



SINGLE COUNTRY/ REGIONAL INNOVATION PROJECT/PROGRAMME PROPOSAL

PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme:	Building Resilience in the Old Lands by Combining Innovations in Irrigation, Agriculture, and Livelihood Activities
Country/ Countries:	Egypt
Thematic Focal Area:	Agriculture
Type of Implementing Entity:	Multilateral Implementing Entity (MIE)
Implementing Entity:	Food and Agriculture Organization
Executing Entities:	Ministry of Agriculture and Land Reclamation, Ministry of Water Resources and Irrigation
Amount of Financing Requested:	4,873,400 (in U.S Dollars Equivalent)

Project / Programme Background and Context:

1. The Arab Republic of Egypt is in northeast Africa between latitudes 22° and 32°. It extends 1,024 km north to south and east to west, 1,240 km. The elevation varies from -133 m (Western Desert) to +2,629 m above sea level (Sinai Peninsula). The total area is 1,001,450 km², including a 3,500 km coastline on the Mediterranean and the Red Sea. Egypt is mostly a large uninhabited desert. The Nile Valley covers 4% of the territory; the Nile Delta 2.5%. Libya is to the west; Sudan is to the south. The Red Sea, Palestine, and Israel form the eastern border; the Mediterranean Sea sets the northern border. Egypt's population in 2021 is 102 million, with a 2% growth rate. The population is projected to reach 160 million, with predictions that 56% of the population would live in urban areas by 2050. ^{1, 2, 3}.
2. **Development and Gender.** Egypt is a lower-middle income country, with a GDP per capita of USD 2,448 (2020)⁴. The GDP by sector in 2017 was: 12% for agriculture; 32% for industry, and 56% for services^{5, 6}. The labour force in 2019 was 28 million, with 29% in agriculture, 24% in industry and 47% in services. Agriculture directly and indirectly engages about 55% of Egypt's labour force. The unemployment rate in 2020 was 8%⁷. In 2019, Egypt was categorized as having a relatively high Human Development Index (HDI), scoring 0.707 and ranking #116 of 189 countries. Its Gender Development Index (GDI) (e.g., the female-to-male HDI) is 0.882, placing Egypt in Group 5 (e.g., countries with low HDI equality between women and men). The Gender Inequality Index (GII), which measures gender inequality in terms of reproductive health, empowerment, and labour was 0.449, ranking Egypt #108 of 189 countries (2019).^{8, 9}
3. **Food Security.** Egypt was ranked #60 of 113 countries (overall score = 61%) in 2020 in the Global Food Security Index (GFSI), meaning that it is 'moderately food secure'. Egypt is scored 5th in the GFSI 'food availability' sub-component, and is less well in other sub-components: 'natural resources and resilience' (47th) and 'food quality and safety' (62nd). It is scored poorly in the 'food affordability' sub-component (81st)¹⁰. Egypt has achieved good progress in reducing the incidence of malnutrition. The stunting of children under 5 years dropped from 23 to 16%, wasting from 8 to 3%, and anaemia from 27 to 22% from 2015 to 2018. The Government of Egypt (GOE) supports food security by improving agricultural productivity and by prioritizing the production and reserves of strategic crops. The GOE's budget allocation for food subsidies increased by about 5% from 2017 to 2020, with the GFSI report highlighting that one of Egypt's great strengths is the coverage and targeting of its food safety net programs, which provide the highest food support to families in the lowest spending category. Egypt quickly implemented additional food security policies at the start of the COVID-19 pandemic, such as stopping the export of strategic items (e.g., legumes), granting agricultural loans at reduced rates, and deferring loan payments for farmers and breeders for 6 months¹¹ (and now for 1 year¹²). The GOE set the poverty line at 8,800 EGP in 2017/2018¹³. Nearly 70% of the poor or food-insecure live in rural areas, mostly depending on agriculture for food and income.
4. **Initiative of rights to decent life:** The GOE is increasing its spending on basic services, health, education, and social protection to substantially cover the most vulnerable. It inaugurated cash transfer programs in 2015: the Takaful (Solidarity) program and the Karama (Dignity) program. It launched the Haya Karima (Decent Life) Initiative in 2019: Phase 1 had a budget of USD 43 million; Phase 2 has a substantial budget (USD 31.8 billion). The beneficiaries of the GOE's social safety nets rose from 60,000 in 2015 to 3.7 million in May 2021. The GOE quickly implemented actions to protect the most vulnerable during COVID-19 (e.g., grants to irregular laborers; it increased the number of beneficiaries in the Takaful & Karama programs). The COVID-19 pandemic has slowed progress in poverty reduction [e.g., extreme poverty rates dropped from 4.5% (2019) to 4.4% (2020), instead of to 4.1% in the without-COVID-19 scenario]. The GOE aims to reduce poverty to 22 - 28% and extreme poverty to 2-4% by 2030. Climate change could impede poverty alleviation efforts due to higher food and fuel prices or negative impacts on livelihoods. Reducing poverty remains a challenge. A UNICEF/Ministry of Planning and Economic Development study to better understand the complex nature of poverty concluded that the following positive

¹ EAAA. 2016. Egypt Third National Communication Under the UNFCCC (UNFCCC). See: <https://unfccc.int/sites/default/files/resource/TNC%20report.pdf>

² https://www.capmas.gov.eg/Pages/StaticPages.aspx?page_id=5035 (agricultural) https://www.capmas.gov.eg/Pages/StaticPages.aspx?page_id=5035 (labour); <https://www.capmas.gov.eg/>

³ <http://www.fao.org/faostat/en/#country/59>

⁴ The Ministry of Planning and Economic Development. 2021. Voluntary National Review. This document assesses progress with implementing Egypt's sustainable development strategy. See: https://sustainabledevelopment.un.org/content/documents/279512021_VNR_Report_Egypt.pdf

⁵ <https://www.cia.gov/the-world-factbook/field/gdp-composition-by-sector-of-origin/>

⁶ <http://www.fao.org/aquastat/statistics/query/results.html>

⁷ https://www.capmas.gov.eg/Pages/StaticPages.aspx?page_id=5035 (for labour statistics)

⁸ http://hdr.undp.org/sites/default/files/hdr_2020_overview_english.pdf Also see: http://hdr.undp.org/en/content/gender-inequality-index-gii?utm_source=EN&utm_medium=GSR&utm_content=US_UNDP_PaidSearch_Brand_English&utm_campaign=CENTRAL&c_src=CENTRAL&c_src2=GSR&qclid=Cj0KCQjw6NmHBhD2ARIsA13hrM3RpppQ

⁹ <http://www.fao.org/aquastat/statistics/query/results.html> (query for Egypt)

¹⁰ See: <https://foodsecurityindex.eiu.com/> Calculated by Economist Intelligence Unit, the Global Food Security Index (GFSI)

¹¹ The Ministry of Planning and Economic Development. 2021. Voluntary National Review

¹² Personal communications with FAO/Egypt, August 2, 2021

¹³ https://www.capmas.gov.eg/Pages/IndicatorsPage.aspx?page_id=6154&ind_id=1124 (poverty line)

factors increased the chance of not falling into poverty: (1) Female headed households are less likely to move downward; (2) Formal employment and small businesses protect individuals from sliding into poverty; (3) In general, having a job reduces the probability of a family falling into poverty; (4) A high education level/or good vocational training protected people from sliding into poverty; (5) In the last 2 years, rural households were more likely to escape poverty than urban household; and (6) A household with at least one Takaful or Karama beneficiary was less likely to fall into poverty. The following negative factors increased the chance of falling into poverty: (1) A high number of dependents (e.g., children below 18 years) in the household; (2) Head of the household works in the informal sector, compared to having a job in the formal sector; and (3) A high number of household members without health insurance.

Structural complexity of agriculture – many a little makes a mickle

5. **Old Lands and New Lands.** Only about 3% of Egypt's land is arable. About 80% of this land is in the Nile Delta and the Nile Valley (called 'Old Lands'), and 20% is in previously non-fertile desert zones east and west of the Nile Valley and Delta (called 'New Lands'). New Lands are lands that were (or are in the process of) being reclaimed. The Old Lands accommodate a high population density (1,600 inhabitants per km²) and are some of the world's oldest agricultural areas, having been irrigated and intensively cultivated since early times. Egypt had 3.5 million ha of land under cultivation in 2005, with a total annual cropping area of 6 million ha due to the high level of cropping intensity (176% of the total cultivated land area). It had about 3.5 million ha (equal to 8.4 million feddans¹⁴) of agricultural land in 2007 and 3.7 million ha in 2017, as result of the reclamation and restoration efforts. Egypt aims to have 11.5 million feddans (4.79 million ha) of arable land by 2030, with a cropping area of 20 to 22 million feddans (8.34 to 9.17 million ha). The production structures and resource availability are substantially different between the Old Lands and New Lands. While New Lands, by the recent development, consist of more modernized and larger-scale farming, the Old Lands keep relying on traditional practices and farm structure. A blatant sign of the underdevelopment of the farms in Old Lands is the low rate of mechanization, having less than 30% of farms equipped with tractors or any other machine. Even farmers with improved irrigation systems remain reluctant to change from traditional to cash crops. In general, the agricultural development pace in Old Lands is much slower than in the New Lands. Regardless of whether it is crop or livestock sector, consultations proved that farmers are risk-averse in the Old Lands, as their livelihood depends merely on small-scale agriculture. This Project is located in the Old Lands in Upper-Egypt¹⁵, the area in dire need for development.
6. **Agriculture.** Egypt has two main cropping seasons: winter (November to April) and summer (May to October). Some farmers grow a third crop between summer and winter (called Nili season). Summer crops include maize, rice, cotton; winter crops include alfalfa, wheat, barley, green beans, clover, and sugar beets. Sugarcane is planted in spring and autumn. New cultivars, modern agricultural techniques, and improved management activities have improved the productivity of field crops over the last 2 decades. Despite the globally high yields in Egypt, the structural flaws of agriculture have now become a major challenge, hampering the development efforts. The two major obstacles of agricultural development are the fragmentation of lands and slow trends of diversification. The fragmented land structure is detrimental to any development; therefore, the creation of reasonable land sizes is fundamental for stimulating the economies of scale of investments, including the financing of climate change adaptation. Fragmentations have further downsides to the efficient production, such as the occupied land size by boundaries (loss of land), lack of direct access to farms, irregular shape of plots resulting in complicated network of irrigation. Making the situation increasingly intricate, FAO conducted an assessment in the Old Lands to assess the willingness of farmers to participate in irrigation improvement projects that, by default, entail the development of system-level infrastructure. The cluster analysis showed that farmers without alternative resources and at larger distance from water sources are more willing to participate in the programmes. The greater interest in the programme is attributed to the disrupted access to irrigation water and the dependence merely on agriculture income¹⁶. The question, then, arises, how can development projects overcome the different degrees of willingness to participate in projects, and what is the best design of projects to respond to the need of both upstream and downstream areas? On the other hand, the past programmes and reforms to move cropping pattern away from the traditional ones have brought ambiguous results, and majority of the poor farmers in the Old Lands showed preference for traditional crops. However, the profit margin of traditional crops is low, and without livestock as alternative income sources, cropping is not sufficient to make ends meet. There is potential for further improvements, but agriculture development must overcome the burden of the structural complexity and find uncompromised solution to ensure a level playing field in access to development¹⁷.
7. **Livestock.** Livestock represents about 25% of the agricultural GDP. Most farms are small family farms that combine livestock and crop production. The livestock sector is an important component of food security and economic activity. The agricultural development strategy to 2030 aims to increase dairy production to 9.5 million tons, red meat (buffalo, cattle, and sheep) to 1 million tons, poultry to 1.4 million tons, and fish to 1.4 million tons per year.¹⁸ Livestock is essential for poor rural households in the Old Lands, as income from meat and dairy products make up the largest part of household incomes. Livestock directly affects the crop production, as over 85% of smallholders produce crops and livestock together. Although the average cattle number is less than 2 cattle per farm, the cropping pattern is cointegrated with livestock. As farmers have no access to forage markets, forage production necessarily takes share from the already over-fragmented agricultural lands. Crop and livestock sectors, therefore, cannot be separated from each other, and interventions should address both to reach all-encompassing impacts. Another non-negligible contribution of livestock keeping to livelihood development is its role in generating income for women. Women have marginal income from crop production by having only occasional and informal work throughout the production cycle. Consequently, women rely on the income from livestock, most importantly from hand-made dairy products.

Strain on water resources equals strain on agriculture

8. **Water Resources.** Egypt's share of the Nile River flow is fixed and limited - 55.5 billion m³/year. The total water requirement is now 90 billion m³/year¹⁹, mainly used to supply agriculture, potable water, and industry. In 2017, water withdrawal²⁰ for agriculture was 61 billion m³; for industry 5.4 billion m³; and for municipal use 11 billion m³. The imbalance between water demand and renewable water resources

¹⁴ Explanatory note: 1 feddan=0.42 ha

¹⁵ Explanatory note: this Project includes Middle-Egypt into the geographical classification of Upper-Egypt. The Project distinguishes the Delta called here „Lower-Egypt“, and Middle- and Upper-Egypt called here „Upper-Egypt“

¹⁶ Salman, M. et al. (-). The pieces of the smallholder puzzle: The add-in role of farmer's characteristics in irrigation improvement projects in the Old Lands of Egypt – manuscript under publication.

¹⁷ EEA. 2016. Egypt Third National Communication Under the UNFCCC

¹⁸ Egypt's *National Strategy for Adaptation to Climate Change and Disaster Risk Reduction*. 2011. <http://www.climasouth.eu/docs/Adaptation011%20StrategyEgypt.pdf>

¹⁹ The Ministry of Planning and Economic Development. 2021. Voluntary National Review

²⁰ <http://www.fao.org/aquastat/statistics/query/results.html>

is addressed through alternative water sources. The water deficit is sourced from desalinated water, rainwater, recycled water (e.g., reuse of agricultural-, industrial-, and sewage waters), renewable shallow groundwater (Nile Valley and Delta), and non-renewable deep groundwater reservoirs (Western and Eastern Deserts and Sinai Peninsula). The total groundwater was estimated at 40,000 billion m³, with abstraction in 2016 at about 2 billion m³/year. Rainfall (about 1.3 billion m³) is considered unreliable due to high spatial and temporal variability^{21,22}. Moving away from the Delta, the annual rainfall gradually declines to nearly zero in the south²³. Consequently, effective precipitation, defined as the portion of rainfall readily available for the plants²⁴, is insignificant, so agriculture must rely on other water sources. Water availability fell below the international water scarcity threshold of 1,000 m³/capita/year in the 1990s. By 2007, Egypt was near the water-poverty threshold, with less than 700 m³/capita/year²⁵. The annual per capita share of water declined to 570 m³ in 2018. Water resources are subject to a high evaporation rate. Egypt currently depends on the Nile River for about 90% of its freshwater, but water scarcity/'water poverty' is a growing at an unprecedented rate due to climate change and changes in water use. The agricultural sector needs to make fundamental changes to the way it uses water to better ensure the sustainable management and equitable allocation of water resources to all economic sectors and services.

- 9. Irrigation.** Agriculture consumes 80-85% of the freshwater resources. Egypt has some of the highest agricultural yields in Africa due to its irrigation and drainage works. Data for 2007 indicated that the water-use efficiency in agriculture had declined due to a 30% reduction in the efficiency of water transport and a 50% reduction in efficiency of on-field-irrigation. Improving the efficiency of water transport and of on-field-irrigation remains highly relevant. In 2017, the total area equipped for irrigation was 3.8 million ha, of which 2.8 million ha was equipped for irrigation by surface water and canals (representing 74% of the area equipped for irrigation)²⁶. New Lands typically use modern irrigation to produce crops, pumping groundwater for drip- and sprinkler-irrigation²⁷. Going forward, the agricultural sector is expected to expand, demanding to reduce water consumption by 10%, and to increase the productivity of every m³ of crop water by up to 30%. Meanwhile, water requirements are expected to increase 5 to 13% because of higher temperatures and higher evaporation and transpiration rates, the continued use of outdated irrigation methods, and seepage and leakage in irrigation canals. It is also expected that the average amount of water supply per feddan per year would drop from 6,900 to 5,565 m³. This brings adaptation measures in irrigation to the forefront of the water resources management issue, as water conservation and increasing water productivity (crop per drop) will help Egypt meet its triple challenge of water scarcity, food security, and sustainable development. The situation for agriculture, water, and irrigation can be summarized as follows: 1. Freshwater resources are getting scarcer; the population will grow to about 150 million by 2037; and the risks associated with climate change and dependency on upstream inflow into Egypt are notable; 2. Additional future water supplies are expected to come mainly from non-conventional water resources; 3. Irrigation and drainage are key components of sustainably managing agricultural water resources; 4. Agricultural Strategy aims to improve the efficiency of transporting irrigation water to 80% by 2030; 5. Water Master Plan 2037 aims to increase the overall water use efficiency to 84% through irrigation system modernization and water reuse; 6. The productivity of water supplies in agriculture is to be improved by producing more with less water²⁸.

Irrigation Improvement Programmes in Egypt (IIPs)

Irrigation improvement started over three decades ago with the first flagship programme of Irrigation Improvement Project in 1984. Mirroring the national efforts to enable irrigation sector to respond the challenges, the initial idea was to convert most of the water delivery systems into improved system. Improved access to water, water use efficiency, better equity amongst users and the establishment of water user organizations are at the heart of these projects. Ever since then, a suite of improvement projects were financed by international donors, which have been following the core design of IIP. Undoubtedly, IIP and its successors have been significantly contributing to the improved performance of irrigation systems. However, IIPs addressed only the water delivery system, while they put negligible focus on the on-farm irrigation. To further enhance the performance of irrigation sector and avoid the setback to the achieved efficiency increase at system level, the development of on-farm irrigation methods is evidently crucial.

FAO has been providing technical support to GOE to assess a number of IIPs (FIMP financed by WB, OFIDP financed by OPEC, OFIDO financed by IFAD) and draw conclusions. The rich experience acquired by the set of assessments is taken into the current project design to leverage the identified good practices while formulating innovative and socially acceptable project design.

- 10. Modernizing Irrigation and Agriculture.** Growing water scarcity and other climate change impacts require the more intensive deployment of water saving technologies. As direct response, the GOE initiated the Irrigation Modernization Program (IMP) in 2019 to improve irrigation- and agricultural productivity, and to rationalize water use at farm level. The program aims to save 5 billion m³ of water per year by lining 20,000 km of irrigation canals and modernizing on-farm systems²⁹. The canal lining is strategic intervention to prevent seepage and the prerequisite of on-farm modernization. The IMP lines out the modernization of farms through the deployment of localized irrigation techniques to replace the inefficient surface irrigation, currently in practices. Nevertheless, transfer of modern irrigation from the region of New Lands to the Old Lands is new concept in Egypt and is considered as an innovation for smallholders. Of note, various challenges arise when modern irrigation systems are applied in the Old Lands, calling for careful consideration and generation of evidence: 1. Modern irrigation techniques require higher irrigation frequency than what the official established schedule at branch canal level; 2. An increase in energy use to operate the pressurized irrigation system, and in increase in farmers' energy cost; 3. Extra challenges with application of modern irrigation in Old Lands, where farmers produce traditional, low-margin crops and most farmers have very small plots; 4. Extra challenges in Old Lands related to collaboration (e.g., an economic irrigation / farming subunit at mesqa level requires the harmonization of farming operations between many individual fields); 5. Extra challenges related to the satisfaction of leaching requirement to avoid secondary salinization.

²¹ Egypt's *National Strategy for Adaptation to Climate Change and Disaster Risk Reduction*. 2011

²² EAAA. 2016. Egypt Third National Communication Under the UNFCCC

²³ FAO. (2016). Country profile – Egypt. FAO AQUASTAT Reports

²⁴ FAO (1978). Effective rainfall in irrigated agriculture

²⁵ IFPRI. 2021. *Climate Change and Egypt's Agriculture*. Regional Program Policy Note 17

²⁶ <http://www.fao.org/aquastat/statistics/query/index.html?sessionId=7C711B7E69A448BD50E9DEFEDF436031>

²⁷ International Food Policy Research Institute (IFPRI). 2021. *Climate Change and Egypt's Agriculture*. Middle East and North Africa. Regional Program Policy Note 17. See: <https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/134318/filename/134531.pdf>

²⁸ Egypt's *National Strategy for Adaptation to Climate Change and Disaster Risk Reduction*. 2011

²⁹ The Ministry of Planning and Economic Development. 2021. *Voluntary National Review*

Results of fact-finding trips on trials

Drip and sprinkler irrigation (also called 'modern irrigation techniques')³⁰ has been a proven technique in the New Lands for decades. Nevertheless, New Lands and Old Lands are considerably different in natural resource endowment, structure of farms, cropping pattern, and production practices and purposes. Drip and sprinkler irrigation has not been transferred to the Old Lands yet due to the uncertainty around the technology absorption. The project formulation conducted fact-finding trips to assess whether localized irrigation techniques have been tried in the Old-Lands, and if so, what experiences have been gained. A unique spot of Old Lands has been identified in Qalyubia Governorate, where farmers have initiated the use of combined drip and sprinkler irrigation system. The farms are characterized by large-scale, cash crop production for commercial purposes and conjunctive water use. Farmers deployed these localized techniques to increase yield and combat water scarcity. However, potential and impact of modern irrigation fell short of expectations, and farmers reported 30% yield decrease compared to the yield levels before the modernization. The field assessment revealed the root causes of failed trials and found that modern irrigation techniques without modified leaching practices and re-balanced application of surface- and groundwater led to soil salinity. Loss of land to salinity is a critical issue globally, but given the extremely limited land resources of Egypt, land degradation has a fatal and immediate spill-over effect on productive assets, thus livelihood of communities.



Figure 1: Soil salinity in strawberry fields in Qalyubia

On-farm modernization is not without risk, and any deviation from the tested and established irrigation practices requires assessment and supervised application. This Project builds on the acquired experiences and rolls out irrigation modernization in the Old Lands in a way that overcomes the abovementioned challenges and provides de-risked and sustainable configurations and practices

Climate change – when it rains, it pours

11. Rainfall. Egypt has a mostly arid-to-hyper-arid desert climate, with only the northern coast having a semi-arid climate. Egypt receives little annual precipitation, with most of the rain falling along the northern Mediterranean coast. The city of Alexandria has the highest rainfall, receiving about 200 mm of precipitation per year. The amount of precipitation decreases moving internally and moving south (e.g., Cairo receives 100 mm and Upper Egypt receives about 25 mm/year). Although most areas receive little rain, sudden and extreme precipitation events with flash floods can occur. **Temperature.** The main difference between the winter and summer seasons is the daytime temperature. The hot dry summer has average summer maximums of 30°C in coastal regions. The summer temperatures in the inland desert vary significantly from 7°C (night) to 43°C (day). The winter is mild, with an average minimum of 14°C and a smaller daily fluctuation, from 0°C (night) to 18°C (day). **Winds.** Egypt experiences khamsin — hot windstorms with sand and dust, especially between March and May. Figure below shows the average monthly temperatures and rainfall across Egypt.

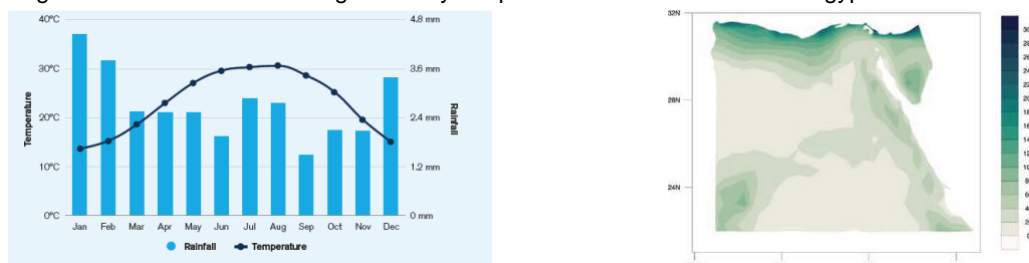


Figure 2: Monthly temperature and rainfall in Egypt (1992-2019) (LEFT) and Annual Precipitation in Egypt (1901-2019) (RIGHT) (source: Climate Risk Profile: Egypt. 2021. World Bank)

12. Observed Climate Trends. The average temperature increased by 0.1°C / decade from 1901 to 2013. As of 1960, the increase is 0.3°C/decade in the summer and a slower +0.07°C / decade in the winter. The daily minimum temperature has increased across Egypt, with an increase in the number of warm nights and a reduction in the number of cool nights. There was a 22% reduction in the amount of annual total precipitation in Egypt over the past 30 years, with the decrease mostly in winter and early spring. There was less water available in some areas, more droughts and dry spells, and some changes in the frequency and severity of flash floods.

13. Vulnerability and Readiness. Egypt is in the top five highly-vulnerable countries to climate change. Climate change is predicted to impact water resources, agriculture, energy, biodiversity, fisheries, health, housing, tourism, and coastal zones. Egypt's near complete dependence on the Nile River to supply freshwater makes it highly vulnerable to rising temperatures and reduced rainfall in the upper Nile Basins and East Mediterranean coast. Increasing temperatures will likely exacerbate the tension between providing water for

³⁰ Explanatory note: This Project Concept Note uses the terms „modern on-farm irrigation” and „localized irrigation” interchangeably. In the project context, this irrigation type refers to the drip and sprinkler irrigation

agriculture, livestock, and other human needs, especially during droughts. Sea level rise will significantly affect the coastal areas - the infrastructure, the agricultural land, and the coastal aquifers³¹. The University of Notre Dame's Global Adaptation Initiative (GAIN) Index provides additional details. It ranked Egypt #107 of 181 countries, with a combined vulnerability and readiness score of 45 in 2019. The GAIN Index calculates a relatively low overall vulnerability (0.440) for Egypt, although Egypt is quite vulnerable under some sub-components, such as cereal yields and dependency on the Nile River. The GAIN Index also shows that Egypt has a low readiness score (0.340), notably related to the subcomponent of innovation. Compared to other countries, Egypt's current climate-change vulnerabilities are considered manageable, but its readiness to adapt to climate-induced challenges is considered weak³². The COVID-19 pandemic is adding to the challenges that vulnerable populations face in day-to-day life, with the potential to create some long-term health-, social-, economic, and environmental-crises, unless the economy is developed in a more sustainable, inclusive, and resilient manner.

- 14.** Egypt will likely become hotter and drier, and it may suffer more extreme weather events in the future. The German Climate Service Centre (GERICS) predicts that temperatures in Egypt will increase 2 to 3°C by mid-century, with the highest increases occurring in the hot summer months. The interior regions are likely to experience a more rapid temperature rise. By 2080, GERICS also predicts a rise in annual mean temperature of 2 to 5°C, with the maximum temperatures increasing by 2 to 6°C and minimum temperatures increasing by 1.5 to 4.6°C. Heat waves are predicted to increase in severity, frequency, and duration, lasting 9 to 77 days longer. Cold spells are predicted to decrease. Rainfall projections are variable, with some projections showing an increase and some a decrease in annual total precipitation. It is more likely that there will be a reduction in total precipitation, longer dry spells, and a higher number of extreme weather events, including flash floods. The projected change in precipitation is higher for the drier summer season. Egypt's future hotter and drier climate will significantly impact key sectors via the following pathways: 1. Population growth in North Africa, projected to reach 1 billion people by mid-century, will increase demand for food, water, and energy; 2. Higher temperatures will increase water evaporation, demand, and consumption; 3. Higher temperatures and changes in seasonal climate pattern will decrease the productivity and yield of some crops and livestock and modify the agricultural zones; 4. Changes in rainfall and evaporation rates will affect water infiltration and groundwater recharge; 5. Sea level rise will affect groundwater quality in the coastal aquifers; 6. Sea level rise will negatively affect coastal areas, tourism, and the agricultural land in the Delta area; 7. Marginal agricultural areas will be negatively affected; desertification rates will increase; 8. Negative socio-economic effects may cause workers to migrate from marginal- and coastal areas; 9. A decrease in land under agriculture and in crop yields will increase food insecurity.³³ To adapt to climate change impacts and improve the livelihood of poor farmers, there is no alternative but further exploiting the water-saving potential of irrigation infrastructure, while strengthening the climate resilience of the entire chain of agriculture.

Project application areas – targeting the most vulnerable in Old Lands

- 15.** Project area selection directly contributes to the objectives of this Project to roll out innovative adaptation practices in areas most vulnerable in the Old Lands, while generating evidence for future scale-out via development projects. To this end, the project formulation took a stepwise approach to select the application areas.
- 16. Selecting the two Governorates.** This Innovation Project used five criteria to select two Governorates. The selected Governorates must fulfil all criteria: (i) high relative exposure to measured climate change impacts, (ii) high relative vulnerability of the communities as per their poverty rate and level of preparedness to withstand climate change impacts, (iii) involvement in Egypt's irrigation modernization programme (IMP); (iv) location in the Old Lands; and (v) not affected by seawater intrusion. The latter three criteria are necessary to ensure the alignment with national strategies and fulfil the technical requirements of the proposed interventions. Based on these criteria, Beni Suef Governorate and El-Fayoum Governorate in Middle Egypt are selected.
- 17. Middle Egypt³⁴.** Middle Egypt includes the Governorates of Beni Suef, Giza, Fayoum, and Minya, and accounts for about 21% of Egypt's total population. Total area of the region is about 54,000 km²: Minya governorate is the largest governorate in Middle Egypt with 23,000 km², while Fayoum is the smallest (around 6,000 km²). Illiteracy rates in the region are high, between 48% and 52%, but reaching up to 90% in certain villages. The Nile River is the primary source of water, and the water resources are considered high quality with a low contamination level. Corresponding to the general trends in the Old Lands, agricultural holdings are highly fragmented, averaging less than 2 feddan per farm. Some areas suffer from drainage problems due to the absence of a drainage network or due to poor maintenance of the existing network. The possibilities to expand agriculture horizontally are limited. Availability of agricultural extension services, skilled and trained farm labour and administrative staff, marketing institutions, contract-farming arrangements, and flexible credit facilities are limited. So, agricultural activities are not as diversified as they could be, as farmers tend to plant risk-free but low-margin crops. The region's total agricultural area is about 1.5 million feddan. The population density in agricultural areas is highest in Giza governorate (21.2 persons/feddan), as it is an urban governorate part of the greater Cairo region. It is at its lowest level in Al-Fayoum governorate (5.84 persons/feddan).
- 18. Beni Suef.** The total area of Beni Suef governorate is 10,954 km². Beni Suef has the highest presence of poor families (44%) in Middle Egypt. Women's participation in the work force was estimated at 28% in Beni Suef. Beni Suef enjoys a relatively moderate climate, with low humidity and it can produce a good diversity of crops. The agricultural sector is important, and Beni Suef is considered a vital trade centre on the west bank of the Nile River, 110 km south of Cairo. The industries in Beni Suef are mostly agricultural, and include flour milling, cotton ginning, and textile manufacturing. Alabaster is quarried near the capital. Much of its irrigation water is supplied by the large Bahr Yūsuf Canal.
- 19. Al Fayoum.** Middle Egypt has two depressions that store agricultural drainage water, Qaroun Lake and El-Rayan depression, in Al-Fayoum governorate. Al-Fayoum governorate is a natural green oasis that lies in the West Desert, southwest of Cairo governorate at 90 km distance, with total area of 6,068 Km². It has diverse nature and a moderate climate year-round. It represents a valley, a delta, and a lake. The governorate's total cultivated area covers about 445,000 feddans. It is famous for cultivating fruits (e.g., grapes and figs), as well as other traditional crops (e.g., wheat, cotton, rice, maize, sugar beets, and sunflowers). Fayoum has two industrial zones: el-Fath city in Koum Osheem (1,102 feddans) and in Quota area (2,000 feddans), producing sunflowers oil, ceramics, refrigerators, nails and

³¹ EAAA. 2016. Egypt Third National Communication Under the UNFCCC

³² See: <https://gain.nd.edu/our-work/country-index/>

³³ Egypt Third National Communication under the UNFCCC. 2017.

³⁴ <https://travel2egypt.org/egypt-travel-guide/beni-suef/> and <https://www.sis.gov.eg/Story/68572>

paints and other large industries on the outskirts of such zones, for cotton spinning and weaving, kleem (flat weaving) and rugs, fodder, sugar beets, porcelain, and pottery).

20. Climate change vulnerability of the areas: Both Governorates are considered severely exposed to climate change impacts. Apart from the coastal areas of the Delta, Egypt's National Strategy for Adaptation to Climate Change and Disaster Risk Reduction denotes 7 Governorates with high degree of vulnerability to climate change impacts, including Beni Suef and Fayoum. The analysis is based on the vulnerability maps of UN-WFP, applying composite indicator analysis. The selected indicators are appropriate to assess the exposure and level of preparedness of communities, therefore, the identified Governorates are considered as high priority areas to introduce adaptation measures. To complement the vulnerability analysis with agriculture-centred assessment, the trends of actual evapotranspiration are estimated in both Governorates. The trend analysis is made up of the aggregated values of monthly evapotranspiration. The alerting increase in evapotranspiration is directly attributed to climate change, and such trends are also confirmed by the observations of consulted communities.



Figure 3: Rate of Evapotranspiration in Beni Suef (LEFT) and El-Fayoum (RIGHT) (2009-2019) (source: FAO - WAPOR)

21. The figure below shows the predicted Standardized Precipitation Evapotranspiration Index (SPEI)³⁵ across Egypt, highlighting that Egypt will be under significant water stress in terms of water quantity and quality, especially in the central and north-western region by 2080. The agriculture in the two selected Governorates will inevitably fall prey to the climate change impacts if farming communities are not prepared and adaptation measures are not introduced.

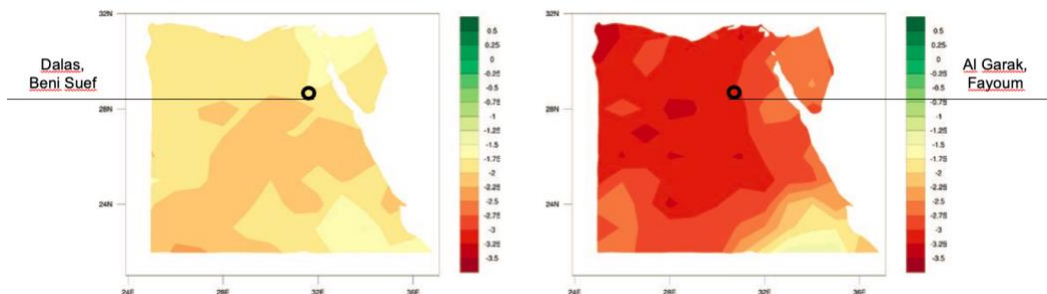


Figure 4: SPEI across Egypt for 2040-2059, 2080-2099 under high emission scenario (climate risk profile, Egypt 2021, World Bank)

22. Selecting the two villages. This Project used the following criteria to select one village per selected Governorate: (i) Included in the Haya Karima initiative; (ii) approved as priority area by MWRI and/or MALR; (iii) climate change impacts observed and reported by communities; and iv) low level of preparedness assessed and confirmed by field visits.

23. Selecting the two mesqa communities. Water resource management in Egypt focuses on three main levels: Nile River system (public pump stations and main canals); Branch canal networks and services (branch canals and drains); and On-farm operations (private pumps, mesqa and marwa)³⁶. Each level is important to the functioning of the system, but each level has its own components and characteristics, and irrigation development projects should always consider the interdependence and interconnectedness of the system levels. This Project used the following criteria to select one mesqa per selected village: (i) located within the selected villages; (ii) representative to other mesqas in the Old Lands to ensure scalability, (iii) different configuration of irrigation systems to provide case studies for the scale-out scenarios, and (iv) supplied by an improved lined-branch-canal to be compatible with modern on-farm techniques. Based on the above criteria, the two selected mesqas are: (1) Brendola mesqa (35.75 feddan), Dalas village, Beni Suef Governorate; and Al-Garray mesqa (53 feddan), Al-Garak village, Atsa District, Fayoum.

Vulnerability of selected areas – farmers sound the alarm

24. This section describes the climate vulnerability of the selected project areas, based on consultations and field observations (please see further characteristics on the two communities under Chapter A). The selected two mesqas and villages, defined as priority in the Haya Karima, are dominated by agriculture sector, involving mixed farms. The access to services is poor, indicated by the complete absence of public services. Villagers live little above or below the poverty line and have no employment opportunity but agriculture. Agriculture provides the sole income of communities, but profitability of the cropping is below sufficient. The average family size of consultees is 9, indicating large households whose livelihood depend on the performance of agriculture.

25. Agriculture is traditional, cropping pattern is limited mostly to maize, wheat, potato and forage. The lands are fragmented, averaging below 1 feddan area per farm. The farms are under-equipped, farmers do not own agricultural machines, such as tractors. Crop yields

³⁵ Explanatory note: The SPEI measures the water deficit in a specific location. SPEI values below -2 indicate severe drought

³⁶ Explanatory note: mesqa is the traditional term of tertiary canal and marwa is the traditional term of quaternary canal (ditches). Down to branch canal, irrigation network is managed by the State, and mesqa and marwa are directly managed by communities

are reasonably high compared to global average but low compared to national average, and the reported climate change impact has severe consequences. Farmers reported around 30 % decrease in yield due to shifting agricultural seasons, induced by climate change. Another severe consequence of climate change is the pest infestation, reaching heights never seen before. The average revenue of maize reaches up to 9,000 EGP per feddan, but due to the high production costs, the total achievable profit amounts around 1,100 EGP (roughly equivalent to 70 USD). Contracted farming is increasingly in the forefront, as farmers try to seek for alternative strategies to eliminate market uncertainties. However, contracted farming makes agricultural value chain longer and make farmers price-takers. As direct result, their share from the value chain is diminished. Even though potato generates average 27,500 EGP revenue per feddan, the average profit does not exceed 4,400 EGP (roughly equivalent to 280 USD) due to the high cost of seeds and fertilizers. Moreover, farmers bear the risk of yield failure in case of climate hazards. Due to the low profitability of the sector, climate change has immediate and serious consequences for livelihood.

26. Livestock keeping, namely dairy production is the main income and contributor to food security at household level. The average number of cattle is one per farm, mostly managed by women. Meat production can generate around 7,900 profit per animal per year, but farmers prefer to keep cattle for milk production, and calves are sold only if any large expenditure arises in the family. Women are responsible for the process of dairy products. During the consultations, women farmers reported a shocking decrease in both quantity and quality of milk due to heat stress on buffalos. As direct result of soaring temperature, cheese-producing women observed the decrease in milk production, from 5-6 to 2-3 kg per day per buffalo. Moreover, climate change spans across the entire production chain of milk, as shifting agricultural seasons reduced the number of cut of forage from 6-7 to 4-5. Women left without enough forage must purchase supplemental stock, which impairs the revenue. 75% of the weekly income from milk and cheese products, equalling 150 EGP, is spent to forage. In actual figures, the income of women decreased from 200 to 50 EGP per week as direct impact of temperature increase.
27. Disrupted access to irrigation water is a common issue in both areas, although, the system configurations are distinct. Climate change has observed impact on water demand, resulting in 20% increase over the past decade. Although the water demand increase is calculated from the fuel consumption by farmers, the estimation corresponds to the timeseries analysis of evapotranspiration trends. Farmers in Beni Suef must rely on both surface water and groundwater. Located in the downstream stretch of the branch canal, the water level regularly drops below the minimum level to lift water into the mesqa. The water supply from the branch canal is rotational, having 5-days on and 10-days off. Farmers use outdated, medium-capacity pumps that require careful setup to supply water into the mesqas and marwas. Moreover, the condition of mesqa is severely deteriorated, thus making conveyance cumbersome. To supplement the water supply, farmers constructed small, informal wells. According to the reports, the wells often run dry as groundwater level drops due to the unsustainable and uncontrolled exploitation. Fayoum is at the geographical depression point of Egypt, enabling gravity-fed irrigation without the need of pumps. Despite the continuous flow in the branch canal, the water level is often too low, thus making farmers unable to divert water to the mesqa. In lack of cross-regulators, the farms remain unirrigated during these periods. Farmers in both areas use only surface irrigation, including border, flood and furrow irrigation techniques, and runoff is diverted into the drains for reuse in other mesqas. Inequity in access to water applies on both inter-mesqa and within-mesqa balances. Within the mesqa, farmers closer to the branch canal have better access to water and irrigate over the actual crop demand. As the mesqa operates in rotational schedule, the 5-days irrigation period is a severe constrain to the distant farms that frequently observe water stress. Due to more frequent extreme heat combined with poor irrigation practices, soil fertility is severely affected. Based on farmers' observation, fertility reduced by 50%, which translates into yield loss.
28. None of the areas have access to electricity grids, so farmers rely on diesel pumps. Cost of irrigation is considerable, in particular, if crops with low profit margins are examined. After the gradual lifting of governmental subsidies on diesel, the cost of irrigation can exceed 550 EGP per feddan in the case of water-demanding crops. The unit cost of diesel is even higher if farmers are forced to use groundwater.
29. Market availability and the bargaining power of farmers against retail companies are poor. Not only the system of contracted farming compromises the farm profitability but the distance from markets, the lack of sufficient production volume to improve the farmers' market position, the rudimentary transportation, and lack of coordination amongst farmers. Market, however, does not only mean the outlets but the input markets. Individual farmers are crowded out from both sides of the market, which adversely affect both the production costs and revenues.
30. What makes the ecosystem more vulnerable to agricultural intensification in Fayoum is the Qaroun Lake, at the desert belt of Egypt. Fayoum mesqas are not equipped with drain for water reuse, and runoff from the fields directly reaches the Qaroun Lake. Despite its ecological importance, the Lake has been undergoing a severe water quality deterioration due to the leaching agrochemicals and domestic wastewaters. As result, the water of the Lake is alkaline, saline and presents high counts of biological contamination. While agricultural drain water is considered valuable water resource for reuse, drain water in Fayoum is the source of diffuse pollution. Therefore, runoff from agricultural lands should be minimized to restore the ecosystem of Qaroun. This project does not directly address the issue of Qaroun Lake, but the externalities generated by the interventions will have positive implication on the status of the Lake and its ecosystem.
31. Although conclusions are drawn based on the reports of farmers, observations and field visits, the prevailing trends and characteristics apply on the majority farmer communities in the Old Lands, in particular, in Upper-Egypt. As farmers in Old Lands encounter the same climate change impacts, the proposed innovative adaptation measures are valid across the Old Lands.

Project approach

32. The climate change impact on agricultural productivity is not an isolated problem that does not have a close link amongst the different parts of the production chain. Just the opposite, the abovementioned challenges posed by the climate change, strained natural resources, ever-increasing food demand and structural problems of agriculture require an integrated approach that treats agricultural value chain as a whole. In other words, granular approaches addressing only some parts of the agricultural value chain would involuntarily trade off the development need of other parts. To address this issue, the Project applies a modified idea of 'suite-of-measures' approach to support climate change adaptation, originally developed by the International Food Policy Research Institute and named as 'suite-of-technology'. The approach stems from the recognition that "rather than simulating a single technology, or 'silver bullet', strategy, a 'suite of technologies' approach to climate change adaptation is [originally "was"] used, since farmers tend to combine various resilience

strategies to counteract the adverse impacts of climate change.” (IFPRI 2021)³⁷. The modification of “technology”-type interventions to “measure”-type interventions is necessary to respond to the nature of this Project that rolls out the combination of technology, process and social innovations, demonstrated success in other regions of Egypt and countries.

33. To this end, the Project encompasses the entire value chain of agriculture, involving both cropping and livestock related activities, from natural resource management to marketing. More precisely, the suite-of-innovative-adaptation-measures (*later referred to as suite-of-measures*) captures the following parts of the production and value chain: water source, water distribution system, on-farm irrigation and agricultural production, post-harvest and marketing. Such sequenced and consistent approach also supports the involvement of most vulnerable groups and members of the communities. As men and women, traditionally and culturally, take different roles in agriculture, the suite-of-measures provides an inclusive and accessible development approach to improve livelihoods in an innovative manner.
34. At the core of the Project stands the community-driven development, as the current structure of production calls for the cooperation of farmers for various reasons: 1. Creating reasonable size of production area and volume is necessary. Voluntary aggregation and harmonization of farm production is, then, a tipping point to reach economies-of-scale and justify the social and economic sustainability of investment in climate adaptation and resilience.; 2. Pro-poor context requires more careful, bottom-up approaches of innovation roll-out. This can make the learning curve of new methods/technologies/process steeper and allow their absorption.; 3. Risk appetite of poor farmers is lower, and interventions addressing individuals would discourage farmers. Community-based and participatory approach of innovation cycles can create common-understanding and stimulate the environment.

Project objectives:

35. The overall objective of the Project titled “Building Resilience in the Old Lands by Combining Innovations in Irrigation, Agriculture, and Livelihood Activities” is adaptation to climate-induced water scarcity by combining social, process and technology innovations in irrigation, agriculture, and livelihoods at a functional scale. The Project objective is achieved through three components in a 4-year implementation period.
 1. **Adapting to climate-induced water scarcity through innovations in configuration and management of irrigation system.** The Component 1 outputs and outcomes contribute directly to the following AF result areas: AF Outcome 1: Reduced exposure to climate-related hazards and threats - AF Output 1.2: Targeted population groups covered by adequate risk reduction systems; AF Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets – AF Output 4: Vulnerable development sector services and infrastructure assets strengthened in response to climate change impacts, including variability; AF Outcome 8: Support the development and diffusion of innovative adaptation practices, tools, and technologies – AF Output 8: Viable innovations are rolled out, scaled up, encouraged and/or accelerated.
 2. **Enhancing agricultural productivity, livelihoods, and adaptation capacity of the most vulnerable through social innovation, in combination with climate-resilient agricultural practices and a sustainable value chain.** The Component-2 outputs and outcomes contribute directly to the following AF result areas: AF Outcome 1: Reduced exposure to climate-related hazards and threats – AF Output 1.2: Targeted population groups covered by adequate risk reduction systems; AF Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets – AF Output 4: Vulnerable development sector services and infrastructure assets strengthened in response to climate change impacts, including variability; AF Outcome 5: Increased ecosystem resilience in response to climate change and variability-induced stress –AF Output 5: Vulnerable ecosystem services and natural resource assets strengthened in response to climate change impacts; AF Outcome 6: Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas – AF Output 6: Targeted individual and community livelihood strategies strengthened in relation to climate change impacts, including variability, by contributing to food security through optimization of agricultural production; AF Outcome 8: Support the development and diffusion of innovative adaptation practices, tools, and technologies – AF Output 8: Viable innovations are rolled out, scaled up, encouraged and/or accelerated
 3. **Project-level and national-level diffusion and scale-out of innovative suites-of-adaptation measures through preparation of national-level strategies and capacity development of decision-makers.** The Component-3 outputs and outcome contribute directly to the following AF result areas: AF Outcome 2: Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses – AF Output 2.1: Strengthened capacity of national and sub-national centres and networks to respond rapidly to extreme weather events; AF Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level – AF Output 3.1: Targeted population groups participating in adaptation and risk reduction awareness activities – AF Output 3.2: Strengthened capacity of national and subnational stakeholders and entities to capture and disseminate knowledge and learning; AF Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets – AF Output 4: Vulnerable development sector services and infrastructure assets strengthened in response to climate change impacts, including variability; AF Outcome 8: Support the development and diffusion of innovative adaptation practices, tools, and technologies – AF Output 8: Viable innovations are rolled out, scaled up, encouraged and/or accelerated.
36. The framework of Components and Outcomes are sequenced along value chain: (1) Component 1 addresses the irrigation management at system level and farm-level, including innovative measures regarding the water distribution system, water monitoring and on-farm irrigation; (2) Component 2 addresses the on-farm production and markets, including innovation measures regarding the crop and livestock related activities, the post-harvest activities, and marketing; (3) Component 3 addresses the innovation management at country level, including the establishment of Innovation Management Platform and scale-up of project results.
37. The Project targets poor farmers in the Old Lands, with a focus on the need for scalable innovations. The overall goal is to further develop, roll out, evaluate innovative measures and prepare them for future scale-out in the Old Lands, thus increasing the climate resilience and preparedness of farmers.
38. The project design is built on rigorous assessment methods and participatory planning. The finalists within the suite-of-measures are the results of broader definition of identified and potential measures, whereas stakeholders and technical assessments distilled the most

³⁷ IFPRI: Climate change adaptation strategies for Egypt's agricultural sector. A suite of technologies approach. By Perez, N., Kassim, Y., Ringler, C. Thomas, T.S. and ElDidi, H

feasible measures. Such innovative measures are inclusive, interlinked, socially accepted, technically feasible, scalable and impactful. The proposed measures are assessed in the light of significance in climate change adaptation and associated risks. To support the roll-out and innovation life cycle, the deployment of measures involves a roll-out plan, incorporating the assessment – design – management roles – adoption – plan of external diffusion – scalability assessment. Knowledge management spans across the components and manifests in a national-level knowledge management mechanism.

Project components and financing:

Project Components	Expected Outcomes	Expected Outputs	(US\$)
Component 1: Adapting to climate-induced water scarcity through innovations in configuration and management of irrigation systems	Outcome 1.1: Access to irrigation water is more reliable and equitable and water-use efficiency for irrigation is enhanced	Output 1.1.1: Community-managed, solar-powered water distribution system (mesqa and marwa) constructed to enhance water use efficiency, improve livelihoods, and increase equity amongst vulnerable water users Output 1.1.2: 360-degree participatory monitoring and evaluation system established to support sustainable use of soil and water resources	1,100,000
	Outcome 1.2: On-farm irrigation system is modernized and monitored, and water-saving potential of on-farm irrigation is exploited	Output 1.2.1: De-risked, modern irrigation systems designed to improve on-farm water management	
	Outcome 1.3: Proven adaptation innovations in configuration and management of irrigation systems are prepared for external diffusion and scale-out, and capacities of stakeholders are enhanced to maintain innovations	Output 1.3.1: Capacity-building programme rolled out to support the adoption and maintenance of innovations Output 1.3.2: Innovation diffusion and scale-out supported to promote innovative adaptation measures in irrigation development	
Component 2: Enhancing agricultural productivity, livelihoods, and adaptation capacity of the most vulnerable through social innovation, in combination with climate-resilient agricultural practices and a sustainable value chain	Outcome 2.1: Social innovation, updated climate-smart practices, and farm modernization are introduced to enhance the productivity, profitability, and resilience of agriculture	Output 2.1.1: Crop Zoning Framework co-developed and production practices modernized to increase production-at-scale, climate-resilience, and productivity, and to reduce the cost of farming Output 2.1.2: Preparedness of livestock sector improved to support the livelihood of women through enhanced forage production practices and climate-smart livestock keeping	2,050,000
	Outcome 2.2: Sustainable and pro-poor value chain is established to increase revenues and improve efficiency of natural resource use	Output 2.2.1: Women community-managed value chain of dairy products established, and grain storage practices at household level improved to increase women's revenues and reduce food losses Output 2.2.2: Crop-marketing arrangements established to shorten supply chain and increase the revenue of farmers	
	Outcome 2.3: Proven adaptation innovations along the agricultural value chain are prepared for external diffusion and scale-out, and capacities of stakeholders are enhanced to maintain the innovations	Output 2.3.1: Capacity-building programme rolled out to ensure the adoption and maintenance of innovations along the value-chain Output 2.3.2: Innovation diffusion and scale-out supported to promote innovative adaptation measures along the value chain	
Component 3: External, project-level and national-level diffusion and scale-out of innovative suites-of-adaptation measures through preparation of strategies and capacity development of decision-makers	Outcome 3.1: Concept of suite-of-adaptation measures in agriculture is rolled out and prepared for scale-out	Output 3.1.1: Innovation diffusion and scale-out strategies prepared to promote and deploy innovative suite-of-adaptation measures at higher scale Output 3.1.2: Capacities of national authorities on adaptation improved, based on evidence-based methods and case studies Output 3.1.3: Collaborative links to Haya Karima (Decent Life) initiative established and partnerships on themes of joint interest developed	915,734
6. Project Execution cost (< 9.5%)			426,293
7. Total Project Cost			4,492,027

8. Project Cycle Management Fee charged by the Implementing Entity (8.5%)	381,373
Amount of Financing Requested	4,873,400

Projected calendar:

Milestones	Expected Dates
Start of Project Implementation	January 2023
Mid-term Review	December 2022
Project Closing	December 2026
Terminal Evaluation	March 2027

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Project components, with focus on concrete adaptation activities

39. The Project supports a country- and community-driven approach, and is well aligned with Egypt's development needs, goals, and strategies. As direct result of the project, livelihoods will be strengthened, water resources will be used more efficiently, agricultural yields will be sustained and increased, and natural resources as productive assets will be better protected from the adverse impacts of climate change. Social innovations and the adoption of innovative technology, tools, and processes in support of climate change adaptation will be accelerated, encouraged, and enabled. Practical knowledge about effective adaptation activities will be generated and widely communicated to strengthen institutional and local capacity for effective adaptation, while building complementarity and coherence with other climate-related efforts. This Project also acts as an accelerator of deployment of adaptation innovations in agriculture, as it is linked to national priorities and programmes that require evidence generation before their implementation.
40. The design of the Project captures the entire range of agricultural value chain, starting from management of land and water resources, on-farm production, to marketing. The suite-of-measures are located along the value chain and are compiled to reinforce each other's impacts. The problems addressed by the Project are universal in the Old Land. After the roll-out in the application areas, the proposed measures can be transferred to other areas, where the defined technical pre-requisite of measures are met.
41. To ensure the most valuable outcome of proposed innovative approaches and measures, the Project will deploy an iterative learning mechanism to capture the results. This process will provide lessons learnt to enhance the understanding of the activities' impacts and will serve as a guidance to eventually correct pathways and or indicate the most effective scaling out direction in the aftermath of the present project. Finally, the iterative learning mechanism will serve for the refinement of innovation indicators along process life. Capacity development programmes, through the range of activities proposed, will embed the learning mechanism, and will be designed as bidirectional exercises whereby innovations can be promoted, while feedback and result can be appreciated to improve the innovations' scaling out process.
42. The project will operate in Brandola mesqa (35.75 feddan) in Dalas village in Beni Suef, and in Al-Garray mesqa (53 feddan), Al-Garay village, Fayoum. The community of Brandola mesqa includes 65 crop producing farmers, and the community of Al-Garray mesqa 80 crop producing farmers. The following paragraphs summarize the characteristics of the beneficiaries (please find further information about the climate vulnerability of the two areas under the Chapter 'Vulnerability of selected areas – farmers sound the alarm').
43. Apart from the traditional, not climate resilient crops in both areas, only a small plot in Beni Suef (less than 1 percent of the area) is used for cash crop production (sesame). Data collected during the consultations shows that yields are well below the national average (i.e. 2.7 ton wheat per feddan, 3.28 ton maize per feddan). Farmers reported a decline in yields over the past decade due to climate change impacts, soil fertility issues, and irregular access to water. Farmers are price-takers and have no bargaining power, except in the case of wheat, which has centrally fixed farmgate price.

Beni Suef	Crop	Productivity	Selling price	# of irrigation	Fayoum	Crop	Productivity	Selling Price
	Maize	2.5-2.8 t/feddan	400 EGP per 160 kg	10		Maize	2.4-2.8 t/feddan	400 EGP per 160 kg
	Sesame	2-2.5 t/feddan	2,000-2,800 EGP per 160 kg	3-4		Forage	4-5 cuts	Own consumption
	Forage	4 cuts	Own consumption	10-12		Wheat	1.4 t/feddan	680 EGP per 160 kg
	Potato	10-12 t/feddan	3,500 EGP per ton	5		Alfalfa	5 cuts	Own consumption
	Wheat	1.4-1.6 t/feddan	680 EGP per 160 kg	5				
	Alfalfa	5 cuts	Own consumption	5-6				

44. Brandola mesqa is located in the downstream part of the branch canal, therefore, access to canal water is often disrupted due to low water level in the tail of the canal. Farmers irrigate for 5 days (5 hours per day) and subsequently have off-irrigation period over 10 days. The typical water supply per farm is high, amounting 4,500-6,000 m³ per season per feddan (roughly equal to 11,000-14,600 m³ per season per ha), of which 30-40 percent is lost to evaporation, runoff and deep percolation. Water scarcity has been escalating, in particular during the past 5 years. As crop water demand is growing, upstream mesqas violate rotational schedule more frequently, thus leaving the downstream mesqas, such as Brandola without sufficient water. As alternative strategy, farmers are forced to use informal wells to satisfy the crop water demand. Groundwater salinity is somewhat high due (1,000 ppm) due to the agrochemical leaching. However, surface water is sufficient to cover only around 50-60 percent of the water demand. The mesqa distribution system is traditional, and the mesqa and marwa are earthen canals, entailing considerable water loss during the conveyance. Substantial part of the crop production cost is spent to diesel to operate the two lifting points (outdated diesel pumps with 50 percent pump efficiency to lift water from branch canal to mesqa, and from the mesqa to marwa). Farmers use inefficient flood irrigation, which results in water loss due to

runoff and deep percolation. Only 5 percent of the land is rented, the rest is owned by farmers. The farms are not mechanized. To carry out basic land works, farmers rent large-scale tractor 3 times per year and use daily workers (72 man-day per season). Around 15 percent of the total profit per feddan (equalling 1,800 EGP) is spent to these additional costs. Agriculture is the sole income of farmers, and productivity/profitability has immediate impact on the livelihood of households. Moreover, farmers reported large households (ranging from 4 to 16 members per family), with average 9 members. There is an observed trend of aging, as young age cohort is underrepresented in crop production activities. The average age of farmers is 54 years, and young generations have no productive assets in hand to generate income, until they inherit the lands. Lack of proper training is one of the main barrier for updating production practices. Moreover, no farmers reported any access to trainings on water management and irrigation. Farmers have no direct access to market outlets, so they randomly search for wholesale buyers on the days of harvesting. Hence, they take on the risk of unsold quantity and loss of produces.

45. Al-Garray mesqa is also located in the downstream part of the branch canal. The difference between Brandola and Al-Garray is that the latter receives continuous flow. Due to the extremely poor condition of the intake of mesqa, and the mesqa and marwa. In lack of proper cross-regulator, farms are occasionally flooded when water level is high in the branch canal, and they frequently run dry when water level is low in the branch canal. In lack of regular access to canal water, farmers divert water from the drains, thus exposing the lands to salinity and compromising crop yields. Consequently, there is no real irrigation schedule. Due to the unpredictability of water service, farmers do not invest in pumps, but they rent outdated diesel pumps with 40 percent pump efficiency when water stress occurs. The mesqa infrastructure is of extremely poor condition, and the flood irrigation on the farms further increases the water loss. Farmers occasionally rent tractors to carry out heavy land works but do not apply any meaningful land preparation works (i.e. levelling). Lands are even more fragmented with an average size of 0.66 feddan. What is even more depriving in Al-Garray is the lack of road network, which slows down the trading of both import and export goods. This makes the rent of services, such as tractor and pumps more expensive (80 USD fee only for 2 days of tractor service). Also, the access to agrochemicals is hampered, and farmers are forced to purchase fertilizer from black market at soaring prices (450 EGP per back, compared to the 245 EGP official price).
46. The communities of the two mesqas and the villages (Dalas in Beni Suef and Al-Garak in Fayoum) are involved in subsistence livestock keeping, and women are responsible for dairy farming. Crop production is slightly more dominant in Brandola, however, over 150 livestock producing households are identified. This number is higher in Al-Garray, where around 350 livestock keeping households. The difference is due to the better road access and the better level of women education in Beni Suef. This comparative advantage allows women to diversify their income and enter service sectors in Beni Suef, while the high illiteracy rate in Fayoum ties women's hands. Households are semi-commercial entities with traditional trading facilities. The average number of cattle per household is one, maximum two due to the limited space and forage production. As further expansion of livestock is overly limited, women maximize their income by value-adding activities, such as cheese making. In Beni Suef, there is a single indirect selling point, namely a small-scale purchaser (male). In Fayoum, there is no indirect selling point, women must find their way to travel to the closest market in the district. Livestock production represents broad age groups. The age of consulted women ranges from 19 to 92. Consultations showed that mothers involve their young daughters in dairy activities.
47. **Component 1** "Adapting to climate-induced water scarcity through innovations in configuration and management of irrigation systems" captures the parts of water source and water distribution. **Rationale:** Water resource availability is sharply decreasing due to climate change and increasing demand, and there is an increasing competition over irrigation water. Downstream mesqas are at bigger risk of water shortage, as they depend on the ideally rule-abiding upstream mesqas. But as in reality, irrigation schedule at branch canal level is often violated. As the GOE has embarked on the improvement of branch canals in the Old Lands since 2020, the rapid execution of canal lining has already brought significant and large-scale results in terms of reducing water loss by seepage. However, the lining increased the velocity and decreased the water level in many sections of the irrigation canals, so water withdrawal must consider lower water depth in the branch canals. This problem adds to the pre-existing issue of water scarcity. While the conveyance capacity of branch canals improved, the piling solid waste in the canals remained a problem, especially in areas such as the selected mesqas, where villages have no access to trash pick-up service. The accumulated waste hampers the water withdrawal and decreases the efficiency of the canals. Equally worrying, the sediment deposit is another concern, as sediment reduces the capacity and the lifespan of the pumps. The branch canal operates as per the nationally defined rotation, involving 5 days irrigation and 10 days non-irrigated period. Farmers still rely on old diesel pumps to withdraw water from the branch to the mesqa and the fields. Before each irrigation events, mobile pumps are installed in the sump, from where water is conveyed by gravity. This conveyance system puts downstream farmers at a disadvantage in access to water and leaves them vulnerable to water scarcity. To compensate the not-received surface water, farmers constructed small-scale and often informal wells. Due to the uncontrolled groundwater extraction, the shallow groundwater is periodically exhausted, and farmers remain without water until the recharge. All farms apply surface irrigation techniques, including flood, border or furrow irrigation. Surface irrigation techniques involve large water loss, as their field irrigation efficiency does not reach 60 percent. To bridge the non-irrigated periods and the water loss of surface irrigation, farmers oversupply irrigation water to maintain sufficient soil moisture. However, the over-irrigation exacerbates the irrigation inefficiencies, as part of the flooded water evaporates and other part runs off into the drains. It also increases the loss of inputs through leaching of agrochemicals. In light of growing water scarcity, such irrigation methods are not sustainable anymore, and complex solutions and configurations are required to overcome the challenges. Component 1 involves three outcomes to eliminate the risk of climate-induced water scarcity through innovative configurations and management of irrigation systems:
- **Outcome 1.1.** Access to irrigation water is more reliable and equitable, and water-use efficiency is enhanced: The Outcome aims to improve the methods of water distribution. The starting point and hard condition of such system-level development is the creation of functional and inclusive grassroots-organizations. The currently operating Water User Association (WUA) is not embraced by all, and farmers are reluctant to contribute to and integrate into the operation of WUA. The core reason of social resistance is the top-down process of WUA establishment, which characterizes the majority of the WUAs in the Old Lands. To create socially enabling environment, the Outcome builds on the improvement and empowerment of WUA to establish the farmers-managed coordination of developed infrastructure. Strengthening farmers' organization is an enabling factor of the deployment of activities that directly contributes to the adaptation to growing water scarcity. Outcome involves a suite of activities that operate at system level. It aims to improve the water conveyance and distribution system to eliminate water loss through the development of piped distribution network and monitored water supply, reduce cost and energy use of irrigation through solar irrigation, and make water management sustainable through an established protocol of conjunctive water use. Monitoring of water

demand (soil moisture) at farm level is proposed to optimize the water supply through the observation of demand, thus increasing water saving. Monitoring at system level (groundwater and drains) also mitigates the environmental risks of salinity through the conductivity measurement at system and farm level.

- Output 1.1.1. Community-managed, solar-powered water distribution system (mesqa and marwa) constructed to enhance water use efficiency, improve livelihoods, and increase equity amongst vulnerable water users: The Output builds on 5 complementary activities:
 - 1.1.1.1. *Awareness-raising and capacity-building delivered to empower grassroots organization and horizontal coordination of system-level irrigation management:* As per the Law on WUAs (Law of 1984, modified by 213/1994, Decree No 14900 of 1995), the geographical entity of WUA is the mesqa, and all mesqas must set up a WUA, which reports directly to the Undersecretary of Water (Undersecretaries of Beni Suef and Fayoum). The two mesqas have already WUAs registered by the MRWI, but due to the lack of participatory approach during the establishment, farmers do not recognize them as their representation, and they do not follow the rules defined by the Law (i.e. participation in assemblies, voting, conflict resolution etc.). The development of WUA is a transformational change requested by farmers. To eliminate the current discords over the functions of the WUA, the project will launch awareness-raising and capacity-building programme to farmers and re-establish the institutional frames of WUA through a participatory approach. To put the existing WUAs on inclusive footing and achieve farmers' acceptance, the reorganization of the WUAs is required. Based on the provision of the Law (Chapter 2, article 6 on Right of Membership and Chapter 3 on the Board of the Association), the project will initiate a re-negotiation of functions, representatives and treasury issues. This will be done through a supervised mechanism to ensure inclusivity and long-term institutional sustainability. The provision of Law on delivery of functions (Chapter 5 on Roles and Responsibilities) is often unknown by farmers, therefore a capacity-building will involve module on the rights and liabilities. The Law provides for the management responsibilities of the WUA, including but not limited to service quality, O&M, irrigation scheduling, organization of trainings, planning, information exchange, communication methods and conflict resolution. Also, general assembly of WUAs provide platform to set membership fees and the use of budget (under the supervisory function of the appointed treasurer). In lack of functional WUA, farmers currently make individual investments to operate and maintain the system, which results in proportionally high costs (i.e. individual pump use, maintenance works on mesqa etc.). Capacities will be developed to enable farmers to craft feasible business plan for central mesqa management, without imposing unreasonable financial burden. The Law also orders the involvement of WUA into the improvement works in the mesqa, and improvement works must be commissioned to the WUA (irrigation management transfer). In line with this article, this project will be based on a participatory approach with the full involvement of the WUA in each part of the project formulation and implementation. Based on FAO's experience on assessing and improving WUAs in Egypt, the delivery of the activity will be grounded in an extensive knowledge
 - 1.1.1.2. *Waste removal structures and sand traps installed to improve performance of branch canal:* The branch canal will be equipped with manual waste removal structures, sand traps and small-scale compactors. While main canals in Egypt are equipped with large-scale trash traps, the project will introduce the first pioneer of scaling trash traps at community-level, and support community-managed waste and sediment management.
 - 1.1.1.3. *Mesqa canals converted into water-efficient pipe network:* The current earth mesqas and marwas are inefficient and their conveyance capacity is low. Such deteriorated infrastructure easily undermines the achieved efficiency increase at branch canal level. To increase water use efficiency and make the conveyance system compatible with modern irrigation techniques, the mesqas and marwas will be converted into piped network. Based on national recommendations and experiences from OFIDO project, the proposed design of the pipeline network (branched) follows the original pathways of the mesqas and marwas, but the canal will be filled up to gain land, and pipes will be buried. The location of the outlets (hydrants) will follow the original location of existing outlets, providing outlet (valve-type over the pipes and hydrants as farm outlets) and management role for all farmers. This will ensure that the land tenure structure is respected, and all farmers have equal and individual access to water. Beyond the above 99% conveyance efficiency, the particular advantage of piped and pressurized network is that downstream farmers along the mesqa will have discharge equal to upstream farmers, the water travel time will be shorter, and hydrant outlets have uniform capacity. Such configuration will improve the equity amongst farmers. Piped irrigation network has also gender relevance, as women have been crowded out from irrigation due to the required maintenance works of earth canals, available only for men.
 - 1.1.1.4. *Conjunctive water distribution system established for sustainable groundwater use:* Farmers in Beni Suef extensively rely on groundwater (sometimes up to 50 percent of water supply). While shallow groundwater is renewable in the area, farmers over-extract it. Development of sustainable conjunctive water use is necessary to rebalance the surface- and groundwater by shifting farmers away from excessive groundwater use. Conjunctive water use is known practices in arid countries, however, formal protocol has not been established in the Old Lands yet. Conjunctive use is also important to allow the deployment of modern irrigation techniques. As drip and sprinkler irrigation systems require 2-3 days irrigation frequency, the current rotation in branch canal would not be sufficient to operate the on-farm irrigation systems. The conjunctive distribution system will be operated on the principle of mesqa operation, under the management of the WUA, and the supervision of the Undersecretary of Water, and MWRI. The change from private, poorly constructed wells to central, monitored and sustainable option was consulted and applauded by farmers, who spend significant amount to operate their wells individually. The conjunctive system will be operated from the mobile solar unit (please see further info in activity 1.1.1.5.), carrying pumps for both surface and groundwater lifting. Like this, the use of groundwater will be centrally managed, follow the defined protocol (including the licensed quantities), and the cheap access to energy will not result in groundwater extraction, as it happens in many solar-powered areas globally. As per the licensing process dictated by national regulation, wells must be managed sustainably. To be compliant with national standards and environmental safeguards, the construction will start off by full geo-surveying, groundwater assessment (yield and quality), selection of appropriate metering device (please see further info in activity 1.1.2.1.), feasibility study, and inspection of design. To shift farmers away from the use of existing wells, awareness will be strengthened. As the improved mesqa configuration (pipe network) will result in significant water saving, the current trend of harmful groundwater use will be reversed in support of groundwater conservation. The project will work out the protocol of conjunctive water use that can operate the modernized systems while keeping groundwater extraction below the recharge capacity.

- 1.1.1.5. *Mobile, community-managed solar units manufactured to support flexible, cost-effective and equitable access to water:* Solar irrigation systems are well-adopted in Egypt, although, the large investment need justifies solar systems mostly in commercial farms. To overcome the issue of localization of energy source and provide equal access to all farmers, the project will introduce the new concept of mobile, community-managed solar pumps, proved successful in countries with similar farm setting. Unlike the single-standing panels, such unit is scaled at community-level, and can be transported to different locations, based on the in-mesqa irrigation schedule. Consequently, the cost of irrigation at downstream parts of the network does not elevate.
- Output 1.1.2. 360-degree, participatory monitoring system established to support sustainable use of soil and water resources: The Output builds on 3 complementary activities:
 - 1.1.2.1. *Groundwater monitoring system established to assess the status and control groundwater use:* Groundwater use is hard to monitor and control by individuals, as visual inspection is not feasible. To address the experiences of dropping groundwater tables and support the sustainability of groundwater use, level loggers and conductivity sensors will be installed on the conjunctive structure. As complementary function of the loggers, the sensor software will have multiple admin account, providing insight into the trends in groundwater movement to the authorities. Such multilevel monitoring will help keep track on renewable groundwater resources, thus making well use compliant with the objectives of national rules and sustainability.
 - 1.1.2.2. *Farms equipped with mobile soil moisture and salinity sensors:* Over-irrigation is a general phenomenon in farmer communities who have unmonitored access to irrigation water, in particular, in the farms close to the water sources. Despite the fact that the concept of diminishing-marginal-returns applies on irrigation water, farmers over-irrigate to avoid the risk of water stress. FAO's on-going pilot project proved that the issue stems from the critically low understanding of demand-supply balance and estimation of crop water requirements. The project will distribute inexpensive, hand-held sensors to farmers to help optimize water resources, thus saving water from evaporative losses. Another function of the sensors is closely related to the next Outcome on modern irrigation techniques. As modern techniques carry the risk of salinity if not well managed, the sensors will indicate even minor salt built-up in the soil, thus informing farmers on the need for leaching.
 - 1.1.2.3.: *Drains equipped with water quality sensors to monitor the re-use potential of drain water:* To decrease the environmental impact of reused drain water, drains will be equipped with sensors to observe water quality parameters. The equipment will inform authorities on the suitability of water for reuse.
- **Outcome 1.2.** On-farm irrigation system is modernized and monitored, and water-saving potential of on-farm irrigation is exploited: The Outcome is in direct support of the national programme on irrigation modernization in the Old Lands. While modernization of on-farm irrigation is necessary to combat climate-induced water scarcity and modernization is programmed as national priority, the innovation roll-out must take stepwise approach Old Lands to avoid risks. This Project, therefore, carries modernization at its heart and aims to develop new practices and generate evidence for modern irrigation in the Old Lands.
 - Output 1.2.1. De-risked, modern irrigation systems designed to improve on-farm water management. The Output builds on two activities:
 - 1.2.1.1. *Combined drip and sprinkler irrigation system designed and developed:* The project will modernize the farms with combined drip and sprinkler irrigation systems. Pioneering such modern techniques in the Old Lands requires well-define adoption steps to ensure that innovation roll-out is successful and practices are sustainable.. Even though modernized systems operate at farm level, they require the aggregation of farmlands to reach breakeven point of investment. This is particularly important when agricultural landscape is scattered, and land sizes are fragmented. Therefore, the agricultural lands will be co-developed, operated by the same pumping unit. The system will be designed as branched network, and farms will be equipped with individual valves to create equitable irrigation schedule.
 - 1.2.1.2. *Effects of combined irrigation systems monitored and O&M protocol established, with emphasis on adequate leaching practices:* Failed modernization initiatives highlighted the importance of establishing adequate leaching practices based on long-term monitoring. On one side, such technology is completely new for farmers in Old Lands in Upper Egypt. The project will construct O&M guidelines for the system. On the other hand, localized irrigation techniques are not sufficient to satisfy the leaching requirements. As effective precipitation is zero in Upper Egypt, leaching practices must be established to avoid the risk of salinity.
- **Outcome 1.3.** Proven adaptation innovations in configuration and management of irrigation systems are prepared for external diffusion and scale-out, and capacities of stakeholders are enhanced to maintain innovations: The suite-of-measures in the project areas must be duly documented and accompanied with continuous monitoring and evaluation. As this Project acts as accelerators of innovation scale-up and scale-out, it aims to build capacities to the extent that both grassroots actors and authorities can transfer and diffuse the measures at larger scale. This Project, therefore, put equal emphasis on the development of capacities and strategic plans in support of scale-out.
 - Output 1.3.1. Capacity-building programme rolled out to support the adoption and maintenance of innovations. The Output builds on three activities:
 - 1.3.1.1. *Capacity needs assessments conducted and capacity building programs on adaptation innovations in configuration and management of irrigation systems, targeting institutional and community stakeholders developed and implemented:* The programmatic approach of capacity-building, following the Knowledge Management Plan, will be introduced to empower stakeholders at all levels. This will support the maintenance of project results and eliminate the potential risks and pitfalls after the commissioning of the systems. The capacity-building will also support the empowerment of farmers to transfer knowledge to out-of-project farmers and stakeholders through specific module on social training. The capacity-building for authorities will support the build-up of national technical network to carry out irrigation improvement and modernization.
 - 1.3.1.2. *Train-the-Trainers programme for grassroots organizations designed and implemented to ensure iterative knowledge management and development:* As this Project envisages the fast-track transfer of technologies after implementation, grassroots organizations must be prepared for the long-term support of farmer communities outside the project command area. Therefore, ToT programme will be implemented in support of the empowerment of the WUAs. It is expected that improved grassroots organizations will be a role model for other farmers' organizations with the same of different functions. Therefore, the ToT will include training on knowledge management.
 - 1.3.1.3: *Inter-community promotion of adaptation innovations in configurations and management of irrigation systems facilitated through site visits:* Consultations showed farmers' interest and commitment to promote the adopted measures. The farmer-to-

farmer knowledge transfer is a powerful tool to enable the diffusion of innovative measures. Therefore, farmer-led training sessions will be organized to adjacent mesqas. This will increase the beneficiaries of the project, and measures that are readily transferable will be accessible to a larger scale of stakeholders. The site visits will serve as a supervised method of knowledge management (peer-to-peer) to kick-off informal transfer of knowledge. Once farmers acquire the skills on knowledge transfer, this activity will be an instrument to support social learning.

- Output 1.3.2. Innovation diffusion and scale-out supported to promote innovative adaptation measures in irrigation development. The Output builds on three activities:
 - 1.3.2.1. *Innovation Management Platform developed, coordinated and maintained by project stakeholders*: The wealth and diversity of rolled out practices and generated evidence require the establishment of an umbrella platform co-operated by the ministries. The IMP will act as open and living library of the documented practices. The IMP will incorporate the measures at components-level, as well as the results of project-level implementation. Further activities related to knowledge management will be archived directly in the IMP.
 - 1.3.2.2. *Participatory monitoring, evaluation, and adaptive planning of adaptation innovations conducted with stakeholders, with implementation of corrective actions*: As the rolled out measures carry new concepts to farmers, and innovation requires the continuous monitoring and evaluation, as well as iterative development, this Project will build up an organizational unit (board of peers) incorporating stakeholders and independent experts. The board will be responsible for monitoring, evaluation, planning and definition of corrective actions, if required. The board will be also responsible for the preparation of technical documentations and knowledge materials in support of the establishment of good practices, diffusion and scale-out.
 - 1.3.2.3. *Evidence-based external diffusion plans, exit- and scale-out strategies prepared, in line with national priorities and development plans*: Each measure as well as the suite-of-measures as whole will have innovation outlets. Diffusion plans, exit strategies and scale-out strategies per measure will be crafted and published as policy-support documents.

48. Component 2 “Enhancing agricultural productivity, livelihoods, and adaptation capacity of the most vulnerable through social innovation, in combination with climate-resilient agricultural practices and a sustainable value chain” captures the following parts of the value-chain: on-farm production, post-harvest and market. **Rationale**: The excessive land fragmentation and dispersal are the results of the growing population, the traditional rules and laws of inheritance and the Agrarian Reform. The small farm size has far-reaching consequences, such as lack of economies of scale to invest in adaptation measures, lack of bargaining power in the input markets due to diverse production practices, heterogeneous production output, and lack of ability to conclude collective agreements due to the insufficient production volume. As farmers have their own production agenda, the community-level investment in agriculture is also hampered. At single farm level, production practices are far from being climate resilient. Farmers are neither equipped nor prepared to mitigate the impacts. Likewise, livestock related activities is equally impacted by climate change from both sides of production input and output. The deficiencies of livestock sector have even more chronic consequences, as decline in performance exacerbates the gender inequality. Women, primarily responsible for animal keeping and dairy production, are not yet sufficiently addressed in climate change programmes. Agricultural development, however, cannot take isolated approach due to the interconnectedness of crop and livestock sectors, and the poor market integration of farmers. To reach impact at scale, the production practices, involving both crop and livestock, must be improved together with better access to markets. Component 2 involves three outcomes to improve climate resilience of agricultural production and develop sustainable value chain.

- **Outcome 2.1.** Social innovation, updated climate-smart practices, and farm modernization are introduced to enhance the productivity, profitability, and resilience of agriculture: The Outcome, firstly, addresses the structural issue of land fragmentation through social innovation. Without the harmonization and the certain aggregation of production, the agricultural development would be, again, lured into the same trap of crumbling production entities. This would hamper the investment in more efficient and resilience-increasing infrastructure, such as drip and sprinkler irrigation, improved mesqa or sustainable, conjunctive water use. It would also have implication on farmers’ representation in the markets. Therefore, the Outcome requires the development of social cohesion through awareness-raising on the fundamentals of cooperation. To avoid any radical intervention that would arouse opposition, the concept of voluntary harmonization called “crop zoning” is proposed. The improved production volumes by crop zoning have effects transmitted to livestock sector, as quantity of forage and length of season can be increased. Crop zoning has a multiplier effect for climate resilient practices, as it stimulates the scale-dependent interventions (e.g. small-scale tractor). Crop zoning supports the adaptation to climate change, as it can increase the production volume without additional input (i.e. land, water or agrochemicals). Furthermore, the Outcome is designed to make the on-farm production and the post-harvest phase resilient. While Component 1 exploits the water saving potential of modern irrigation, this Component puts emphasis on water conservation through better crop production practices, mitigating the impact of heat on cattle, and increased resource use efficiency through eliminating food loss.
- Output 2.1.1. Crop Zoning Framework co-developed and production practices modernized to increase production-at-scale, climate-resilience, productivity and reduce cost of farming. The Output builds on four activities:
 - 2.1.1.1. *Awareness-raising on crop zoning scenarios implemented and consent of farmers institutionalized*: Dictated cooperation proved to trigger the resistance of farmers in Egypt. This is clearly depicted by the frequent failure of WUAs to integrate farmers. The success of the sustainable and long-term cooperation amongst farmers rests on bottom-up approaches. Also, crop zoning is not a pre-fixed setting that cements the cropping pattern, but a dynamic and flexible pattern adjusted to farmers’ requests. To generate appropriate scenarios of optimized cropping patterns, the needs and proposals of farmers must be surveyed. Therefore, awareness-raising activities will be implemented to sensitize farmers, reach their consent and integrate farmers’ requests into the process.
 - 2.1.1.2. *Framework for Crop Zoning concept developed, and crop zoning completed to support input optimization and production-at-scale*: Crop zoning is built on the voluntary engagement of farmers to divide the command area (in current case, the mesqa) and allocate zones to specific crops. Such zoning intervention has multiple benefits, such as the land gain through the use of farm borders as agricultural area; optimized water and agricultural input use through the joint implementation of best production practices; increased production volume per unit land through the land gain and best practices; deployment of investments and interventions that would require a certain scale; and, improved market power through homogenous production outcomes. In the light of growing water scarcity, the optimized amount of water and better control of water supply are essential, and crop zoning will help improve the efficiency of on-farm irrigation. The advantages of such concept to other methods are the following: no changes in ownership, flexible scenarios to provide equal benefits, community-driven, voluntary participation,

and scalability. The framework will be developed through a series of optimization methods, considering the critical parameters of production practices. The framework will be established and monitored in the mesqas to enable an iterative development. The know-how of the framework will be handed over to the ministries to support the future implementation.

- 2.1.1.3. *Small-scale, community-managed smart tractors deployed to improve agricultural productivity and labour standards:* Low level of mechanization is a main obstacle of efficient production and profitability, as farmers are required to rent such services. Most of the farmers cannot afford to purchase the services, which, in turn, has a downside to soil fertility and efficient water management. Mechanized land work carried out by light, renewable energy-powered machines with disc auxiliaries do not harm the soil structure, and it helps turn and keep the organic residues in the topsoil, thus increasing the soil fertility and the water retention capacity. Keeping crop residues in the soil also helps build CO₂ stock. Mixing topsoil with organic residues will also help avoid soil erosion and contributes to the carbon sequestration potential of the soil. As light-weight tractor is only able to keep the soil preparation to a minimum, the CO₂ loss from the soil can be reduced. Inappropriate or complete lack of land levelling is a typical phenomenon in the Old Lands, although, uneven and sloped surface impairs the field irrigation efficiency. Mechanized works results in a more uniform land preparation, and levelling supports the equal distribution of water across the lands. Investment in tractors is expensive, thus it is the privilege of more wealthy landowners. However, joint investments can significantly improve the recovery rate and makes poor communities financially viable to purchase machines. The project will design a prototype of inexpensive, locally manufactured smart tractor, having various functions. The design will enable a community-managed operation to partly replace manual works. The merit of community-managed tractor rests on its affordability, and reduced production cost (labour cost saving). Also, agricultural machinery is known for its ability to improve work standards. Another advantage of the small-scale tractor is its light weight. Unlike the heavy, large-scale tractors, it does not compress the soil, so erosion is not induced, and buried pipes are not exposed to explosion.
- 2.1.1.4. *Climate-smart agricultural (CSA) options selected and successfully implemented via chat software:* No CSA practices are currently in place in the areas. However, such practices are undoubtedly critical to adapt to climate change impacts and secure agricultural production. CSA practices are also complementary to the water saving measures, such as modernized irrigation, as it stimulates the demand side of the production. Consequently, the project will support increase in production per unit of applied water. Based on the consultations and field observations, the most needed practices are the integrated pest management, optimized use of agrochemicals, mulching and climate resilient varieties. 1.) In case of current pest management practices, farmers apply pesticide with limited working spectrum. The project will work towards more integrated approach, involving monitoring and definition of pests, and recommendation on organic pesticides with targeted working spectrum (compliant with biodiversity and environmental objective). 2) On the other hand, field survey proved that farmers use extensive amount of fertilizers (up to 750 kg per ha). However, such amount is unreasonable, as it vastly exceeds the crop demand. The project will work towards the optimization of fertilizer amount to avoid further soil erosion and loss of topsoil. 3) Climate resilient varieties are not yet in practice in the area due to the distance from market and unexplored supply channels. 4) Uncovered crop production exposes the soil to the heat and sun, thus inducing dust-forming and topsoil erosion. Mulching is an organic approach to reduce the exposure and keep the moisture in the soil, therefore, mulching practices will be advocated. The project will help farmers enter the seed market to have better access to certified climate resilient varieties, developed and recommended by the Agricultural Research Centre. While the project will work towards the integration of CSA in near-local farm field schools (FFA), the FFA network has not been reached the project areas yet. The consultations called for non-traditional methods to deliver the learning materials due to the high illiteracy levels. The project will implement a face-to-face training on CSA practices and will develop e-learning materials that transmitted through chat software (podcasts). FFA network, relevant to the project area, will be also trained on the CSA practices in ToT modality to support reach out at scale.
- Output 2.1.2. Preparedness of livestock sector improved to support the livelihood of women through enhanced forage production practices and climate-smart livestock keeping. The Output builds on two activities:
 - 2.1.2.1. *Updated forage production practices developed to maximize the production volume and prolong production season:* Improvement of forage production is crucial to restore the previous production levels of livestock and improve women's livelihood. On one hand, the need for increased production volume will be incorporated into the scenario design of crop zoning. On the other hand, forage production practices will be updated to respond to the shift in agriculture seasons, induced by climate change. This will be done through the use of CSA practices also in forage production, and the use of lands gained by crop zoning for production. This will counterbalance the forage volume lost to climate change-induced changes in agriculture seasons.
 - 2.1.2.2. *Climate-smart practices of livestock keeping developed and demonstrated, with focus on heat-stress alleviation:* The reported impact of heat stress is detrimental, and the reduced quality and quantities of milk production are growing concern amongst women farmers. Consultation with women showed a general reluctance to accept direct intervention in animal keeping. The risk-averse behaviour is the result of women's dependence on cattle, and forced intervention would, most probably, discourage women. Therefore, the project takes an indirect but effective approach and sets-up demonstrations of climate-smart livestock keeping. The training on adaptation practices will offer options of heat-stress alleviation, including stall ventilation practices, shading, drinking practices, and soaking. This will minimize the heat stress and support animals in better milk production, in terms of quantity and quality. This Project does not propose increased number of cattle, as there is a biophysical limit of livestock population in the area. Taking this limit into account, the project will focus on increasing the productivity of existing livestock. By improving the milk productivity of animals, this activity also has a contribution to increased water productivity. Given the fact that the forage production (alfalfa and barseem) is water demanding, the improved milk productivity per animal will also enhance the livestock water productivity. The training will also include climate smart practices related to improved manure management to profit from organic manure. This will include inexpensive practices, such as the enhancement of existing composting methods, covering manure, use of flooring etc. The project will leverage the results of an implemented programme of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), which partly touched upon good manure practices in the Old Lands.
- **Outcome 2.2.** Sustainable and pro-poor value chain is established to increase revenues and improve efficiency of natural resource use: The potential of improved production practices and increased production volume can easily crumble down if the access to market is not simultaneously developed. The poor marketing channels have twofold impacts: the natural resource input goes to waste if products are not used or sold; livelihood of farmers remains uncertain, and farmers are forced to downgrade their

production. To address both adverse effects, the Outcome aims to create access to markets and improve the position of farmers along the value chain. The market outlets of crops and livestock are substantially different, so the Outcome addresses dairy markets and crop-marketing separately. This will improve livelihood of men and women in tandem, without trading off the interest of any.

- Output 2.2.1. Women Farmer Association empowered to increase women's representation in agriculture and improve management procedures of dairy sector. The Output builds on four activities:
 - 2.2.1.1. *Women Farmer Association empowered to increase women's representation in agriculture and improve management procedures of dairy sector*: As dairy products (milk, cheese and butter) are individually sold in distant markets, women either rely on the local collector to purchase their milk at depressed price or travel long distances to sell their products in informal and underequipped markets. The production and marketing are unorganized, which leaves women exposed to loss of milk products or unrealised gains. To overcome the issue and improve women's market position, local Women Farmer Association (WFA) will be empowered. The WFA will be responsible for the voluntary registry of women and the support to set up better organizational frames for milk market. Awareness-raising campaign will be launched to integrate local producers and establish inclusive organizational structure.
 - 2.2.1.2. *Smart tuk-tuk with cooling facility designed, developed and distributed to women for the safe process and transport of milk products*: Milk and dairy products are perishable, and households have small capacities to store milk in fridges. Also, the traditional vehicle of donkey stagecoach is inappropriate to transport milk at large distances, a concern expressed by the women consultees. Tuk-tuks are widely used vehicles in Egypt due to their low cost and are easier alternatives of large vehicles. Thus, women drivers can easily accommodate to the new transportation facility. Food transportation requires modified design though. Smart tuk-tuk will be designed and manufactured to support the collection and transportation of milk through cooling boxes. The tuk-tuk, operated by the WFA, will be equipped with cooling facility to improve food safety and allow the milk collection in large quantity.
 - 2.2.1.3. *Woman-operated milk / cheese / butter collection point established and made operational to increase the revenues of women*: Milk collection point is no new intervention in Egypt. However, the existing collection points are rather large-scale, located in areas close to intensive livestock holdings, and operated by retail companies. Such small-scale, formal, community-managed collection points do not exist in poor areas. The collection point, managed by WFA, will be solely women-driven enterprise that have direct access to markets. This will improve the marketability of dairy products and stabilize and improve women's income.
 - 2.2.1.4. *Mobile silos distributed to support women in post-harvest grain storage at household level, eliminate food loss and improve food safety*: The households maintain traditional practices of grain storage, keeping the grain in the house without any specific process or infrastructure to protect it. As the stored grain is exposed to humidity, pests and insects, the traditional practices lead to significant food loss, and often food safety issues. However, direct storage of harvested product is vital for the household food security and the optimization of household expenditure. Small-scale, collapsible, rolling silos will be provided to households. The design of silos will consider several factors to withstand climate hazards and support women in physical work.
- Output 2.2.2. Crop-marketing arrangements established to shorten supply chain and increase revenues of farmers. The Output builds on three activities:
 - 2.2.2.1. *Market actors identified, contacted and internalized in the value chain*: Farmers are price-takers and have no bargaining power to sell their products at higher price. However, the increased volume by the crop zoning will allow a strengthened representation in the market. To facilitate the marketing, buyers will be identified, and pre-agreement will be facilitated to improve the market uptake of products, without compromising the income of farmers.
 - 2.2.2.2. *Business dialogue amongst actors facilitated, and model contracts drafted to maximize farmers' benefits*: The formal agreements and contracting are undoubtedly the sore points of agricultural profitability. Farmers often sell their products informally without information about the real values and market prices. A dialogue amongst buyers and farmers will be facilitated, and model contracts will be drafted to provide good examples. The negotiation and formal contracting will act a safeguard of farmers' livelihood. Farmers' capacities will be strengthened through the involvement in business dialogue.
 - 2.2.2.3. *Smart tuk-tuk deployed to enhance access to distant markets*: Formal markets are distant, and farmers have no vehicles or transportation facilities. To sell their crops, they either transport the crops at daily basis with rudimentary vehicles or call for trailers to collect the harvested crop. Both of them entails significant cost increase, as personal transport takes labour time, and the order of camions must be purchased. Smart tuk-tuk designed for crop transportation will be prototyped and supplied to farmer communities. Unlike the tuk-tuk for milk purposes, such tuk-tuk will be equipped for small-scale freight transport. However, such tuk-tuk is not only for the transportation of larger volumes, but for taking perishable crops (e.g. tomato, cabbage etc.) to the market.
- **Outcome 2.3.** Proven adaptation innovations along the agricultural value chain are prepared for diffusion and scale-out, and capacities of stakeholders are enhanced to maintain the innovations: The overall objective of the Outcome is similar to the Outcome 1.3. under Component 1 but refers to the outputs and activities under Component 2. It is well understood that the approaches of how activities will be implemented are different between Component 1 and Component 2. By keeping it in evidence, the Concept Note remains concise and lists the activities together with a brief description, and the full proposal development will provide more in-depth information on the implementation methods of the activities.
- Output 2.3.1. Capacity-building programme rolled out to ensure the adoption and maintenance of innovations along the value-chain. The Output builds on four activities:
 - 2.3.1.1. *Capacity needs assessments conducted and capacity building programs on adaptation innovations along the value chain, targeting institutional and community stakeholders developed and implemented*: The activity, in nature, is similar to the activity of 1.3.1.1., but the programme will capture the intervention along the value chain.
 - 2.3.1.2. *Train-the-Trainers programme for grassroots organizations designed and implemented to ensure iterative knowledge management and development*: The activity, in nature, is similar to the activity of 1.3.1.2., but the programme will capture the intervention along the value chain.
 - 2.3.1.3. *Community campaign conducted to increase the geographical and thematic scopes of Women Farmer Association*: The intervention on development of milk production and dairy products has larger geographical scope including the entire

village, which allows women from adjacent mesqas to join the programme. Therefore, this Project will implement a community campaign close the mesqas to support women in access to the WFA and participate in the milk collection point.

- 2.3.1.4. *Awareness-raising on labour standards targeting women farmers carried out to improve decent work conditions in agriculture*: The field visits and consultation with women showed that current labour norms and standards affect the well-being and health of women. The recognition of the need for improving work standards and create decent work conditions is paramount, as women are the hidden driving force of field works, and without their protection, the overall objective of improving livelihood cannot be achieved. Awareness-raising will include unconventional learning tools to make sure that women are reach at large scale. The empowered WFA will also be an information hub of women, where social learning process can be facilitated.
- Output 2.3.2. Innovation diffusion and scale-out supported to promote innovative adaptation measures along the value chain. The Output builds on three activities:
 - 2.3.2.1. *Innovations along the agricultural value chain integrated into the Innovation Management Platform*: The activity, in nature, is similar to the activity of 1.3.2.1., but the programme will capture the intervention along the value chain.
 - 2.3.2.2. *Participatory monitoring, evaluation, and adaptive planning of adaptation innovations along the value chain conducted with stakeholders, with implementation of corrective actions*: The activity, in nature, is similar to the activity of 1.3.2.2., but the programme will capture the intervention along the value chain.
 - 2.3.2.3. *Evidence-based external diffusion plans, exit- and scale-out strategy prepared, in line with national priorities and development plans*: The activity, in nature, is similar to the activity of 1.3.2.3., but the programme will capture the intervention along the value chain.
 - 2.3.2.4. *Location specific business plan prepared to map and integrate market actors at-scale*: Farmers have no surrounding infrastructure to identify and contact market actors. The project will support the identification of market actors. Such map will be used at authority levels to support farmers in extending their network and creating direct access to markets.

49. Component 3 “External, project-level and national-level diffusion and scale-out of innovative suites-of-adaptation measures through preparation of strategies and capacity development of decision-makers” is designed to pave the way for the external diffusion and scale-out of innovations. **Rationale**: The current level of collaboration amongst authorities is rather weak, and no institutional mechanism has been established to coordinate agriculture and water resource development either horizontally or vertically. What makes water resource development even more intricate is that system-level development and on-farm level development fall under the mandates of different authorities. MWRI is responsible for irrigation system development, and MALR for on-farm irrigation development. However, water resource management and agriculture cannot be separated by any means. This Project will uniquely position the WUAs and WFAs as the link between system and on-farm level development. The project is in support of several national priorities and plans, which are at the starting line (notably Irrigation Modernization Programme). Due to lack of generated case studies and accumulated knowledge on the modus operandi and impacts of national level plans, the introduced concept must be systematically assessed and prepared for external diffusion and scale-out. How innovations prove to comprehensively address the identified problem is decisive, as given the multiplying arrays of climate change impacts, efforts to build adaptive capacities cannot wait in Egypt. The Component involves one Outcome to prepare national decision-makers to adopt the presented suite-of-measures.

- **Outcome 3.1.** Concept of suite-of-adaptation measures in agriculture is rolled out and prepared for scale-out: Innovation roll-out by nature require rigorous process to enable them for internal and external diffusion while eliminating the risks of adoption. As the project takes the suite-of-measures approach, it necessarily entails the need for measure-wise and comprehensive evaluation. The measures must prove their impact at individual level, but how the measures act together must be assessed as system-as-whole.
- Output 3.1.1. Project-level innovation diffusion and scale-out strategies prepared to promote and deploy innovative suite-of-adaptation measures at large scale. The Output builds on three activities:
 - 3.1.1.1. *Project-level monitoring, evaluation, and adaptive planning of suite-of-adaptation measures conducted with stakeholders, with assessment of the results of corrective actions and synthesis of lessons-learn*: High-level mechanism will be established to enable the monitoring and evaluation of the interventions. This will capture both vertical and horizontal actors. As per vertical actors, the results will be monitored from WUAs and WFAs (representing the farmers), extension service as direct reporting line of WFAs, undersecretaries of Water as direct reporting line of WUAs, to the ministries (MRWI and MALR). The reporting line will also include non-traditional actors with roles in innovation development (research centres, peer board, project steering committees, Haya Karima representative etc.). Direct interaction amongst these vertical levels is paramount, as adoption challenges, success, lessons will be measured through the grassroots organizations (WUAs and WFAs). Therefore, the WUAs and WFAs will play crucial role in both innovation adoption and scaling phases. At vertical direction, the mechanism will be established through inter-ministry and inter-organizational board and will continuously operate throughout the project. The regular update and channelled information are crucial not only to conclude what works but to understand what does not work out and why not. This will help avoid the mal-adoption of the proposed measures (please see further information in Section I). The mechanism will require regular information-exchange through workshops and the operation of the Innovation management Platform.
 - 3.1.1.2. *Project-level external diffusion plans, exit- and scale-out strategy prepared, in line with national priorities and development plans*: Similar to the measure-wise diffusion plans, master diffusion plan, exit- and scale-out strategies will be prepared, which will detail the pathways of adopting the suite-of-measure at large scale.
 - 3.1.1.3. *Geographical roadmap of innovation scale-out prepared to support the efforts of country in irrigation and agriculture development within the context of climate change adaptation*: This Project captures the geographical area of Old Land, however, some measures are risk-neutral and can be applied anywhere, while other measures have technical pre-conditions that restrict the adoption in certain areas. Therefore, geographical roadmap will be constructed to inform decision-makers where and what measures can be applied.
- Output 3.1.2. Capacities of national authorities on adaptation improved, based on evidence-based methods and case studies: The Output builds on two activities:
 - 3.1.2.1. *Capacity-building on and promotion of Innovation Management Platform carried out to cross-sector authorities*: The Innovation Management Platform (IMP) is a cross-sectoral tool that carries important lessons and information for wider audience. In Egypt, no such computerized platform has been developed yet to showcase innovations. As the generation of

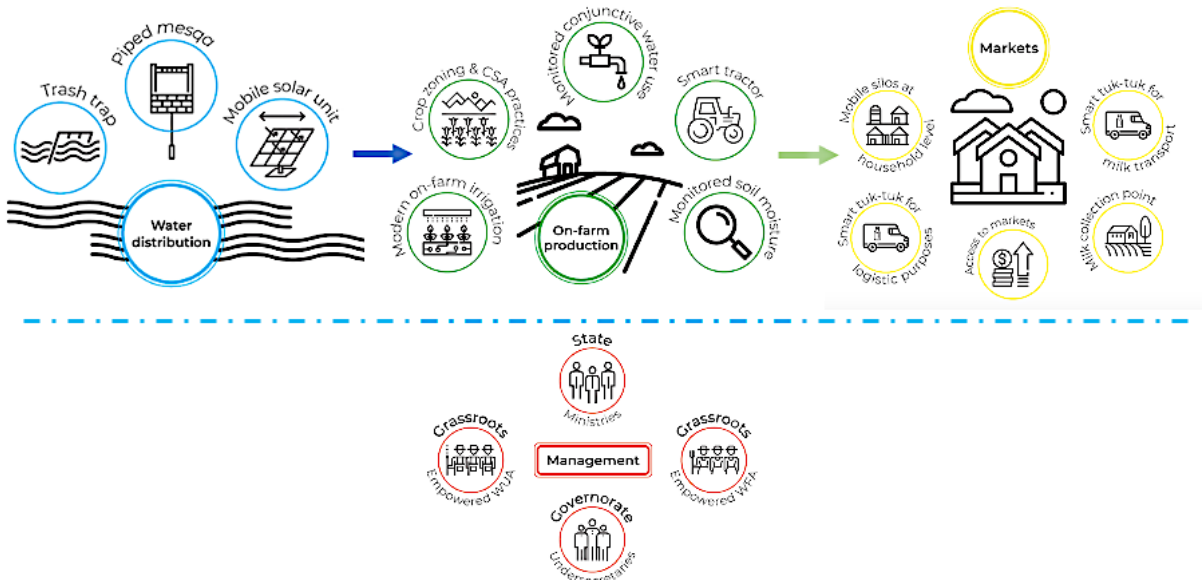
further information is expected to speed up as response to the climate change impacts, the promotion of IMP will support its scalability and regular update with the newest innovations.

- 3.1.2.2. *Capacity-building and national-level workshop on the suite-of-adaptation measures in agriculture conducted and diffusion plans, exit- and scale-out strategies validated:* There is a need to increase the system-level thinking and break up the silos of innovation and development in Egypt. Isolated and halted innovations have been waxing and waning in the country, and even impactful innovations can easily faint if not well promoted. Capacity-building programme will be conducted to promote the concept of suite-of-measures. The capacity-building will also include field visits to enable a dialogue between farmers and policy-makers and demonstrate the impact of well-functioning grassroots organizations (WUAs and WFAs) in the uptake of project results. Also, the prepared diffusion plans, exit- and scale-out strategies (both measure-specific and master plans) will undergo validation process that will be concluded with national-level workshop.
- Output 3.1.3: Collaborative links to Haya Karima (Decent Life) initiative established and partnerships on themes of joint interest developed:
 - 3.1.3.1. *Mechanism to inform Haya Karima on innovative adaptation measures established:* The goal of Haya Karima is to provide equal support to the most vulnerable areas of Egypt, to improve livelihood and provide decent life standards. As the project objectives align with the goal of Haya Karima, it is expected that partnership and close coordination will help leverage the project results at large scale. The recent interventions of Haya Karima will be monitored through up-to-date databases and results tracking. This will be incorporated into the national-level diffusion plans, exit strategies and scale-out plans. Results will be articulated to be compatible with the existing database of Haya Karima.
 - 3.1.3.2. *Participation in strategic planning of Haya Karima:* Links with Haya Karima will be further developed through the participation in strategic planning and provision of background documentation to the plans. This will contribute to the most appropriate implementation of Haya Karima programme, related to water management and agriculture.

50. The two mesqas represent the two typical settings of water management at system level in Egypt: the branch canal system has rotational schedule in Beni Suef and continuous flow in Fayoum. Although the suite-of-measures is design to respond to common needs in an innovative manner, some measures must be adjusted to the different conditions:

- Due to the continuous flow in Fayoum, the modern on-farm system does not require groundwater use to bridge the off-irrigation periods. Therefore, conjunctive water use and groundwater monitoring will be introduced only in Beni Suef, while the mesqa in Fayoum will be supplied solely from surface water.
- Households do not store grains in Beni Suef, as farmers prefer keeping the harvested crops on lands, and grain milling is not practiced. Therefore, mobile silos will be introduced only in Fayoum, where grains are stored by the households.
- The markets are at rational distance in Beni Suef, while markets are at large distance in Fayoum. Therefore, the smart tuk-tuk for transportation will be supplied only in Fayoum.
- WFA exists in Beni Suef (Dalas WFA) but requires improvement to take additional functions. Women communities in Fayoum have not established WFA yet, therefore, the project will establish the WFA.

51. To infographics below sum up the proposed project approach and demonstrate the suite-of-measures located along the value chain.



B. Promotion of new and innovative solutions to climate change adaptation

52. AF's Innovation Grants address the need for innovation in the climate-change adaptation sector. AF's guidance on the expected results (ERs) for the promotion of new innovations are addressed under: ER3: Development of (new) innovative adaptation practices, tools and technologies encouraged and accelerated; ER4: Evidence of effective, efficient adaptation practices, products and technologies generated as a basis for implementing entities to assess scaling up. This Innovation Project responds to the expected result of "Successful innovations rolled out. Innovative adaptation practices, tools and technologies that have demonstrated success in one country spread to new countries/regions".
53. **Innovation landscape.** Agricultural innovation is not an untapped resource in Egypt. In contrary, Egypt Vision 2030 set the objective that "by 2030, Egypt shall have a balanced, diversified competitive economy that counts on innovation and knowledge, and based on justice, social integration and participation". The Vision defines five major challenges facing the innovation uptake, involving the "poor effectiveness in the coordination between the social needs and innovation" and "absence (weak) of innovation culture in the society". Food and Agriculture is one of the main pillars of the Vision. Egypt draws on thousand-year long experience on science and research in agriculture. However, the research often remains isolated, without creating links and pathways to stakeholders. This leads to the underutilization of innovations, and often, new tools, technologies, processes do not reach to the field. How innovation is defined in Egypt is unclear. Screening several innovation initiative and project showed that innovation, at programme level, is interpreted as scale-out of existing practices. In this interpretation, the typical examples are the transfer of good agricultural practices, cash-crop production, digital agriculture, or organic farming. At research level, Egypt has significant achievements in breakthrough innovations in agriculture, such as new crop varieties, development of agrochemicals and biotechnology. Agricultural Research Center (ARC) is the lead organization of agricultural and irrigation innovations, and as the result of decades-long scientific excellence, ARC development numerous innovations that put Egypt at the top of the global ladder of agricultural productivity. Little wonder, then, that Egypt ranks high on the global list of countries with highest crop yields. The major concern today is how can the yields be maintained in the light of climate change? However, there is a geographical imbalance in innovation transfer, whereas Upper Egypt lags behind the development level of Lower Egypt. Also, the more optimal conditions and newly developed areas in the New Lands are considered as more fertile ground for innovation, merely due to their juvenility. Innovations that reach smallholders in the Old Lands are mostly related to improved crop varieties, irrigation improvement at system level and involvement in vocational education. Even if some innovations are transferred to traditional farms in the Old Lands, the innovation and technology uptake at farm level is slow, and the learning curve remains flat due to the lack of effective reach out and necessary capacity-building at user level. However, poor farmers are under-resourced to build resilience and improve their preparedness from own resources. Consequently, they are more exposed to climate change impacts and remain without means to apply adaptation measures. This Project aims to address the existing innovation gap between commercial farming (mostly located in the Delta and New Lands) and small-scale, poor farmers (mostly located in Old Lands in Upper Egypt) through the roll-out of proven innovations from other regions and countries. The approach of the innovation conceptualization differs between traditional, partly subsistence-driven farmers and medium/large, commercial farms. There is a need for thorough assessment of the ability and willingness of poor farmers to consider any innovation. Any risk associated with the innovations must be eliminated to dispel any doubts and safeguard the poorest. This has been already initiated during the consultations and field visits, and the identified and proposed suite-of-measure contains are already discussed with and accepted by the farmers to guarantee the successful roll-out.
54. Farming communities are increasingly feeling the impacts and shocks of climate change (e.g., heat waves, droughts, water scarcity), resulting especially in higher levels of crop damage and lower yields, livestock mortality, loss of livestock productivity (e.g., due to heat stress), and pest infestations, altogether negatively affecting household incomes. Based on the consultations conducted in the targeted areas during this Concept Note development phase, the local farmers don't fully know how to adapt their irrigation, agricultural, and livestock practices and livelihoods to the future climate. Integrated and new ways of thinking, innovative and integrated technologies, tools, and mechanisms, resource-efficient practices, social innovations, and the sharing of best practices across relevant geographical areas can all play a key role in adapting to climate change. However, various constraints to the adoption of innovations were identified during the consultation process. For instance, the local population has a high-risk aversion, especially women in relation to safeguarding their livestock. Various enabling factors were also identified by the mesqa inhabitants. Farmers indicated their willingness to adopt the innovations, where benefits are clear and with the hard condition that this Project facilitates the creation of better market links for their produce and re-establish the grassroots-level organizations based on bottom-up approaches.
55. Taking account of the listed hard conditions and the suite-of-measure approach, the Project incorporates different types of innovations that are introduced and adopted in other regions and countries. What is common in any of the categories is that they, both separately and together, work towards climate change adaptation and livelihood development.
- Systematic social innovation: The Project addresses the socio-economic backwardness of rural areas. It aims to address the inequalities hitting the vulnerable communities, including women and households living under the poverty line.
 - Process innovation: The Project works along the agriculture value chain by providing appropriate, inclusive and socially acceptable measures at each part of the value chain.
 - Technology innovation: The Project proposes a series of technologies. The designs of the technology prototypes are adjusted to the identified needs.
56. The following chart provides the categorization of innovations in the context of the Project and the national and international baseline. The final definition of suite-of-measures is based on mapping of relevant adaptation innovations at national and international level, the assessment of feasibility in the project context, and the consultation with farmers. The measure-wise categorization demonstrates how the roll-out of successful innovations is aligned to the specific context of Old Lands.

Project concept		National and international baseline
	Complementary measures	Social innovation
Enabling	Bottom-up development of grassroots organizations	Pro-poor and integrated innovation design
Poor smallholders have been crowded out from innovations in Egypt. The project addresses the specific need and capacities of smallholders in the Old Lands through risk-free adaptation measures that provide easy up-take		

Suite-of-measures	Climate smart agricultural practices	Women empowerment	Women empowerment requires a holistic approach and a clear definition of activity profiles, where women have the highest potential. The targeted measures are all-encompassing, starting from decent work standards to increased revenues, under the overarching umbrella of climate change adaptation
		Process innovation	
		Market dialogue	There are several initiative to support transitioning farmers in Egypt (e.g. on-going SAIL project). The merit of this process innovation is the initiation of community-centred empowerment and establishment of two-way communication channels
		Milk collection point	Medium and large-scale collection points exist in some areas in Egypt, but such facilities are managed by private entities and require large scale production (e.g. the Delta of Egypt). Micro-households averaging 1-2 cattle per farm have poor access to collection point. The collection point is a model of women-managed facility in areas characterized by micro-scale livestock production.
		Crop zoning	Consolidation is frequently practices in countries dominated by fragmented lands (e.g. FAO's work in Central and East Europe), but consolidation is considered as culturally sensitive intervention in Egypt, as it requires ownership changes. The framework of crop zoning is a new practices to create socially acceptable aggregation of lands, based on voluntary cooperation.
	Monitoring of water quality	Technology innovation	
		Mobile silos	Silos in practice are usually large scale or traditional in Egypt. Mobile silos in small-scale production are good international practices (e.g. Germany). The new prototype of silos is designed specifically to withstand climate hazards and support women in household works.
		Tuk-tuk prototypes	Tuk-tuks are usually used for personal transport and commercial purposes in Egypt. Multifunctional tuk-tuks are piloted and introduced in other countries (e.g. Bangladesh), representing similar environment. The upgraded versions with cooling or transportation function are prototypes of converting tuk-tuk for agricultural marketing purposes in Egypt.
		Smart tractor	Old Lands are poorly mechanized, and the existing machinery services involve large tractors. Commercial farmers in Egypt and other countries already apply smart tractors, mostly in precision agriculture. Downscaled, inexpensive, community managed tractor with different functionalities is a prototype suited for poor farmers.
		Modern on-farm irrigation	Modern on-farm irrigation is widespread in the New Lands, but the technology has not been successfully adopted in the Old Land yet. The project develops and adopts sustainable, modern on-farm irrigation in Old Lands, as community-level infrastructure.
		Moisture sensors	Smart agricultural practices in commercial farmers often involve the use of sensors under the concept to Internet-of-Things, currently piloted by FAO in Egypt. The handheld, affordable sensors is considered new technology for farmers in the Old Lands to monitor soil moist and salinity.
		Sustainable and monitored conjunctive water use	Groundwater use for supplemental irrigation is frequent practice in arid countries (e.g FAO experiment in Jordan). The protocol of balanced and monitored conjunctive water use is first developed practices in the Old Lands to model the sustainable groundwater use.
		Mobile solar irrigation	Irrigation with fixed solar system at system level is trialled technique in Egypt. The design of mobile unit follows the successful example of international prototypes (e.g. India), which enables the decentralized energy production at system level.
		Small-scale trash and sand trap	Trash traps and sand traps are general parts of system design at main canal level in Egypt. Based on the international experience of FAO in Lebanon, the proposed small-scale traps are proposed to increase water use efficiency through community-managed infrastructure. To provide additional function and improve inclusivity, the barscreen is upgraded to function as a bridge.

57. The Project's strategy to roll-out innovative approaches integrates the constraints and enabling factors identified during the field work, and it embraces a diversity of perspectives, sectors, stakeholder types, administrative levels, technical innovations, and social/process innovations, within a robust multi-layered Knowledge Management system. As measures are not only adopted but adjusted to local context, innovations in the Project have also incremental nature. The Project adopts nine (9) design elements to encourage, roll-out and accelerate the adoption of innovative solutions and generate evidence on the conditions that lead to successful innovation pathways in the Project context:

58. **Element 1 - Being consistent with the national framework, consultation, and collaboration:** The Project is consistent with the goals, pillars, and measures identified in Egypt's key sustainable development strategies, including the National Strategy for Adaptation to Climate Change and Disaster Risk Reduction, Sustainable Agricultural Development Strategy towards 2030, Nationally Determined Contributions, and Third National Communication under UNFCCC. The Project supports this national framework, rolling out proven innovations and synergy to related efforts. This Project will also generate the evidence of best practices to avoid errors. Another important aspect is the consistency with the request of final beneficiaries, a mutual agreement that eventually determines the engagement of farmers, thus the success of the interventions. The Project's innovation pathway is based on a good understanding of the local problems. Extensive discussions were conducted with national and sub-national government stakeholders and local beneficiaries on the existing situation and local trends. The planning, monitoring, and evaluation systems will be designed and implemented to foster ongoing stakeholder consultation and collaboration. It will create stakeholder forums (e.g., government officials, community members, private sector, and academics) to regularly convene around Project progress and climate change challenges. The forums will identify and analyse challenging problems and develop new and different approaches based on field results. Successes and challenges will be fully documented to showcase and disseminate successful combinations and to revise planning based on successful innovation roll-out. The Project promotes collaboration, which is expected to support innovativeness. It will strengthen the vertical and horizontal links between MALR and MWRI, requiring joint interventions at mesqa level to build adaptive capacity in a synergistic manner. It also synergizes development efforts by linking to and partnering with the National Haya Karima / Decent Program initiative. The objectives of the Haya Karima initiative and this Project mesh well, given the aim to enhance agricultural productivity and support and enhance livelihood activities. It should be noted that the Haya Karima representatives endorsed having a collaborative relationship with this Project and agreed to share the Haya Karima database on the needs of the most vulnerable persons located in the Project's targeted areas consultations (*please see section J. Consultation for more details*). This collaborative arrangement is innovative in the sense that it is an explicit output under Component 2 with the expectation of being mutually beneficial.

- 59. Element 2 - Revising and improving an available concept of successful adaptation innovations:** Preliminary assessment of national and international baseline is already included in the Concept note, but further screening will be conducted during the full proposal development to identify any further concepts, which this Project can draw on. To do so, FAO revised proven innovations in areas with similar climate change and development challenges. After the listed stocktaking, the feasibility of identified measures was assessed through expert observations and field visits. The potential measures were discussed with beneficiary farmers, and exclusively those measures were taken forward, which were endorsed by farmers. FAO technical team together with national experts subjected the selected innovations to a full Technology Feasibility Assessment, outlining for each selected innovations the innovation pathways and roll-out modalities via the following sections: required training/skills, prerequisites, relevance to addressing the most vulnerable, modality/steps for adoption, required monitoring and evaluation, source of manufacturing, potential external diffusion plan, scalability potential, cost-benefits, relevant national rules and regulations, associated risks, and technology alternatives. Some proven innovations require adjustment to the field; therefore, each measure was validated in the field. The full proposal development will include the final pathway and roll-out plan, including the abovementioned details.
- 60. Element 3 - Empowering actors to create ground for innovation uptake:** The proposed approach is grounded in community-driven process, therefore, the development of relevant organizations linking grassroots-level and authorities is the prerequisite of this Project. The key strength of the innovation design is that the proposed measures have already reached the acceptance of farmers through a tailoring process. Closely related to the previous Element (2), the rounds of the feasibility assessment of the identified measures were followed by several beneficiary consultations, where farmers investigated the proposed measures, selected the required ones, and expressed their opinions and needs. Based on their requirements, the design of the measures was finalized. All included measures are endorsed by farmers, therefore, the risk of acceptance was eliminated at the stage of Concept Note formulation. Maintaining this approach throughout the full proposal development and implementation help avoid the past pitfalls of innovations in the Old Lands, as previous processes of innovation roll-out failed to effectively speak to individual farmers. The project design involves mitigation measures to further eliminate the risks and nurture farmers' interest (please see Section E). At farmer level, the sensitization of communities has been already initiated through consultation. The consultations reached a social turnaround, when farmers defined the necessary interventions to make WUA more appealing (e.g. democratic election of Board, full responsibility of operation and maintenance, being contact point with market actors etc.). Likewise, women requested the better access to WFA and the improvement of organizational frame (e.g. denoting office, physical place for gathering etc.). Farmers pledged to support the innovation scale-out during the consultations. To exploit this potential and facilitate social learning, several activities related to capacity-building involve knowledge catalysing intervention (i.e. training module on information transfer). The WUAs and WFAs are or will be registered and linked to the Undersecretaries of Ministries (as immediate authority level) and extension service to support the formal operation.
- 61. Element 4 - Supporting gender equality:** Women tend to be more risk-averse than men, signalling a greater exposure to external factors. The involvement of women requires more stepwise approach that respects the somewhat longer pace of engagement. The explicit attention to integrating women's voices yielded innovative project design features during the Concept-Note development phase. The Project aims to ensure women's involvement and the integration of women's voices in all Project stages, from formulation stage to completion. Women are expected to be actively engaged in developing the full Project proposal, and especially the livestock activities and dairy farming under Component 2. During implementation, women are expected to be represented in the oversight committees, the innovation management, the project management, and the community-based organizations. Women are expected to be actively engaged in various Project activities and outputs, including marketing activities and training activities (as training facilitators and trainees). During implementation, women are also expected to be fully engaged in any monitoring, evaluation, or work-planning processes.
- 62. Element 5 – Harnessing the power of youth:** Agriculture, in particular crop production witnesses a trend of aging and youth exodus from the sector. The consulted communities portray this trend, as the average age of crop producing farmers exceeds 50 years. The consultation also highlighted that despite the large families (average 9 members per family), the average number of family members engaged in agriculture is less than one (0.5). Younger generations do not take up the line of agriculture. This is grounded partly in cultural background and partly in economic reasons. Farmers remain active throughout their lifetime, thus young generations inherit productive assets only in late ages. Given the low profitability of agriculture, other sectors are more appealing for youth. However, this Project has multiple entry points to integrate youth and harness their potential. Innovation, by nature, is a call for youth. The presented innovative measures entail an entire pathway that mobilizes other sectors and markets, such as research and development, prototyping, construction, service sector, information services etc. Also, the upstream markets (i.e. repair shops) and market outlets (i.e. crop purchasers, food processing sectors etc.) involve a range of indirect stakeholders. These sectors and markets are typically dominated by younger generations, therefore, the project will catalyse the benefits of youth through these entry points. Livestock sector represents an entirely different picture, as young women take active role in dairy production, especially in the processing phase of milk (i.e. cheese, butter). This inclusivity of the dairy products and the value-adding activities can employ and benefit young women. Youth is expected to participate right at the pre-design phase of innovative measures at both levels of full proposal development and project implementation.
- 63. Element 6 - Implementing the concept through development and application at lower administrative level:** This Project builds on rigorous targeting approach to amplify project impact. The lowest administrative levels are the villages and mesqas. Mesqas represent the traditional groups of irrigating communities, using the same section of irrigation infrastructure. Breaking up the pre-fixed setting of mesqas would meddle into the social structure. This Project, similar to other projects in Egypt, sets the mesqa as lowest administrative level and core development entity. The selection of application area considered the fact that this Project excludes the concept of 'trial and error' of innovations to minimize any risk. The selected area allows the planning of recall-correct-re-implement cycle, in case of need. Also, the bottom-up approach of innovation uptake requires substantial knowledge management, awareness-raising, and development of grassroots-organizations, which require direct and continuous interaction with farmers. This model of innovation roll-out is risk-averse, sustainable and inclusive. The suite-of-measures is, however, not fully compressed to the geographical extent of the mesqa but multiple activities reach beyond the physical boundaries of the two mesqas. Some measures are scaled at larger level than the mesqa (e.g. CSA practices, milk collection point and tuk-tuk, smart tractor use etc.), which will increase the number of direct stakeholders. As the project builds around community-managed measures, the project follows a bottom-up and participatory approach from the concept note development, the full proposal development to the implementation (*please see the roll-out plan in the next chapter*). Positioning the project evolution at lower administrative level and layering the geographical extents of measures address the described particularity of the target beneficiaries, vulnerable poor farmers in the Old Lands. Addressing lower administrative level also enables a direct and

personal interaction with beneficiaries, who can become the catalysers of innovation scale-out in similar setting through transferring lessons-learned to other farmers.

- 64. Element 7 - Implementing the concept in different types of environments:** The area selection process involved the criterion of developing two areas with differences in key features: rotational irrigation schedule in Beni Suef and continuous flow in Fayoum. As the project also aims to generate evidence for future, large-scale programmes, this substantial difference must be addressed to demonstrate success of innovations in different environments in the Old Lands. Like the configuration of Beni Suef, reliance on groundwater is a growing concern in Egypt, as groundwater extraction in the Old Lands is not sufficiently monitored and increasing number of farmers drill informal wells. Critical in understanding the feasibility of modern irrigation techniques (requiring high-frequency irrigation) is the impact on groundwater. Like the configuration of Fayoum, in areas relying solely on surface water, the impact of modern irrigation techniques on drain water availability must be evaluated. The project locations presenting different environments are, therefore, crucial to build national capacity and inform the planning processes.
- 65. Element 8 - Focused attention on integrating the monitoring, evaluation, and adaptive planning processes and on Component-level and Project-level knowledge management and diffusion to both internal and external stakeholders:** Monitoring and evaluation is key parameter of the innovation pathway. Not only the documented success but the occurring errors must be evaluated at specific measure and project levels. The establishment of peer board is necessary to regularly follow-up on the project results and keep the technical documentation up to date, in an iterative manner. This board operates at supervisory level, including the technical focal points of the Undersecretaries and the Ministries, academic focal points (representatives of ARC) and international agencies. The board membership will be defined during the formulation of full proposal, and presented in the Part III of the project document. To make the process more inclusive and transparent, the Innovation Management Platform is proposed as physical admin tool. Beyond the real-time evaluation of the project results, exit strategies, diffusion plans and master diffusion plan are prepared to accelerate the future innovation uptake of external stakeholders. To duly implement these requirements, the project framework includes measure-specific coordination of these activities as independent outcomes. Adding to it, Component 3 is designed to accomplish the upscale of the measures at national level.
- 66. Element 9 - Promotion of successful evidence and creating the pathway for scale-out:** The scalability of the measures rests on their inexpensive nature. While compiling the suite-of-measures, expected return ratio and affordability to poor farmers were the driving principles to avoid an on-paper profitable project. Without fulfilling these criteria, the proposed measures would not be sustainable and transferable in the Old Lands. As next step, innovation promotion acts at all project levels. Farmers have already committed the support to promote the innovations to farmers in external mesqas, as powerful tool to spread the innovation idea and support peer-to-peer learning. At decision-maker level, scale-out is supported with the preparation of scale-out plans, including a geographical roadmap of innovation transfer.

C. Roll-out of successful innovative adaptation practices, tools and technologies

- 67.** The roll-out of the innovative measures takes a bottom-up approach, as top-down development and transfer would not be easily adopted by poor farmers. Therefore, the empowerment of grassroots organizations is a starting point of the project, and proven measures will be gradually scaled up at authority level. This evidence-based approach starts with the direct collaboration of farmers, experts and research institutes to develop the prototypes, methods, practices and processes, which have proven history in other places. The components of suite-of-measures are different in natures, thus, they require different roll-out strategies to ensure innovation uptake at farm level. For this purpose, each measure is evaluated separately, making up the roll-out strategy: brief technical description, transferred management responsibilities, pre-requisites, adoption plan, external diffusion plan and potential for scale-out after the project.
- 68.** To support the external diffusion and scale-out after the project implementation, complex (online) Innovation Management Platform is proposed. The Innovation Management Platform will be jointly operated by the MALR and MWRI, as admin users. The open-access Platform will be the repository of the results of innovation deployment, relevant to climate change and the project sectors (all project outcomes, outputs, activities – including planning and evaluation reports; and knowledge products – including external workshop reports, training materials, guidelines, case studies, farmer-to-farmer demonstration videos, and lessons learnt). The two research centres of MALR and MWRI (namely Agriculture Research Centre-ARC and National Water Research Centre) will be responsible for collating and synthesizing the documented results approved by the peer board. This routing line will also enable the second-level review of the results, involving innovation experts and researchers. Joint management will also support the scalability of the Innovation Management Platform, as the centres will be able to integrate other than this projects' results on innovation deployment. The proposed mechanism will create a physical link between the sectors and institutions with different, but interconnected mandates. All measures separately and as-whole will entail the documentation of design and adoption processes, as well as the endorsed and validated plans and strategies of external diffusion and scale-out. The real-time and iterative monitoring and documentation of the project results are critical, as the suite-of-measures must be prepared for immediate technology transfer by the end of the project. To reach this goal, a technical board will be established for the innovation coordination (*please refer to the Chapter B*).
- 69.** Another considerable potential of the project scale-out is the alignment with Haya Karima, and the involvement of representation in the strategic planning. Haya Karima initiative was launched to make concerted efforts for the catching-up of the rural poor. As a strategic initiative in terms of territorial cohesion and balanced development, Haya Karima concentrates on rural communities, hit by the highest poverty rate. Vast majority of the rural communities relies on agriculture in Egypt, and climate change affects all, albeit to varying degrees. Haya Karima has already resulted in tangible outcomes in rural development, but mostly related to housing, health, WASH sectors and other public services. As Haya Karima is responsible for fund-raising, project designs and implementation, the transferred knowledge will support Haya Karima experts in replicating the results of this project.

Measure	Technical specification and unit	Management responsibility	Pre-requisites	Adoption plan	External diffusion plan and scale-out potential and limits
Small-scale trash and sand trap	<ul style="list-style-type: none"> Manual bar-screen (full metal with vertical screens) equipped with bridge to support crossing the branch canal. Small-scale compactor to facilitate trash deliver. Basin-like sand trap on the bottom of the main canal. Number: 1 structure in Brandola, 1 structure in Al-Garray, shared by all farmers in the mesqa 	<ul style="list-style-type: none"> One operator hired by the WUA, while supervision responsibility remains at the WUA to conduct the activity. The WUA collaborates with the local NGO responsible for solid waste collection to pick up the compacted waste in a timely fashion. 	<ul style="list-style-type: none"> No pre-requisites but safety measures during the design of the bridge must be respected (perpendicular fences). 	<ul style="list-style-type: none"> Final location co-selected with the communities. Technical design and specification/know-how conducted by the executing entity. Optimize the cost of manufacturing to reach affordable price for future consumers. Training on the use of system integrated into the activity targeting the WUA empowerment. ToRs of responsible person developed and handed over to the WUA. Contract signed with the local NGO to ensure the sustainable disposal of collected waste. Location for the compacted waste selected based on multiple criteria. 3 months roll-out period supervised by the executing entity to ensure the correct use and collaboration between the WUA and the NGO. 	<ul style="list-style-type: none"> Geographical extent: all branch and drain canals Beneficiaries: equal benefits to all Sector/market: Solid waste sector as per the nature of the intervention; manufacturing sector if the intervention will be embraced by other villages Manufacturing capacity: Sufficient local manufacturing capacity (village and governorate level), as the structure is small-scale and relatively easy to replicate. Level of diminishing marginal revenues: High trap density might unnecessarily increase the cost of operation. If the technology is adopted at larger scale (more traps along the canal), the design should be established as a network to optimize the cost.
Mobile solar pump	<ul style="list-style-type: none"> Autonomous mobile unit (solar panel and pumps) fixed on trailer Off grid design 1 main electric pump, 1 diesel pump as back-up 30 kW installed capacity, equivalent to 61,000 kWh per year energy production 18 m³/h discharge capacity 180 days/year irrigated day Number: 1 unit in Brandola, 1 unit in Al-Garray, shared by all farmers in the mesqa 	<ul style="list-style-type: none"> WUA responsible for the management, operation and maintenance 	<ul style="list-style-type: none"> Detailed quality plan: certification of procurement materials, in-built design, capacity scaling On-site operation, re-assembling Year-long supervision. 	<ul style="list-style-type: none"> Engineering activities and design calculations to create the prototype/know-how, along with supporting drawings and bill of quantities Site studies, detailed design concept and investigations. Inspection and pre-installation maintenance activities to ensure compliance with manufacturer's recommendations and applicable standards. Management documentation. Procurement and installation. Optimize the cost of manufacturing to reach affordable price for future consumers. Adjustment of management rules to the defined irrigation schedule. Definition of yard location. Definition of repair garage and building capacity of local technicians. Training for the WUA on the operation and maintenance. Supervision of the use of mobile units 	<ul style="list-style-type: none"> Geographical extent: all mesqas converted to modern irrigation. Beneficiaries: equal benefits to all Sector/market: manufacturing sector, renewable energy sector, pump manufacturers. Manufacturing capacity: sufficient manufacturing capacity at national level. Level of diminishing marginal revenues: solar capacity reaching beyond the irrigation water need increases the investment and requires the extension of supplied area. Capacity and size of unit should not exceed what is portable with a single trailer, using animal power or small-scale tractor.
Sustainable conjunctive water use	<ul style="list-style-type: none"> Centrally controlled and monitored well, replacing private wells Equipped with groundwater monitoring probe (level and conductivity logger, automated, equipped with communication device) Mesqa and marwa replaced with buried pipes 	<ul style="list-style-type: none"> WUA responsible for the O&M of the well, based on the newly established irrigation schedule. WUA responsible for the data 	<ul style="list-style-type: none"> Conduct 2-year long monitoring supervised by groundwater expert. Carry out periodic soil and water sampling to measure the salt-built up. If salinity level increases, 	<ul style="list-style-type: none"> Conduct soil and water sampling, and define the optimal location of the well. Define the technical specifications of the well. Carry out environmental impact assessment and obtain the license. Select suitable device for the monitoring, including multiple functions of level metering and conductivity measurement. Construct the well. 	<ul style="list-style-type: none"> Geographical extent: Old Land relying on licenced groundwater use Beneficiaries: all farmers Sector/market: - Manufacturing capacity: Local manufacturing and construction of well; provision of technical requirements of monitoring devices Level of diminishing marginal revenues: Deploying multiple wells would increase the risk of over-exploitation and make

	<ul style="list-style-type: none"> Irrigation schedule established to re-balance surface and groundwater use Number: 1 unit in Brandola, shared by all farmers in the mesqa 	<p>acquisition from the loggers, data transmission to the Undersecretary.</p> <ul style="list-style-type: none"> WUA responsible for the control of well use if the groundwater drops under the defined level. 	<p>modify the frequency of leaching requirement accordingly, and continue the monitoring.</p>	<ul style="list-style-type: none"> Define the location of the monitoring well, representative to the entire area. Set up monitoring well. Calibrate the devices to the local conditions. Carry out test run and pressure test of the well and the monitoring devices. Install the software with multi admin access. Carry out the trainings on O&M. Deliver the awareness raising campaign. Provide management training at national level. 	<p>monitoring more difficult. The concept of single and shared well will support better control of groundwater use.</p>
Moisture sensor	<ul style="list-style-type: none"> Inexpensive, handheld sensors, displaying the level of moisture and indicating the irrigation need or over irrigation. Number: 65 in Brandola and 80 Al Garay, equal access provided to all crop producing farmers in the mesqas 	<ul style="list-style-type: none"> The farmers as the owners of their sensors. WUA trained to provide supervision, support the troubleshooting and recalibration. 	<ul style="list-style-type: none"> Quality assurance and calibration process through the local laboratories of the University. 	<ul style="list-style-type: none"> Calibration of the sensor in the University laboratory. Training of farmers with field demonstration. Training of WUA on supervision, technical support, troubleshooting. Identification of local repair shops, retailers, laboratories for calibration. Distribution of the sensors; Supervision of the use of sensors. 	<ul style="list-style-type: none"> Geographical extent: agricultural areas Old Lands. Beneficiaries: all farmers. Sector/market: energy sector, if irrigation optimized by moisture observation. Manufacturing capacity: imported device, local calibration and repair. Level of diminishing marginal revenues: not relevant.
Modern on-farm irrigation	<ul style="list-style-type: none"> Combined system consists of drip irrigation during the summer season and sprinkler irrigation during the winter season. High-frequency and pressurized system Branched network with valves for each farm (35.75 in Brandola +53 feddan in Al-Garray) Equipped with pressure sensor, sand filter Connected to solar pump unit Number: 65 in Brandola and 80 Al Garay, equal access provided to all crop producing farmers in the mesqas 	<ul style="list-style-type: none"> Irrigation schedule controlled by the WUA. Operation and maintenance of laterals by farmers. WUA to assist farmers in maintenance issues. 	<ul style="list-style-type: none"> All parts of the system to undergo quality assurance, expert recommendation concluded, and certification of the suppliers issued upon the compliance with requirements. The system to undergo a test run and pressure test to avoid failure. Two seasons monitored to ensure the correct use and technology uptake. 	<ul style="list-style-type: none"> Prepare the technical specification and design of the system. Select and certify suppliers of the drip and sprinkler systems. Develop irrigation schedule based on the system requirement. Train farmers on the O&M and management of the system. Train the WUA on maintenance and supervision role. Install the system and conduct several test runs. Supervise the operation throughout 2 seasons. Conduct ex post impact assessment and draw conclusions. Conduct training for the authorities. 	<ul style="list-style-type: none"> Geographical extent: agricultural areas Old Lands. Beneficiaries: all farmers. Sector/market: Manufacturing industry due to the increased demand for modern techniques; energy sector due to the increased energy need. Manufacturing capacity: Manufacturing capacity available in the area to supply the demonstration. Scale-out plans require the careful review of the available suppliers at national level. Level of diminishing marginal revenues: the larger the system, the more vulnerable to diminishing capacities. Drip and sprinkler irrigation must be designed at or below the optimal energy use, otherwise, the pressure loss increases the energy need.
Smart tractor	<ul style="list-style-type: none"> Inexpensive, shared, small-scale and fuel-efficient tractor Equipped with simple, offline GPS to keep track on the works Equipped with the following auxiliaries: trailer axle, plough disk, harrower, cultivator, rototiller, and compactor 	<ul style="list-style-type: none"> WUA responsible for operation and maintenance and work schedule. 	<ul style="list-style-type: none"> Test run in the assembly-site. Test driving in the area trialling all auxiliary devices. 	<ul style="list-style-type: none"> Design the prototype machine/know-how with tracking equipment and auxiliaries. Provide technical specifications and expert recommendation to the manufacturer. Supervise the assembling process. Optimize the cost of manufacturing to reach affordable price for future consumers. Transport the tractor to the area, and assign storing garage. Identify repair services. 	<ul style="list-style-type: none"> Geographical extent: all lands. Beneficiaries: farmers. Sector/market: manufacturing and agricultural mechanization industry. Manufacturing capacity: sufficient capacity at national level. Level of diminishing marginal revenues: To reach return on investment, the tractor purchase requires joint investment, thus certain aggregation of farms.

	<ul style="list-style-type: none"> Number: 1 tractor in Brandola, 1 tractor in Al-Garray, shared by all farmers in the mesqa 			<ul style="list-style-type: none"> Train the WUA on the management and O&M, and provide a plan for carrying out the annual works. Supply accessories for decent work conditions (boots, gloves, hats, glasses etc.) and distribute the accessories amongst farmers. Train farmers on decent work conditions Train the driver. Supervise the test run and assess the satisfaction of farmers. Commission the tractor to the WUA. 	
Mobile silo	<ul style="list-style-type: none"> Small-scale, collapsible, rolling silos Silo body is of plastic with high thermal performance (maintains the grain quality, such as the permeability, transmission of heat, security locks, lifted height) Portable silo design (wheels) Weighing function Number: 80 in Al-Garray, equal access provided to all households in the mesqa 	<ul style="list-style-type: none"> Private household receive the silos. 	<ul style="list-style-type: none"> The prototype silo tested, as per the following criteria: heat transmission, resistance to water. 	<ul style="list-style-type: none"> Measurement of grain volume after harvest Sizing of silo dimensions. Selection of best materials to make silos weatherproof. Manufacturing the prototype/know-how and identify local manufacturers for serial production. Optimize the cost of manufacturing to reach affordable price for future consumers. Delivery of silos and demonstration of assembling. 	<ul style="list-style-type: none"> Geographical extent: households. Beneficiaries: all women. Sector/market: food safety. Manufacturing capacity: local manufacturing capacity available. Level of diminishing marginal revenues: not relevant.
Crop Zoning	<ul style="list-style-type: none"> Voluntary participation in harmonized production practices and zoning crops to adjacent areas Generated scenarios for multiple options of zones Number: 65 in Brandola and 80 Al Garay, equal access provided to all crop producing farmers in the mesqa 	<ul style="list-style-type: none"> Farmers as driving force of crop zoning. Responsibility of coordination of crop selection, agricultural and irrigation practices, and communication with retailers transferred the WUA, under the supervision of the undersecretary of the ministries. Project period provides technical support from established expert group under contracted assistance. 	<ul style="list-style-type: none"> The zoning assisted by expert group, responsible also for the scenario development. Project implementation period supervised by the expert group, covering at least 2 years trialling, including the 3 seasons (summer, Nile, winter). 	<ul style="list-style-type: none"> Sensitization campaign for farmers. Market actors identified based on multicriteria assessment and joint group discussion and negotiation. Sign agreement with research institute to develop know-how. Development of methodology for zoning, and provision of scenarios. Development of guiding practices along the crop value chain. First trial of the zoning under expert supervision. Conclusions, corrective measures. Preparation of scale-out plans and dissemination. 	<ul style="list-style-type: none"> Geographical extent: Old Lands. Beneficiaries: all farmers. Sector/market: Post-harvest and processing market benefit from the standardized and scaled production amount. The zoning directly contributes to the livestock profitability, in particular to dairy farming through the improved quantity of forage production. Manufacturing capacity: not relevant. Level of diminishing marginal revenues: The over-sized mono-cropping can increase the risk of pest manifestation, therefore, the optimal size of production area is preferred over the maximum size of area.

<p>Milk collection point and smart tuk-tuk</p>	<ul style="list-style-type: none"> • Small-scale facility equipped with cooling (not freezing) unit • Sterilized environment • Electric tuk-tuk with cooling box • Direct market access • Capacity: 500-800 l/day storing capacity • Number: 1 collection point and milk tuk-tuk in Dalas village (up to 250 women); 1 collection point and milk tuk-tuk in Al Garak village (up to 350 women); 1 tuk-tuk for grain transport in Al Garak, equal access provided to all farmers in Al-Garray mesqa 	<ul style="list-style-type: none"> • Dalas WFA in Beni Suef and newly established WFA in Fayoum. collection point. 	<ul style="list-style-type: none"> • The milk collection start off with “innovation accelerator” farms. • Gradual development increased number of participants to ensure that both supply and demand sides are sufficiently prepared. • Throughout the testing period, the awareness raising will be extended. 	<ul style="list-style-type: none"> • Create women survey and assess the willingness to participate • Conduct training for the WFAs to operate and maintain the system. • Create management plan based on participatory approaches, define women representatives, and prepare business plan. • Provide awareness raising campaign for women • Provide technical specifications and expert recommendation to the manufacturer of tuk-tuk. • Supervise the construction of tuk-tuk and provide prototype. • Document the prototype/know-how and optimize the cost of construction. • Construct the milk collection point and smart tuk-tuk. • Provide routing plan for the tuk-tuk. • Train WFA on the operation and maintenance of the collection point and tuk-tuk. • Train the drivers of the tuk-tuk. • Draft ToRs of the operators. • Conduct food quality sampling and testing to comply with food safety measures. • Connect market stakeholders through negotiation between WFA and buyers/retailers. • Supervision of the operation of collection point and tuk-tuk throughout a year. 	<ul style="list-style-type: none"> • Geographical extent: surrounding areas of mesqas • Beneficiaries: women working in livestock and dairy sector • Sector/market: dairy farming, dairy products. • Manufacturing capacity: Local manufacturing capacity sufficient to construct both the collection point and the tuk-tuk. • Level of diminishing marginal revenues: Large-scale facility requires the development of electricity grid, O&M costs of cooling facilities, and any market shock would lead to significant loss of profit.
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70. In principle, the roll-out of Component 1-2 will take the following chronological steps: (1) empowerment of grassroots organizations, (2) facilitation of market dialogue and stakeholder mapping, (3) design and development of overarching measures (improvement of mesqa distribution systems, trash traps and sand traps, crop zoning, mobile solar units, development of conjunctive water use, development of milk collection point), (4) design and development of single-standing measures (smart tractor, moisture sensors, silos, tuk-tuk), (5) development of community-training curriculum (CSA practices), (6) external diffusion and scale-out plans. The activities related to innovation management, coordination (peer board), monitoring and evaluation, as well as Component 3 will be conducted in parallel. The cornerstones of the future scaling (including the definition of adoption challenges, requires corrective measures, enablers of success and lessons-learned) will be measured through the WUAs and WFAs as representatives of farmers, such grassroots organizations will play an essential role in each step of the innovation pathways. The establishment of Innovation Management Platform is indicated under Component 1 and 2 on reasonable grounds. Project-generated evidence will come from ground-truth information, thus strengthening the role of grassroots level in the innovation pathway. As some roll-out processes are overlapping, the full proposal development will also provide a Gantt-diagram demonstrating how measures will be interconnected, based on which the schedule of project evolution will be designed.

D. Economic, social, climate, environmental and institutional effects and benefits

71. The Project focuses on building resilience to climate-induced water scarcity in Old Lands by introducing the suite-of-measures, spreading innovative adaptation practices. It will roll out and scale up its successes and challenges through coordination, collaboration, monitoring, evaluation, adaptive planning, vertical and horizontal internal and external knowledge management, and component-level and project-level diffusion plans, exit strategies, and scale-out strategies. The full proposal will provide a detailed description of all activities by outputs, as well as an Environmental and Social Management Plan, a Final Gender Assessment and Gender Action Plan, and more details on the expected beneficiaries.

72. The Table summarizes this Project’s expected effects and benefits. The quantified benefits are estimated based on consultations, fact-finding trips, field observations and technical dialogue. Wherever possible, the benefits are estimated as relative number to demonstrate both project-level gains and the potential of scaled-out measures.

Economic Benefits

Baseline in the two targeted areas:

- Less rain, more frequent droughts, longer and more intense heat waves increase water scarcity, decrease livestock productivity and affect agricultural yields, thus jeopardizing farmers' livelihoods and increasing the risk of food insecurity.
- Women purchase forage to feed cattle, while productivity and quality of milk product gradually decline.
- Farmers use increasing amounts of diesel at high cost to pump more groundwater to supplement the canal water.
- Farmers use increasing amounts of agrochemicals to keep soil fertile.
- Land is severely fragmented, which leads to loss of land, compromised agricultural and irrigation practices, and because of lack of economies of scale, farmers market power is low.

Expected economic benefits:

The FAO technical team conducted a preliminary cost-benefit analysis (economy; efficiency; effectiveness and equity) on the selected technological, concluding that:

- Buried mesqas will increase conveyance efficiency by 20 % compared to the existing earth canals, by reducing the evaporative loss, deep percolation and water use of aquatic weeds.
- Waste traps will improve the conveyance efficiency of the branch canal by 1 to 3 %.
- Drip- and sprinkler-irrigation will save up to 30 % of the irrigation water per land unit by reducing evaporation, runoff, and deep percolation.
- Drip- and sprinkler-irrigation will improve yields by 25-30 % due to better control of weeds and stable soil moisture at root level.
- Drip- and sprinkler irrigation will decrease the leaching of agrochemical and hence decrease the cost of agrochemicals used.
- Solar pumps will reduce energy cost of irrigation by 70 % compared to diesel pumps, in case of crops with low profit margin (e.g. maize), the profitability of crops can increase by 20-30 %.

Mesqa-level / farmers' benefits:

- Drip- and sprinkler irrigation combined with renewable energy will be developed in 35.75+53 feddan, benefitting 65+80 farmers, of which around 30 percent women farmers (10 percent land owner, 20 percent co-owner with brothers)
- The amount of land under cultivation due to canal lining/burying and crop zoning will increase, which, in turn, increases agricultural production volume.
- Crop zoning will facilitate the formation of larger, more economically viable irrigation units at mesqa level, which provides economies of scale and net economic benefits via enhanced agricultural production.
- Crop zoning will facilitate mechanisation for tillage and land levelling, increasing agricultural production and saving time
- The cost of maintaining diesel pumps will be avoided.
- Time and labour to irrigate crops will be reduced by using modern irrigation practices.
- The reliability, equity and flexibility of water distribution will be enhanced, due to the increased frequency of irrigation events and the pressure-based conveyance.
- Higher water quality will increase the lifespan of pumps.
- Use of smart tractor will reduce the cost of production by avoiding the need to purchase land management services (e.g. 600 EPG per feddan cost of soil compacting service saved) and could increase yields by about 5% (through better land management). Smart tractors can be used also in adjacent mesqas, thus the direct beneficiaries will exceed 150 farms.
- Productivity and incomes will increase via optimized climate-smart irrigation and optimized (CSA) agricultural practices (e.g., application of optimized inputs will reduce costs, increases yields, and thus increases income).
- Poverty will be reduced by reducing costs (e.g., diesel costs), increasing household incomes, enhancing food security, and enhancing the resilience of livelihoods.

Specific benefits to local women:

- Women (estimated 500 women farmers) will increase their income by 200 % by selling their products through the milk collection point at daily basis.
- Women will recover their weekly profit from 50 EGP to 200 EGP due to the higher volume of forage production.
- Improved irrigation services and modern irrigation will be equally available for women farmers, who own about 18% of the target areas and share with their brothers another 34% of the land.
- Climate smart livestock practices will decrease the heat stress on animals – if adopted, and will improve the milk quality and quantity.
- Milk collection point will create 4 jobs for women.

Specific benefits to youth:

- The development of innovative measures (i.e. prototyping the small-scale tractor, tuk-tuk, mobile silo etc.) will involve youth working in research centres and private companies as actors of designing, manufacturing and contracting.
- The technical specification of prototyped measures will be handed over to the partner entity (academia, private companies etc.), most likely managed by youth. The full know-how will enable youth to roll out the series production, thus supporting the scale out.
- The associated markets mobilized by the project (defined in the table in the previous chapter, under the title "External diffusion plan and scale-out potential and limits") are fertile lands for youth involvement, as they are mainly related to service and construction sector. Thus the project will stimulate further economic activity for youth.

Government and Private Sector Benefits:

- Government authorities, contractors, suppliers, distributors, and other market actors (e.g., farmers' associations) will gain technical and social knowledge and contract management experience, enhancing their employment prospects and job performance
- Contractors, manufacturing business, and suppliers' capacity will be enhanced to build groundwater wells, build mounting structures for solar panels, build/assemble smart tractors, supply materials (e.g., monitoring devices) and services to support modern irrigation during the Project period and scale-out plans

Social Benefits

Baseline in the two targeted areas:

- Farmers (especially downstream farmers) have insufficient access to irrigation water, which is further exacerbated due to climate variability and climate change
- Competition over increasingly scarce water resources generates local conflicts
- Vulnerable groups are particularly subject to severe, insufficient, and poor water quality, and food insecurity, negatively impacting their health
- Food loss due to inappropriate storage of grains remains high

Expected social benefits:

- A piped irrigation system can improve the equity amongst the water users, providing an equal amount of water to all farmers. Buried pipes will allow water to reach downstream plots, helping to reduce poverty and increasing the food security for all. As the most downstream farmers are the most vulnerable to disrupted access to water, the Project supports the groups most exposed to water scarcity.
- Developed trash traps will be equipped with bridge to facilitate crossing of branch canal, which will benefit the most vulnerable (e.g. women, community members with underlying health conditions, elderly).
- Increase in collaboration between farmers (especially via WUA or farmers' associations), in line with the GOE's policy of integrated irrigation and water management.
- More reliable water and smoother flows will save time, which can be allocated to other productive community activities.
- Health and hygiene will improve given that water quality is better protected from chemical and/or microbiological contamination
- Vulnerable groups will have access to reliable water for agriculture and other purposes, supporting better food security, health, and livelihoods for all.
- Spontaneous diffusion of the above listed social benefits will be realized in directly adjacent mesqas, as neighbours observe the benefits. And peer-to-peer learning (social learning) will be further supported through farmers' empowerment during capacity-building
- Additional incomes can cover family health and education costs, the purchase of higher quality food and assets, or new business start-ups.
- The format of the community-level trainings will respond to the needs of illiterate members, as most vulnerable, through preferring vocational trainings and chat software.
- Innovation promotion facilitated by farmers will benefit all adjacent mesqas that directly surround the selected mesqas, as farmers in direct proximity can observe the innovation deployment.
- CSA specific trainings are transferable to adjacent mesqas with similar features, resulting over 400 direct beneficiaries. If CSA is incorporated to FFS, the number of indirect beneficiaries will be higher.

Specific benefits to local women:

- By ensuring that women and men are equally consulted and engaged over the Project cycle, gender equity and sustainable development will be promoted
- Women will be empowered through new knowledge and skills and enhanced livelihoods, promoting their decision-making role
- Piped irrigation system will increase the integration of women into irrigation and cropping by eliminating the disputed tasks around irrigation (most importantly, working in pump sump and cleaning of canals). Consequently, Women can operate the modernized irrigation works, which supports their empowerment at household and community level.
- Empowerment of the Women's Farmer Association, with membership averaging 250 local women per mesqa (500 in total)
- 80 households will be equipped with improved silos to reduce food loss, which can save up to 20 % food from several factors (insects, rodents, humidity, heat).
- WFA can act as an information hub to bring women together and enable information and knowledge exchange.

Specific benefits to youth:

- Young women already involved in dairy farming will benefit from the improved profitability.
- The accumulated knowledge on innovation development (research and development, prototyping, repair services etc.) will enhance the capacities of youth involved in project relevant sectors.
- The innovation in agriculture will strengthen the link between the agriculture and service sector/research, thus providing opportunity to youth to re-enter and develop agriculture sector.

Climate Change Adaptation Benefits**Baseline in the two targeted areas:**

- Less rain, more frequent droughts, longer and more intense heat waves, flash floods, and more salinization increases vulnerability, negatively impacts agricultural production, health, and livelihoods of farmers.
- Food insecurity risk increases.
- Climate change increases the water demand, thus increasing the need for additional energy.

Expected climate-change adaptation benefits:

- The irrigation and agricultural sectors will be more productive and be more resilient and adapted to the future climate.
- Project beneficiaries will strengthen their adaptive capacities through climate-smart on-farm irrigation assets and practices, climate-smart agriculture, and climate-smart livelihood activities.
- A broad range of internal and external institutional and local stakeholders and beneficiaries will strengthen their adaptive capacities through smart partnerships, the capacity development programs, and the use and availability of climate-smart / multi-sector knowledge products that are widely disseminated/diffused.

Environmental Benefits**Baseline in the two targeted areas:**

- Low irrigation efficiency wastes water resources.
- Irrigation water is not sustainably managed, including groundwater.
- Environmental degradation continues due to droughts, floods, excessive use of groundwater, excessive use of inputs, and insufficient management of polluted (agricultural) wastewater.

- Low quality of drainage water increases the salinity of irrigation water and pollutes the ecosystem (Quaron Lake in Fayoum).

Expected environmental benefits:

- Water-use efficiency and sustainable water management will be enhanced through application of efficient water-use techniques (canal lining; irrigation scheduling; soil moisture monitoring, modern drip- and sprinkler-irrigation; groundwater management)
- Combining soil moisture sensors with modern irrigation techniques will improve the water balance at local level (e.g., the amount of water applied will closely reflect the water required)
- Land management and agricultural practices will be more sustainable: CSA practices applied, salinity of soil and groundwater is managed. The CSA options including mulching, crop resilient varieties, integrated pest management, optimized fertilizer use will enhance the sustainability and maximize the productivity and utility of the land and water units. For instance, by optimizing the use of agricultural inputs (e.g., fertilizers and pesticides), water and land quality will be maintained or improved. Using mulching will prevent the erosion of topsoil and dust-forming.
- Small-scale tractors in support of good agricultural practice will improve the soil fertility and water retention capacity by turning and keeping crop residues in the soil.
- Certified, resilient seeds recommended by ARC will reduce the water demand of cropped area.
- Access to clean irrigation water will be increased, resulting in higher agricultural production
- By optimizing fertilizer use, the soil restoration capacity will improve.
- A single, shared and monitored centralized groundwater well to serve each mesqa will support a more sustainable use of groundwater
- By monitoring salt accumulation and salinity, water quality will be managed as needed (e.g., through flushing the excess salinity)
- Using solar energy will replace or reduce the use of other more polluting, non-renewable energy sources; solar pumps will reduce greenhouse gas emissions and decrease the risk of water and soil pollution from accidental spills

Institutional Benefits

Baseline in the two targeted areas:

- Weak institutional capacity of local associations, government entities, and private sector remains.
- Weak institutional knowledge management remains.
- Dysfunctional grassroots organizations (WUAs and WFA) keeps operating without the involvement of farmers.

Expected institutional benefits:

- By selecting villages included in the Haya Karima initiative, synergy between different development efforts will be supported.
- The capacity of institutions (from local to national) will be strengthened through training, demonstrations, and guidance materials (government, local institutions, other types of institutions, e.g., contractors).
- Re-established grassroots organizations will integrate farmers, system-level infrastructure will be managed by farmers' organizations, representation of farmers will improve. Full management transfer will be enabled.

73. The suite-of-measures were defined based on need and vulnerability assessment, with particular emphasis on the most vulnerable groups (women, youth, and illiterate women). Activities (including alternative activities), definition and design of measures, targeting tools, learning methods have been defined to support the most vulnerable (i.e. landless women, youth exiting crop production, illiterate women hampered in learning, etc.) Accordingly, this Project addresses systematic inequalities and supports a transformative process. The suite-of-measures approach along the entire value chain enables the adaptation to different impacts of climate change at the same time, so they reinforce each other's effect. This approach also provides roles and direct benefits for the most vulnerable. The innovation pathways support the involvement of larger scale beneficiaries, including youth positioned at the heart of innovation development. The objective and effectiveness of measures to support adaptation were assessed individually to assure that measures targeting most vulnerable groups provide equal benefits. This Project includes shared and individual measures to address the vulnerability through equal access to project benefits. To further avoid the maladaptation, this Project incorporates multiple outputs and activities on capacity-building and institutional development of farmers' organizations (WUAs and WFAs). This will include also the reorganizations of the existing associations (2 WUAs in the mesqas, 1 WFA in Dalas village, establishment of WFA in Al-Garrak), putting them on inclusive footing, capacity-building on roles and liabilities, decision over the financial management). This will support the full transfer of management responsibilities to farmers both in cropping and livestock sectors and strengthen their representation power to reach out to support in case of need (extension services, undersecretaries, research centers etc.). This Project will ensure that all farmers exercise their rights and become active member of the associations. The shared infrastructures are designed with the capacities and scales, which allow an inclusive access in equitable manner. The Table on innovation pathways in Section C demonstrates the quantities, scales, capacities of the measures in alignment with the number of beneficiaries defined in Section A. The individual measures (i.e. drip and sprinkler system, moisture sensor, silo etc.) are already quantified as per the number of beneficiaries of the project. All farmers will have access to receive and own these measures. The project will also create an enabling environment by mobilizing and preparing the relevant sector and market actors (please see the Table on innovation pathways in Section C - External diffusion plan and scale-out potential and limits). Initial mapping of the existing capacities has been already conducted in both areas, but the full proposal will apply further multicriteria assessment to select the most appropriate sector and market actors. This will also allow the full assessment of youth groups, who will be involved in the project. By putting emphasis on the assessment and capacity-building of these actors, the use of project results and support for the maintenance will be guaranteed over long term. Hence, the project will amplify its vulnerability-reducing impact also beyond its implementation period. All project activities are accompanied with stakeholder-targeted capacity-building and monitoring mechanism to assess the success of innovation uptake and provide sustainability (please see Section I on knowledge management). The equitable distribution, the strengthened grassroots organizations and the capacity-building together will warrant that vulnerability will be consistently reduced in the case of all beneficiary groups and no potential conflict will arise throughout and beyond the project life cycle.

74. Some measures reach beyond the mesqa communities (CSA practices, market dialogue, small-scale trash traps etc.), and they will provide benefits at scale. As far as capacity-building programmes are concerned, the learning tools (i.e. use of chat software, vocational training etc.) are designed to provide equal access to other communities where the measure is geographically feasible. As far as structural measures with large-scale impacts are concerned, the infrastructure (trash trap, sand trap, compactor) is defined and designed in a way that bring only positive impact to non-beneficiaries (i.e. trash removed from branch canal will be a benefit for more downstream mesqas). None of the

measures will entail negative externalities what would increase the vulnerability of non-beneficiaries. The project will facilitate the peer-to-peer learning by equipping farmers with knowledge to exploit channels of informal knowledge transfer, thus supporting vulnerable, non-beneficiary groups.

- 75. Initial Gender Assessment (IGA).** Egypt's Gender Development Index (GDI) stands at 0.882 and Gender Inequality Index (GII) at 0.449. In brief, gender inequalities are still common, especially in rural areas. Women face limited access to land resources, extension programs, financial credit, and job training; women generally have longer work hours, and a large share of all unpaid work; and women are underrepresented in decision-making positions and in government, especially local government. Climate change could increase the existing gender gaps. Egypt, however, expects its GII to reach 0.367 by 2030, given its commitment to gender equality. Egypt scored 0.639 (rank #129 of 156) in 2021 in the Global Gender Gap Index (GGGI) of the World Economic Forum³⁸, Egypt scores high in sub-indices for 'educational attainment' and 'health and survival' specifically showing very strong improvements in 'educational attainment' between 2006 and 2021. However, women in Egypt can be considered significantly behind men in the 'economic' and 'political empowerment' sub-indices, being underrepresented in the (formal) labour force and in political decision-making positions.
- 76.** According to the Khafagy (2020), violence against women and girls (e.g., sexual harassment in public places and domestic violence) is a chronic problem. Some 3 of 10 married women between 15 and 49 years were exposed to physical, psychological, and sexual violence by their husbands. There is little training on gender equality, women's human rights, and the protection of women from violence. There is no comprehensive Egyptian law prohibiting all forms of violence against women and girls (which would need to deal with prevention, protection, services/support, and judicial procedures). The Personal Family Status Law (family code), including amendments in 1929, 1979, 1984, 2000, and 2004 discriminates against women, and supports patriarchy. It still assumes that men provide for their families; women are therefore subordinate to their husbands; it gives men the unconditional right to divorce, whereas women must go to court for a divorce; men can have four (4) wives; a divorced wife loses custody of her children, if she remarries; wealth accumulated during a marriage is not shared. Women must fulfil household chores and take care of family members.
- 77.** Egypt ranks #146 (with a score of 0.421) in the sub-category of Employment and Participation in Economy of GGGI. Only 6 million Egyptian women (20%) participate in the formal labour force, compared to 22 million men (75%). Only 7% of senior positions (e.g., senior officers and managers) are held by women. Women have a higher unemployment rate (22% vs. 7% for men) and women are more often employed on a part-time basis (21% vs. 12% for men). However, men make up a larger share of the workers in the informal sector (66%) compared to women (53% of women participate in the informal sector). Of note, the Egyptian Labour Law excludes many workers, especially in areas where women are the dominant workers. The excluded groups are workers less than 18 years, informal sector workers, domestic service workers (98% women), agricultural workers, and street vendors. These workers are therefore not covered by social insurance. Women also do most of the unpaid work (35% of this work in 2018), compared to men (only 6% of the unpaid work). Poor women do a lot of this non-waged work, with estimates that 43% of poor women work for the family without pay (whereas only 8% of men do this non-waged work)³⁹.
- 78.** This IGA was initiated during the Project concept development period, as an entry point for mainstreaming gender over the entire Project cycle, from Project concept to Project completion. The two project areas host communities who rely on agriculture income, with poor or no access to other diversified incomes. Women of different age cohorts were represented during the consultation, ranging from 19 to 92 years old members. As starting point of inclusive project design, the illiteracy rate is high, reaching up to 80 percent in Fayoum, which requires tailored design of training programmes. Most vulnerable women were consulted separately, including elderly, widowed and pregnant women. In overall, women are landowners in less than 40 percent of the area, including farms co-owned with brothers. Only 18 percent of the area is owned by women without male co-owners.
- 79.** Local women explicitly indicated that they participate in a significant manner in various agriculture activities, as 93 percent contribute to agriculture, mostly in the following activities: protecting water quality and disposing of agricultural wastes (90%); cropping (=sowing) (86%), harvesting crops (82%); raising birds, rabbits, and poultry for household purposes (82%); breeding and fattening calves (70%); manufacturing dairy products (93%); selling agricultural products and other manufactured goods at the market. The activities in which women do not participate are land preparation, land service with heavy machines and irrigation. Notable that women are not allowed to take role in irrigation management due to the current system configuration. Irrigation requires preparatory works, such as mesqa and marwa cleaning, set-up of diesel pumps in the sump. Such physical works would require the clothes rolled up, which is culturally not acceptable. Closely related to the limited role in physical operation of the irrigation system, women are less represented in WUAs. By Law, only the farmers (owner or renter) of the mesqa can be members of the WUA. However, women own only very small portion of the lands in the two mesqas (less than 18% in Brendola and less than 10% in Al-Garray) due to two main factors: families follow patrilineal system and inherit lands to male children; Islamic inheritance law provides a female child only half the inheritance of a male child. Hence, the representation of women in the WUA is limited to the number of female owners. This disproportion is well recognized and mitigated through the project design. Insisting on a mixed-gender WUA would easily result in discords due to cultural norms and would require the change of legislation. A more powerful approach is the empowerment of existing women farmer association (WFA) in Dalas village (Beni Suef) and establishment of WFA in Al-Garrak village to provide parallel development of grassroots organizations (WUAs and WFAs) and equal access to benefits.
- 80.** The integration of women into any agricultural cooperative is low due to logistics issue. For the same reason, women have disrupted access to market, although selling agricultural products (mostly dairy products and vegetables) is their main income. Results show that only 8 percent of women indicate that market is in walking distance, and 92 percent requires transportation facility. 66 percent of women use tuk-tuk to reach market.
- 81.** Local women noted that the local climate had changed, observing the extreme hot waves in the summer (*please refer to the Part I – Vulnerability of selected areas to read the gender-disaggregated climate change analysis*). The women mentioned that they feared that agricultural productivity and household income would decrease because of climate change. Local women identified the type of climate-adapted activities that are of interest to them. These include generating income for the family; the production and value chain of dairy sector; obtaining training in marketing; training on climate-smart practices in livestock sector; adaptation to climate change.
- 82.** The gender-targeted interviews and consultations with women were fundamental for paving a way for participatory project design. While the expert-based assessment of potential innovation measures presented more interventions in livestock and dairy sector, women expressed their concerns about multiple measures. Such measures were then eliminated from the list, as they would have been too much

³⁸ World Economic Forum. 2021. Global Gender Gap Report (GGGI). See: http://www3.weforum.org/docs/WEF_GGGR_2021.pdf

³⁹ Khafagy, F. 2020

of a risk during the project implementation. Women appear to be more risk-averse than men. As their works in crop production are mostly informal and not paid, women solely rely on the income from animal production. There is a general reluctance to accept measures that directly affect the animals due to the already high animal mortality and high price of calves. The participatory design of the project enabled the definition of the activities, in which women farmers can take active role and realize tangible and equal gains. This Project will maintain a rigorous monitoring of women' participation to eliminate any risk of potential setback (please see the details below).

83. To address the inequalities, the Project integrates women into different components: the new, piped configuration of irrigation system won't require the roll-up clothes, as canals will be eliminated, so landowner women can be integrated into irrigation; the activities on on-farm crop production will put high emphasis on increasing the volume of forage, so livestock profitability will improve; the activities on livestock keeping will provide climate-smart practices to support the climate change adaptation of livestock sector, so livestock productivity will increase; the activities on milk collection and transportation will enhance the profitability of dairy products and access to markets, so women will increase their income; the empowerment of WFA will support the better integration of women into gender-specific association, so women representation in agricultural value chain will be sound (please see the role of WFA in gender empowerment below).
84. Equity and access of project benefits were the driving principles of the project approach, embracing the entire value chain. Women already dominate the dairy production, where men have marginal or no contribution. Yet women's full potential along the dairy value chain is unexploited due to the lack of storage and transportation facility. Also, women are less powerful as they act as individual entities without meaningful cooperation. The establishment and institutional development of the WFAs in both villages will be the accelerator of improving women's representation. While individual women might be forced to compromise their benefits (i.e. the only milk purchaser in Dalas village is a male who has direct access to larger markets), joint representation in the sector and market will lift women out of the susceptibility to deprivation. Furthermore, the physical infrastructure (milk collection points, tuk-tuk vehicles etc.) will be commissioned to the WFAs, thus increasing the productive assets of women. Infrastructural development targeted to women is a key element of the gender strategy, as female children are most often excluded from the heritage of lands and agricultural assets.
85. Also, the activities related to the coordination of this Project will maintain fair gender balance, such as the representation in established technical board. To ensure women's participation in the project, monitoring mechanism will be set up. The Project will hire gender focal point to ensure that women area properly involved, and benefits are equally shared. Also, women focal points will be appointed in both executing entities, who will oversee the implementation and take actions, if women participation is at risk in any of the project activity. Also, the full proposal will include a full Gender Assessment and Gender Action Plan (please see section N). The Action Plan will define gender quotas with qualitative indicators including but not limited to representation and memberships, market power, increased knowledge, and ownership of productive assets. The Action Plan will define a monitoring protocol to be duly documented over the project's lifecycle.

E. Cost-effectiveness of the project

86. The cost-effectiveness of the suite-of-measures approach was a key consideration during the screening of measures. As the project aims to roll out innovations to poor farmers, the affordability is the cornerstone of adoption and scale-out potential. In this Project, the term of "affordability" includes both investment and running costs. As innovations entail additional costs, such as research and development, testing, monitoring and evaluation, corrective measures, it is expected that the cost of the measures will gradually decrease after the development/adjustment of prototypes/processes/practices in the context of the application area.
87. The selected approach of suite-of-measures proves to be more impactful and inclusive than taking the approach of isolated technology/process/practice development. In case of isolated innovation, the group of target beneficiaries would dramatically decrease. Also, isolated innovation would respond to a restricted scope of climate change impacts and leave irrigation and agriculture development in their silos. As this Project focuses on innovation and generation of evidence, the scale-out potential would drop.
88. The other merit of the approach which makes it more cost-effective compared to other approaches is the community-managed measures. Providing shared investment can significantly improve the return rate of investment and lower the unit cost of operation. It also decreases the cost of operation and maintenance per farmers, so the measures will be sustainable after the project implementation.
89. Investment and long-term cost-effectiveness largely depends on the degree of farmers' engagement. Traditional farmers in the Old Lands often do not have the means to capitalize innovations due to the lack of resources, insufficient information, missing technical support, scarcity of learning tools etc. Consequently, traditional farmers in the Old Lands embark on innovation deployment with some reservations or withdraw. The Project acknowledges this risk and has mitigation measures in-built. The selected measures are the results of a multi-layered process (combined bottom-up and top-down), involving the interaction of experts and farmers. The selection of measures was an iterative process, where expert group conducted the vulnerability and need assessment of farmers in the context of climate change and livelihood. A list of potential innovation measures was proposed, and feasibility assessment was conducted by the expert group. The feasible measures were subjected to the assessment of farmers in multiple rounds of stakeholder-group consultations, including the in-depth presentation of each measure and project intervention. Based on investigation, dialogue was initiated about the following main topics: acceptance and relevance of the measure; need for design modification; foreseen benefits and advantages; role and contribution of the measure to improve resilience and livelihood; role of youth and community for further development and scale out; required training, training methods and learning tools; recommendations on scale-out to other places. The final design and innovation pathway were finalized by expert groups and validated by farmers. To address the knowledge gaps of farmers, capacity-building programmes are mainstreamed into component and provide training related to each project activity (please see the description of programmatic trainings in Section A and the proposed trainings per measure in the table of Section C. Beyond the structured trainings, the project supports the informal transfer of knowledge by empowering beneficiary farmers. To this end, farmers expressed their desire to promote the implemented measures during the consultations. Finally, an important aspect to mitigate the risk of non-engagement is the continuous monitoring and cooperation with farmers. The active involvement of farmers has been maintained from the beginning of the project formulation. The project logframe and its activities have several interventions to keep their strong commitment (i.e. participatory design and implementation, empowerment of grassroots organizations, M&E of knowledge management, activating farmers' potential in knowledge transfer, etc.). This together will lead to a strong engagement that will ground innovation in socially enabling environment, where farmers are committed to take and maintain the project results.

- 90.** Through the project formulation process and the project design, the consultation outcomes guided the mitigation measures in terms of innovation uptake, risk of failure and risk of financing. The initial results will be further developed into a mitigation plan throughout the full proposal development:
- Risk of innovation uptake (No/low expected risk) – mitigation measures: 1) Implement interventions that were either proposed or approved by the local community.; 2) Manage risks related to uptake through appropriate and substantial training.; 3) Integrate the conditions set by farmers (i.e. farmers accept crop zoning if market actors are identified).; 4) Empower the Women’s Farmer Association to take on new tasks through awareness raising, training, and development of a business plan.; 5) Integrate efficiency principles into the Project interventions.; 6) Tailor the design of the measures and take corrective measures/modifications if required; 7) Demonstrate benefits and advantages over the design and implementation phases (i.e. comparative assessment to show farmers the attained gain through pre- and post-conditions).
 - Risk of innovation failure (Low expected risk) – mitigation measures: 1) Ensure that O&M contracts are signed or revised, as needed (i.e. contracts with upstream sectors, manufacturing company etc.); 2) Assess capacity of local suppliers and services, certify compliant suppliers and services, and put beneficiaries in contact.; 3) Provide adequate supervision and corrective actions during any testing period.; 4) Collaborate with the appropriate actors with excellency in the field (i.e. soil moisture calibration with local university lab, development of crop zoning method together with the academia).; 5) Provide adequate training to indirect stakeholders to conduct their new tasks (i.e. train manufacturers on repair and troubleshooting, distribute technical documentations widely).; 6) Provide coordination mechanisms or tools (i.e. irrigation schedule and a schedule to share the tractor).; 7) Transfer the management of innovation to the right organizations and empower the organizations (i.e. management of shared measures to WFAs and WUAs.).
 - Risk of financing (Low expected risk) – mitigation measures: 1) Assess the cost benefits of each measure individually, and eliminate the measure if cost outweigh the benefits.; 2) Provide reliable interventions with clear cost savings (e.g., solar powered irrigation helps reduce energy costs and better guarantees a stable and reliable on-farm energy supply).; 3) Train stakeholders to perform their new functions, including timely maintenance.; 4) Train local repair shops to comply with technical specifications; 5) Optimize the costs of prototypes based on the first-hand manufacturing experiences.; 5) Provide small-scale devices that are inexpensive and easily purchased (e.g., soil moisture sensors; mobile silos).; 6) Conduct mapping of reliable service providers and monitor them.; 7) Assign and involve multiple actors with the same function to avoid the establishment of monopoly.
- 91.** Regarding the Component 1 on development of water distribution system and monitoring, the total investment of structural measures, excluding the prototype development costs, amounts 300,000 USD per area. This includes both the system and farm-level development on over 80 feddan, considering a community-level infrastructure. Considering only the yield increasing impact of modern irrigation and cost reducing impact of solar irrigation, even crops with low profit margin (e.g. maize) can generate around 120,000-140,000 USD additional income per year per 80 feddan. In case of more profitable crops, such as potato, the return is faster. This means that the return on investment is envisaged in short-term. If the project takes the approach of development of single farms, the system configuration would consist of earth or lined canals, individual pumps per farm, development of main and lateral pipes of drip system per farm. Due to the purchase of individual pumps, the estimated cost of individual farm development would increase to 280,000 EGP in 80 feddan, compared to the current 140,000 EGP in 80 feddan. This would, however, include only the drip irrigation system without improving the distribution system, providing renewable energy and monitoring system. Also, this would require the purchase of diesel pumps, as there is no access to electricity grids in the areas. Both the investment and cost of system operation (operation and maintenance) would put financial burden on farmers. Also, only the yield increasing impact of drip can be considered, so the profit increase of the 80 feddan would be around 90,000-100,000 USD. Consequently, developing infrastructure at community level proves to have higher return on investment.
- 92.** Regarding the Component 2 on crop zoning and climate smart practices, the total investment amounts 200,000 USD, including the development of the framework of crop zoning and CSA practices. Once the practices and process developed, the cost of investment and running costs will diminish to zero, and practices can be adopted without entailed cost. An alternative of the crop zoning would be the full land consolidation, entailing the allotment planning, changes in and registry of ownerships and allocation of public land reserves for compensation. It would, however, not solve the problem of production volume at community level, as it would consolidate only the lands owned by the same person. As public lands are not likely available in the Old Lands to support land banking, the compensation should be located in the New Lands. Reclamation and purchase of lands in New Lands has a cost of 9,000-12,000 EGP per feddan. In contrary, once the framework established, the cost of crop zoning includes only the negotiation and sensitization of farmers. Consequently, improving production volume and making farming climate resilient without changing ownership structure is more profitable.
- 93.** Regarding the Component 2 on milk collection point with tuk-tuk, the total investment amounts 200,000 USD per area, excluding the capacity buildings and awareness-raising campaigns. The cost of tuk-tuk is expected to reduce once the prototype is developed and design is handed over the manufacturers. Such investment enables the gradual increase of capacities without increasing the cost of operation. At project stage, 250 women per area are expected to join milk collection point, and trainings on CSA practices. Considering the reduced loss of raw milk and selling milk at market price, the annual income of 250 women reaches 180,000 USD. An alternative approach would be the increase in number of animals per household to compensate the reduced productivity. However, this would not solve the problem of marketing and food safety. Only the investment in stall extensions would cost 50,000 in a project area (considering as little as 200 USD investment per stall). In lack of sufficient volume of forage production, the additional forage per animal would cost 140 USD annually, and this would almost turn into negative profit. Considering the limit space for the extension of cattle population, this option would entail further hidden costs, e.g. local capacity of veterinary. Consequently, approaching the dairy sector from the productivity of animal and market side proves to be more profitable.
- 94.** The full proposal development will include a scenario analysis of investment return, calculated per measure. This will prove the eligibility of individual and suite-of-measures in pro-poor context.

F. Consistency with national sustainable development strategies

- 95.** The Project is expected to contribute to various Sustainable Development Goals (SDGs): 1 (poverty); 3 (good health and well-being); 5 (gender equality); 6 (clean water and sanitation); 9 (innovation and infrastructure); 10 (reduced inequalities); 11 (sustainable cities and communities); 13 (climate change); and 16 (peace and justice).
- 96.** The Project supports Egypt’s adaptation to climate change. Egypt was one of the first countries to endorse the global efforts to address climate change threats based on the principles of equity and common-but-differentiated-responsibilities-and-capabilities. It ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1994, the Kyoto Protocol in 2005, the Paris Agreement on climate

in 2017, and the Doha Amendment in February 2020. Egypt submitted its initial (1999), 2nd (2010) and 3rd (2016) National Communications to the UNFCCC. The 4th National Communications is under preparation, with expected completion date of December 2022. It submitted its Intended Nationally Determined Contribution (INDC) in 2015 and communicated its Nationally Determined Contribution (NDC) to the UNFCCC in 2017, which was activated in 2020. The INDC/NDC have a strong focus on adaptation, conditional and dependent on international financing. Egypt submitted its first Biennial Update Report (BUR) in 2018. This Project supports Egypt's climate change adaptation objectives. In addition, the Project supports and is consistent with various pillars and objectives identified in Egypt's sustainable development strategies. The Table summarizes the consistency of the Project with Egypt's Constitution and sustainable development framework, using the pillars and objectives identified under each listed national policy/strategy. A detailed version of this assessment is available and will be appended to the full proposal. The Project fully aligns with and directly feeds into the national initiative Haya Karima, working towards the most vulnerable in Egypt.

Table 1: The Project's Consistency with Egypt's Constitution and Sustainable Development Strategies

Strategy	The Project's Consistency with the Pillars and Objectives of Egypt's Framework Documents
Constitution of The Arab Republic of Egypt 2014 (unofficial translation) ⁴⁰	The Project addresses various Articles of Egypt's Constitution, for example, the provisions related to 'equity'. Article 11 of the Constitution seeks to build a just society that guarantees citizens equal rights and opportunities and commits to achieving equality between women and men. Article 29 states that the State shall protect and expand agricultural land and shall criminalize encroachments thereon. It shall develop rural areas; raise the standard of living of their population and protect them from environmental risks; it shall strive to develop agricultural and animal production and encourage related industries. Article 46 states that every person has the right to a sound healthy environment and that the State shall take measures to protect and ensure not to harm the environment and ensure a rational use of natural resources to achieve sustainable development.
Arab Republic of Egypt: A Poverty Reduction Strategy for Egypt (published in 2004)	The Project addresses the poverty-reduction strategy pillars focused on optimizing resource use to optimize income (e.g., through higher agricultural productivity), reducing unemployment and inequities, increasing capacity through knowledge development, strengthening the social safety net and food security, and protecting the vulnerable in the agricultural and irrigation sectors, where there are many poor and unpaid workers.
Sustainable Agricultural Development Strategy towards 2030 (published in 2009)	The Project directly addresses the strategy pillars focused on promoting sustainable use of agricultural resources (water and land units), increasing the productivity of land and water units, strengthening food security, developing animal production with a gender sensitive approach, improving livelihoods (including attention to marketing), and encouraging the participation of stakeholders (farmers, the poor, rural women, and farmers' associations).
Sustainable Development Strategy (SDS): Egypt Vision 2030 (published in 2016)	The Project addresses the strategy pillars focused on supporting inclusive economic development, efficient use of energy resources (e.g., through solar pumps), expansion of sustainable water systems, integration of environment into agriculture and irrigation, social justice (e.g., equitable access to water), reducing gender gaps, knowledge development and innovation to face climate change, and quality education/training.
National Strategy for Adaptation to Climate Change & Disaster Risk Reduction (2011)	The Project addresses the strategy pillars focused on applying climate-smart irrigation and climate-smart crop agriculture to improve irrigation techniques, increase water-use efficiency, and continuously improve agricultural productivity (including through climate-smart soil management practices), while also addressing the climate-change-adaptation capacity needs of local farmers.
Medium-term Sustainable Development Plan 2018/2019 – 2021/2022	The Project supports this plan by reducing the percentage of the population below the poverty line, increasing the participation of women in the labour force, and reducing unemployment at 2 mesqas.
National Strategy for Mainstreaming Gender in Climate Change in Egypt (published in 2011)	The Project addresses the strategy pillars focused on enhancing the capacity of women and men in local communities to manage and efficiently use agricultural water, and to build the capacity of officers to integrate women's concerns into the water and agricultural sectors. The Project will conduct awareness campaigns on the impact of climate change on women, improve the conditions of women's agricultural work through training and empowerment, and introduce low-cost technologies for sustainable production to support economic activities.
National Strategy for the Empowerment of Egyptian Women 2030 (published in 2017)	Most strongly evident in Component 2, the Project addresses the strategy pillars that focus on supporting and increasing the productivity of women in the agricultural sector (and in the informal sector), ensuring women a safer work environment, introducing new fields of work to women, building the capacity and awareness of women on measures to adapt to climate change, and building women's capacity to engage in sustainable livelihood activities, market opportunities, and agricultural value chains.
Water for the Future (NWRP) (published in 2017)	The Project addresses the plan pillars focused on improving the performance of the water resources system and promoting the coordinated development and management of water, land, and resources to maximize welfare in an equitable and sustainable manner, while also protecting health and environmental quality (in 2 mesqas).
Egypt's Intended Nationally Determined Contribution (NDC) (published in 2016)	The Project addresses the NDC pillars by improving irrigation, reducing surface water evaporation by lining/burying the local canals, increasing the efficiency of irrigation water (while maintaining crop productivity and protecting land from degradation), raising awareness on the need to rationalize water use, changing / adapting the cropping patterns, applying good land management practices, and supporting rural communities to adapt to the expected climate-induced-changes on crops and livestock.
Third National Communication (NC) under the UNFCCC (published in 2016)	The Project components address the pillars of the 3 rd NC that focus on building capacity to adapt to climate change by constructing appropriate climate-smart irrigation infrastructure, apply climate-smart irrigation, and applying appropriate climate-smart / conservation agricultural and land management practices to conserve and optimize the use of water, and reducing water loss and wastage.

⁴⁰ Constitution of The Arab Republic of Egypt 2014 (unofficial translation). <https://www.sis.gov.eg/Newvr/Dustor-en001.pdf>

Third National Communication (NC) under the UNFCCC (published in 2016)	The Project components address the pillars of the 3 rd NC that focus on building capacity to adapt to climate change by constructing appropriate climate-smart irrigation infrastructure, apply climate-smart irrigation, and applying appropriate climate-smart / conservation agricultural and land management practices to conserve and optimize the use of water, and reducing water loss and wastage.
Support Programme on Scaling up Climate Ambition on Land Use and Agriculture through NDCs and National adaptation Plans (SCALA)	The 2021-2025 SCALA programme is consistent with this project. The Project is in line with the goal of SCALA translate the priorities of National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs) into action. SCALA programme is jointly implemented by UNDP and FAO, and FAO has been working in Egypt to deliver the expected outcomes of SCALA. Given that Egypt is implementing a GCF-financed NAP Readiness project, the Egyptian Ministry of Environment and MALR recommended that SCALA-Egypt support the GCF-NAP-Egypt project. SCALA's national-level activities focus on strengthening policies; appraising / adopting innovative approaches; removing barriers related to information gaps, governance, finance, gender mainstreaming, monitoring, and reporting; and generating evidence to help integrate mitigation and adaptation into national and sectoral planning and budgeting. SCALA results are expected to be an input to the NAP. Such results require evidence generation mostly related to climate risk and vulnerability assessments; innovative climate research on water management and irrigation adaptation measures; capacity needs assessment on disaster risk reduction and early warning mechanisms; and environmental impact assessments of land use plans. The project is in line with and in support of generating evidence on innovative climate research on water management and irrigation adaptation measures and capacity needs assessments. The alignment and support will be implemented through Component 3 (based on the results of Component 1 and 2) via its proposed institutional mechanism, platform, and cooperation, involving key actors, such as authorities, research institutes, international agencies etc. Given that key partners of SCALA (Ministry of Environment, MALR, etc.) take active role in the project, the mutual benefits will be obtained.

G. Relevant technical standards

97. The Project will involve the Ministries that implement project-relevant national standards. Of note, the national environmental regulation does not require an Environmental and Social Impact Assessment (ESIA) (e.g., a limited ESIA), public consultation, and a Gender Assessment ESIA for a category-B project. However, this Project will comply with international standards (AF and FAO environmental and social standards, including the AF and FAO gender policies), and conduct a limited ESIA and a full Gender Assessment. The environmental assessment and gender assessment were initiated during the concept development phase and will be completed during the full proposal. Furthermore, building on the consultations conducted during the concept development phase (*please refer to chapter J*), the Project will continue its consultations with national and local stakeholders over the Project lifecycle (including the formulation phase) to ensure that all Project activities comply with relevant national and international standards, including national and international labour standards.
98. The activities meet the technical standards and the AF ESP principles. These standards and principles will be further consulted during the development of the full proposal. The project activities area screened against the laws, decrees, and regulations relevant to the project. The project activities will be fully compliant with the required standards and ESPs. The table summarizes the requirements of standards and their relevance to the specific activities within the Outputs, Outcomes and Components. During the full proposal development, the detailed design of activities will be submitted along with the demonstrated compliance with the standards, the full process of alignment, the licencing process where required.

Table 2: The Project and the related National Standards

Law / Decree / Regulation	Scope & Relevance to Project
Law No. 93 / 1962 (and amendments 1962, 1982, 1989)	Scope: Regulates the discharge to open streams and the discharge of liquid waste <ul style="list-style-type: none"> Requires wastewater discharged to the sewerage network to comply with the standards stipulated in the regulations / decree 44/2000 Relevant to Components 1 (Outputs 1.1.2., 1.2.2.), and especially Activities 1.1.2.2, 1.1.2.3 and 1.2.2.2 focused on monitoring water quality. Relevant to AF Principles 1 and 12.
Law No. 27 / 1978	Scope: Regulates water resources and treatment of wastewater Relevant to Component 1 (Outputs 1.1.1, 1.1.2, 1.3.1, 1.3.2), especially Activities 1.1.1.5, 1.1.2.1, 1.1.2.2, 1.1.2.3, 1.3.1.1, and 1.3.2.2 related to using water resources and monitoring water quality. Relevant to AF Principles 1, 12, and 15
Law No. 48 / 1982 (MWRI) Regulations: Decree No. 9/1983 Decree 8/1993 & August 1995 Ministerial Decree 402 /2009 Ministerial Decree 92/2013 Ministerial Decree No. 44/2000	Scope: Protects the Nile River, canals, and drains from pollution <ul style="list-style-type: none"> Applies to water channels: (a) freshwater areas, including the Nile River, 2 branches and canals; (b) non-freshwater areas (e.g., lakes, pools, and water in closed system); (c) underground water reservoir Forbids the discharge of any solid, liquid, or gas emissions to water channels from real estates, shops, commercial, industrial, tourist establishments, and forbids the discharge of sanitary drainage without a license from the Ministry of Irrigation, and in accordance with a Ministry of Public Health requirement Requires the Ministry of Agriculture to apply caution when choosing pesticides to abate agricultural pests (Art. 10) and when choosing herbicides to abate water herbs (Art. 11) Forbids the reuse of channel water directly or mixed with water for any purpose unless is proved valid for use (Art. 12) The Implementing Regulations set due fees and expenses to execute this Law Scope of Implementing Decrees / Regulations: <ul style="list-style-type: none"> Set the rules for issuing permits to discharge treated liquid effluent Set the water quality effluent standards (e.g., from pH to coliforms) Control the discharge of wastewater into the sewage system and public network Relevant to Component 1 (Outputs 1.1.1., 1.1.2., 1.3.1, 1.3.2.), especially Activities 1.1.1.5, 1.1.2.1, 1.1.2.2, 1.1.2.3, 1.3.1.1, and 1.3.2.2 related to using water resources and monitoring water quality. Relevant to AF Principles 1, 12, 13, and 15.
Law 38/1967 Executive regulations / Decree 134/1968	Scope: Concerns cleanliness and sanitation <ul style="list-style-type: none"> Sets the ambient water quality before reaching main watercourse Also regulates the collection, transportation, storage, and disposal of solid waste

	Relevant to Component 1 (Output 1.1.1., 1.1.2., 1.3.1., 1.3.2.), especially Activities 1.1.1.5, 1.1.2.1, 1.1.2.2, 1.1.2.3, 1.3.1.1, and 1.3.2.2 related to using water resources and monitoring water quality. Relevant to Component 1 Activity 1.1.1.2 related to solid wastes. Relevant to AF Principles 1, 12, 13, and 15.
Law No. 12 / 1984, concerning the issue of the Law on Irrigation and Drainage, and Law No. 213/1994 (supplement) (MWRI)	<p>Scope: Defines public properties for irrigation and drainage, the use and maintenance of private canals and field drains (e.g., main canals, drains and mesqas branches) and the arrangement to recover the costs of drainage works</p> <ul style="list-style-type: none"> • Provides rules to allocate water • Regulates the construction of water intakes from the Nile and public canals and use of groundwater and drainage water • Requires consultation with landowners • Controls the development of New Lands and the price for irrigation and drainage • Sets measures for navigation, coastal protection, and protection against flooding • Stipulates penalties for violations and has provisions to settle disputes <p>Relevant to Component 1 (Output 1.1.1., 1.1.2.), especially Activities 1.1.1.3, 1.1.1.4, 1.1.1.5, 1.1.2.1 related to canals, irrigation, water allocation, use of groundwater, and drainage. Relevant to AF Principles 1, 2, 3, 5, 12 and 15.</p>
Law No 147 of October 2021 (replacing Law 12 1984) The executive regulations for Law 147 will be issued soon	<p>Scope: Improves water management</p> <ul style="list-style-type: none"> • Requires well owners to install a control system to monitor groundwater use • Provides steeper penalties for non-compliance • Establishes a high-level committee / board to review applications to dig groundwater wells and to issue the groundwater license (Article 68) • Requires government to conduct technical studies on groundwater resources to regulate the use, and to protect and monitor groundwater quantity and quality • Forbids entities and individuals from digging underground wells without a license (Art. 70) <p>Relevant to Component 1 (Output 1.1.1., 1.1.2.), especially Activities 1.1.1.4, 1.1.1.5, and 1.1.2.1 related to using and monitoring groundwater (The Project will need to obtain a groundwater licence, before building the centralized groundwater (in Beni Suef). Relevant to AF Principles 1 and 12.</p>
Law No. 4 / 1994 for Environment Protection, Amended by Law 9 / 2009 and Law 105 / 2015 Executive Regulations: No 338 / 1995 Amended Regulation No.1741 / 2005 Amended Ministerial Decrees: No.1095 / 2011 No. 710 / 2012 No. 964 / 2015, and No. 26 / 2016 Egyptian Environmental Affairs Agency:1996 Guidelines on Egyptian Environmental Impact Assessment, including 2009 update	<p>Scope: Law 4/1994 and Executive Regulations have provisions for Environmental Impact Assessment (EIA). It:</p> <ul style="list-style-type: none"> • Requires the Competent Administrative Authority (CAA) or licensing authority of projects requiring licenses to prepare an environmental impact assessment (EIA); the EIA must be submitted to the Egyptian Environmental Affairs Agency (EEAA) for review • The Project is considered category B. Category B projects are not required to submit a full ESIA study, with consultations, and document disclosure. However, based on the international requirements and good practice, the Project conducted (and continues to conduct) public consultations activities. <p>Law No. 4 and regulations also has provisions for 'work environment and operational health and safety':</p> <ul style="list-style-type: none"> • Articles 43 – 45 has provisions for air quality, noise, heat stress, and worker protection • Gaseous pollutants (e.g., from machinery) must comply with the maximum allowable limits for air quality and air emissions (gases and particulates) during construction arising from: <ul style="list-style-type: none"> ○ Particulate matter and suspended solids from excavation/backfilling operations ○ Possible dispersion from stockpiles of waste or sand used for filling trenches ○ Exhaust from excavation equipment and heavy machinery (excavators, trenchers, loaders, trucks) containing SOx, NOx, CO, VOCs, etc. ○ Traffic congestion • Permissible noise intensity decibel (note that IFC guidelines and Law 4/1994-9/2009-105/2015 have defined standards for noise intensity and exposure periods in the workplace, in addition to certain limits for ambient noise levels for different types of urban and rural areas) • Law 4/1994-9/2009-105/2015 for the Environment and Law 38/1967 stipulate that wastes should be disposed of in licensed sites by the local authority. During construction and operation, all wastes including debris waste, general waste, packaging waste, and commercial wastes must be disposed of by licensed waste contractors according to the rules set by Law 4/1994 <p>Scope of Executing Regulations and their Amendments:</p> <ul style="list-style-type: none"> • Regulates air quality/air pollution, EIA, Hazardous substances, Environmental standards, Pollution control, Marine pollution, Soil pollution/quality, Effluent wastewater/discharge, Hazardous waste, Waste disposal, Freshwater quality/freshwater pollution <p>Most relevant to Component 1 (Output 1.1.1., 1.1.2., 1.2.2., 1.2.2.), especially Activities 1.1.1.4, 1.1.2.1 and 1.2.2.1, 1.2.2.2 focused on digging a groundwater well and monitoring groundwater and drainage water quality. Relevant to AF Principles 1, 2, 3, 5, 6, &12.</p>
Law of Labor No. 12/2003 Minister of Labor Decrees 48/1967, 55/1983, & 116/1991 Law 12/2003 on Labor and Workforce Safety Book V on Occupational Safety and Health (OSH)	<p>Scope:</p> <ul style="list-style-type: none"> • Labour Law 12/2003 addresses workforce safety and the adequacy of the working environment. The law also deals with the provision of protective equipment to workers and emergency response plans. Several laws and decrees provide for occupational health and safety in the workplace, in addition to the provisions under the Environment Law (see Law 4/1994 above for discussion on air quality, noise, heat, and humidity). These laws and decrees apply to any work crew. <p>Occupational Health and Safety is relevant to all Project Components, Outputs, and Activities. The Project supports health, safety, and decent work. Relevant to AF Principles 5 and 6.</p>
Law No. 213/1994, concerning Farmers' Participation MWRI	<p>Scope: Establishes Water User Associations (WUAs) at mesqa level in New Lands and in Old Lands (1995 update)</p> <ul style="list-style-type: none"> • Provides a management transfer process to develop and maintain improved mesqas and to promote water protection • Discusses cost-sharing arrangements • Indicates the roles and responsibilities • Defines the election process, institutional set-up of the Board <p>Most relevant to Components 1 and 2 (Outputs 1.3.1, partly 2.2.1 and 2.3.1), especially the capacity development Activities 1.3.1.1., 1.3.1.2, partly 2.2.1.1, 2.3.1.1, 2.3.1.3. under given that the Project will strengthen the WUAs at the targeted sites and that the Project will improve the mesqas and protect the water resources. Relevant to AF Principles 1, 2, 3, and 5.</p>
Ministerial Decree No. 33/2001 (MWRI)	<p>Scope: Defines the mandate of the Water Boards</p> <p>Somewhat relevant to Component 1, especially the capacity development Activities under Output 1.3.1 for the WUAs. Of note, the Project will work with WUAs. Relevant to AF Principle 1 to 3, and 5.</p>

<p>Egyptian Code for Water Resources and Irrigation Works of 2003</p>	<p>Scope: Supports the design, implementation and monitoring process of irrigation projects.</p> <ul style="list-style-type: none"> Chapter 1 has provisions on engineering alignment of irrigation network at different levels, estimation of supply (discharge) and demand, water quality requirement, preparation of operation and maintenance documentation, training requirements. Chapter 2 has provisions on canal linings (pipes), distribution and auxiliary infrastructure, assessment of the status of groundwater, set the maximum limit of groundwater extraction, design and construction of wells, operation and maintenance of wells. Chapter 3 has provisions on mechanical works related to pump selection, auxiliary equipment, installation of pump, operation and maintenance of pumps, performance test. Chapter 4 has provisions on electrical works related to electric motor selection, speed control, operation and maintenance, electric protection and earthing of AC systems, control circuits and devices. <p>Most relevant to Components 1 (Outputs 1.1.1., 1.1.2, 1.2.1), especially Activities 1.1.1.2, 1.1.1.3, 1.1.1.4, 1.1.1.5, 1.1.2.1, 1.1.2.3, 1.2.1.1., on mesqa improvement, conjunctive water use, monitoring of well and drain, modernized on-farm system.</p>
<p>Law No. 14 of 2019 Amending some provisions of Law No. 38 (1976) (MALR)</p>	<p>Scope: Supports modern field irrigation methods & works to improve, maintain, and develop farm-level field irrigation</p> <ul style="list-style-type: none"> Establishes a network of open field drains and requires MALR to estimate the cost of the irrigation improvement at field level, based on the actual cost per acre Article 1 allows MALR to carry out irrigation improvement operations on farmers' land, regardless of the state of the existing cultivation; provides for compensating farmers for any crop destroyed due to these works at market value Article 3 requires landowners to clean the open field drains and maintain the irrigation works on their lands <p>Relevant to Component 1, especially Outputs 1.1.1, 1.1.2, and 1.2.1 and the corresponding activities, focused on irrigation management and sustainable use of water resources. Relevant to AF Principles 1, 2, 3, and 8.</p>
<p>Climate Change Laws and Regulations, Prime Minister's Decision No. 1129/2019</p> <p>Article 12 of the Kyoto Protocol (CDM)</p>	<p>Scope: Establishes Egypt's state's policies for climate change</p> <ul style="list-style-type: none"> Provides the framework to develop and update the national and sectoral strategies and plans for climate change, considering international agreements, national interests, and links to the sustainable development strategy Raises the awareness of officials, decision makers, and the public on climate change Integrates climate change into the education sector Assists non-Annex 1 Parties to achieve sustainable development and the objectives of the Convention Assists Annex 1 Parties to comply with their quantified emission limits and reduction commitments (Article 3) <p>Relevant to all Components and Outputs, as the Project supports implementation of Egypt's climate change policy framework. Relevant to AF Principles 1 and 11.</p>
<p>Electricity and Renewable Energy Regulations in Egypt</p>	<p>Scope</p> <ul style="list-style-type: none"> Requires state-owned projects to apply competitive bidding for engineering, procurement, and construction (EPC) contracts and competitive bidding for build-own-operate contracts; provides for feed-in tariffs; provides a merchant scheme which allows independent power producers to enter bilateral contracts to sell power directly to consumers using the national grid against wheeling and grid-access charges payable to the grid operator <p>Relevant to Component 1 (Output 1.1.1.), Activity 1.1.1.6, focused on the procurement of solar panels. Relevant to AF Principles 1, 2, 11, 12, and 13. The provision on feed-in tariffs is not relevant to the project, as the mobile units are off-grid systems.</p>
<p>New Electricity Law No. 87 of 2015 (Egypt ERA, 2016a) supported with Law No. 102/1986</p>	<p>Scope</p> <ul style="list-style-type: none"> Creates a competitive power market, based on bilateral contracts; provides milestone to develop renewable energy sources in Egypt, and the legislative and regulatory frameworks to reform the electricity market <p>Relevant to Component 1 (Output 1.1.1.), Activity 1.1.1.6, focused on the procurement of solar panels. Relevant to AF Principles 1, 2, 11, 12, and 13. The provision on bilateral contracts is not relevant to the project, as the mobile units are off-grid systems.</p>
<p>Decree No. 230/2016 of the Minister of Electricity and Renewable Energy</p>	<p>Scope:</p> <ul style="list-style-type: none"> Encourages energy efficiency and the generation of electricity from renewable sources; provides for the independence of the activities of generation, distribution, and transmission of electricity to achieve a liberalized and competitive electricity market <p>Relevant to Component 1 (Output 1.1.1.), Activity 1.1.1.6, given the use of solar water pumps. Relevant to AF Principles 1, 2, 11, 12, and 13.</p>
<p>The Renewable Energy Law No. 203/2014</p>	<p>Scope</p> <ul style="list-style-type: none"> Encourages the private sector to produce electricity from renewable energy sources; allows a shift away from state-administered to privately-financed projects; provides mechanisms and incentives to develop renewable energy projects; supports the creation of a favourable economic environment to increase investment in renewable energy' defines renewable energy resources as 'natural sources of energy, which are non-depletable and can be used to produce electricity' <p>Relevant to Component 1 (Output 1.1.1.), Activity 1.1.1.6, given the use of solar water pumps. Relevant to AF Principles 1, 2, 11, 12, and 13.</p>
<p>The Renewable Energy Law No. 1947/2014 and No. 2532/2016 Prime Ministerial Decree No. (37/4/15/14) (2015)</p>	<p>Scope:</p> <ul style="list-style-type: none"> Establishes offtake tariffs for the 1st & 2nd regulatory periods of the solar and wind feed-in tariff programme Regulates how to avail land for renewable energy projects <p>Not relevant to this Project, as there is no land acquisition needed and the solar energy will not be sold.</p>
<p>New Investment Law No. 72/2017</p>	<p>Scope</p> <ul style="list-style-type: none"> Creates a 2% unified customs duty for the project equipment and machinery (down from 5%) Article 11 stipulates that Projects can receive a discount on the taxable net profits if they depend on or produce renewable energy; Article 20 supports partnerships between the private and private sectors, State, public, and public business sector for public utilities, infrastructure, and new or renewable energy projects <p>Relevant to Component 1 (Output 1.1.1.), Activity 1.1.1.6, focused on the procurement of solar panels. Relevant to AF Principles 1 and 11.</p>

H. Project duplication

99. The recent, ongoing, or planned climate-change related projects were screened during the preparation of this Concept Note to assess

whether this Project duplicates and/or complements these other initiatives. The screening did not identify any initiative that duplicates or overlaps the technical or spatial elements of this Project. However, this Project can inform the on-going initiatives to strengthen the integration.

Project	Complementary nature of other projects
<p>GOE Irrigation Modernization Program, initiated in 2019, pipeline</p>	<p>This GOE program is focused on increasing irrigation efficiency, rationalizing farm-level water use. It aims to apply modern irrigation systems on Old- and New Lands, adopting and using drip- and sprinkler systems to improve agricultural productivity. One million feddans, in New Lands, have already been converted. IMP rolled out the lining of branch canals to increase water saving. This Project is aligned to the pace of canal lining selected areas, where it is already completed.</p> <p><u>Relationship to this Project:</u> Component 1 of the Project includes a focus on modernizing irrigation and complements this GOE effort. This Project will monitor and liaise with the GOE program through its Executing Entity (MWRI) to share lessons learnt during implementation. This Project provides additional climate-adaptation elements, such as the conjunctive use of surface and groundwater (in Beni Suef), integration of climate-smart agriculture and livelihoods, and a strong knowledge-management focus to support innovation.</p>
<p>National Haya Karima Initiative, on-going</p>	<p>Haya Karima initiative includes interventions related to water supply infrastructure, economic empowerment and employment, and training.</p> <p><u>Relationship to this Project:</u> The overall objectives of Haya Karima mesh well with this Project, especially in relation to strengthening irrigation infrastructure and assets (Component 1), enhancing agricultural productivity and livelihood activities to support economic empowerment and employment (Components 2), and training (Components 1-4). The Project established links to Haya Karima while developing the Concept Note and a list of potential joint activities will be investigated during the full Project proposal development process.</p>
<p>The On-Farm Irrigation Development Project in the Old Lands (OFIDO) (IFAD), closed</p>	<p>OFIDO was implemented in 8 Governorates and on 31,916 feddans (13,405 ha) in Lower-, Middle-, and Upper Egypt. It improved the livelihoods of smallholders by improving or supporting: i) The irrigation network; ii) The extension services; iii) Smallholders and landless farmers in marketing; and iv) Job creation and income-generating micro- and small-enterprises. The OFIDO project improved the <u>main</u> distribution network, converting the upstream canals into a piped system. A pump station was constructed to withdraw water from the branch canal to the mesqas.</p> <p>FAO conducted a technical audit of the OFIDO project. It attributed the increased productivity in OFIDO to the better agricultural practices. The audit recommended that the GOE promote the modernization of on-farm irrigation. The audit identified these specific lessons (among others):</p> <ul style="list-style-type: none"> • Non-improved <u>mesqas</u> perform poorly, have a high rate of water loss, do not provide sufficient water, and can be inflexible and inequitable • Poor maintenance of the canal decreases the canal performance • Improving on-farm irrigation can provide high benefits <p><u>Relationship to this Project:</u> This Project builds on and integrates the knowledge gained under OFIDO by addressing on-farm irrigation at mesqa level.</p>
<p>Egypt-Farm-Level Irrigation Modernization project (FIMP), World Bank, closed</p>	<p>The FIMP focused on improving mesqa / marwa canals and on-farm irrigation. The 2018 evaluation concluded that the FIMP provided significant incremental benefits to the farmers, also highlighting the need to:</p> <ul style="list-style-type: none"> • Provide mitigation measures for low capacity, poor quality of materials, poor workmanship, delays in procurement, and insufficient coordination • To the extent possible, complete the engineering feasibility studies during project preparation • Clearly define the project roles, responsibilities, M&E arrangements, and the results framework indicators <p><u>Relationship to this Project:</u> This Project integrates the knowledge and the lessons learnt under the FIMP. For instance, it has a strong focus on capacity development and inclusiveness (to address capacity and quality issues); it integrated a focus on coordination in all components; and, it started various feasibility studies during project preparation. The Project will clearly define its M&E and results framework during the full proposal phase.</p>
<p>Building Resilient Food Security Systems to Benefit the Southern Egypt Region WFP Phase 1 & 2, on-going</p>	<p>WFP 1 complemented and scaled up GOE's efforts by promoting technology transfer and capacity development for climate change adaptation. WFP 2 has adopted a wider scope, introducing more adaptation techniques and intensifying crop production.</p> <p><u>Relationship to this Project:</u> The WFP and this FAO/AF project are complementary in their aim to adapt to climate change. But WFP 1 & 2 target southern Egypt; there is no overlap in geographical location (modernization in New Lands) or target population. Furthermore, this Project includes efforts to modernize irrigation, which is not in the scope of WFP 1 & 2. This Project will keep track of the general lessons learnt during the WFP 2 through its external stakeholder engagement forums.</p>
<p>Sustainable Agriculture Investment and Livelihood (SAIL) project, on-going</p>	<p>The SAIL / IFAD / Ministry of International Cooperation project (2014 to 2023) supports resilience in Middle- and Lower Egypt, targeting 40,000 rural households (280,000 people) in the <u>New Lands</u>. The project focuses on: i) Strengthening smallholder institutions; ii) Improving agricultural production and marketing; and iii) Improving capacity for employment and enterprise development. SAIL aims to enhance food security and nutrition.</p> <p>FAO is implementing a sub-component of the SAIL project called: <i>Enhancing crop productivity and livestock production in New Lands</i>. It will provide technical assistance to establish Farmer Field Schools (FFSs) to promote Climate-Smart Agriculture (CSA) and Natural Resources management (NRM) in <u>New Lands</u> (172 FFS in all). The activities include reviewing and updating social and economic studies, analyzing the situation in the targeted villages, identifying and training FFS facilitators on CSA and NRM practices and technologies, monitoring and evaluating the performance of FFS facilitators, establishing FFS databases at governorate level, and supporting the FFS network to continuously exchange information and lessons learned⁴¹.</p> <p><u>Relationship to this Project:</u> Component 2 of this FAO/AF Project is also focused on sustainable agriculture and resiliency to climate change, but its focus is clearly on <u>Old Lands</u>, rather than <u>New Lands</u>. As previously noted, the challenges in the <u>Old Lands</u> are very different (e.g., the high degree of land fragmentation), so the 'technical' outputs of the SAIL project will not be generally relevant to this Project. Nevertheless, the SAIL outputs and activities and lessons learnt related to strengthening smallholder institutions (including forming water user groups), improving marketing, and improving capacity for employment and enterprise development can offer this Project some insights into institutional and organization development issues. Otherwise, the July 2021 SAIL supervision</p>

⁴¹ <https://www.fao.org/egypt/news/detail-events/en/c/1418890/> and <https://www.fao.org/3/cb6512en/cb6512en.pdf>

	report also provides relevant lessons learnt for use by this Project regarding: development of business skills, coordination and engagement, procurement, and project staffing .
Ongoing FAO trial on sensor-based irrigation, on-going	This is a FAO pilot project on a farm in Bahira Governorate (Wadi El Natroun) being conducted from Nov. 2021 to early 2022. The objective is to test and use a soil-moisture meter, as part of a smart-irrigation system. The field data will be used to evaluate the technology and compare the results to a traditional irrigation system. Both MALR and MWRI are involved in this pilot. <u>Relationship to this Project</u> . The sensor being trialled here is more expensive and more sophisticated than that proposed by this Project. However, the general lessons and the need for farmer-managed data acquisition emerge from FAO pilot project.
Agricultural Innovation Project (AIP)	The objective of the 2020-2023 AIP [German Federal Ministry for Economic Cooperation and Development (BMZ) and MALR] is to increase incomes in small-scale agriculture in Upper Egypt through agricultural innovation. The AIP addresses farmers' challenges (e.g., fragmentation of land tenure, inefficient farming techniques, insufficient value addition, inefficient processing, poor marketing infrastructure, and inadequate post-harvest facilities) along the agricultural value chain. It focuses specifically on horticulture sector with high-value crops (aromatic plants, onion, garlic and chili pepper). It promotes innovation in agricultural business models, technologies, and practices to overcome challenges and increase incomes. The AIP is skewed towards the on-farm and marketing activities and coordinates with MALR. The AIP targets 10,000 rural smallholder farmers in Upper Egypt, the members of 30 producer associations, and MSMEs through organisational assistance, technological innovations, consolidation of marketing abilities, and diversification of marketing channels by strengthening smallholders' market access; institutional support; and innovations in productivity and sustainability. Market linkages are being fostered; out-grower schemes and public-private partnerships are being developed; smallholder management and business capacities are being strengthened; a knowledge hub is being established; certification processes, organic farming, digital solutions to improve information on input supply, marketing, extension, and financial services are being explored and promoted. The specific needs of women and youth are addressed in the project activities. <u>Relationship to this AF/FAO Project</u> ; No duplication is identified with AIP, as the AF/FAO project involves mesqas with traditional crops and change in crop selection is not envisaged in the project. Consultation with MALR did not indicate geographical overlap. Even though the AIP is focused on high-value horticultural crops, the two projects are synergistic and complementary, especially under the Component-2 marketing outputs. Sharing lessons learnt related to innovative marketing approaches and technologies should yield mutual benefits. Of note, the thematic scope of this AF/FAO appears wider, starting with its explicit focus on climate change adaptation and the sustainability of irrigation systems, water resources, agricultural practices, and marketing, and internal and external knowledge management, whereas the geographical scope is smaller (i.e., only two mesqas).
The projects listed below are relatively new or under development and may provide some points of interest for this AF/FAO Project. Additional information on the below listed will be sought during the full Project proposal development phase to assess the degree of duplication and/or complementary and to identify additional stakeholders to engage in the Project's information exchange forums.	
Enhancing Climate Change Adaptation in the North Coast and Nile Delta Regions in Egypt. This 2018 GCF / UNDP / Ministry of Environment / MWRI project targets 5 coastal governorates in the <u>Nile Delta</u> (Port Said, Damietta, Beheira, Dakhalia, and Kafr ElSheikh). This capacity-development project is focused on monitoring, reporting, verification of GHG emissions, and adaptation and mitigation measures, to reduce the risk of coastal floods on the North Coast. <u>Relationship to this Project</u> : Although this project is focused on coastal areas and coastal issues, it complements this AF/FAO Project as both cover climate-vulnerable areas in Egypt and allow the GOE to enhance its response to climate change.	
Enhancing Climate Resilience of Smallholders in Middle Egypt. This 4-year project, to be funded by GCF/WFP and MALR, was expected to start in 2020. It is focused on the resilience of smallholder communities in the Old Lands of Middle Egypt. <u>Relationship to this Project</u> : The status of this project is unclear, and this Project will seek further information on this project during full Project proposal development. It is likely that the Projects are complementary, but this is to be determined.	
EVAS project (USAID) and STAR project (IFAD) (2019-). The USAID EVAS and IFAD STAR projects focus on enhancing market access of smallholders through establishing connections to domestic and international markets. <u>Relationship to this Project</u> : EVAS and STAR project efforts related to marketing provides lessons to conduct high-performing market-related activities. The full project formulation will be informed by USAID and IFAD, and will be incorporated in the Project.	
A partnership between the International Finance Corporation (IFC) and the Agricultural Bank of Egypt (ABE). The collaboration aims to finance solar-powered irrigation systems in Egypt, and it will also review private sector involvement with out-grower models to source their raw products from smallholders. <u>Relationship to this Project</u> : The AF/FAO Project will be interested in monitoring lessons learnt under this partnership related to solar-powered irrigation and the development of contract-farming / out-growers' models.	
Third National Drainage Project. This project is to include construction of new drainage systems and rehabilitation in 0.6 million feddan. <u>Relationship to this Project</u> : This project could offer some insights into drainage issues for this AF/FAO Project's target areas.	
Other relevant initiatives of peripheral interest to the proposed Project	
National Budget: Egypt is directing public funds to climate-related projects, allocating USD 28.5 billion in the 2020/2021 investment plan (USD 2.3 billion for 2020/2021) to 691 green projects. About 50% of the green projects target the transportation sector and 29% target the Housing and Utilities sectors. The intent is to increase public green investments to 30% of the fiscal budget for 2021/2022 and to gradually opt out of unsustainable projects.	
2020 GOE and World Bank project: This project supports Egypt's to reduce air pollution in critical sectors and increase resilience to air pollution in Greater Cairo (USD 200 million).	
2020 Converting Climate Finance Systems project, with Ministry of International Cooperation and the French Development Agency (AFD): This project aims to provide long-term loans and technical support to small-and-medium enterprises, especially in four sectors: sustainable tourism, waste management, water and sanitation, and transportation (USD 182 million). AFD is also providing a grant of USD 1.8 million to support the Egyptian banking sector in not financing projects that directly contribute to climate change.	
Green Value Chain programme (€70 million) will allow small and medium-sized enterprises (SMEs) to invest in advanced technologies and climate mitigation and adaptation solutions to improve competitiveness and enhance the development of green value chains.	
Extension of the Green Economy Financing Facility: the facility will provide green finance up to €150 million to SMEs in the agricultural, construction-, commercial-, and manufacturing-sectors	
The Green Climate Fund (GCF), the European Bank for Reconstruction and Development (EBRD) and the European Union (EU) are responding to the impact of the coronavirus pandemic on the Egyptian economy by boosting green finance and developing value chains for the private sector. Two programmes worth €220 million were launched in partnership with local banks.	
Various other green and climate-friendly projects to be further investigated:	
<ul style="list-style-type: none"> • Sustainable Management of Kharga Oasis Agro-Ecosystems in the Egyptian Western Desert • Egypt Renewable Energy Financing Framework (GCF?) • Wind Energy Scale Up Program (IPPs)-200MW Wind farm in the Gulf of Suez; Wind Power Development Project • Improving the energy efficiency of lighting and building appliances • Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry; Grid-Connected Small-Scale Photovoltaic Systems • Industrial Energy Efficiency (IEE) • Egyptian Programme for Promoting Industrial Motor Efficiency • Fourth National Communication to the UNFCCC; First Biennial Update Report 	

I. Describe the learning and knowledge management component to capture and disseminate lessons learned

- 100.** Innovations for adaptation to climate change could potentially be transformative on their own or in combination, but the site-level evidence and learning must be harnessed. This learning (e.g., on what worked and what didn't work and why) must be collected, analysed, packaged into various user-friendly formats, and shared vertically (to system level) and horizontally (e.g., to other mesqas and to decentralized institutional players).
- 101.** One key characteristic of successful projects is the use of an adaptive innovation management approach⁴². Hence, this Project has adopted a participatory, all-levels, collaborative, internal and external stakeholder engagement process to collect – synthesize data – learn – share – exchange – adapt/revise-planning approach to generate and integrate internal and external knowledge and lessons learned. The aim to fully integrate the participatory, collaborative 'monitoring and evaluation (M&E) system' into an 'adaptive management / planning framework'. The participatory and collaborative M&E system will serve as an explicit knowledge acquisition, learning, and vertical and horizontal feedback system with direct and explicit links to the work-planning processes. The joint planning process will incubate new innovations during implementation. This two-way dialogue system will function from field-level to national and international levels, including explicit feedback to field level (please see the institutional mechanism of the dialogue below). The M&E system and work-planning system will engage the beneficiaries at the two mesqas, local associations engaged in Project activities, the Executing Entities at decentralized and national levels, the Implementing Entity (at country- and international-levels), Project Management, and all Project Oversight Bodies (e.g., technical board, steering committees) through appropriate forums/peer board meetings (monthly and annual meetings; workshops; newsletters; field visits) to ensure that lessons learnt, best practices, and/or new needs are met in an ongoing and evolving manner during implementation.
- 102.** Component 3 addresses project-level innovation management and supports and synergizes the results of Components 1 and 2 through its focus on project-level coordination, monitoring, evaluation, reporting, integrated planning, and internal and external knowledge management and dissemination. It provides the project-level diffusion plan (external) and will formulate the project-level exit strategy, both of which complement similar component-level efforts. Knowledge management is therefore fully integrated into the logical framework and has explicit activities, outputs, and progress indicators within each component and at Project level. The established mechanism of national-level knowledge management will require the set-up of a coordination body. The Project will identify focal points in all relevant organizations, who contribute to the upscale of knowledge products. On the other hand, the Project will recruit knowledge experts responsible for coordinating the knowledge products, communicating with project beneficiaries, overseeing the capacity-building programmes, conducting evaluations of learning progress, coordinating the communication and venues with peer boards and focal points, keeping track of knowledge objectives and indicators, and organizing national-level venues around knowledge management and capacity-building. Component 3 will source information from two channels: primary channel is the project-results stemming from ground-truth experiences and generated by grassroots level (farmers, WUAs, WFAs); the secondary channel is the information acquired by the coordination with relevant projects and initiatives. Regarding the primary channel, the Project proposes an arrangement for monitoring, evaluation of project activities, and the development of external diffusion plans, exit- and scale-out strategies at component level. To collect and synthesize information, and to process this information into plans and strategies, the project will create direct link between farmer beneficiaries including their representations and project-level authorities, namely 1. extension service in both areas and undersecretaries of water responsible for the coordination with grassroots level, 2. ARC and NWRC responsible for the peer reviews and scientific evaluation and publication of results, 3., peer board and the Project Management Unit (steering committees) responsible for the endorsement of the generated knowledge, and 4. MWRI and MALR responsible for the operation of Innovation Management Platform, dissemination and coordination at national and regional level (please see further information on the management arrangement of the Platform in Section C.). The peer board will be the platform to invite external stakeholders (i.e. implementing entities of relevant projects, Haya Karima representative, international agencies, etc.). At ministries' level, Ministry of Environment will be fully integrated in the process to support its work on climate change adaptation. Given the innovative nature of the project and the requirement of increasing capacities at all levels, the full proposal development will include Component-level and Project-level Knowledge Management Plans (KM Plans), defining the actors of organizations, responsibilities, routing lines, monitoring measures and means of coordination (infrastructural, such as channel of communication, places, learning tools and supporting devices and equipment).
- 103.** One of the key merits of the participatory/collaborative approach of knowledge management is its potential to harness informal transfer of knowledge. Farmers expressed their commitment to transfer information by defining the out-of-project areas of innovation transfer (i.e. other mesqas) and the intention to act as information hubs. Traditional learning methods have potential to develop community of practice by encouraging communities to interact with each other. By leveraging the cultural dynamics in the Old Lands, the project will support the social learning, where beneficiary communities can be the engine of the scale-out of innovative measures and practices. This has several enabling aspects in the project areas, i.e.: mesqas are adjacent, so neighbouring communities can observe and learn about the project results; mesqas are not isolated, so social learning is complemented with experiential learning; farmers have big families, so family members can spread knowledge to different areas; agrotechnology is relatively homogenous across the mesqa communities, so measures can be adopted elsewhere; objectives and roles of farming in livelihood are similar, so degrees of farmers' motivation in the enhancement of farming are balanced; social and cultural settings are similar across the rural Old Lands, so cooperation and social dialogue are facilitated. To some extent, informal transfer of knowledge must be assisted to guarantee that there is no information loss throughout the process. To fulfil this requirement and internalize the informal knowledge channels, the direct beneficiaries must be equipped with sufficient information, thus they become the catalysers of knowledge transfer. The Project will use the capacity-building programmes to facilitate and kick-off the informal transfer of knowledge. Capacity-building activities, such as Train-the-Trainers to farmers organizations or inter-community promotion through site visits, are entry points to provide models for future, not structured learning. To strengthen the role of beneficiary farmers in the process of informal learning, the capacity-building programmes will be under the project-level M&E to measure the progress

⁴² Please note that innovation management does not refer to the project management that will be elaborated in Part III during the full proposal development. Innovation management is the project-level coordination of the design, implementation, evaluation, correction, conclusion, synthesis and future planning of innovation measures, which supports the learning cycle and scalability.

and take corrective actions if necessary. Also, the capacity-building programme for farmers will include a module on knowledge transfer. This will guarantee that information and knowledge streams through peer-to-peer are technically sound. Another safeguard to build sufficient knowledge is the supervision period defined in the adoption plan of each measure (please see the table of innovation roll-out in Section C). The supervision follows the implementation of the measures in support of the learning-by-doing. This period of technical assistance will allow a self-paced learning of community members and reinforce the social learning process. Altogether, the project will benefit a larger scale of farmer communities by channelling information directly through farmers.

- 104.** In support of knowledge management, learning, and sharing/exchanging experiences, the Project's M&E system and adaptive work-planning system will at minimum:
- Set-up a coordination body to manage knowledge, using learning experts and institutional focal points;
 - Implement the Component-level and Project-level Communications and Coordination Plan;
 - Establish an information management system with mechanisms that institutionalize and facilitate the timely collection, analysis, management, and sharing of data, evidence, and learning at component level and Project level;
 - Channel Project knowledge/learning in bottom-up and top-down, and sideways manner (e.g., the informal horizontal transfer of knowledge from farmer-to-nearby-farmer) to all key stakeholders;
 - Establish an Innovation Management Platform that is open-access and provides lessons-learned not only to direct project stakeholders and management, but for a larger audience of funding agencies, NGOs and national banks (who will be responsible for financing the Irrigation Modernization Programme);
 - Routinely monitor/evaluate Project progress at component level and at overall Project level by comparing actual outputs and outcomes to the planned and expected targets;
 - Routinely identify and analyse changes to the Project context, which could affect component-level and Project-level success, risks, and assumptions;
 - Routinely identify component-level and Project-level strengths and weaknesses and provide corrective measures to ensure that the full Project remains fully relevant and focused on results;
 - Require the internal and external M&E process to identify and share component-level and Project-level lessons learned and best practices with stakeholders;
 - Allow each type of stakeholder (e.g., beneficiaries, Executing Entities, the Implementing Entity, Project Management, and Oversight Entities) to provide input to monitoring, evaluation, and work-planning processes, resulting in work plans that reflect field evidence, actual progress and challenges, and lessons learned;
 - Monitor the generation of related external knowledge (e.g., through attending donor coordination forums and other external forums);
 - Share relevant external knowledge internally and share relevant internal knowledge externally.
- 105.** The Project will host workshops/meetings/seminars/field missions at various levels from local to national level in advance of or in conjunction with its monitoring and evaluation and planning procedures. One aim of those events will be to capture, analyse, use, and share recent knowledge and lessons learned.
- 106.** The Project will exploit a diverse set of knowledge-capture-and-sharing mechanisms, tools, products, and capacity development events adapted to the diversity of stakeholder types. This comprehensive approach includes:
- Implementing its participatory/collaborative M&E system and participatory/collaborative work-planning system to foster and maintain its multi-level, multi-stakeholder feedback and learning loops and to strengthen and sustain its innovation-friendly, learning, and adaptive culture;
 - Identifying Knowledge-exchange Champions / Focal Points at all levels, including identification of farmers interested in transferring their new knowledge to nearby sites within its executing and implementing entities;
 - Designing capacity-building-and-knowledge-management-and-sharing activities that align to and are scaled to the learning and knowledge needs and literacy level of the various stakeholders (e.g., decision-makers, government staff, community organizations, and male and female);
 - Implementing a diverse set of capacity-development-and-knowledge-exchange activities, including online training and physical workshops, seminars, and field visits (e.g., fact-finding trips by farmers or women's groups to nearby mesqas with similar climate risks to exploit opportunities for local replication and oral dissemination);
 - Building a climate-change adaptation knowledge network of internal and external public-, private-, NGO-, community-, and academic institutions interested in gender issues and in climate-adapted irrigation, agriculture, and livelihoods. The Project will actively and explicitly cultivate/grow those relationships and networks by routinely convening events focused on sharing the Project's progress, achievements, challenges, and lessons learnt at knowledge-exchange events, such as:
 - Internal events, including Project M&E or planning workshops; meetings convened by the Executing Entities and Implementing Entity, and meetings with for example the WUAs, farmers' associations, community committees, marketing groups, and women's or group⁴³;
 - External events, including active participation in donor coordination forums and partner workshops to share/exchange experiences and to keep abreast of the successes and challenges within other climate change adaptation projects (e.g., World Bank; UNDP; IFAD; WFP; GEF, AFD; GIZ; USAID);
 - Other knowledge-exchange outreach activities and events using other tools (e.g., internal and external mailing lists, websites with knowledge portal, blogs, social media, traditional media, and annual external events).
- 107.** Another aspect of the knowledge management is how to leverage the developed prototypes, processes, methods of measures. This Project will provide full documentation of newly developed prototypes, processes and methods, which will be handed over to research centres under the coordination of ARC, universities and certified manufacturers. This will be supervised by the Executing Entities to harmonize the scale-out with the developed geographical road-map of innovation feasibility.
- 108.** This Project builds on the experience of several projects implemented by FAO in Egypt and other countries. The practice shows that general learning curves of new innovations and technologies are flat at field level. If innovation development outpaces the absorption

⁴³ The Project will help ensure that the community governance structures are inclusive, functional, and motivated to engage with the Project and share successes and challenges.

capacity and willingness of innovation uptake, the results may fall short of their potential. To overcome this issue, the project formulation – already at concept note level – mapped the capacity-building requirements of farmers. Farmers expressed their need for specific training modules per each measure. Such requirements are fully incorporated in the project activities, and detailed description will be provided at full proposal level. Developing diverse knowledge products, which will be disseminated as widely as possible to transfer the innovations and knowledge gained during implementation (as per Table 6).

Table 3: The Project’s Likely Knowledge Products (in English and Arabic)

<p>Printed knowledge products:</p> <ul style="list-style-type: none"> • Component-specific guidelines and manuals to cover Components 1 to 3 outputs: A Canal Operation Procedure for the New Irrigation System; Protocol of design and management of modern on-farm irrigation; A Manual on Climate-Smart Agricultural Management Scenarios; Case Studies documenting climate-resilient livelihoods • Flyers, brochures, and pamphlets to summarize or explain the Project interventions • Newspaper articles • Internal and external mailing lists • Project progress reports: Annual Monitoring and Evaluation reports and workplans; Other reports and presentations (e.g., workshop reports; PowerPoint presentations); Project write-ups and reports, including sector-specific technical reports or field results on innovative technologies <p>Presentations (oral and printed presentations):</p> <ul style="list-style-type: none"> • Project meetings (e.g., presentations to Steering Committees; presentations to local stakeholders) • Project-related workshops (e.g., local-, district-, Governorate-, or national-level workshops) • Other forums and external workshops (presentations at workshops conducted under other projects and at international conferences or workshops) <p>Audio-visual products, showing field level activities, challenges, and demonstrations of tools and procedures by mesqa farmers to nearby farmer, and successes, for example:</p> <ul style="list-style-type: none"> • Video presentations; video trainings/demonstrations; photographs; posters; voice recordings; radio episodes; and media interviews • Recorded tutorials or voice messages on mobile phones that can be sent to account-holders of chat software, saved, further posted, and forwarded to other nearby farms and other interested parties <p>Documented know-how, full technical specification, design, drawing of the developed prototypes for sharing:</p> <ul style="list-style-type: none"> • Guidelines for manufacturers, research centres universities for future development. <p>Social media pages and communications platforms (e.g., YouTube – official FAO channel, and WhatsApp groups)</p> <p>Websites: government websites; FAO website; other websites; and the Project’s Innovation Management Platform website</p> <p>National and local events (e.g., local events, including farm-to-farm visits, visits to demonstration fields, and FAO Country Office events; technology demonstrations)</p>
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109. Altogether, the Project’s knowledge management system at component and project-level should accelerate the implementation of effective and innovative adaption measures, identify challenges, promote adaptive planning and management, while co-creating incremental ideas, approaches, and solutions, and identifying best practices. Altogether, this should enrich global, national, and local knowledge on climate change adaptation within an increasingly water-scarce context. It should enable the local stakeholders, the local-and-national-level Executing Entities, the Implementing Entity, Project Management, and the Project’s Oversight Bodies (e.g., committees) to engage in knowledge creation, exchange, and learning, enhancing Project efficiency and effectiveness. This systematic and comprehensive approach will support knowledge transfer and hence the scaling up, replication, roll-out, and wide dissemination of useful climate change adaptation knowledge from mesqa level to international level, both upwards and downwards again. The Project will actively promote reflection at all levels and what is termed ‘double or triple learning’. The full Project proposal will provide more details on the roadmap knowledge management activities and the Knowledge Management Plan.

J. Consultative process

110. Consultations conducted to develop this Concept Note. This AF/FAO Concept Note was prepared through a consultative and inclusive multi-stakeholder process. In coordination with FAO, MALR and MWRI, direct and intensive communications were maintained over the duration of the Concept Note process, with the key partners and stakeholders at different levels (national, governorate, district, village, and mesqa level), from decision-makers to local farmers, including women farmers. This allowed all stakeholders to understand the requirements of the Adaptation Fund Innovation Grant and to shape the Project components, outcomes, and outputs.

111. Fact-finding trips. From June to July 2021, fact-finding trips were conducted to assess the status of climate change adaptation at field level and identify critical needs. This included visit of existing, farmer-led initiatives (plots of modernized farms in Qalyubia) and women-driven activities (cheese-making gardens, forage production plots, milk-selling processes etc.). This Project draws on these experiences to leverage the successful national and national innovations and avoid failures.

112. Consultees. From late June to mid-July 2021, preliminary ideas were discussed with national government partners (MWRI and MARL) to help shape the initial concept. Once the key partners reached a consensus on the general components of the Project, the consultation process was widened with a series of field-site visits from mid-July to end of November 2021. The field visits entailed extensive discussions in three Governorates with these key stakeholders: Government authorities (Governorate-level and district-level MALR and MWRI engineers), Haya Karima; men and women farmers from various mesqas, including the project target areas and outside the areas.

113. General results of the consultation from mid-July to end of November 2021. Separate focus group discussions and interviews were conducted with the government authorities and Haya Karima, and with male and female farmers at each mesqa. In addition, women-only consultation sessions were conducted, including visits to women’s agricultural plots. The site visits allowed the stakeholders to identify the local issues related to climate change, water supply, water quality, irrigation, agriculture, gender, and livelihoods. The farmers highlighted the need to develop market links and to re-establish grassroots-level organizations (WUA and WFA). The women further clarified their specific needs, especially related to livestock activities, market links, and the production of forage. The site visits enabled the Project to

strongly anchor its focus on the farm-level needs, as identified by the actual beneficiaries (e.g., focus on a value chain approach and on women's livestock activities).

- 114. Consultations from mid-July to end of October 2021.** FAO developed the 1st interview guides, questionnaires, and survey templates in advance of the field missions (mid-July, end of July and mid-October). The preliminary Concept Note was developed, integrating the results of the 1st round of local consultations. A digital copy of the concept was shared with the National Designated Authority (NDA) and then presented to the NDA Technical Working Group on August 26, 2021. The NDA's feedback (e.g., to strengthen the 'innovation' rationale) was integrated into the draft Concept Note.
- 115. Consultations in November 2021.** The FAO technical team developed the 2nd interview guides, questionnaires, and survey templates, covering the assessment of innovative technological alternatives, in advance of the field missions to Beni Suef and Al Fayoum in November 2021. FAO discussed in detail with the farmers the various options being explored for the Project. The male and female farmers clearly identified the list of innovative technological options of most interest to their actual climate-adaptation local needs. All measures, then, were discussed with farmers via the guidelines and questionnaire prepared by the consultation team. Farmers received an introduction about all innovative measures, then semi-structured questionnaire was launched to guide the discussion about the inquiries about the measure, the defined role of participants in the management of the measure, the required trainings, the relevance of measure to climate change adaptation, the quantified benefits, suggestions on feasibility in other areas, and further ideas to be integrated.
- 116. Consultation materials and consultation notes.** All detailed materials related to the consultation process are available and will be appended in the full proposal, including: interview and survey templates; summary of all consultations (with dates, participants, and key points); all interview notes, including the technology assessments conducted with male and female farmers; all of FAO's expert group technology assessments; proof of consultation (e.g., sign-in sheets for consultation with local government; some sign-up sheets of farmers at the various mesqas; or extra photographs, where it was not possible to have participants sign an attendance list); photo library.
- 117. Summary of some key findings from the consultation.** The key findings stemming from the consultation procedure were integrated into the Project design. The community consultations clearly highlight that the mesqa farmers are already experiencing significant climate change impacts, that there is limited understanding on how to adapt irrigation, agriculture, and livelihoods to the future climate, and that there is very little training being offered at mesqa level. The following table concludes the high-level summary of the consultations. The consultations were accompanied with the Executing Entities (MALR, MWRI), pre- and post-consultation briefings were held after each site visit, both in-person and via Zoom meetings.

Table 4: High-level Summary of a small number of the Consultations conducted during the Preparation of this Concept Note

<p>CONCEPTUALIZATION PHASE: Haya Karima Representatives:</p> <ul style="list-style-type: none"> • Indicated the type of initiatives that it conducts; confirmed their willingness to collaborate with the Project, especially in areas focused on vulnerable people • Agreed to share their database on vulnerable people with the Project <p>Focus group discussion with farmers (both men and women, but with higher men representation) at Beni Suef mesqa and Faoumy. Farmers reported / identified:</p> <ul style="list-style-type: none"> • The type of crops they grow and the challenges they face related to water, diesel pumps, crops, crop irrigation, and the changing climate • Their training needs <p>Focus group discussion with women (questionnaire also completed). The women clarified / identified:</p> <ul style="list-style-type: none"> • The type of crop agriculture and livestock activities they engage in • Their involvement in marketing and their interest in micro-enterprises • Their experience with climate change to date <p>Egyptian Environmental Affairs Agency (EEAA) / NDA; also present: National Research Centre; Egyptian General Meteorological Authority; Ministry of Health and Population; National Research Centre participants; MWRI; MALR; and FAO/Egypt. A PowerPoint on the preliminary Concept Note (CN) was presented to the NDA and Technical Work Group (TWG) of the National Council for Climate Change (NCCC). The TWG:</p> <ul style="list-style-type: none"> • Provided positive feedback on the draft • Emphasized the need to build a stronger climate rationale, to better link the Project to the AF criteria, and to continue to strengthen the 'innovativeness' of the Concept • Requested MALR to send an official letter requesting this project; the Minister of Agriculture sent the letter to the Minister of Environment Oct. 17, 2021
<p>CONCEPT FINALIZATION PHASE: On-site discussions and interviews with male farmers: The male farmers highlighted:</p> <ul style="list-style-type: none"> • Temperature is the variable that most affects their crops; confirmed that climate change impacts their wealth / income • Increase in water demand by 20% over the last decade (based on increase of fuel consumption) • Use of groundwater is mandatory to supplement canal water (in Beni Suef). • 50% decrease in soil fertility and they must buy more and more fertilizers and pesticides to cope • Climate-change induced surge in pests can lead to total crop failure (recent failure due to the fall armyworm) • There are new diseases and pests, thus the Project needs to focus on Integrated Pest Management • The newly constructed canal is prone to waste accumulation and sediment deposits, which could lead to clogging • New branch canals don't have a bridge, which is difficult for older farmers • The farmers concluded that it was important to develop the capacity of the WUA to take on provide oversight on various functions (e.g., groundwater use) for sustainability <p>Male Farmers' Assessment of Technological Options: The men's focus group endorsed the following technology options, if the Project would provide adequate training and clear guidance for each selected technological option, including how to interpret soil-moisture data and how to conduct O&M:</p>

- **Solid waste removal structure** (manual rack, with bridge, upstream of the mesqa inlet); farmers offered to clean out the wastes themselves, as waste removal was seen as an important intervention (both mesqas).
- **Hand-held soil moisture sensors:** farmers had not seen this type of innovative/mobile device before and readily agreed that this technology could be used to avoid waterlogging and water stress on their crops (both mesqas).
- **Solar pumps** (replacing diesel pumps), including having management of the solar system integrated into the work of the WUA (both mesqas).
- **Crop zoning:** was endorsed; the farmers understand that this collaborative, harmonized production system could enhance their market power and personal benefits; they set 2 conditions: i) include forage production and ii) develop the market links; they proposed that the WUA (after training) monitor implementation of crop zoning (both mesqas).
- **Modern on-farm irrigation:** after expressing concerns that drip irrigation had not been introduced into Old Lands (due to its clay soils) and concerns about O&M, farmers endorsed this technology, under the condition that each farmer would get a valve per farm to manage their own water. The WUA was proposed as the entity to enforce the drip-irrigation schedule. The farmers highlighted that the capacity of extension services and government also had to be built, as drip irrigation in Old Lands is new (both mesqas).
- **Climate-smart agricultural (CSA) practices:** The farmers specifically endorsed two CSA options: i) climate resilient varieties (including forage); Integrated Pest Management; the farmers noted that CSA must be integrated into the curriculum of extension services (both mesqas).
- **Smart tractor:** Farmers proposed the option of mechanization and sought for project support to find the most suitable design (both mesqas)
- **Tuk-tuk/crop transportation:** Farmers requested a solution for overcoming the market distance. The tuk-tuk was proposed as farmers' unique idea based on the prototype of milk transporting tuk-tuk (in Fayoum).
- In addition, farmers requested the re-establishment of WUA as management entity of the suite-of-measures. They required democratic election of the Board, full integration and control over the management functions.

On-site / home plot discussions with women farmers. The women highlighted the following issues:

- Women are very risk averse, and do not want to jeopardize their livestock income in any way.
- Fodder issues: climate change has shortened the winter season and hence the fodder-growing season; they now must buy additional fodder; climate change has significantly affected the quantity of fodder; the Project must address the production of fodder.
- The women noted these climate-related issues: their poor and/or limited access to good seed quality; a reduction in crop yields due to the higher temperatures; excessive use of fertilizers and pesticides and definite impacts on soil quality; increases in pest problems and livestock disease; heat stress on livestock, affecting quantity of milk production, but also affecting quality / fat content of milk, which has seriously affected their cheese production.

Women's Assessment of Technological Options:

- **Social innovations:** The consulted women highlighted the potential to market milk/cheese through the Women's Farmer Association (existing WFA in Beni Suef, and establishment of WFA in Fayoum), suggesting establishing a woman-operated collection point for milk to enhance women's market power (both mesqas).
- **Tuk-tuk/milk transportation:** Women requested the innovation of transportation vehicle to release the pressure on donkeys and avoid food loss during the transportation in high temperature. The tuk-tuk with cooling facility was applauded by women to solve these problems, without requesting them to obtain additional driving license (both mesqas).
- **Solid waste removal structure:** The women support screening the waste from the branch canals and recommended that the canal waste be compacted (both mesqas).
- **Safe work:** the consultees showed a high interest in enhancing their work safety and decent work conditions (both mesqas).
- **CSA interventions, modern irrigation in combination with soil sensors:** The women specifically endorsed 3 CSA interventions: i) crop residue use; ii) integrated pest management; and modern on-farm irrigation with soil sensor (both mesqas).
- **Mobile silos:** Women applauded the idea of mobile silos at household level, and requested the equipment of all households with silos. Women voiced the need for portable units, which they can easily move (in Fayoum).
- All agreed that CSA be integrated into the curriculum and work of the Women Farmers' Association



K. Drawing on multiple perspectives of innovations from partners

118. The Project is designed to embrace multiple perspectives and to support and stimulate innovation over the project cycle. For one, the Project components are strongly interlinked, which is expected to provide fertile ground for further innovation. Specifically, the Project is designed to:

- Support GOE priorities (e.g. Haya Karima, National Strategy for the Empowerment of Egyptian Women, Irrigation Modernization Programme), aligning with the GOE's sustainable development strategies and climate adaptation priorities, and hence, multiple viewpoints.

- Engage multiple sectors (irrigation, crop agriculture, livestock, gender, livelihoods, and economic sector), and hence, multiple viewpoints.
- Builds on national and international best practices of adaptation innovations.
- Engage multiple types of stakeholders (e.g., public authorities, private sector, academia, community organizations, and the individual farmers and women at two mesqas), and hence, multiple viewpoints.
- Act at different administrative levels (from farm level to national and international level) and nurture the horizontal and vertical linkages.
- Provide institutional and local capacity development at different administrative levels.
- Nurture partnerships by working with two ministries (MWRI and MALR), the high-priority Haya Karima government program, community organizations, local businesses, and individual men and women farmers, as part of its strategy to diffuse and scale-up innovations.
- Engage and integrate the voice of vulnerable stakeholders e.g., unlicensed farmers, illiterate women, widows, and divorcees (the Project will help ensure adequate representation and participation of the most vulnerable in committees, in training, and in all aspects of work planning).
- Continue to assess new and innovative climate-smart farm-level technologies in a participatory and inclusive manner, involving both technocrats and the vulnerable communities.
- Combine various types of innovations to achieve synergy.
- Continuously engage its institutional and local stakeholders in participatory monitoring, evaluation, and adaptive planning and management (nurturing its partnerships, collaborations, and multiple perspectives through this participatory process).
- Develop and nurture its internal and external collaborative networks for knowledge exchange, joint learning, and the generation of new solutions.

L. Justification for funding requested

- 119.** This Project does not envisage any explicit co-financing. It will feed into and inform the activities of Haya Karima program, but this will be viewed as a bonus and a means of creating further synergy. The Project will deliver all the listed outputs and outcomes and cultivate a synergy with Haya Karima.
- 120.** Part I of this Concept Note indicates that Egypt's hotter and drier future climate will significantly impact key sectors. The predicted impacts on the energy-, water resources-, agricultural land-, livestock-, crops-, and food security are discussed in more detail to justify this funding proposal in Part I.
- 121. Component 1. Baseline.** Climate-induced scarcity at national level keeps growing, and irrigation sector – as largest water consumer – is not sufficiently prepared to exploit the water saving potential of irrigation infrastructure. The heatwaves further exacerbate the harmful consequences, and climate change translates in yield reduction or yield failure. The growing gap between demand and supply is compensated with groundwater, and groundwater tables are sharply dropping. The efficiency increase by system-level development is undermined by the inefficient on-farm irrigation, and significant amount of water goes to loss through evaporation, runoff and deep percolation. Due to the increased water diversion of upstream mesqas and the deeper groundwater levels, the lower water level requires more extensive use of pumps, and irrigation sector induces a rapid growth in energy use. This, in turn, increases the production cost of poor farmers. **With Project.** Improved access to water without the expansion of water demand will increase the performance of irrigation sector, thus providing more reliable irrigation water service. The innovative, improved and modern irrigation configuration at system and farm level will save water and make access equal amongst community members. The established configuration of solar-powered, conjunctive and modernized water use will showcase best practices of irrigation development for large-scale roll-out and contribute to the higher objective of making agriculture climate-resilient in Egypt. The development phase will de-risk the investment in modernization, in terms of social (equal access to modern infrastructure), economic (optimal size of pressurized network) and environmental risks (salinization).
- 122. Component 2. Baseline:** Increased temperature has different effects on cropping and livestock. Heatwaves increases crop water demand, manifests pest infestation, impairs soil fertility. Heatwaves and increase temperature induce heat stress on animals, thus decreases the quantity and quality of milk production. Climate change keeps having detrimental impacts on the livelihood on men and women. While climate change gradually decreases the productive assets (loss of topsoil, animal mortality etc.), farmers must produce more to maintain income. The production inefficiency is further affected by the fragmented land, and meaningful investments cannot be deployed. Similar to the fragmentation of lands, women keep maintaining their income from livestock without any coordination or harmonization. They remain exposed to the random selling points, far from markets, where they could better match their prices to the demand. Due to lack of organized marketing, their dairy products are subject to spoiling. **With Project.** The better harmonization of production practices, together with climate smart practices and improved of working conditions, farmers will produce more quantity in both terms of aggregated quantity and quantity per land unit. They will optimize the production input to lower production cost without compromising their yields. They will have better access to markets, thus avoiding the loss of products and jeopardizing the efficiency of natural resource use. Market presence will be stimulated by both direct access and better logistics. Women will have improved income through increased forage volume, climate smart practices and cooperation with other women. This will also empower women and strengthen their role along the agricultural value chain.
- 123. Component 3. Baseline:** Egypt's innovation landscape remains ruled by the top-down and random diffusion of innovations. The innovations keep being developed in an isolated manner, with a restricted geographical feasibility and accessibility. The innovations will be specialized on mainstream research and development subjects. The different mandates of Ministries keep separating the innovation pathways of different sectors. The life-cycles of innovations are increasingly shorter and uptake at field level is slow. The learning curves of innovations and new technologies are flat, and farmers prove reluctant to deploy new methods. Farmers-led innovations remain at risk and untested, therefore, no evidence is generated to support the high-level objectives of climate change adaptation. **With Project.** Innovation pathways in each part of the agricultural value chain will be well-developed, and risks will be eliminated. Coordination mechanism amongst the Ministries with different mandates will be established, which facilitates the further collaborations on innovations in climate change adaptation. Innovation Management Platform will be created as high-level admin of scale-out of proven measures and development of new innovations. Innovation pathways will define the geographical roadmap to inform the feasibility of measures in the Old Lands.

M. Sustainability of the project

- 124.** The Project, from the onset of Concept Note preparation, applied a participatory and inclusive process. It involved national and local governments, and two governorates, districts, villages, and mesqas, and the mesqa men and women. Given this modus operandi, it is expected that the local and national ownership of the activities, outputs, and outcomes will continue over the entire Project cycle, supported through an ongoing participatory, inclusive management and planning approach. The participatory, inclusive approach and the implementation of a robust capacity development program at all administrative levels (local, district, governorate, and national levels) and targeting the key stakeholders is also expected to sustain the outcomes at the post-Project phase.
- 125. Environmental sustainability.** The Project investments (e.g., improved canals, modern irrigation network, waste traps, mobile solar, sensors, and locally-made tractors, and tuk-tuks) have a long lifespan, and require basic maintenance; the capacity for O&M and repair and calibration services of the assets will be built locally as well as at institutional level. The climate-smart assets, technologies, and practices support water- and land-use efficiency. There are no expected additional harmful emissions. Water and land units and agricultural inputs will be optimized at each site. The Project will decrease pollution due to optimized agrochemical use, increase agricultural productivity, combat water scarcity, increase water use efficiency, and maintain and manage soil fertility (through CSA practices, such as mulching). The significant environmental risk is the salinity, induced by the modern irrigation techniques. This Project will set up best leaching practices, conduct a year-long monitoring of soil and provide soil salinity sensors to farmers. These safeguards together will eliminate the risk of salinity. The protocol of conjunctive water use will support the recharge of shallow groundwater, and groundwater will be monitored. With its value chain approach, the Project will optimize processing (e.g., of milk products and vegetables) and reduce food waste. The interventions altogether support environmental sustainability via the integrated management of local water and land resources, the applied monitoring devices to regularly assess the status of land and water resources, and actions to protect, sustainably manage, and restore land fertility and environmental resilience.
- 126. Socio-economic and social-cultural sustainability.** The Project engages with the residents of the two mesqas. It will transfer know-how to the communities and to local contractors, suppliers, and services. The socio-economic sustainability rests on the project approach, as suite-of-measures provide equal access to all community members. Further down the economic and financial sustainability, the prototypes/processes/practices will undergo a cost optimization process. The technology innovations (e.g. modern irrigation, tuk-tuks, sensors, silos etc.) are expected to reach a market price that is affordable for poor farmers (please see further elaboration on the financial aspects below). The processes (e.g. crop zoning, conjunctive water use etc.) are expected to be available for free by the end of the Project. Likewise, the practices (e.g. CSA practices, leaching practices etc.) are knowledge products that will be readily available without a price tag. Where relevant, the innovation pathways involve specific actions on development and transfer of know-how, mapping and certifying local service providers and capacity-building. These together will ensure that both investment and operating expenses of the measures are optimized and can be inserted in pro-poor context. Embracing the entire value chain and supporting farmers in access to markets are the pillars of long-term financial sustainability. Without market outlets, the betterment of practices and increased production volume would be fading, and farmers could not necessarily realize their expected revenue. Profitability and maintenance of the project results are warranted by the improved access to markets. In turn, the extra income will contribute to the improvement of livelihood and support the business plans of the improved infrastructure. As far as social-cultural sustainability is at issue, the design of this Project is gender-responsive and inclusive in a way that it concerns the traditional social settings while increasing the benefits of the most vulnerable.
- 127. Institutional sustainability.** The institutional development of grassroots level organizations (WUAs and WFAs) and the authorities (ministries, research centres, undersecretaries and other stakeholders) is at the heart of this Project. As the project operates at mesqa and marwa level, the management responsibility of measures will be transferred directly to the WUAs and WFAs (*please refer to Chapter C*). To strengthen the position of the farmer organizations, local manufacturers, service providers and yards will be certified and prepared to facilitate the O&M of the technologies, and farmer organizations will be put in contact. The authorities will play key role in supervision, knowledge management, preparation of diffusion and scale-out. Institutional sustainability largely depends on improved capacities and knowledge. To this end, component-specific capacity assessments and training programs will be implemented as part of the Project activities. Institutional sustainability is also the entry point of the external diffusion and the scale-out of the measures and approach after the Project. Routine M&E, Knowledge Management Plans, diffusion plans, exit strategies and scale-out plans play a key role in building capacities in an iterative manner, thus ensuring institutional sustainability.
- 128. Financial sustainability.** The financial aspect of proposed innovations has been assessed and consulted with farmers. The innovative measures have proved cost-effective, affordable and can be financially sustained in long-term. Regarding the shared measures (i.e. piped mesqa, conjunctive water use, modern irrigation etc.), the project will increase the productive assets of farmers while optimizing the cost through co-management. For example, pump renting or purchasing irrigation service take a large share of current production cost (up to 100 EGP per irrigation turn per feddan). Through the project, communities will own pumps, and solar energy will minimize the cost of operation. Beyond energy cost, O&M will be organized through the WUA, where farmers can decrease the cost of O&M by in-kind contribution (i.e. cleaning hydrants). Transferring the management responsibility of other shared measures such as small-scale tractors, milk transportation etc. to community level will also have an implication of cost optimization, so unit cost of O&M will be lower, and O&M won't be a financial burden on individual farmers (i.e. shared tractor replaces the need for purchasing tractor services; or, smart tuk-tuks unload the burden on women to finance logistics individually). Regarding the individual measures under the direct ownership of farmers (i.e. sensors, silos etc.), which might require replacement in medium- to long-term, the project proposes strictly inexpensive options, and saving through the application of these measures far exceeds the cost of reinvestment even in short-term (within a year). Basic O&M of measures will be conducted by the communities and individual, based on the printed guidelines and capacity-building. To further strengthen the financial sustainability of the project and decrease the contingent extra costs (i.e. replacement of parts, troubleshooting etc.), the innovation pathways have already conducted initial mapping of the additional markets and actors (i.e. manufacturers, repair services etc.), who will be engaged, trained and certified during the implementation as mentioned before. This process will also include cost optimization to create win-win position and avoid exaggerated service prices. This will also minimize the need for contingency planning. While full business planning will be incorporated in the full proposal, it has been already calculated that introduced measures and the project intervention as-whole entail operating expenses lower than the current expenses.
- 129. Project-level sustainability.** The key considerations of component-wise sustainability are concluded in a matrix. The full proposal development will provide more detailed description of how innovative measures will operate after the Project, and how scale-out plans will ensure the transfer of measures at larger scale.

- Environmental sustainability: Component 1- Focus on sustainable management of surface and groundwater resources; Eliminate risk of salinity; Decrease water pollution; Increase water-saving through enhanced crop water productivity. Component 2 - Focus on sustainable natural resources management and restoration; Increase livestock productivity without increasing the number of livestock. Component 3 - Disseminate climate-resilient and more sustainable water-and-land practices to a wide set of stakeholders
- Social sustainability: Component 1- Promote equitable management of water resources. Component 2 - Promote decent work conditions; Improve the role of women in agricultural value chain; Design socially inclusive measures. Component 3 - Dissemination of climate-resilient agricultural practices that enhance equity and health to a wide set of stakeholders.
- Economic sustainability: Component 1 - Decrease cost of irrigation; Provide community-level infrastructure to reduce operating expenses; Switch to renewable energy to reduce cost of operation; Optimize cost of investment and operating expenses of technologies. Component 2 - Enhance yield productivity; Reduced costs of production; Strengthen market links; Increase production volume and yield productivity without extending production area; Optimize cost of investment and operating expenses of technologies. Component 3 - Dissemination of climate-resilient livelihoods activities to a wide set of vulnerable stakeholders.
- Institutional sustainability: Component 1 - Build institutional capacity of the WUAs, as community governance framework; Provide capacity-building at all-level; Maintain supervision role of authorities; Prepare component-level documentations, diffusion plan, exit plan and scale-out plan. Component 2 - Build institutional capacity of the WFAs and WUAs, as community governance framework; Provide capacity-building at all-level; Maintain supervision role of authorities; Prepare component-level documentations, diffusion plan, exit plan and scale-out plan. Component 3 – Disseminate proven measures of climate-resilient integrated water-, agricultural-, gender-inclusive, and value chain approaches; Prepare project-level communications, coordination, and knowledge management plan, diffusion plan, and exit strategy plan; Operate Innovation Management Portal.

N. Overview of the environmental and social impacts and risks

130. The Project investments and outputs don't carry significant social and environmental risks and are expected to generate successful evidence on innovative adaptation measures. The Project will comply with the 15 principles of AF's Environmental and Social Policy. The Project is ranked in B category, requiring environmental and social assessment regarding a minor part of the project. Category B is defined due to the following reasons: modern on-farm irrigation carries environmental risks, thus requiring an environmental monitoring plan; modern on-farm irrigation is partly based on groundwater use where branch canals operate as per rotational schedule, thus requiring a groundwater assessment monitoring plan; women's rights in traditional communities are often compromised by male household members, thus requiring Gender Assessment and Gender Action Plan, social monitoring plan. As per the national regulations, only the groundwater well requires license that will be obtained upon a risk assessment plan. Hence, the Project requires a limited Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP), and Gender Assessment and Gender Action Plan (GAP) to enhance the potential benefits and to mitigate any potential negative impacts. The ESIA/ESMP and the GAP will be finalized during the full Project proposal development phase. The draft ESIA/ESMP, Gender Assessment, and GAP will be subject to stakeholder consultations before their finalization.

131. The impact-based risk screening is conducted at Concept Note level, considering the 15 AF principles. This chapter is complemented with a synthesis risk assessment of the innovations – based on the measure-wise risk assessment. This is, conceptually, part of the innovation management and serves as additional information to the defined innovation pathways and innovation roll-out of Chapter B and C. The screening as per AF principles are based consultations outcomes, and the table displays the results of the screening at CN level. Further screening and impact analysis will be conducted during the preparation of the full proposal to ensure that the Project fully meets all applicable standards and to identify other theme-relevant construction-and-operational phase potential impacts and mitigation measures.

Table 5: Results of screening as per AF principles

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law	Further assessment will be conducted for full proposal	As detailed in section G, the project will be in compliance with national and international laws. The processes of compliance will be further detailed in the full proposal. Risk (no/very low likelihood): Changes in environmental legislation regarding groundwater (Law No 147 of October 2021) use may occur and would cause delay the licensing. Mitigation measures: Consultation held with Ministry of Environment and MWRI, responsible for the licensing process anticipated no changes in legislation related to groundwater use. The consultation will be continued with relevant authorities to ensure compliance, upon which groundwater license will be obtained. The designated authority (MoE) and executing entity (MWRI) are the responsible authorities for the licensing process and will ensure monitoring and compliance with any changes and legislation.
Access and Equity		The project will not reduce or prevent communities in the targeted areas from accessing basic services. The full project proposal will take a number of transparent steps that will help ensure that the benefits of the project are being distributed fairly with no discrimination nor favouritism. Beneficiaries have been consulted through a participatory approach on the project approach and interventions, on the development of Water User Associations (WUA) and the awareness raising activities under Component 1, and the empowerment of Women Farmer Associations (WFA) under Component 2. Proposed measures and interventions have been quantified and scaled as per the number of beneficiaries to provide equal access to all (individual measures provided to each beneficiary, shared measured scaled to provide equal access and benefits to all), and will be further monitored and verified during the full proposal development. Risk (very low likelihood): Expenses associated to interventions may not be affordable, which would hamper the access of the poorest to project results

	<p><u>Mitigation measures:</u> Costs of project intervention have been estimated, cost optimization process (relevant to investment and running expenses) will continue to ensure affordability, and business plans will be provided to each measure. Monitoring of the project results and access of all identified beneficiaries will be ensured. Stakeholder-disaggregated consultation and participatory implementation will be continued. Access and equity will be monitored per stakeholder groups.</p>
Marginalized and Vulnerable Groups	<p>Marginalised and vulnerable groups have been consulted for the CN and will be further consulted for the full project proposal. The project directly targets marginalised and vulnerable groups: women, youth, illiterate women, elderly. It aims to support them in making decisions on concrete adaptation actions, valuing their traditional and local knowledge. This project will encourage women, youth, illiterate women, and elderly to choose adaptation activities in a transparent and participatory manner and will respect land, property and customary rights.</p> <p><u>Risk</u> (very low likelihood): Illiterate beneficiaries may be hindered in capitalizing project results, which would lead to reduced benefits.</p> <p><u>Mitigation measures:</u> capacity-building programmes, knowledge products will be designed in an inclusive manner, considering the high rate of illiterate women. Knowledge management plans including M&E protocol will be developed at full proposal level and will be operationalized during the project. Learning experts will be hired to provide continuous monitoring and take actions if required.</p>
Human Rights	<p><u>No risk.</u> The CN's risks to Human Rights is reduced by Egypt's ratification of the core human rights treaties on: the Convention against Torture and Other Cruel Inhuman or Degrading Treatment or Punishment; International Covenant on Civil and Political Rights; Convention on the Elimination of All Forms of Discrimination against Women (CEDAW); International Convention on the Elimination of All Forms of Racial Discrimination; International Covenant on Economic, Social and Cultural Rights; The International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families; The Convention on the Rights of the Child; and The Convention on the Rights of Persons with Disabilities. There are currently no outstanding Special Procedures relevant to the Concept Note for which requires consideration. Compliance with the Universal Declaration for Human Rights will be monitored.</p>
Gender Equity and Women's Empowerment	<p>At Concept Note level, it is not expected that a risk will be posed by ESP 5. Women have been consulted and actively involved for the Concept Note and will be further consulted for the full project proposal.</p> <p><u>Risk</u> (low/medium likelihood): cultural norms and religious inheritance laws exclude women from owning land, generating revenue from cropping and participating in decision-making on land and water management</p> <p><u>Mitigation measures:</u> The project will promote alternative activities for women to enhance their empowerment and livelihoods. The Concept Note conducted targeted gender consultations that resulted in the identification of gender-responsive activities, as detailed in Outputs 2.1.2., 2.2.1, 2.2.2. Knowledge management plans will be formulated at full proposal level, and based on it, capacity-building programmes will be targeted to women. The full proposal will have gender quotas and will promote women participation and decision-making power in grassroots organizations (WFAs). During project formulation women machinery will be consulted at national and local level and a full Initial Gender Assessment will be conducted that will enable the appropriate risk screening of the ESP 5 and will also include a Gender Action Plan.</p>
Core Labour Rights	<p><u>No risk.</u> The CN and Full Proposal will not pose a risk to ESP 6. Egypt has ratified 8 fundamental conventions on Forced Labour; Freedom of Association and Protection of the Right to Organise; Right to Organise and Collective Bargaining; Equal Remuneration; the Abolition of Forced Labour; on Discrimination (Employment and Occupation); Minimum Age; and Worst Forms of Child Labour. The project will ensure that at all times international labour standards will be applied, it will not engage child labour in any of its activities and will apply the FAO framework on ending child labour in agriculture. The prohibition of child labour will be part of the agreement with the beneficiaries and will be a non-negotiable provision of the agreement. FAO has a longstanding collaboration with the International Labour Organisation (ILO) dating back to 1947. Furthermore, FAO is a founding member of the Rural Youth Action Plan 2019-2021 (RYAP) and of the International Partnership for Cooperation on Child Labour in Agriculture (IPCCLA). FAO is also an equal opportunities employer and as such it works to ensure that all its projects are free of discrimination in respect of employment and occupation.</p>
Indigenous Peoples	<p><u>No risk:</u> There are no Indigenous Peoples in the project area, as such ESP 7 does not apply.</p>
Involuntary Resettlement	<p>The identification project area, locations of intervention have been conducted in consultation with the communities at Concept Note level. The project is not expected to lead to involuntary resettlement.</p> <p><u>Risk</u> (very low livelihood): The use of fixed pump station installed may be required, and land acquisition would be necessary.</p> <p><u>Mitigation measure:</u> The project will not engage in involuntary resettlement, as mobile pumps will be used on a portable unit, which does not require installation or fixing. All consultations will be based on the Free, Prior and Informed Consent (FPIC) Principle. Should a situation of resettlement or economic displacement arise during the implementation of the project that was not anticipated during design, the implementers and FAO will ensure that a consultation and negotiation process is undertaken with the potentially affected people, according to the FPIC and do-no-harm principles. In case no agreement is reached, the project implementers will modify the specific interventions associated with the affected people, or halt them if changes are not possible. In the case where project implementers fail to undertake a consultation and negotiation process with the affected people, according to the</p>


		FPIC and do-no-harm principles, the conditions and terms of the agreement could be considered to be breached and suspended, following FAO normal procedures for suspension.
Protection of Natural Habitats		<u>No risk</u> : Based on the Consultations at CN-level there is no expected risk to ESP 9. The project area has been identified, and both the project area and surrounding environment have been inspected. The project is not expected to have any negative impact on critical natural habitats including those that are (a) legally protected; (b) officially proposed for protection; (c) recognized by authoritative sources for their high conservation value, including as critical habitat; or (d) recognised as protected by traditional or indigenous local communities.
Conservation of Biological Diversity		<u>No risk</u> : The project area has not been found to contain UNESCO biosphere reserves or RAMSAR sites applicable to this ESP. The project will only use indigenous crops certified by the executing entity (MALR).
Climate Change		<u>No risk</u> : The project is not expected to have negative impact on climate change. The project does not promote any drivers of climate change (energy, transport, heavy industry, building materials, large-scale agriculture, large-scale forest products, and waste management). The project will not be supporting intensive dairy production or promote the introduction of new livestock heads. The target group are engaged in subsistence agricultural activities and the project will be targeting households that typically have one cattle head of cattle per household. Also, the tilling being proposed by the project will not have an impact on climate change as the small-scale, light machines with disc auxiliaries do not harm soil structure as soil preparation is kept to a minimum and turn the organic matter residues back into in the topsoil to inter alia build the CO ² stock in the soil.
Pollution Prevention and Resource Efficiency		The proposed project activities at CN-level are not expected to pose any significant pollution risks, but further assessment is required at full proposal stage. <u>Risk (low/medium likelihood)</u> : conjunctive water use may impact the status of groundwater <u>Mitigation measures</u> : in line with the national legislation, Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) will be conducted to obtain license and prove sustainability of groundwater use (briefly described under Activity 1.1.1.4 in Section A). The executing entity (MRWI) and designated authority (MoE) are responsible for the compliance with national rules. Monitoring device will be selected based on the requirement of the executing entity, including function on discharge and quality. Monitoring device will be real-time, and data will be regularly handed over to the authorities to monitor sustainability.
Public Health		As detailed at the Concept Note stage and with a focus on water conservation and improved livelihoods, the project is not expected to have adverse effects on public health. A further assessment will be conducted at full proposal stage.
Physical and Cultural Heritage		<u>No risk</u> : There is no expected risk at CN or Full proposal stage as Egypt ratified the Convention Concerning the Protection of World Cultural and Natural Heritage in 1976 and the project area also does not contain UNESCO World Heritage Sites. Concept note findings also concluded that there are also no national cultural heritage sites in the project area.
Lands and Soil Conservation		At Concept Note level it is not expected that the project will produce adverse impacts on marginal lands and soil conservation. <u>Risk (low/medium likelihood)</u> : modern irrigation (drip and sprinkler) may cause soil salinization. <u>Mitigation measures</u> : A full risk assessment and Environmental and Social Management Plan will be conducted to minimise any possible risks at full proposal stage, results of the ESMP will be integrated into the activity on the monitoring and establishment of O&M protocol with emphasis on adequate leaching practices (Activity 1.2.1.2.). Salt built-up will be monitored with devices throughout seasons, and ex-post impact assessment will be provided after the monitoring period. Distributed soil moisture sensors will have functions on conductivity measurement. Capacity-building on leaching practices will be conducted at all levels.

PART IV: ENDORSEMENT BY GOVERNMENTS AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government

Mr. Sherif Abdel Rehim Head of the Central Department for Climate Change Egyptian Environmental Affairs Agency PO Box 11728, 30 Misr, Helwan El-Zyrae Rd. Maadi – Cairo, Egypt Tel: +202 252 56452 Fax: +202 252 56490 Email: adaptation_fund_eg@yahoo.com	Date: (Month, day, year)
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B. Implementing Entity certification

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans and subject to the approval by the Adaptation Fund Board, <u>commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund</u> and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
<i>Maher Salman</i> Implementing Entity Coordinator	
Date: December 18, 2021	Tel. and email: 0039 0657054718 Maher.Salman@fao.org
Project Contact Person: Maher Salman	
Tel. And Email: 0039 0657054718, Maher.Salman@fao.org	

ADAPTATION FUND

Letter of Endorsement by Government

[of Egypt]

[22/12/2021]

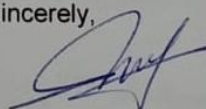
To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for the project "Building Resilience in the Old Lands by Combining Innovations in Irrigation, Agriculture, and Livelihood Activities (Egypt)"

In my capacity as designated authority for the Adaptation Fund in Arab Republic of Egypt, I confirm that the above single country project proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in the Arab Republic of Egypt.

Accordingly, I am pleased to endorse the above-mentioned project concept proposal with support from the innovation facility large grants up to 5 million USD dollar at the Adaptation Fund. If approved, the project will be implemented by Food and Agriculture Organization of the United Nations (FAO) and executed by the Ministry of Agriculture and Land Reclamation and Ministry of Water Resources and Irrigation & Ministry of Environment.

Sincerely,



Mr. Sherif Abdel Rehim
Head of the Central Department for Climate Change
Egyptian Environmental Affairs Agency