Policy Constraints and Key Drivers for Enhancing Egyptian Agrifood Systems

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1. Introduction

Food security is one of the most important strategic issues for all countries, as it represents an integral part of their national security. For this purpose, all countries all over the world aim to achieve food security for their citizens to ensure the political independence and well-being of their citizens. In this framework, food security has been one of the most important issues for the Egyptian government following the revolution on the 25th of January 2011, since one of the basic demands of the revolution was achieving food security for Egyptian citizens under the slogan “Bread - Freedom - Social justice”, and the achievement of the dignity of humanity. Therefore, the issue of food security represents a fundamental pillar in the Egyptian economy due to its close connection to the process of economic development on the one hand, and political and social stability on the other hand.

Currently, Egypt is still suffering a food gap in most food commodities in a way that threatens Egyptian food security, the most important of which is the food gap in grains that amounts to some 17.1 million tons, accounting for 41.4% of the quantity consumed. This gap represents a heavy burden on Egypt's food import bill, particularly with the foreign currency crises, which threaten Egypt's Food Security due to the currently existing global threats that may obstruct the flow of grain imports to Egypt.

To meet the needs of the growing population, the current agricultural policy has given priority to implementing several steps to ensure enhancing self-sufficiency rate in cereal crops. This paper aims to shed light on agricultural policies adopted by the Egyptian government to curb the food gap in grains by increasing domestic production of grains, as well as rationalizing consumption.

2. Current Situation of Agricultural Production

2.1. Cultivated Land Area

Currently, the average cultivated area is estimated at 9.7 million acres (4.07 million ha), of which 11% are cultivated with perennial crops (fruits and sugarcane), while the rest of the area (89%) is cultivated twice a year, i.e., the winter and summer seasons, bringing the total cropped area to about 17 million acres. Almost 80% of the holders belong to the holding category of less than 1.26 hectare and live on around 37% of the agricultural land area (of whom nearly 42.2% fall in the holding category of less than 0.42 hectare and live on about 8.6% of the agricultural land area).
2.2. Total Cropped Area

The total cropped area in Egypt is distributed among grains, sugar crops, vegetables, fodder crops, and other crops, in addition to orchards, palms, and perennial crops. Old Lands are the main source of agricultural production as they represent about 69% of the total cropped area, while New Lands represent only 31%.

About 47% of the total cropped area is allocated for grain production, of which 81% is in Old Lands and 19% is in New Lands). However, winter grain crops are concentrated in both wheat and barley, with an average area estimated at 1.43 million hectares for wheat, and 147.1 thousand hectares for irrigated and rain-fed barley. As for grains grown during the summer season, they are concentrated in white and yellow maize, sorghum, and rice, with areas estimated at 1.1 million hectares, 151.3 thousand hectares, and 0.55 million hectares, respectively.

Figure 1. Agricultural and total cropped area in old and new land in Egypt (Million ha)

Figure 2. Relative importance of cropping patterns in Egypt (%)

3. Agricultural Policy

Egypt's food gap is concentrated in both wheat and maize. However, domestic wheat is mainly used for making bread loaves (Balady bread) after mixing with imported wheat, which consumers depend on for their daily food. While average domestic wheat production is almost 9 million tons, demand stands at some 20.4 million tons per year. In some rural areas, people mix wheat with white maize to make dry bread. However, due to insufficient domestic production of wheat, there has
been a traditional reliance on imports, which has led to importing around 12 million tons of wheat per year. Besides, the shortage in yellow maize production resulted in the importation of some 8.9 million tons, mainly utilized as feed in the poultry sector. The following are suggested options to reduce the gap between domestic supply and demand.

3.1. Agricultural Inputs' Policy

Seeds, chemical fertilizers, and irrigation water are considered the main inputs that have direct impacts on Egypt’s cereal production. To maximize the benefit of these inputs, the government adopted the following policies to help farmers expand cultivation of cereal crops:

3.1.1. Seeds' Policy

The availability of certified seeds is the main factor determining the increase in production. Statistics indicate that, except for maize, the coverage rate of base and certified seeds is estimated at about 32% for wheat, 46% for rice, 5% for barley, 40% for sorghum, and 20% for fava beans. High prices of certified seeds represent one of the obstacles to farmers' adoption of such seeds, despite their availability in some cases. Therefore, the Ministry of Agriculture adopted a package of tools that aim to:

• Increase the coverage rate of certified seeds to 100%.
• Focus on genetic engineering in producing varieties that tolerate water scarcity and have less fertilizer needs. Genetic engineering can be used for pest control as well, because of the armyworm's rapid adaptation and mutation to resist the effectiveness of pesticides.
• Supporting farmers by providing them with certified seeds for free, as support can be allowed within the framework of the Free Trade Agreement if it conforms to the conditions allowed in the Green Box, such as subsidizing production inputs, the agricultural extension system, and many other operations.
• Abide by crop rotation (double or treble) to preserve the quality of the land and soil.
• Abide by the variety map developed to match varietal demands by producers.

3.1.1.1. Main Challenges Facing the Seed Sector

• Difficulty in finding proper sites for contracting to produce seeds.
• The high commercial price of maize that exceeded EGP 20 thousand per ton, (US$ 467.5). With an average yield of 3 tons per acre (7.14 ton per hectare), total revenue per acre of maize is EGP 60 thousand (US$ 1,942).
• Seed production, especially for single cross hybrids, is becoming a challenge. The yield capacity of parents is quite low because of the low traits and sensitivity to weather conditions, where yields may sometimes not exceed 2 ardab per acre (0.7 ton per hectare), and 750 kg per acre at the highest estimates (1.78 ton per hectare).

To address these challenges, the following are suggested:
• Set a trigger procurement price for farmers for seed production and delivery that is not lower than EGP 40 thousand (US$ 1,295) as an equilibrium point. This is because seed production requires maintaining variety purity through seedbed preparation; timely completion of tillage operations; irrigation; supplementary pollination measures, if required; weed control; pest and disease control measures; identification and removal of the contaminants, off-types, obnoxious weeds, objectionable crop plants, diseases with seed-borne nature, disposal of the parents before harvesting, drying, etc.

• To overcome the challenge, which will be very difficult in the valley and the delta, it is possible to expand maize production in the lands of East Owainat, Dabaa Axis, etc., provided that milling machines are made available due to a lack of labour in such areas.

### 3.1.2. Chemical Fertilizers

Since 1995, the agricultural sector has been facing challenges in providing fertilizers. Some of these problems relate to the deficit in fertilizers, especially when the government exports fertilizers to foreign markets. In this case, farmers lack the amounts of fertilizer sufficient to add to their land. On the other hand, the fertilizer distribution policy has not been updated, as fertilizer regulations have not been updated, which requires consideration of achieving a balanced policy between nitrogen, phosphorus, and potassium (NPK) elements, and the necessity of providing subsidized fertilizers to farmers.

It is worth mentioning that global fertilization balance ratios are estimated at 5: 3: 1 for nitrogen, phosphorus, and potassium, while Egyptian ratios are estimated at 17: 2: 1. Accordingly, the goal of the Soil, Water and Environment Research Institute (SWERI) is achieving the global balance ratio via a dynamic fertilizer map that must be respond to climate changes, considering the limited land and water resources and the issue of intercropping methods, maize with soybeans for example.

Matching the global fertilization balance ratios requires educating farmers about them and about considering the elements available in their lands, whether in the valley or the delta, through farmers’ field schools and national campaigns.

The Russo-Ukrainian crisis led to higher prices of natural gas, and consequently higher prices of nitrogenous fertilizers in the global market, which in turn resulted in higher prices of agricultural products all over Europe due to the higher costs of transportation, logistics, electricity, and fertilizers. To mitigate these challenges, the Agricultural Research Centervii (Soil Water and Environment Institution) has suggested some innovations:

• Using liquid ammonia to mitigate the impact of pressure on nitrogenous fertilizers. To optimize the benefits of this alternative, it is critical to estimate the amount of liquid ammonia used or the recommended amount; estimate the increase in yield per acre or by hectare because of using liquid ammonia; determine the types of soil suitable for fertilization with liquid ammonia; and estimate the response of new high-yielding crop varieties to fertilization with liquid ammonia.

• Determining the needs of fertilizers for new high-yielding crop varieties.
• Revisiting the currently applied fertilizers distribution policy so that it is based on land holding area to overcome the problem of linking the distributed fertilizers to wheat planted area (like the ration cards for individuals).
• Expanding\textsuperscript{viii} the use of liquid fertilizers and fertilizers suitable for modern irrigation systems wherever applicable.
• Orientation\textsuperscript{ix} to using organic fertilizers (compost, humus, etc.) to ease the pressure on mineral fertilizers and protect the soil from pollution.
• Linking fertilizers' distribution policy to grain crops' delivery policy.

3.1.3. Irrigation Water Use Policy

Crop production mainly depends on irrigated agriculture, which constitutes around 84.5\% of the total agricultural land. The surface irrigation method is considered the most common in Egypt and is applied in almost 82\% of the agricultural lands. Drip irrigation is used in only 10\%, while sprinkler irrigation is used in the rest area, i.e., 8\%. Currently, the government is developing an irrigation system to switch from flood to drip and sprinkle irrigation in old lands. Besides, incentives have been set for farmers, represented in supporting the establishment of irrigation networks.

Egypt 2030 updated Sustainable Agriculture Development Strategy has targeted maximizing water use efficiency through promoting the adoption of water use rationalization methods; issuing ministerial decrees defining\textsuperscript{x} bananas, rice, and sugarcane cultivated areas; promoting the adoption of modernized irrigation systems in new lands; and issuing ministerial decrees for modernizing irrigation systems in orchards in the Valley and the Delta.

3.2. Agricultural Price Policies

The agricultural sector in general, and the grains sector in particular, were exposed to several external shocks that led to negative impacts on food crops’ production, including the COVID-19 crisis, the Russo-Ukrainian war, and the US dollar crunch. Such negative impacts led to governmental interventions to adopt indicative cropping patterns through implementing a package of policies to mitigate the impact of such crises, the most important of which include:

\begin{itemize}
  \item[a)] Contract farming policy.
  \item[b)] Expand the cultivation of yellow maize and soybeans to overcome the poultry and livestock feed crisis.
  \item[c)] Allocate part of the reclaimed land areas in mega projects to expand the cultivation of grain crops.
  \item[d)] Setting price incentives to encourage farmers to grow and deliver grain crops (wheat and rice). Farmers are late in crop planting dates (e.g., maize) due to relatively low profitability compared to competing crops. This year, the government announced remunerative procurement prices for crops, which encouraged farmers to buy approved seeds. The indicative prices announced by the government should consider the following factors:
\end{itemize}
• Covering production costs and realizing a remunerative profit.
• International prices of grains.
• Equating incomes realized from grain crops with those realized from competing crops.
• Maintaining the purchasing power of farmers.

e) Distortions in rice pricing this year occurred due to the following reasons:
• The government has set an indicative price for paddy rice at EGP 7 thousand per ton (US$ 226.54).
• Merchants purchased the crop from farmers directly from the field for EGP 10 thousand per ton, (US$ 323.62).
• The Ministry of Supply and Internal Trade then purchased rice from merchants for EGP 16 thousand per ton, (US$ 517.8).
• The crop grain delivery by farmers to the government should be voluntary because there is no need to force farmers to deliver their produce when they have no desire to do that.
• It is necessary to subsidize agricultural production because it can lead to increasing supply in the market thus reducing consumer prices, and hence alleviating burdens on consumers.
• Applying the contract farming system where it can be feasible.

3.3. Grain Trade Policy
In the past, the government adopted the policy of import concentration, where Egypt’s wheat imports are concentrated in Russia (about 50%) and Ukraine (about 25%). As for yellow maize, Egypt's imports are concentrated in Argentina (about 35%), Brazil (about 33%), and Ukraine (about 24%).

After the Russo-Ukrainian War, world prices of wheat and maize soared and almost doubled from US$ 150-200 to US$ 400-450 per ton, which resulted in huge negative impacts on the imports of such commodities. Therefore, the government decided to adopt the policy of diversifying grain-importing sources to hedge against the risk of banning exports by some countries (the case of Indian wheat). Currently, the government is considering activating the win-win deals mechanism with some countries; Russia, for example. The General Authority for Supply Commodities (GASC) actively explored this option, while also increasing planned procurement prices from domestic sources by 38% over last year’s figure.

3.4. Egyptian Action Plan Policies for Cereal Crops Production:
Agricultural production policies aim to curb the food gap in grains, estimated at approximately 50% for wheat and 75% for yellow maize, which the government covers through imports from abroad. However, Egypt faces challenges in increasing wheat and maize cultivated areas because the maximum possible expansion area for both crops is 500 thousand acres (210,000 hectares). Accordingly, the vertical expansion strategy comes on top of the solutions that can contribute to increasing yield per unit of land and water by focusing on improving the yields of varieties; raising
farmers’ awareness of the proper cultivation packages associated with such varieties and implementing modern technology.

In this context, the government developed a strategic plan to promote expanding the production of strategic crops, which is being implemented and followed up by the Ministry of Agriculture. It focuses on curbing the gap in strategic crops, including wheat and yellow corn, by adopting the following policies:

1.4.1 Horizontal Expansion Policy

Increasing the cultivated area of some crops (including wheat and corn), either by increasing the agricultural area in New Lands, or by deducting areas from some crops which area is intended to be reduced. Results achieved from applying the technical recommendation packages in the implemented national mega projects in newly reclaimed areas revealed that wheat yield under the “Future of Egypt for Sustainable Agriculture” project reached 22-24 ardab per acre (7.86 – 8.57 tons per hectare) in some regions, while reached 27 ardab per acre (9.64 ton per hectare) in other regions.

1.4.2 Vertical Expansion Policy

Vertical expansion policy aims to increase productivity per hectare by developing modern, high-yielding, disease-resistant and early maturing varieties; expanding the production of certified seeds; applying good agricultural practices; activating the varieties map and expanding extension fields.

1.4.3 Cereal Crops Policy

1.4.3.1 Wheat

several years ago, Egypt ranked fifth at the world level in terms of wheat yield. The multistakeholder workshop revealed that a gap exists between the yield capacity of varieties planted in pilot plots and average yield at the country level. Therefore, the government’s agricultural policy aims to close this gap, especially since some farmers can achieve even higher yields than those realized on the pilot plots. Such policy aims to increase wheat planted area up to 1.51 million ha (3.6 million feddan), besides increasing yield up to 7.86 tons per hectare (3.3 tons /feddan) by the agricultural season 2024/2025, bringing total production to some 11.8 million tons. To achieve that goal, the government has expanded the national campaigns for grain crops so that one pilot plot is allocated for each village. It is expected that a 25% vertical increase in wheat yield can be realized without exerting additional efforts. In case more efforts are exerted, and more funds are allocated for research studies, yield can be increased by more than 40%. Implementation tools include:

- Increasing wheat planted area by 200,000 acres during the season 2024/2025 by deducting from alfalfa planted area without affecting the total production of green fodder due to expansions in planting improved alfalfa varieties, as well as expanding wheat planted area in new lands.
- Increasing certified seeds’ coverage rate to reach 50%, which will lead to an increase in productivity by 715 kg/ha (300 kg/feddan). It is worth mentioning that the Central
Administration for Seed Certification (CASC) has established a mechanism to control the quality of certified seeds.

- Promote farmers’ commitment to applying good agricultural practices (planting on raised beds and adhering to planting on the recommended dates), which will lead to an increase in per-area productivity at a rate of 715 kg / hectare (300 kg/feddan).
- Promote farmers’ commitment to following the variety map.
- Expanding the establishment of extension fields to reach one field for every 210 ha (500 feddan), i.e., establishing 7,000 extension fields in which productivity is estimated at 8.8–10.4 tons/ha (3.7- 4.5tons per feddan).

### 3.4.3.2 Yellow Maize

The government of Egypt is expanding the yellow maize cultivated area to provide the feed required for livestock and poultry production in response to the world grains crisis, which is expected to worsen after the destruction of the Kakhovka Dam in Ukraine in early June 2023. The World Grain Program expects that Ukraine will be able to export only 40% of the volume of grains it used to export two years ago.

In this case, the government's policy aims to increase the yellow maize planted area up to 840,000 hectares (2 million feddan), as well as increase productivity up to 8.33 tons per hectare in the agricultural season 2024/2025, which would help to bring the total production to some 7 million tons. Implementation tools include:

- Gradually increasing yellow maize planted area using those areas illegally planted with rice, areas allocated of white corn, as well as expanding yellow maize planted area in new lands.
- Limiting silage production to white maize.
- Promoting farmers’ commitment to applying good agricultural practices (planting on the recommended dates).
- Promoting farmers’ commitment to following the variety map.
- Expanding the establishment of extension fields until reaching one field for every 420 ha (1,000 feddan), i.e., establishing 2,000 extension fields.
- Obliging the Union of Poultry Producers and Feed Factories to receive yellow maize from farmers, provided that sufficient storage capacities are provided to accommodate the received quantities, in addition to providing dryers.

### 4. Food Losses and Waste Reduction Policy

Loss and waste in food crops across all stages of the value chain is one of the main obstacles to agricultural food systems policy. According to the FAO, global loss in plant and animal production is estimated at 13.8%. Domestically, loss in Egyptian food production is estimated at 14.2%, which can be attributed to the low level of technology used in agricultural operations. Both the Ministry of Agriculture and the Ministry of Supply have exerted several efforts to reduce losses, starting from land preparation, through the production stages, until harvesting. Besides, the development of wheat transportation methods, silos, and storage facilities led to reducing wheat losses to only 2%.
5. Investment Policy

The government gave special attention to the agricultural sector by increasing the value of governmental investments in the field of land reclamation and cultivation. Official statistics show a continuous increase in the value of public and private investments in the general budget allocated for implementing infrastructure projects, either new or renewal, as well as other projects in the agricultural sector. During the last executive plans, the government has expanded in implementing major national projects, including:

- Field Irrigation Improvement projects, rationalization of irrigation water use and allocating the saved water to horizontal expansion areas.
- Establishing several high-tech storage silos to increase wheat storage capacities and accommodate the expected increase in local production.
- Urging the private sector to pump more investment in the field of drying yellow maize grains to use in manufacturing feed for the poultry sector.

6. Farmers Support Policies

The government supports farmers through:

- Providing production inputs (seeds, fertilizers, pesticides).
- Bearing part of the cost of resisting some agricultural pests.
- Reducing seed prices.
- Providing soft loans for some agricultural purposes.

The policy implementation tools include:

- Activating the Farmer's Card System.
- Providing conditional support to crop production, especially strategic crops.
- Conditional support is focused on subsidizing the cost of agricultural production inputs, especially seeds and fertilizers.

7. Agricultural Marketing Policy

7.1 Wheat

During the past few years, the government estimated and announced wheat procurement prices to farmers during the harvest season, and farmers supplied the harvested crop optionally. During the last agricultural season:

- The government set and announced wheat procurement prices well before planting and revisited them during the agricultural season based on international prices.
• Some regulatory controls have been set for supplying to the silos of the Commodities Supply Authority.
• Farmers were obligated to supply at least 50% of their production, and some penalties were imposed on those who did not supply the specified percentage, such as denying access to subsidized fertilizers, as well as excluding from governmental support to citizens in the future.

7.2 Yellow Maize
• The government sets and announces the procurement price well before planting. However, the government is not obliged to purchase it from farmers; rather, purchases are made by poultry production companies.
• Currently, there is competition in marketing yellow maize as grains for the poultry sector against marketing as green silage for dairy farms.
• Private post-harvest logistics are very weak when it comes to drying, storing, and distributing the crop.

7.3 Rice
Farmers manage their rice production by retaining part of their production to cover their annual family consumption needs and storing the surplus for other purposes like selling to domestic merchants, or exporters, based on the announced price. It should be noted that domestic rice prices are mainly affected by policies adopted by the government regarding allowing or prohibiting exports or imposing extra custom duties on rice exports.

8. Food Commodities Distribution Policies

8.1 Food Subsidy Policy
• Low-income groups suffer from the high prices of food commodities, especially after the outbreak of COVID-19 and the Russo-Ukrainian war, which led the state to increase the value allocated to subsidy to enable these groups obtain their basic needs of food.
• Support is provided in kind to low-income families by distributing certain amounts of subsidized local bread loaves, and providing certain rations of cooking oil, rice, sugar, and pasta through ration cards.
• To rationalize families’ consumption of subsidized local bread, the government designed and adopted the program of replacing the saved value of local bread by corresponding food commodities included in the list of subsidized goods in ration cards.

8.2 Strategic Stock Policy
The key policy objectives are addressing emergency cases of food shortages and balancing price rises during supply shortage of the commodity. This can be implemented such that in case price levels fall, the government purchase additional quantities of goods and store them. When price
levels rise due to increased demand and supply shortage, the government releases quantities from the stock to markets.

8.3 Strategic Stock of Wheat
- The General Authority for Supply Commodities (GASC) stores the locally purchased wheat, as well as the wheat imported to manufacture “Subsidized Balady Bread” in their stores and silos.
- Private sector companies annually import wheat, or wheat flour, for their own purposes, and undertake the management, storage, and trading of the imported quantities, whether in their own stores that are attached to mills, or by renting silos that have accommodating spaces.

8.4 Strategic Stock of Yellow Maize
- Locally produced Maize (white and yellow) is stored by farmers at their homes for family consumption and animal feed. The surplus is sold to local merchants.
- Poultry companies purchase small quantities of the locally produced yellow maize and import the large amount of their needs on several batches according to their storage and manufacturing capacity, and their daily and monthly capacity.
- There are no reliable statistics or data available on maize crop to analyze the strategic stock in the conventional sense.

8.5 Strategic Stock of Rice
- Paddy rice is usually stored and traded, either by farmers, or by the merchants in their own stores.
- Paddy rice is milled into rice grains by local merchants to sell at local markets, or by exporters to sell to world markets.
- The government has no specific role in managing, trading, or storage of paddy or milled rice, whether intended for local or export markets, which are all carried out by the private sector.

9. Conclusion
Improving the performance of agricultural policies and achieving their desired goals requires proposing a system of executive mechanisms for monitoring and evaluating the implemented policies, introduce whatever required amendments to increase their effectiveness, and coordinate between the ministries related to implementing the system, through:

a) Establishing a database for strategic crops, which can be electronically accessed by relevant authorities. Main data and relevant authorities include:
- Area cultivated with strategic crops at the level of production governorates (old lands - new lands). Relevant authorities: Ministry of Agriculture and Land Reclamation; Ministry of Water Resources and Irrigation; Ministry of Planning; Ministry of Finance.
• Consumed quantities. Relevant authorities: Ministry of Agriculture and Land Reclamation; Ministry of Supply; Ministry of Trade and Industry.
• Monitoring climate change. Relevant authorities: Ministry of Agriculture and Land Reclamation; Ministry of Environment.
• Local and international prices. Relevant authorities: Ministry of Agriculture and Land Reclamation; Ministry of Supply; Ministry of Trade and Industry.
• Imports, i.e., imported quantity, import timing, main import countries, transaction prices, transportation freight, and local transportation cost and services. Relevant authorities: Ministry of Agriculture and Land Reclamation; Ministry of Supply; Ministry of Trade and Industry.

b) Linking the production system of strategic food commodities to demand for such commodities by implementing contract farming, because it helps in:
• Announcing the main buyer of strategic goods.
• Setting the purchase price of crops well before planting.
• Formulating indicative contracts that include specifications of the produced crops and the good agricultural practices that must be followed to obtain the required crop quality.
• Concluding contracts between the purchasing entity and farmers (individuals; cooperatives; farmers’ unions).
• Establishing an arbitration mechanism to settle disputes that may arise between the contracting parties.

c) Establishing a Monitoring and Evaluation System that includes:
• Indicators to measure the state of food security, food commodity markets and food safety.
• Long-term estimates of strategic food needs that allow policy makers to simulate the balance between local production and import requirements (i.e., when, from where and how imports will take place).

d) It is also important to:
• Conduct a comprehensive review of grain import policies, whether for the government or private sector, with the aim of improving purchasing procedures in terms of quantity and import timing, as well as technical and health specifications.
• Adopt proper incentive policies that help attract investors.
• Expand the storage capacities and improve the local supply chains of strategic crops.
• Activate the purchasing mechanism through futures contracts (Stock Market Exchange) and carry out the hedging process on deals.
• Establish a joint-stock company to carry out logistic operations for drying yellow maize and manufacturing local poultry feed.
• Establish a joint-stock company under GASC's umbrella to collect paddy rice from farmers, mill it and then directly sell in the market, or distribute on the ration cards.
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