Background and Strategic Context

Agriculture is a key sector of the Egyptian economy , providing livelihood for about 55 percent of the population and directly employing about 30 percent of the labor force .

Agriculture contributes 14 percent of GDP and 20 percent of total exports and foreign exchange earnings : industries linked to agriculture , such as processing and marketing , account for another 20 percent of GDP .

- But agriculture uses the bulk of Egypt , s limited water resources and average irrigation efficiency at the field level is estimated to be only about 50 percent .

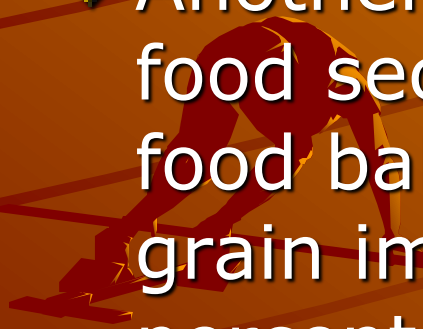
- The poor condition of off farm irrigation systems including large pumping stations , main and secondary canal networks , and open ditch mesqa (tertiary canal) systems , as well as problems associated with land drainage such as water logging and soil salinity , have also led to sub – optimal use of very limited water and land resources .

- The demand for water in Egypt is growing rapidly , fuelled by population growth , industrial development , and agricultural expansion . Because it is impossible to increase the amount of water available , Egypt is left with only one option for agricultural expansion : the country must improve the productivity .
- Farms are typically small (with an average of about 1 feddan (0.42 hectare) and with about 90 percent of the farms being less than 3 feddans) , yet farmers get a lot out of their land .

- Egypt has achieved some of the highest rice yields in the world with an average of 9.5 tons per hectare in 2005 , boosted by the introduction of a range of new varieties . In addition to rice , yields in the Old Lands for sugar cane , wheat , maize , cotton , and sorghum are also very high . However , yield growth has slowed markedly in recent years , and Egypt still imports about
- 40 percent of its food requirements for non – traditional high – value crops , yields remain below potential and the margin for improvement is quite high .

- Long term challenges put pressure on Egypt to increase agricultural productivity .
- One challenge is water scarcity . Egypt has approximately 750 m 3 / capita / year of renewable water resources , less than half the Middle East and North Africa (MENA) average of 1200 m 3 / capita / year .
- The Nile is Egypt , s only source of renewable water sources and is shared among Egypt and nine other upper riparian nations.

- Meanwhile , the demand for water , fuelled by rapid population growth , agricultural expansion , and industrial development , has increased substantially since the Nile Waters Treaty and will continue to do so in the future .
- Another challenge is the need to improve food security . Projections of the country's food balance indicate that dependence on grain imports will increase by over 100 percent over the next twenty years , implying that domestic production cannot keep pace with increasing demand .



- Given limited land and water resources , an increase in agricultural productivity is necessary to enhance supply . A third challenge is climate change , which puts further strain on scarce water resources and food security .
- Climate change models project an increasing probability of severe weather events that would increase yield volatility and decrease global production of key crops . This would contribute to food commodity market instability and increase Egypt's risk of food shortage .

- Agriculture and Food security : -
- Agriculture (Land & Crops)
- Cultivated Land :-
- The total population of Egypt inhabits less than five percent of the national territory , approximately 17 percent of the Egyptian population lives in upper Egypt . The rest is distributed between lower and middle Egypt .
- The Egyptian rural population represents about 51 percent of the total population .

- The total area cropped annually increased from 4.7 million ha in 1982 to 6.4 million ha in 2008 due to increased cropping intensity , which reached about 18 percent

- This was made possible by the introduction of earlier maturity varieties of various crops , which permit up to three harvests per year .

- At present , only 5.4 percent of the land resources in Egypt is qualified as excellent , while about 40 percent is of either poor or of low quality , due mainly to salinity , water logging and sodicity problems .

- The cultivated land in Egypt consists of four regions :
- Old land , rain fed area , oases and reclaimed land .
- This land is located in the Nile Valley and Delta regions , it covers a total area of 2.25 million ha and is characterized by alluvial soils (clay to loamy) .
- The Nile is the main source of water for irrigation . The main crops planted in this region are field crops , vegetables and fruits
- Oases are characterized by alluvial , sandy and calcareous soils . They cover a total area of 40000 ha , underground water is the

- main source for irrigation . Date is the main crop in the oases , in addition to vegetables and fruits .
- Rain fed areas include approximately 0.17 million ha of land located in the North Coastal areas , where rainfall fluctuates between 100 and 200 mm annually .
- Traditional soil fertility management can lead to the mining of nutrients from the soil due to an insufficient application of nutrients , to nutrient imbalances and to environmental contamination through the over – application of fertilizers .

- Barley is the main crop in these areas followed by wheat , olives , almonds and figs trees are also cultivated in these areas .
- Reclaimed land located mainly on both the east and west sites of the delta and scattered over various areas in the country . It covers 1.05 million ha . Reclamation of this land has started in the early 1950 and is continued .
- Nile water is the main source of irrigation water but in some desert areas underground water is the only source of irrigation water .
- Sprinkler and drip irrigation regimes are practiced .

- The main fruits in the new land are apples , grapes , figs , dates , peaches , apricots and almonds , while main vegetables are tomatoes , peppers and watermelon .
- The productivity of old land is relatively high but additional yield gains could be achieved with improved seed quality , more mechanization , strengthened extension support and better land and soil management .
- The performance of the newly reclaimed areas has been below expectation . The area under cultivation should increase from

- 3.3 million ha in the year 1997 to about 4.7 million ha by the year 2017 i.e. an increase of 1.4 million ha , according to the objectives of the agricultural strategy .
- The aim of the present development strategy is to optimize the use of agricultural resources . By 2017 it is planned that the cropping system should involve : -
- 1. A gradual increase in the area under wheat from about 1 million ha in 1997 to about 1.4 million ha in 2017 . The aim is to raise wheat production to about nine million tones annually by the year 2017 , in order to meet the increasing national demand resulting from the growing population .

- 2. The area under cotton would be kept at about 420000 ha to meet the demand for local consumption and to conserve foreign markets .
- 3. An increase in the area under green fodder in the summer season , improvement of natural pastures in rain fed areas and increasing the yields of these crops .
- 4. A decrease in the area under berseem , thus increasing the area available for cereals .

- 5. A decrease in the area under rice to 420000ha annually , compared with 650000 ha in 1997 . A total production of paddy rice of about four million tones annually should increase to five million tones annually by the year 2017 , by planting the whole area with short duration , high yielding varieties , which have lower water requirements . MALR has new varieties that require only 120 days from planting to harvest , giving an average yield of 9.5 to 13.1 tones / ha , compared with 8.3 tones / ha from old varieties .The water consumption / evapotranspiration of the new varieties should be around 14000 m 3/ ha , compared with 21000 to 24000 m 3 / ha for the old varieties .

- Land management , degradation and conservation : -
- Land management is the process of managing the use and development (in both urban and suburban settings) of land resources in a sustainable way . Land resources are used for a variety of purposes which interact and may compete with one another ; therefore , it is desirable to plan and manage all uses in an integrated manner .
- Knowledge of current land use is essential to support improved management of land , vegetation and water resources and to develop responses to catchments management issues such as salinity , water quality , and the maintenance of biodiversity .

- Egypt has an area of about one million square kilometers or 238 million feddans (one feddan =0 .42 ha
- The total agricultural land in Egypt amounts to nearly 8.4 million feddans (3.5 million ha) and accounts for around 3.5 percent of the total area .
- Unsatisfactory management of the land is the main limiting factor to agricultural productivity . The following land management practices are necessary in order to increase crop production : -

- 1. Control of salinity , water logging and deterioration of soil structure .
- 2. Prevention and control of soil degradation .
- 3. Proper use of reclamation land , based on land capability .
- 4. Concentration of intensification efforts on the best land .
- 5. Recycling of organic matter for use as fertilizer .
- 6. Identification of areas where soil regeneration should be given high priority .

- 7. The construction of open drainage systems and the installation of shallow tile drain .
- 8. Promotion of land leveling to increase water use efficiency in transition and fresh water zones .
- 9. Development of land use plans for reclaimable areas .
- 10. Use of reclaimable land in sweet water areas to grow ecologically appropriate crop .
- 11. Promotion of the most efficient crop husbandry practices .
- 12. Integrated crop and livestock systems

- The management practices and human aspects related to the sustainable use of different soil types can be summarized as follows : -
- Hydro technical methods : Methods adopted to improve root zone include :
- Remove salt accumulation on the soil surface by mechanical means .
- Flushing by working away surface especially with area of K values and adequate slope . Surface drainage is accompanied to drain the salty water .

- Leaching by application of excess water allowing it to pass downwards to leach salts from root zone .
- So , the need for drainage become obvious soon after controlled irrigation replaced the flooding technique .
- A preliminary economic and financial analysis of the investment to improve irrigation systems and water resources management across the 5 million feddan of old lands as proposed in the SADS 2030 Project area and development approach

- Physical improvements will include :
- Main and secondary canals as well as control structure and pumping stations .
- Application of continuous flow irrigation .
- Tertiary systems based on single point collective lifting pumps on mesqas (substituting for many individual private diesel pumps).
- Land drainage improvements wherever needed
- Improvements to the quaternary or marwas canals –with most of them being converted to low pressure pipelines

- On – farm land improvements including laser land leveling and soil amendments . By forming new water user association and marwas committee , the program will also extend participatory irrigation management to most of the old lands . These measures are expected to significantly increase overall water –use efficiency and productivity .
- The program area include orchards where modern , localized irrigation systems that support the cultivation of higher – value crops will be targeted . This will lead the way toward accelerating the productive diversification of the old lands , which are still mostly based on field crops that offer limited opportunities for substantially higher incomes , especially given the small size of the farms .
- Project investment costs

- The program development objective is to increase agricultural productivity and ensure sustainability of available land and water resources for approximately 3.5 million small – scale farmers across 5 million feddan in the old lands , located in the Nile Delta and Middle and Upper Egypt . The program aims to increase the efficiency and sustainability of agricultural water use by improving management of both water supply and demand . Only if infrastructure improvements (supply management) are accompanied by demand management measures will real water savings be accomplished .

- For the purposes of this preliminary economic evaluation of the impact of the program , all development costs of the irrigation systems for the 5 million feddan to be improved from 2011 to 2030 in the Nile Delta and Valley old lands were include . Investment costs were estimated based on 50,000 feddan modules , and on actual costs from the ongoing IIIMP and the proposed FIMP- as well as other sources –as shown in Table 1.Physical improvements of main and branch canals , drainage systems where needed , mesqas , marwas , and on – farm costs were assumed to average LE 11,585 per feddan . In addition , the program would invest an average of LE 1,250 per feddan to support the development of the export value chains , institutional development , and farm – technology development and dissemination .

Table 1 summarized the estimated program investments , totaling about LE 64 billion (US $ 11.3 billion) to be invested between 2012 and 2030 .

Table 1 . Program investments (5 million feddan 2012 – 2022)

Items	Cost per feddan LE/fed	Cost per 50,000 fed million LE	Total investment (5 million feddan)	
			million le	million$
Land amendments and leveling	230	11.5	1,150	$203
Mesqa improvement	5,448	272.4	27,240	4,804
Marwa improvement	1,620	81	8,100	1,429
Electrification Grid	1,496	74.8	7,480	1,319
Drainage improvements	1,251	62.6	6,255	1,103
Total costs to be recovered	10,045	502.3	50,225	8,858
Design , Engineering , Construction supervision	300	15	1,500	8,505
Main & branch canal improvements	1,240	62	6,200	1,093
Total physical improvements	11,585	579.3	57,930	10,217
Strengthening the horticultural export value chains	250	12.5	1,250	220
Farm technology development & dissemination	500	25	2,500	441
Institutional development & capacity building	500	25	2,500	441
Total investments in 5 million feddan	12,835	642	64,180	11,319

- According to the proposed plan , the pace of implementation for the 5 million feddan total will increase from 60,000 feddan per year expansion to be achieved under the FIMP to 110,000 per year in 2013 , and reaching a rate of 295,000 feddan per year from 2016 on wards (Table 2) .

Table 2 . Preliminary plan for irrigation improvements 2012-2030 (in 000fed)

Region	2012	2013	2014	2015	2016-2022	Total
West Delta	7	10	20	30	40/year	667
East Delta	-	10	20	25	40/year	655
Central Delta	38	50	70	90	100/year	1,748
Middle Egypt	13	20	30	50	60/year	1,013
Upper Egypt	2	20	30	40	55/year	917
Total	60	110	170	235	295/year	5,000

- Expected Benefits from the program
- Public goods
- Currently , a high proportion of irrigation water is lost to drains , evaporation , and evapotranspiration of weeds . Much of this water loss is unrecoverable . The program would reduce water usage by about 10 billion cubic meters (20percent of current usage) by improving conveyance to the fields and reducing on – farm losses , with each farmer being served by a structural conveyor and outlet (hydrant) . This will be coupled with improvements to main , secondary , and mesqa canals , including the application of continuous flow irrigation .Drainage improvements will also be essential for ensuring the

- sustainability of agricultural production . Monitoring and evaluation studies of the W-10 pilot indicated that conveyance efficiency has increased from 76 percent for earthen marwas to 92 percent for piped ones , and that the water use index has decreased from 1.2 for earthen marwas to 0.99 for piped ones . Laser – Land leveling technology also contributes directly to a reduction in water application rates . These rates have been estimated at approximately 11.5 percent for the on – farm component of the irrigation improvement project (2006).

- On the demand management side , measures to reduce water consumption by crops will be effective in increasing water productivity . These may include the reduction of rice – cultivation ; the replacement of current rice varieties with shorter – life varieties that require less water ; the development of more productive crop varieties using genetic engineering ; and the design of more optimal cropping patterns .

- Part of the saved water , mainly from the head of the system , will be conveyed to the underserved farmers at the tail end .
- Some of the saved water could also be recovered by the administrative authority for use elsewhere . The value of this water diversion to new areas is surprisingly high and helps to justify the program investment .
- In addition to a substantial economic benefit to farmers , the conversion from diesel to electric pumping will have a positive environmental impact by reducing carbon emissions and pollution from fuel spills .

- Private goods

- At the individual farm level , benefits will include :
- Production and productivity increases due to enhanced water distribution through the application of continuous flow irrigation , better extension services , timely irrigation scheduling , equity for tail end farms , improved water quality and quantity , improved drainage , lowered groundwater table and decreased soil salinity , and reduced soil erosion ;
- Land gains for production and / or communal service space (about 2 percent of total project area) due to covering of open mesqas and marwas ;

- Reduced irrigation costs (depreciation and O & M cost of pumps , energy costs , and labor costs) due to the piping of the tertiary and quaternary systems and switching to electric pumps , enhanced water application , fertilizer saving , and r5eduction of weed control costs and of marwa maintenances costs ;
- Some changes in cropping patterns due to more reliable and timely access to water through application of continuous flow , fewer risk , renewed technical assistance providing support for the use of improved production technologies , and promotion of higher value crops .