Food Security as a Public Good: Oman's Prospects

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ABSTRACT

The recent phenomenal crisis in the financial sector and the surge in food prices have resurrected the debate on the role of government, in economic management and in particular in securing national food security. This paper briefly reviews the theoretical literature in favor of government intervention in the market to secure food security. It is argued that food security needs to be considered as a public good, hence justifying government intervention in supplying it. Sustaining the potential to domestically produce safe minimum amounts of a staple food should be considered as a national strategic objective to achieve food security.

Wheat is a staple food in Oman and it has been a major crop in the farming systems of Oman. Wheat cultivation under present circumstances of crop prices, yield, agricultural technology and resource availability in Oman's commercial farming is not viable, without government support. With the use of a linear programming model that simulates the farming systems; in a major agricultural region in Oman (Batinah region) the production subsidy that is required as an incentive to promote the cultivation of wheat is estimated. The wheat yield in Oman is considered as 3 Tons/Ha and world price of wheat is around 100 OR/Ton. Wheat cultivation under commercial farming would be viable if a subsidy of at least 414 OR/Ha (138 OR/Ton) is provided. This subsidy can be instrumented as an input subsidy and/or price supports as Saudi Arabia had done (190 OR/Ton of wheat). If the wheat yield could be increased through technological and managerial means to global potential yield of 5 Tons/Ha then the price support needs to be at least 83 OR/Ton of wheat. The extent of its achievement in terms of extent of land cultivated and total domestic production of wheat, need to be considered in relation to the trade-off of fiscal cost and political choice of the degree of food security deemed as necessary to achieve.

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Introduction

The unprecedented surge in food prices experienced during 2007-2008, particularly of the staples wheat and rice, have awakened worldwide interests on food security. The rise in food prices is attributed to changes in demand and supply factors in the general unempirical literature. The demand factors are conjectured to be such as; the increased food demand and change in consumption patterns in China, India and other countries with high economic growth, the substitution of land and other resources from food production to bio fuel production (compromising food security with energy security) induced by concerns on global climate change and escalating oil prices, and market speculation for food. The supply factors are conjectured to be such as; droughts in major grain producing areas, complacency on investments in agricultural research, education and development and policies minimizing government involvement in food production and distribution. Although the food prices have receded, it is expected that the phenomenon of food price volatility would continue due to the 'thinness' of global cereal markets (World Bank, 2009), i.e. only 18% of the wheat produced globally is traded. Hence even small changes in supply and demand factors would cause high international price volatility. Compounding the market induced price volatility, is the probable nature induced volatility through global climate change impacts of droughts and flood on food production. Further, from a political-economic view, 73% of the world's supply of cereals is by five countries. Thus countries dependent on cereal imports may have to depend on the political relationships with these countries to assure food security (World Bank, 2009). During the recent food price surge several cereal exporting countries banned exports of cereals to ensure their national food security.

In Oman, post 1970, with increased income from petroleum and increased population, the demand for food had drastically increased leading to food imports. Only 2% of the cereal requirement of Oman is domestically produced. In cognizance of Oman's vulnerability to food insecurity in general and the food insecurity experienced with the food price surge during 2008 in particular, it is imperative and impending that strategies are developed to assure a realistic degree of food security, within economic and political realities and resource scarcity.

Oman has the potential to increase the production of wheat, as it has past experience of wheat cultivation, the right climate and reasonably high average yields, subject to resource availability, particularly water. Cultivation of wheat domestically may be considered a minimal strategic measure to assure food security. This paper examines the prospects to cultivate wheat in Oman using a farming systems and production economic analysis. Section 2 reviews the recently resurrected arguments in favor of government

intervention in the market to secure food security, following to a review of position and prospects to achieve food security in the Arab region and in Oman in particular. Section 7 to 9 presents an empirical analysis on estimating the production subsidy that is required to promote wheat cultivation in Oman's existing farming systems.

Food Security as a Public Good and Role of Government

Economic theory provides the basis to argue, for and against intervention of government in economic management. Neo-liberal economic theory explains that individuals pursuing private economic interests in a perfect market context, with minimal government intervention would achieve maximum social welfare. However, where markets fail; due to poorly defined property rights, imperfect information, externalities, public goods and missing preferences, pursuance of private economic interests does not maximize social welfare. Where markets fail, the government has a justified role to intervene and direct the market, to manage the economy. Though theory justifies government intervention in the market, the degree of government intervention is yet debated, and remains more as a political issue than an empirical economic issue to resolve.

In practice the neo-liberal economic approach that was dominantly advocated and practiced during the past few decades expected the market with minimum intervention of the government to maximize social welfare in most economic sectors including the food sector. This policy was promoted by international development organizations as 'structural adjustment' policy. Such policies have brought mixed results but more of failures in the food sector. In a global sense the neo-liberal economic approach was challenged unequivocally upon the financial crisis and food price surge that was experienced in the latter years of this decade. Governments in capitalist countries too, had to intervene in the financial markets to bring about stability of the economy. Many countries, particularly those that were heavy importers of food were urged to consider measures to secure food security, towards reducing over-dependence on markets for supply food.

The degree of involvement of the government in the food sector has been higher than in most other sectors both in developed and developing countries, though for different reasons. In developing countries government involvement in the food sector has been for reasons such as; ensuring food security of the nation, livelihood of numerous poverty stricken rural farmers and more recently the conservation of the environment and natural resources. From a consumption point of view, the fact that people of poor countries not having adequate disposable income to demand thus access food in markets, has been a major compelling reason for government intervention in the food

sector. The government interventions in the food sector have been through government investments in large infrastructure of irrigation, research and extension and in credit, insurance, marketing service programs, in supporting farm production through subsidies, price support, price stabilization, import regulation etc. The involvement of government in price stabilization has been theoretically justified on the reason of substantial price variations due to inelastic supply and demand of food. The recent food price surge too could be theoretically attributed to the same, justifying government intervention to assure nations food security.

Theoretically free markets with free trade will lead to efficiency gains for participants involved in trade. However, protectionist policies have been and are been adopted and justified on grounds of reducing vulnerability of nations to vagaries of global food trade (Rocha, 2006). As Rocha (2006) notes, given the market failures that lead to food insecurity, "There will be situations in which the only way of guaranteeing food security is through by-passing markets and having direct state provision of food and nutrition programs."

There is also an emergence of thinking as reasoned by Rocha (2006) that prevalence of negative externalities and public goods in the production and distribution of food as cause of food insecurity and justifies government intervention in the production and distribution of food to secure national food security. The negative externalities are such as over-exploitation and degradation of natural resources (water, soil, biodiversity, fish, and impact on climate change) and pollution due to use of chemical materials etc. Rocha (2006) explains further that although food itself is not a public good, as it is reasonably provided though markets given the possibility of excludability and the rivalry in consumption; 'food security' is a public good as every one in society enjoys without rivalry and exclusion the sense and benefit of food security. Food security provides public goods of a healthy, productive and harmonious society. Food security is linked to national security in the sense that in the event of extreme situations of war, assuring of food supplies becomes a critical issue. The acceptance of the paradigm that 'food security is a public good', justifies government intervention and support in the market to supply it.

Public goods have the characteristic of non-excludability and non-rivalry in consumption, which leads to market failure of production of such commodities. Private firms would produce staple foods and retain reserves of food only up to gaining private benefits and not to secure public benefits of food security as explained above. The theory of the second best suggests that when markets fail government intervention could improve social welfare. However the right form (least costly and most effective) of government

intervention needs to be decided. The best intervention would be a policy that is targeted to the root cause of the market failure.

Parlberg (2002) reasons that it more important to improve governance of nation states than global governance to achieve food security. It is claimed that the most food insecure regions of the world; Sub Sharan African and South Asia are weakly linked to the world food markets that improvements in world food markets may not impact food security in these regions. It has been opined that it is a responsibility of national governments to secure food security than await global economic systems do so. Food insecurity has been a reason for social unrest and political instability in many countries at different times.

Position and Prospects to Achieve Food Security in the Arab Region

The concept of food security, from a national perspective, is based upon; availability (in adequate quantity, nutrionally balanced, of acceptable quality, culturally preferred and safe), accessibility (in terms of physical transport and economic affordability to purchase) to the nation's population. Food security also expects that food availability is reliable and resilient such that food availability is assured at all times. Reliability of food supply although basically depends on weather and the biological character of food production, in modern times it depends on market conditions too. The recent surge in food prices, which was unpredicted, and the resultant action taken by some countries on placing embargoes on food exports lead to a situation of uncertainty of food supplies to countries that are heavily depended upon food imports, such as Arabian countries. Although oil-rich countries may be able to absorb the increased spending for food with increased food prices, the problem of uncertainty of food supply remains a challenge.

The World Bank in association with the Food and Agriculture Organization of the United Nations and the International Fund for Agricultural Development has comprehensively deliberated on the issue of improving food security in Arab countries given the recent experience of the food price surge (World Bank, 2009). It identifies Arab countries as the most vulnerable to food insecurity, given rapidly increasing demand for food, limited capacity for domestic food production and thus heavy dependence on world food markets. The study projects that dependence of food imports in the Arab region would increase by 64%. A three prong strategy to secure food security has been proposed. These include (i) strengthening food safety nets such as through improved family planning and education, (ii) reducing vulnerability to international food market vagaries through adoption of improved supply chain management and use of financial instruments and (iii)

improving and increasing domestic food production despite the constraints of resources such as water.

There is thus a need for these heavily food import depended countries to act with cautiousness on precautionary principles and maintain safe minimum amounts of food supplies in reserves or maintain domestic potential to produce safe minimum amounts. As a strategic approach, maintaining potential for domestic production of a safe minimum amount of a staple is perhaps the least risky and most resilient option. Maintaining the potential to domestically produce safe minimum amounts of food to assure reliability and resilience is neither an argument for achieving self sufficiency in food production nor an argument against free trade. It is an argument favoring the achievement of food security which is a public good.

Food Security in Oman

In Oman, post 1970, with increased income from petroleum and increased population, the demand for food had drastically increased leading to food imports. In 1980 Oman has imported 65,547 tones of wheat which has increased to 303,809 tones in 2000, more than 300% increase (FAOSTAT). Vide Figure 1 the total and per capita cereal production in Oman has increased since 1980s, with a slight dip post 2005. However, at present only 2% of the cereal requirement is domestically produced (FAOSTAT). Oman is self-sufficient in fish and partially (30-50%) self-sufficient in milk, meat, poultry, vegetable and fruit products.

Figure 1: Cereal production in Oman
Source: FAOSTAT

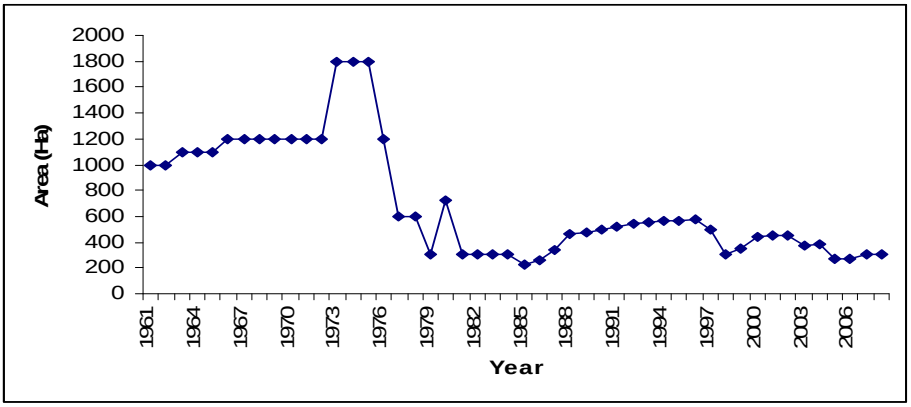
Oman will have to depend on the world market for food, given resource scarcity, particularly water, to expand domestic agriculture. However, sustaining national food production capacity of staples is a prudent policy objective to achieve reliability and resilience aspect of food security, given the recent experiences of food price surges and uncertainties imposed by food export embargoes by producing countries.

Wheat Cultivation in Oman

Wheat has been a staple Omani food and has been cultivated in Oman since time immemorial (Thesiger, 1959). Prior to 1970s, approximately 1,700 ha in Oman were under wheat and this has declined to approximately 500 ha by 2005 (Figure 2). During this period, gross wheat production in Oman has declined from 1,500 tones to less than 1,000 tones (Figure 3). During the

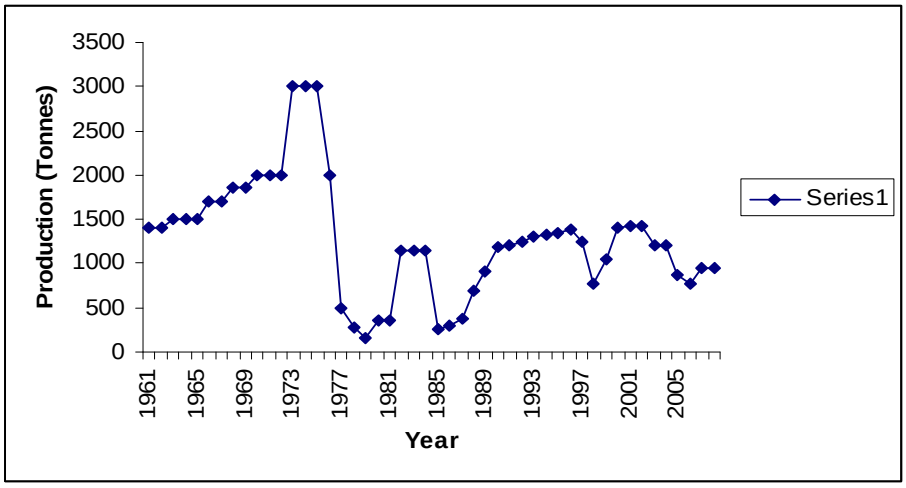
same period, the average wheat yield has increased from 1.2 t/ha to 3.2 t/ha (Figure 4). Decline in wheat area is possibly attributable to the increase in rural household income associated with increased national income through increased oil revenues post 1970, moving rural farmers away from dependence on farm income. The increase in yield per ha is attributable to increased, adoption of high yielding varieties, use of fertilizers and irrigation. Over time the decline in area of wheat cultivated has been compensated through improvement in productivity to sustain production. Since, Oman's average yield per ha (3.2 t/ha) is comparable to the world average (2.75 t/ha), it is reasonable to consider that wheat can be successfully grown in Oman. The feasibility to grow wheat in Oman, in new lands depends on the availability of particularly water and in existing cultivated lands on the possibility for wheat to compete in terms of profitability with other crops and enterprises. This paper examines the feasibility to encourage cultivation of wheat in existing cultivated lands.

Figure 2: Extent of wheat cultivation in Oman



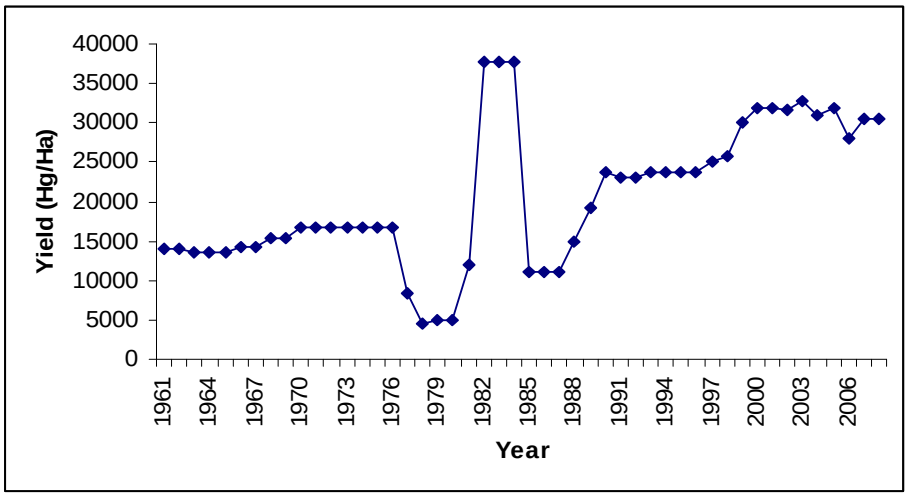
Source: FAOSTAT

Figure 3: Wheat production in Oman



Source: FAOSTAT

Figure 4: Wheat yield per ha in Oman



Source: FAOSTAT

Arabian Experiences on Wheat Cultivation with Government Support

Saudi Arabia although did not have a comparative advantage in cultivation of wheat, promoted wheat cultivation through governmental policy and incentives, considering wheat as a strategic crop that can provide food security, achieve income distribution equity and encouraging the adoption of modern agricultural technology (Al-Kahtani, 1994; Al-Hamoudi, 1997). The policy incentives to encourage wheat production were in the form of

distribution of land free of charge, provision of grants, subsidies, and interest free loans. The wheat support price has been 2000 SR/ton, (533 US$/ton at US$ 1 = S.R. 3.75) or 190 OR/ton (1 OR = 2.8 US$) (Al-Kahtani, 1994) whereas the world market price has been about 60 OR/ton and input subsidies has been as much as 50% (Al-Hamoudi, 1997). Thus Saudi Arabia had achieved wheat self sufficiency and surplus production by 1984, where production was 3 million tons and consumption was 1.219 million tons. However, the wheat yield harvested in Saudi Arabia ranged between 1 to 4 tons per hectare compared to the global potential of 5 tons per hectare (Al-Hamoudi, 1997) indicating inefficiency despite acute scarcity of resources such as water. It is considered that the extensive cultivation of wheat in Saudi Arabia has led to rapid depletion of groundwater.

Existing Farming Systems in Oman

As indicated above wheat had been a prominent crop in the farming systems in Oman in the past. However since 1970 the extent of wheat cultivation has dropped from 1,700 ha to 500 ha. Recent studies (Al Said *et al*., 2007) on farming systems in Batinah region indicate a shift towards seasonal commercial crops (apart from perennial crops and livestock rearing) and do not indicate farmers cultivating wheat. Al Said *et al*., (2007) have identified 4 types of farming systems and analyzed their profitability. The 4 types of farming systems, in the 49 farms surveyed (394 ha) are vegetables, tree crops and vegetables, fodder and vegetables and mixed, covering 66%, 23%, 5% and 6% respectively. The farm level data on gross margins for the present analysis is derived from Al Said *et al*., (2007) study based on major cropping system (66% of area), viz; vegetable cropping. The major crops grown in vegetable farms are in terms of area cultivated are 31% watermelon, 27% melon, 25% tomatoes and the balance of assortment of vegetables. The average gross margin of these farms is 1,674 RO/ha/season (winter). According to the same study 53% of the cropped area in Batinah region depends on ground water. Al Suliemani and Al Wohaibi (2006), based on a water metering pilot study form 1998 to 2000 has estimated that 20,481 cu.m/ha/yr of ground water is abstracted by farms in Oman.

Analytical Methodology

A Linear Programming (LP) model was formulated to represent a typical farming system in the Batinah region of Oman. The general structure of the model is as follows.

Maximize: π f (Σ P_i .Y_i): where π is gross margin, P_i are gross margins per hectare of land Y_i are hectares of land of alternative crops i:

subject to constraints of $\Sigma C_{ij} . Y_i \leq X_j$ and $Y_i \geq 0$; where C_{ij} are input-output coefficients and X_j are available input level.

The model optimizes through maximizing per season (winter) farm gross margin constrained to resource constraints of land, water, capital and labor. The considered alternative crops are vegetables crops grown in majority of the farms in the Batinah region and wheat is introduced to the model. Secondary data on gross margins, resource use and availability were obtained from recent studies done by Al Said *et al*., (2007) and (Naifer, 2009). The input-product coefficients on wheat cultivation were based on Tunisian experience of wheat cultivation (Naifer, 2009).

Results and Discussion

The data used and the result of optimized solution on simulating the potential for wheat to compete with crops in the existing vegetable farming systems in winter in Al Batinah region are given in Table 1. The simulation indicates that wheat cannot compete with the existing crops and be a component crop of the existing farming system with present gross margins at import price of wheat. The present cropping system is constrained in achieving its full potential in terms of use of land and water due to labor constraint.

Table 1: Farming systems model with wheat option with import price of wheat

Max Gross Margin (OR)	14531									
Alternatives	Cucumber	Onion	Pepper	Melon	Watermelon	Tomato	Wheat			
Gross Margin (OR/Ha)	1399	1456	1897	1217	1235	3105	51			
Out put Level (Ha)	0.00	0.00	0.00	0.00	0.00	4.68	0.00			
Input output co-efficient								Resources used	Const	Resources Available
Land (Ha)	1	1	1	1	1	1	1	5	<=	9
Labour (Md/Ha)	80	85	100	100	100	100	15	468	<=	468
Cash (RO/Ha) (Operating cost)	2611	2015	1870	1662	1272	2166	245	10137	<=	11277
Water (m3/Ha)	1979	2277	1999	4141	4617	2156	2010	10090	<=	10240

The sensitivity analysis showed that the 'Allowable Increase' of wheat gross margin as 414 OR/ha. Thus if the gross margin of wheat increased by more than 414 OR/ha from the present gross margin of wheat (51 OR/ha) to 466 OR/ha, then wheat would become a competitive crop and farmers would cultivate wheat. However, with the water constraint the extent wheat that could be cultivated would be only 2% of the cultivated extent and

the farm gross margin increases by only 10 OR/ha (Table 2). This increase in gross margin would not be substantial enough to encourage farmers to cultivate wheat.

Table 2: Farming systems model with wheat option with price of wheat increased by 'Allowable Increase'

Max Gross Margin (OR)	14542									
Alternatives	Cucumber	Onion	Pepper	Melon	Watermelon	Tomato	Wheat			
Gross Margin (OR/Ha)	1399	1456	1897	1217	1235	3105	466			
Out put Level (Ha)	0.00	0.00	0.00	0.00	0.00	4.67	0.09			
Input output co-efficient								Resources used	Const	Resources Available
Land (Ha)	1	1	1	1	1	1	1	5	<=	9
Labour (Md/Ha)	80	85	100	100	100	100	15	468	<=	468
Cash (RO/Ha) (Operating cost)	2611	2015	1870	1662	1272	2166	245	10130	<=	11277
Water (m3/Ha)	1979	2277	1999	4141	4617	2156	2010	10240	<=	10240

According to Al Suliemani and Al Wohaibi (2006), there is a 24% over-extraction of water, over crop water requirement. If it is considered that over-extracted water as available to farms though improved efficiency of water use, the water availability can be increased to 12,698 cu.m./ha. A simulation of 24% increased water availability, along with increased gross margin of (466 OR/ha) for wheat indicates that wheat cultivation will be competitive and viable under present cropping systems (Table 3). About 25% of the cultivated extent (6.1 ha) would be cultivated with wheat. However, the increase in gross margin is not significant. Hence, the wheat gross margin needs to increase significantly to promote wheat cultivation among farmers. The constraining resource as expected is water.

A sensitivity analysis on viability of wheat cultivation in Oman based on permutations of wheat price and yield is given in Table 4. If the wheat yield could be increased through technological and managerial means to global potential yield of 5 tons/ha (Al Hamoudi *et al*., 1997) then the price support need to be 83 OR/ton of wheat.

Table 3: Farming systems model with wheat option with price of wheat increased by 'Allowable Increase' and increased availability of water

Max Gross Margin (OR)	14543									
Alternatives	Cucumber	Onion	Pepper	Melon	Watermelon	Tomato	Wheat			
Gross Margin (OR/Ha)	1399	1456	1897	1217	1235	3105	466			
Out put Level (Ha)	0.00	0.00	0.00	0.00	0.00	4.45	1.55			
Input output co-efficient								Resources used	Const	Resources Available
Land (Ha)	1	1	1	1	1	1	1	6	<=	9
Labour (Md/Ha)	80	85	100	100	100	100	15	468	<=	468
Cash (RO/Ha) (Operating cost)	2611	2015	1870	1662	1272	2166	245	10013	<=	11277
Water (m3/Ha)	1979	2277	1999	4141	4617	2156	2010	12698	<=	12698

Table 4: Wheat price and yield permutations on viability of wheat cultivation in Oman

Wheat Price (OR/T)	Wheat Yield (T/Ha)	Gross margin (OR/Ha)	Viability	Comment
100.00	3.00	55.00	No	Present yield and world price.
255.00	3.00	466.00	Yes	Price support and present yield. World wheat price has not increased beyond 150 OR.
100.00	5.00	255.00	No	Present price and world average yield (5 T/Ha).
183.00	5.00	505.00	Yes	Support price with world average yield.

Policy Guidelines

Wheat cultivation under present circumstances of crop prices, yield, agricultural technology and resource availability in Oman's commercial farming is not viable. The wheat yield and price in Oman is considered as 3 tons/ha and 100 OR/ton, respectively (FAOSTAT). Increasing the gross margin of wheat by 7 fold of as present (by improving yield and/or input subsidy and/or price support) along with water availability by about 25% of present water use, makes wheat cultivation viable under commercial farms in Oman. Wheat cultivation under commercial farming would be viable if a subsidy of more than 414 OR/ha is provided. This subsidy can be instrumented as input subsidies and/or price supports as Saudi Arabia had done. The price subsidy provided in Saudi Arabia has been 190 OR/ton of wheat (Al Hamoudi *et al*., 1997). If yield of wheat in Oman is considered as 3 t/ha, the required subsidy to promote wheat cultivation would have to be more than 138 OR/ton of wheat. If the wheat yield could be increased through technological and managerial means to global potential yield of 5 tons/ha (Al

Hamoudi *et al*., 1997) then the price support need to be more than 83 OR/ton of wheat.

Considering food security as a public good, the cultivation of wheat in Oman could be achieved through governmental support. However, the extent of its achievement in terms of extent of land cultivated and total domestic production of wheat, need to be considered in relation to the trade-off of fiscal cost and political choice of the degree of food security deemed as necessary to achieve. The governmental support in the form of a production subsidy need to be also compared with other alternatives; such as the cultivation of wheat in new land (provided resources such as water is available) undertaken by a government organization or outsourced to private companies, considering the fiscal cost and the transaction cost required for the successful implementation of a subsidy program. Sustaining the domestic potential to cultivate a staple food crop and produce safe minimum amounts of it, needs to be considered as producing a public good of strategic national importance, which should not be traded-off with other alternatives of producing, sourcing and supplying food through the market.

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