agricultural product markets, including value chains (FAO, 2009). Many agricultural research systems are not sufficiently development-oriented. The decline of public investment in agricultural research and development needs to be reversed. Funding for national research systems must be substantially enhanced, and linkages between public and private sector research strengthened.

Institutions must also ensure farmers' access to relevant external knowledge and help link it to traditional knowledge. Rural advisory and agricultural extension services were once the main channel for the flow of new knowledge. Government market information services suffer many of the same weaknesses as extension services. There is now interest in market information, taking advantage of advancements in the information and communications technologies (ICT) sectors (FAO, 2009). The inability of local financial institutions to offer longer term loans, coupled with farmers' lack of collateral, hampers sustainable crop intensification. In addition, insurance would encourage farmers to adopt production systems that are potentially more productive and more profitable, but involve greater financial risk.

Finally, poor marketing facilities and institutions are some of the constraints to increased agricultural production. The major marketing constraints comprise high transportation costs, improper handling, poor storage facilities and wastage. These result in fluctuations in both productions and incomes. Small farmer access to markets can be improved through better organization and greater cooperation, which may involve not only farmers but also a larger number of stakeholders, including agricultural support service providers, NGOs, researchers, universities, local government and international donors (Cavatassi et al., 2010).

7. Contribution of achieving targets 2.3 and 2.4 to food availability

It is perhaps unrealistic to say that achieving SDG Targets 2.3 and 2.4 in the Arab region is attainable particularly that the region is currently struggling with major security and economic problems. However, this is feasible by adopting sustainable and resilient agricultural practices, in parallel with enhanced regional cooperation. Its achievement depends on a number of factors that may improve labor productivity of small scale enterprises. In addition good governance and appropriate policies to promote agriculture and rural development can increase the chances that targets 2.3 and 2.4 are reached.

All these measures can be successful only if coupled with environment protection, given that the preservation of natural resources remains at the heart of promoting sustainable production, attaining food security and meeting the Sustainable Development Goals.

8. Recommendations and conclusions

Prospects for improving food availability through increased agricultural production and productivity in the Arab region could be reflected through a number of options that consider agricultural sustainability and food security perspective.
Therefore, a set of recommendations are described as follows:

- Boosting crop productivity in irrigated and rainfed systems, especially cereals, is key to enhancing local production.
- Adoption of policies and farming practices that focus on preserving agricultural sustainability and natural resources of Arab countries.
- Increasing irrigation efficiency through rehabilitation of existing irrigation networks and the use of modern methods for on-farm irrigation.
- Providing adequate funding for agricultural research institutions and organizations for developing high yielding and drought-tolerant crop varieties.
- Strengthening Arab intra-regional cooperation in food security and enhancing food accessibility at regional level through intra-regional trade in agricultural products.
- Promoting cooperation among Arab countries and other neighboring countries in food security concerns.

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