

Agriculture Sector

Policy Brief to Climate Change Adaptation of Agricultural Sector

Main issues

Overview of the Agricultural Sector: Importance in the Egyptian Economy

Egypt's agriculture sector is a vital and integral component of the country's economy. It contributes 14.7% to GDP year 2012 and 20% of the country's exports. The agricultural sector employed 32% of the workforce in 2012, exceeding 8.7 million workers. About 40% of the population is engaged in agriculture sector as their main source of income. On the food security front, about 60% of national food needs are provided by the local resources as opposed to importing 40% of food needs.

Agricultural production is highly concentrated along the Nile River and in the Nile Delta. About 97% of the area of Egypt is uncultivated due to the extremely limited rainfall. Virtually all agricultural land is allocated to crop production, and 98% of total agriculture area is irrigated under fixed irrigation system.

Although the arable land per person is quite small (0.04 ha), this is offset to some extent by multiple cropping with two growing seasons (winter and summer) and intensive production making up a total cropped area of about 6.3 million ha compared to total agricultural area of 3.5 million ha. Smallholder-based mixed farming is the dominant production system (about 80% of farms are smaller than one ha). The main agricultural products are wheat, cotton, rice, maize, and fruit and vegetables, poultry, cattle, water buffalo, sheep, and goats. Egypt is a net importer of food, and the self-sufficiency ratio in various food crops has declined since the 1960s. Egypt suffers from severe food shortage particularly in basic food commodities including wheat, maize, edible oil and sugar. The rising dependence on imported food is a major concern among policymakers and has resulted in various attempts to restrict food imports and stimulate domestic production. Major agricultural exports include cotton, rice, onion, fruits and vegetables.

Key Challenges Facing Agriculture and the Need for New Policy

Egyptian agriculture is almost entirely dependent on irrigation, while the agricultural land base is limited to about 3.5 million ha, of which about 2.3 million ha are located in the old lands while the remaining area lies in the newly reclaimed desert land. Some of the current challenging issues facing Egypt's agriculture and water resources include: rapid population growth straining the Nile and the country's natural resources; limited natural fresh water resources; agricultural land being lost to urbanization and windblown sands; increased soil salination; desertification; water pollution from agricultural pesticides, raw sewage, and industrial effluents. In addition, due to the low percentage of certified seeds, production for at least 70% of the crops is already low. Further challenges are aggravated by increasing population growth rates and decreasing the per capita share of agricultural land and water resources. Also future climate change is evidenced by higher temperatures, changing humidity regimes, higher variability as well as

an increase in extreme weather events (including spells of very high temperatures and droughts) and how these might affect the incidence of insects and plant diseases.

Given Egypt's limited land and water resources, the challenge for increasing food productivity in the face of increasing food demand is a constant preoccupation.

In the face of the climate change risks, increasing water scarcity, food insecurity and rural poverty, and increasing pressures on natural resources, relatively modest efforts have been done so far. Over the last two decades there has been lack of funding and as well as obsolescence of legislations that has greatly weakened the capacity of agricultural institutions in the area of climate change adaptation. An indication of marginalization of the agricultural sector in general and agricultural research in particular is the public budget allocation to the Agricultural Research Center, which has been reduced to about LE 70 million annually. The agriculture sectors share of the total public investments is as low as 3%. The continuation of such policies would result in further deterioration in the agricultural and food production and make the country more vulnerable to climate change risks and more exposed to food market fluctuations due to its dependence of food imports.

Potential Socioeconomic Impact of Climate Change on Agriculture

Under Climate Change conditions, all crops are projected to have a decrease in yields and will require an increase in irrigation needs. Some crop yields decrease from a few percent while others have a reduction of more than 25%. Using the agricultural model, estimated agricultural production in future scenario, even when the flow of the Nile increases. In all cases, food prices rise by a larger percentage than the reduction in yields and more food is imported. Employment in the agriculture sector is estimated to decrease because of climate change.

Agricultural production decreases in all climate change scenarios, even when water supplies are projected to increase. This decrease can range between 8% to 47% depending on the crop and crop variety by 2060. There is still a wide gap between farmers' yield productivity and demonstration fields carried out by the research departments. This is apparently because crop yields are lower in all of the scenarios, which must outweigh the gains from increased water supplies.

Agricultural production is estimated to decrease by 8 to 47% by 2060, with changes in agriculture-related employment of -39 to +3% and food prices increases of 16 to 68%. Annual welfare losses in agriculture in 2060 are estimated to range from 40 to 234 billion Egyptian pounds (EGP; about \$7 to \$42 billion). The annual value of property in the Nile River Delta threatened by sea level rise is estimated to be 7 to 16 billion EGP (\$1 to \$3 billion). It should be noted that the Renaissance Dam of Ethiopia would boost the possibilities of decreasing the Nile flow and potentially create substantial complications for the irrigation system and increase climate changes adverse impacts for the Egyptian economy in general and the agriculture sector in particular.

The Major Policies to be considered: Climate Change Adaptation Policy Framework (CCAPF)

Purpose of the CCAPF

A Climate Change Adaptation Policy Framework (CCAPF) is of utmost importance to outline a set of principles, actions, roles and responsibilities, and financing recommendations to guide

different stakeholders engagement in implementing agriculture- related climate change adaptation programmes in Egypt. The framework should guide engagement at all levels from national to local and across the levels. The framework will form a common strategy for proactively addressing climate change through adaptation measures, linking together partners at all levels, all focused on achieving the goals and objectives of development.

The core of the framework is the "scaling up of best practices" related to climate change in agriculture as shown in the annexed figure 1. The elements to achieve this include: Technologies; R&D; policies; capacity building; financing .Other elements related to application of best practices include: organization; partnerships; training; knowledge management.

Long-term adaptations are major structural changes to overcome adversity such as changes in land-use to maximize yield under new conditions; application of new technologies; new land management techniques; and water-use efficiency related techniques. The major classes of adaptation include: seasonal changes and sowing dates; different variety or species; water supply and irrigation system; other inputs (fertilizer, tillage methods, and grain drying, other field operations) new crop varieties.

Policy Recommendations

Recommendations related to crop production

- 1.Generalization of certified seeds. Using higher quality certified seeds instead of traditional home-retained seeds would result in up to 20% increase in crop yields. Wheat, rice, and berseem cultivations with a total area of more than 7 million feddans are recommended to fully cover by certified seeds. In light of the high return for expenditure on seed certification, the generalization of this type of seeds is highly recommended particularly for major crops
2. Breeding Stress tolerant cultivars: Breed for high-yielding early maturing cultivars, more heat-tolerant, salinity-tolerant and stress-resistant varieties
3. Adaptation of current cropping patterns, including reduction of crops with excessive irrigation water requirements
4. Adaptation of crop husbandry practices (e.g. changing optimum sowing dates; changing crop varieties depending on specific characteristics of agro-climatic or agro-ecological zones; changing irrigation techniques (shift to water-saving technologies) and practices in terms of amounts and timing). Present productivity is below the productive potential of existing varieties, and there are great possibilities for its increase at rates between 25 - 40%, through improving agricultural practices and farm management
5. Application of integrated pest management (IPM)
6. Developing the irrigation systems to reduce the general water losses
7. Develop adaptation measures of soil maintenance under different agricultural systems, Consider integrated coastal zone management (particularly in the Nile Delta) as an area for priority
8. Raising the farmer awareness about the important of proper use of water resources and Good Agricultural Practices (GAP)
9. Support and develop early warning mechanisms.

Recommendations related to livestock production

10. Improve cattle breeds through an artificial insemination program developed for smallholders. Field services should be based on specialized full-time inseminators allowing the maximum number of inseminations per day. The provision of pregnancy diagnosis and sexual health control services to the owners will increase the owner's appreciation for the service. To ensure successful insemination program it could be accompanied by an effective awareness campaign aiming to promote farmers' acceptance for cross breeds;
11. Biotechnological animal adaptation, selection and breeding options other than artificial insemination to be introduced include: reproductive biotechnologies including embryo transfer, in vitro fertilization, sexing and cloning; and molecular biotechnologies;
12. Vaccination against avian flu.
13. Close feed gap: Introduce new techniques for producing nontraditional animal feeds (of higher nutritional value), including from the agricultural residues, while encouraging a greater role for agricultural cooperatives in introducing these feeds : (a) supplementing animals fed on berseem only with silage made from corn stalks; (b) increase feed supply through:
 - (b-1) developing high-yielding certified berseem seed (see action above relating to certified seeds);
 - (b-2) use crop residues and by-products;
 - (b-3) feed on hydroponic barley fodder;
 - (b-4) utilization of saline water for crop / forage production;
 - (b-5) integration of livestock into farming systems;
14. Conducting a national project to select the best livestock types adapted with climate change challenges and limited contribution in GHG emissions.

Recommendations related to fisheries production

15. Allow more access of aquaculture and fish farming to fresh water, fresh water is used in only 30,000 feddan, with drainage water feeding the remaining 200,000 feddan. Besides this being a health hazard, limited access to fresh water will not allow Egyptian fish to be exported to European markets
16. Expansion of fingerling production to support intensive production is essential
17. Capacity building in effective fish feeding practices is required
18. Further research in the production of improved feed for maximum productivity. Productivity per feddan is about 2.0 - 4.0 tons annually, while some farms with modern technologies produce up to 8 tons per feddan.
19. Introduce new technologies and improved fish feed quality to enhance productivity of fish farms
20. Research and investment is required in the development of marine aquaculture, another underexploited fish industry in Egypt.

Recommendations related to water resources and irrigation

21. Programme for a substantial increase in irrigation water use efficiency and productivity. A long-term project proposal in the water sector known as the "On-Farm Irrigation Development

in the Old-lands" (OFIDO) aims at improving five million feddan of irrigation systems in the old lands over a period of ten years. Recommended activities to be implemented under the Agricultural Research Centre (ARC) in MALR include:

(i) Renovation of mesqas and marwas through cement coating and converting to pipes; this would result in converting about 0.5 million feddans to the cultivated area. (ii) Switching traditional on-farm irrigation systems to improved, water-saving on-farm irrigation systems (iii) Applying localized irrigation in fruits and vegetables fields; (iv) applying crop water requirements based on climate conditions. IFAD, JICA and the European Union are seen as potential donors for this long term project (10 years). Upon completion of the project, water use efficiency in traditional agriculture is expected to increase from 45 percent to 80 percent. This increase would save about 35 percent of irrigation water used in the old lands (or about 13 billion cubic meters, BCM)

22. Adopt cropping patterns adapted to climate change conditions and which optimize on-farm water resources use.

23. Applying technical strategies to optimize water resources followed by the incentives for a water conservation culture. Such as water demand management, leakage rate reduction, water reuse and recycling, water desalination, rain water harvesting, groundwater recharging, reduced imperviousness in the city area, storage reservoir, changing cropping patterns, increasing irrigation efficiency etc...

24. Scheduling irrigation on the basis of crop water requirements - or fractions thereof - determined through accurate measurements and/or models, to improve the efficiency of both water application and agronomic water use efficiency

Recommendations related to recycling farm residues

25. Promote value added of farm residues and by-products: It is estimated that an amount of more than 25 million ton of crop residues in the agricultural sector can be economically utilized either for organic fertilizers or for animal feed.

Moving the Framework into Action - operational systems/coordination mechanism; Monitoring and Evaluation

To move the recommended framework into action, necessary elements/conditions should be met and certain procedures should be taken. Legal and institutional procedures needed include new legislations for establishment of agricultural cooperatives, fish farming/aquaculture, livestock, and water resources and irrigation. Financing the adaptation agenda in agriculture is also an important element. The implementation of New Climate Change policy can be financed through five sources: (a) Public investments; (b) Principal Bank for Development and Credit (PBDAC); (c) Private sector, (d) Commercial banks; (e) International institutions and donors.

To narrow the R&D gap in Egypt, sharp increase in investments in R&D must be at the top of the new policy agenda. Investments in R&D should be at least 10 times the current level, i.e. LE 700 million annually. Yet this amount represents only 0.3% of the Agricultural Gross Domestic Product (AGDP). The share of agriculture in the national investments should be increased up to 10% from the currently 3%. Information, communication, training, and extension services should be strengthened. Relevant policies, capacity building, and public-private partnerships are all important for successful climate change policy.

Monitoring and Evaluation: Water resources and agriculture are the most adversely impacted by climate change. Monitoring the progress in adaptation of these sectors is therefore critical. CCAPF results framework should be integrated with sectoral results framework of each key ministry. Ministries such as MALR, MWRI and MSEA should develop M & E manuals, which would be a good entry point for integrating indicators for climate resilience.

The Financial Resources needed and the Financial Savings as a Result of the New Policy

The financial resources needed should be covering the following cost items:

- 1. Cost of all agricultural R&D - related activities:** This will be covered by the budget proposed to be allocated to the ARC. These developing stress-tolerant and new varieties, adaptation of current cropping patterns, including reduction of crops with excessive irrigation water requirements; adaptation of crop husbandry practices (e.g. changing optimum sowing dates; changing crop varieties depending on specific characteristics of agro-climatic or agro-ecological zones; changing irrigation techniques (shift to water-saving technologies) and practices in terms of amounts and timing)
- 2. Cost of certified seeds program:** The total cost of generalization of certified seeds in the cultivations of the major three crops; wheat, rice, and berseem, is estimated at LE 1.67 billion annually. This cost could be shared equally between government (support) and producers
- 3. Cost of implementing "best practices" related to farming operations:** Costs of adopting best farming practices including crop, livestock, fisheries, irrigation, and crop residues will be covered by the public extension services. As it is suggested, additional budget of LE 300 million should be allocated to extension agencies.
- 4. Investment in improved irrigation water use efficiency** is LE 52 billion (10 years) to be paid by IFAD, JICA, and European Union as potential donors
- 5. Total financial resources to be afforded by the government,** estimated at LE 1.87 billion annually represents less than 1% of the AGDP.

The Financial savings

The impact of climate change on the agricultural and food production in Egypt is estimated under two scenarios: 1) when there is a high Nile flows scenario, the projected losses would result in 8% losses or LE 40 billion in 2060, 2) when there is a low Nile flow scenario, it is estimated that the losses would reach 47% or LE 200 billion in 2060. These losses could be considered "inaction" costs or costs under "without" the New Climate Change Adaptation Policy (NCCAP). Therefore, these losses could be saved in case the adaptation policy is implemented or "with" the NCCAP.

Also increased production could be realized above the saved losses. The value of the additional agricultural production above the climate change losses depends on two factors:

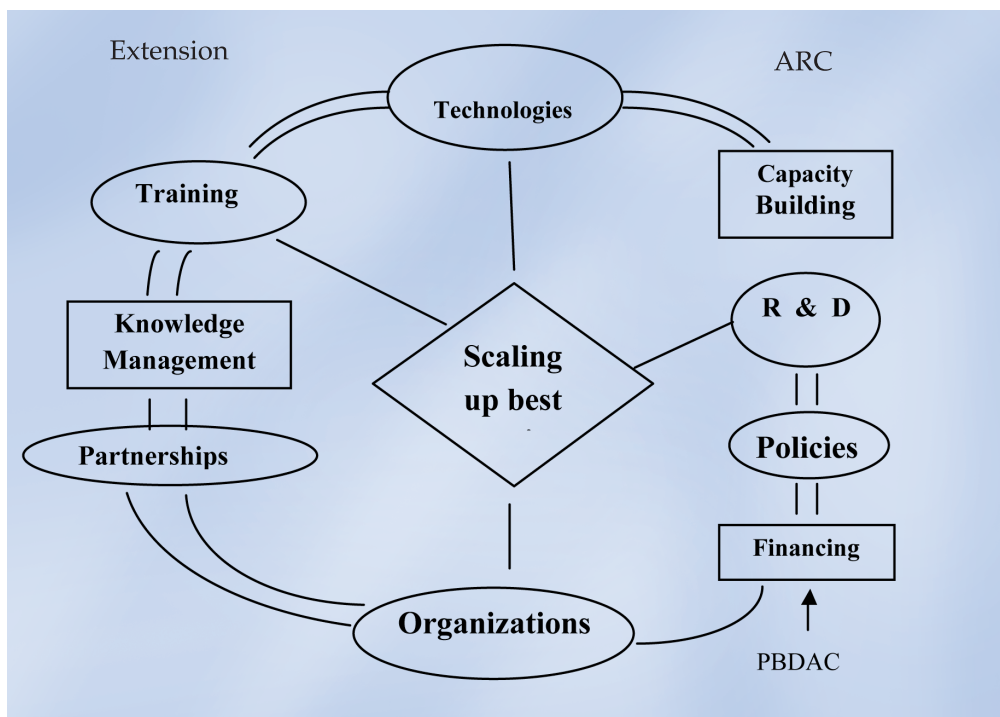
- 1) the amount of losses determined on which climate change scenario would potentially prevail throughout the next fifty years; 2) the growth of agricultural production under the New Policy which is mainly dependent on the commitments of the Egyptian government towards needed investments allocations and institutional reforms. Allocating an amount of

investments of LE 2 billion annually or 1% of the Agricultural Gross Domestic Product (AGDP) would be the first step in the road towards long term climate change adaptation. Given that agricultural institutional reforms are made, this amount of investments would result in incremental increase of at least 3% of the AGDP. It should also be noted that the delay in the adaptation interventions would make things more difficult in attaining the same results. In other words attaining the same level of policy performance indicators would require increasingly more financial resources. Enormous gains are expected to be achieved, as a result of the new policy, with respect to food security, poverty alleviation, and other MDGs.

Concluding remarks

In the face of the increasing climate change risks accompanied by increasing population pressure on the already limited natural resources, the current agriculture climate policies are definitely inappropriate and should be discontinued. The historical policy bias against agriculture is still continued so far. This bias is reflected in a low share in public investment, low budget allocation for agricultural research, lack of agricultural institutions, and outdated agricultural legislations. To divert these trends to the right directions, a new agriculture-based climate change adaptation policy should be adopted. To empower the Egyptian agriculture in order to minimize climate change losses or to maximize potential gains from Climate Change Adaptation Policy, agricultural institutions need to be strengthened in their capacity to develop an appropriate blend of policies, research and regulatory frameworks. Sufficient investments should be allocated to the agricultural sector. The execution of climate change adaptation new policy is expected to generate considerable gains, which are far beyond the costs, for the economic growth and for the social objectives concerning Egypt's food security, rural poverty and other MDGs.

Annex figure: Climate Change Adaptation Policy Framework Structure



Disclaimer:

The views expressed in this publication are those of the team.

Reasonable efforts have been made to ensure that the contents of this publication are factually correct and properly referenced.

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Please see MALR for the detailed report

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