Food and Agriculture
Organization of the
United Nations

ANNEXES
SUPPORTING MATERIAL FOR THE CLIMATE-SMART POLICIES TO ENHANCE EGYPT'S AGRIFOOD SYSTEM PERFORMANCE AND SUSTAINABILITY

FAO
INVESTMENT
CENTRE

Annex I

Methodologies for the identification and prioritization of climate-smart agriculture options

SECTION I. ANALYTICAL FRAMEWORK FOR CLIMATE-SMART AGRICULTURE EGYPT

The analytical framework of the study includes four stages with diverse methodological approaches and inputs/tools to attain key outputs.

Step 1. Delimitation of AFS goals and subsectors, mostly driven by the National Structural Reform Programme and sectoral strategies.

- Approach: Validation of AFS goals and selection of subsectors based on criteria agreed with the GoE. The criteria includes: (a) economic relevance; (b) possibility to increase productivity (while improving the environment); (c) relevance to food and nutrition Security; (d) climate change adaptation and mitigation potential.
- Inputs/tools: AFS rapid assessment; national climate change strategy and priorities (NCCS 2050, First Updated NDC and NWFE); key AFS policies and expenditure analysis; and, consultations with decision-makers.
- Key outputs: Four subsectors selected for in-depth assessment – wheat, maize, dates and dairy.

Step 2. Collaborative stakeholder-driven definition of key uncertainties, main trends, and priority climate-smart technologies.

- Approach: Identification and refinement of best-bet CSA technologies per subsector, addressing the main climate change threats.
- Inputs/tools: Step 1 (particularly the AFS rapid assessment, First Updated NDC, NWFE directions and the policies and expenditure analysis); climate change scenarios and projected impacts in AFS (CCDR = World Bank 2022b, studies from IFPRI and other secondary sources of information); consultation (workshop and interviews) with stakeholders (GoE, researchers and value chain actors) to select CSA packages, based on expert knowledge of the climate smartness of such technologies (efficiency, resilience, climate change mitigation potential and adoption potential).
- Outputs: Delimitation of CSA packages per subsector, including an initial description of technologies applied in the conventional system with respect to those adopted in the CSA scenario.

Step 3. Quantitative and qualitative analysis of the different best-bet CSA options.

- Approach: Technical, financial and economic analysis of CSA packages, compared to conventional systems – incremental analysis, and specification of minimum conditions relevant for adequate application and sustainability.
- Inputs/tools: Data shared by the GoE and value chain stakeholders; research papers and other secondary sources of information (cited in Annex 2).
- Outputs: Technical description of CSA investment models and estimates for key environmental indicators: water use efficiency, energy use efficiency, land-use efficiency and GHG balance; financial performance indicators (incremental analysis) per investment model/CSA package (IRR, NPV, pay-back period for investments, SVC, SVB); and, socioeconomic data to: (a) build the economic assessment (also incremental analysis) of CSA options at scale (EIRR, ENPV sensitivity analysis of economic cost and benefit streams); and (b) delimitate minimum conditions for scaling up. Indicators are presented in comparable units among the various CSA packages. Annex 2 provides a summary of the quantitative and qualitative assessments of CSA options.

Step 4. Assessing potential to scale up CSA and definition of policy options, including the analysis of co-benefits and barriers to adoption.

- Approach: Delimitation of scale-up potential for CSA packages, based on quantitative (i.e. EFA) and qualitative evaluation of barriers/opportunities for adoption.
- Inputs and tools: Environmental and financial performance indicators per CSA package (Step 3); economic performance indicators at scale (based on the BaU and CSA scenarios developed in Step 3), as well as two other macroeconomic indicators – job creation potential (direct and indirect along the value chain) and contribution to food and nutrition security (in terms of reduction of the production/consumption gap); and, technical description of CSA investment models, including minimum requirements for adoption (Annex 2). The delimitation of CSA scale-up potential is based on conservative assumptions, which are corroborated with secondary sources of information, mainly academic papers, reviewed during Step 2 and Step 3.
- Outputs: Identification of key factors hindering the adoption of CSA packages; definition of general policy priorities to overcome the current barriers to CSA adoption; and, delimitation of investment priorities in the short, medium and long term.

SECTION II. METHODOLOGICAL APPROACH AND INPUTS FOR THE TECHNICAL AND FINANCIAL ANALYSIS OF CSA PACKAGES (STEP 3 OF THE CSA ANALYTICAL FRAMEWORK)

The financial analysis starts with a technical description of the CSA package adoption scenario (CSA) and the business-as-usual (BaU) scenario. A template applies for all investment models, representing the transition from BaU to CSA. The template includes a detailed description of key parameters, assumptions and sources of information for BaU and CSA scenarios. It also comprises all typical inputs for cost-benefit assessment of investment models: initial investment (BaU and CSA), general costs (BaU and CSA), operational costs and benefits (BaU and CSA), incremental net benefit flows and a summary section of key indicators and findings, including minimal considerations to facilitate adoption in the face of potential constraints by stakeholders (particularly small-scale farmers). The technical definition of CSA and the BaU scenarios uses the same unit of production and period of assessment to allow for comparisons. For all investments models selected in the analysis, at least one of the investment assets has a life cycle of at least 20 years. Thus, the period of technical, financial and economic analysis for all models is 20 years.

The technical definition of the CSA and BaU scenarios also allows for the assessment of environmental indicators in terms of water, land and energy efficiency, as well as implications in the GHG balance. The environmental indicators considered in the analysis follow the priorities set by the First Updated NDC and the NWFE. Four environmental performance indicators are critical in the view of climate change impacts in Egypt's AFS: water use efficiency: net productivity gain in kg/m3; energy efficiency: net change in kWh/feddan/season; land-use efficiency: potential gain (in feddan per season); and, GHG balance: BaU vs CSA (tCO_2e per feddan per year – one season). More detail on the definition, evaluation means and relevance of each environmental indicator is provided in Table A.2.1.

Table A1.1

Definition, evaluation means and relevance of environmental indicators included in the CSA analytical framework of Egypt's AFS

Indicator	**Water use efficiency**
Definition	Water productivity gain from application of the CSA technology package in comparison to the BaU system.
Evaluation means	Water efficiency is assessed in kilograms (kg) of product generated per cubic metre (m^3) of water used for irrigation. The indicator is evaluated for the BaU and CSA models taking into consideration one production cycle (season) and the same unit of production. In this study, the water-use effi-ciency value in kg/m3 is specified for BaU and CSA to allow for the differentiation of each case. The net water productivity gain is therefore the difference from CSA and the BaU (CSA water efficiency value minus BAU water efficiency value). Sources of information for the technical definition of each model are included in Annex 2.
Relevance for Egypt's AFS	Water is one of the most constrained resources in Egypt's economy. Increased temperature, alteration of rainfall patterns and sea level rise due to climate change are profoundly influencing water availability and quality. The current and projected impacts of climate change on water resources and the effects cascading along the AFS are significant. Other important considerations are the growing population, changes in consumption patterns, and external shocks to Egypt's AFS. Therefore, water use efficiency is a priority for Egypt's First Updated NDC and NWEF. Challenges and priorities for Egypt's AFS are detailed in Chapter 2.
Indicator	**Energy efficiency**
Definition	Net change of energy equivalents in kWh in one feddan and one season due to the transition from the BaU system to the CSA package.
Evaluation means	Energy equivalents of the system's operation (expressed in kWh) are calculated for each model per feddan and season. The net change comes from deducting the BaU value from the CSA value (CSA energy equivalent minus BAU energy equivalent). Sources of information for the technical definition of each model are included in Annex 2.
Relevance for Egypt's AFS	Egypt's First Updated NDC and NWEF highlight the potential of increased energy efficiency to facilitate a transition towards a more resilient and sustainable development pathway.
Indicator	**Land-use efficiency**
Definition	Potential land-use gain expressed in feddan per season.
Evaluation means	Potential land-use gain estimates derive from increased efficiency and investment capacity (higher net revenues) per CSA package application (assessed in an area of 2.38 feddan – one hectare), based on the level of production in the BaU system. The simulation of land-use gain assumes the producer keeps the same level of production as in BaU and dedicates input savings and increased net revenue to diversify its production system. The increase in net revenue comes from reduced costs (less inputs required to produce the same output and/or saving of inputs from reduced product losses). The use of improved cultivars and livestock breeds, as well as other technologies that enhance the quality of products (i.e. nutritional value and taste) could lead to higher demand and better prices but this is not considered in the CSA models (conservative assessment). Therefore, the land-use gain estimate only considers the area in which higher factor productivity and incremental net revenues from the updated output (same as in the BaU) allow for diversifying the system. In order to comply with the initial investments and approach of the CSA package, the system's diversification must incorporate economic activities that generate at least the same environmental benefits and targets for climate resilience. Notably for stakeholders, this new activity generates at least the same net revenues as the current one.

Relevance for Egypt's AFS	Climate change scenarios of higher temperatures, changes in rainfall and sea level rise have implications in the soil capacity to produce food. Moreover, land is already one of the most constrained resources in Egypt's AFS. Besides climate change, the use of land for agriculture has other pressures such as urbanization and fragmentation. Therefore, increasing land-use efficiency in Egypt's AFS is essential, as pointed out by the national priorities for reform in the NSRP and in the national climate change strategy and action plans (NCCS 2050, First Updated NDC, and the NWFE). The sources of information reviewed (Annex 2 for each CSA option) to define the CSA options corroborate that there are various products fulfilling the conditions proposed for the land-use gain assessment. The potential land-use gain, derived from the implementation of the CSA model, could be dedicated to diversify production towards a nutritious crop that is more resilient to climate change, with higher water efficiency and at least the same level of production costs and net revenue. Examples of particular relevance for wheat, maize and dairy are broad beans, chickpeas and MAPs (caraway, cumin, coriander, bardacoch and anise). In the case of dates, there is growing evidence that multistrata agroforestry systems could provide higher benefits than conventional systems.

Indicator	**GHG balance**
Definition	Net reduction of GHG emissions due to the transition from BaU system to CSA package, expressed in tonnes of CO_2 equivalent (tCO_2e) per feddan during one production cycle (season).
Evaluation means	FAO Ex-Ante Carbon-balance Tool (EX-ACT) (FAO, 2023) was applied to assess the GHG fluxes of the BaU and CSA, with respect to the baseline scenario. For the purpose of this assessment, the baseline scenario and the BaU are the same. All the models analysed in this study used the same basic parameters and key assumptions for GHG accounting in EX-ACT: the period of assessment corresponds to the technical and financial models; variables follow a linear dynamic along the pe-riod of assessment; and, default 'tier 1' coefficients are applicable. To facilitate the analysis, one EX-ACT excel file was generated for each CSA option and its corresponding BaU system.
Relevance for Egypt's AFS	Egypt's agriculture sector makes a minimal contribution to GHG emissions with respect to other sectors. However, when we consider the AFS in total, there are additional sources of GHG emission, such as food loss and waste and inefficiencies along the system, particularly overuse of water and fertilizers linked to market distortions. In addition, population growth and changes in the con-sumer preferences lead to increased emissions. However, as indicated by Egypt's First Updated NDC and the NWEF, the AFS has great potential to mitigate climate change, while enhancing the system's climate resilience. See Chapter 2 for a full description of AFS challenges and opportunities in the face of climate change.

SOURCE: Authors' own elaboration.

The financial analysis follows an incremental cost-benefit assessment of a CSA package adoption scenario compared to the BaU scenario. The financial analysis builds on: (a) initial investment costs; (b) general costs; (c) operational costs (inputs and labour); and (d) benefits, all valued at market prices for the units of production applicable to each model in the BaU and CSA scenarios (same units of production in both scenarios). These inputs allow the costs and benefits of the BaU and CSA scenarios to be estimated over the 20-year period of assessment. Net benefits (flow of benefits minus flow of costs) of the CSA and BaU scenarios are contrasted to estimate the incremental net benefit stream (CSA net benefits minus BaU net benefits). The financial performance indicators (incremental analysis from BaU to CSA) considered in the analysis are: IRR (percentage), NPV (using a 12 percent discount rate), pay-back period for investments (in years); SVC (in percentage of cost increment up to the break-even point, where NPV is zero and the IRR is equal to the financial discount rate: 12 percent), SVB (in percentage of benefit reduction up to break-even point, where NPV is zero and the IRR is equal to the financial discount rate of 12 percent). Annex 2 provides a profile for each model including the technical description of the BaU system and the CSA package, key performance indicators (environmental and financial), minimum conditions to facilitate the adoption of the CSA package by stakeholders and sources of information.

SECTION III. METHODOLOGICAL APPROACH AND INPUTS FOR ASSESSING THE SCALE-UP POTENTIAL OF CSA PACKAGES (STEP 4 OF THE CSA ANALYTICAL FRAMEWORK) AND OUTLINING POLICY OPTIONS

The CSA scale-up potential assessment is informed by the quantitative (i.e. EFA) and qualitative evaluation of barriers and opportunities for adoption. The EFA of CSA packages at larger scale requires an incremental cost and benefit assessment from the perspective of stakeholders and the whole society. The economic analysis builds on the incremental financial assessment of CSA and BaU models. It then integrates externalities and appraises the incremental net benefits distribution by applying economic values. The analysis incorporates the economic valuation of environmental benefits generated by the application of the CSA packages, such as water, land and energy efficiency, as well as the net reduction of GHG emissions.[24] The incremental economic analysis uses a 20-year timespan, and a discount rate of 10 percent. The delimitation of CSA scale-up potential is based on conservative assumptions, which are corroborated with secondary sources of information, mainly academic papers, reviewed during the previous steps of the CSA analytical framework. It takes into consideration the minimum requirements for adoption, evaluated per CSA option (for a detailed description see Annex 2), as well as challenges and opportunities identified in the global assessment of Egypt's ASF (Chapter 2) and the policy framework analysis (Chapter 3). Table A.1.2 indicates the main sources of information and assumptions applied to delimitate the scale-up potential area for each subsector.

---

[24] The economic valuation of the net reduction of GHG emissions applies a shadow price of carbon using the established time series of shadow price per tCO_2 (World Bank, 2017). The economic value of carbon price considers a range from a low to high carbon price. This study applies the low carbon price adjusted per the 2021 Consumer Price Index for the United States of America.

Table A1.2
Delimitation of the area for scaling up

Maize	The area considered in the economic analysis is 404 469 feddan. The potential area corresponds to 25% of the area already used for maize (as identified by Ouda *et al.*, 2016).
Wheat	The area considered in the economic analysis is 850 000 feddan. The potential area corresponds to 25% of the area already used for wheat (as identified by Atta *et al.*, 2022).
Date palm	Potential area is 30 258 feddan, assuming 25% of the total area cultivated with date palm could adopt the CSA tech. Total area based on the latest value available consulted in FAOSTAT on September 2022, which corresponds to 2021 (estimated value) (FAO, 2022b).
Dairy	The area considered in the economic analysis is 279 250 feddan. The potential area corresponds to 25% of the current herd and area estimates (as identified by El-Eraky *et al.*, 2022).

SOURCE: Authors' own elaboration.

To complement the EFA, the assessment takes into consideration estimates of two macroeconomic indicators. The first indicator is 'job creation potential,' which includes direct and indirect employment along the value chain (from agricultural and non-agricultural activities). The other indicator seeks to assess the potential contribution to food and nutrition security, given a reduction of the production/consumption gap.

Job creation potential is a key indicator in the NSRP and a relevant criterion for policy action. The job creation potential of CSA options is based on employment multiplier estimates proposed by Osman *et al.*, 2021. This study is relevant because it conducts a mixed multiplier analysis under water and land constraints to identify the seasonal agricultural activities with high output and income multipliers. It uses the 2008/2009 Social Accounting Matrix (SAM) for Egypt with a detailed representation of Nile-related production factors employed by agricultural activities across irrigation seasons. Even though the 2019 SAM is available, this FAO study applies the assessment conducted by Oman *et al*. due to their focus on higher water productivity as the main technological improvement driving employment generation in key subsectors. This is the case for all the packages considered in the study, which integrate at least one CSA technology aimed at increased water use efficiency. The indicator selected for this study, cited as 'job creation potential along the value chain' indicates the number of people directly and indirectly employed (in agricultural and non-agricultural activities) given an increase in output (in percentage), which is ultimately derived from higher water productivity.

The ultimate outcome of the AFS is food and nutrition security and it is important to understand how the CSA options contribute to FNS. CSA seeks to enhance climate resilience and sustainability in the AFS by tackling three main objectives: sustainably increasing agricultural productivity and incomes, adapting and building resilience to climate change, and reducing and/or removing GHG where possible. In these ways, CSA contributes to ensure the AFS's operation and ability to achieve FNS (food availability, access, utilization and stability) in a changing climate. It is complex to assess all the positive effects of scaling up CSA in Egypt's AFS and in the FNS of the population. There are multiple levels of assessment, methodologies and indicators with different requirements for data inputs. Given the scope of this study and the data at hand, the production/consumption gap indicator is included to assess the supply and demand dynamic of selected subsectors. For this purpose, FAO's food balance sheets are the main source of information and/or validation of the production/consumption gap estimates per subsector (maize, wheat, dates and milk commodities). In this case, the indicator cited as 'Food and Nutrition' relates to the percentage reduction of the production/consumption gap due to CSA scaling up. The data applied to assess the changes in the production/consumption gap by subsector comes from FAO Food Balance data (FAO, 2022c).[25]

---

[25] In the case of maize, the production/consumption gap analysis is based on data from CAPMAS, 2019; contrasted with 2019 food balance data from FAOSTAT (FAO, 2022c). For wheat, the production/consumption gap estimate is based on 2019 food balance data from FAOSTAT (FAO, 2022c). For dates, there is no production/consumption gap; the surplus domestic production is exported. It is assumed that 25 percent of the dates produced are Medjool cv. prime category suitable for export; estimate based on 2019 food balance data from FAOSTAT (FAO, 2022c). For dairy, the production/consumption gap estimate is based on 2019 food balance data from FAOSTAT (FAO, 2022c).

Annex 2
Profiles of climate-smart agriculture and business-as-usual scenarios

This annex presents profiles of CSA and BaU scenarios, as well as a summary of key conditions to support scaling up CSA by subsector. The following tables summarize the main aspects of the CSA package in comparison to the conventional system (BaU). The summary includes the main incremental net benefits of CSA implementation. All models take into consideration a 20-year period of analysis and a financial discount rate of 12 percent. The sources of information are provided for the CSA and BaU scenarios. In addition to the profiles, minimum conditions for CSA adoption at large scale have been identified by subsector (maize, wheat, date palm and dairy), based on the CSA and BaU scenarios applied for this analytical study. These inputs have also been useful to derive broader policy directions for scaling up CSA approaches in Egypt's AFS (presented in Chapter 5 and detailed in Annex 3).

Maize – BaU and CSA investment models

CSA package	Maize – canal lining, mulching and reduced tillage
BaU scenario	Full tillage and flood irrigation
CSA package	Canal lining, mulching, reduced tillage and improved cultivar
CSA strategy	Varietal improvement, soil management and higher irrigation efficiency
Expected impact of CSA compared to BaU	• Yield increased by 7.2% • Total variable costs reduced by 3.2% • Financial NPV increased by 0.4% (20 years at 12% discount rate) • Water productivity increased from 0.7 kg/m^3 to 1.20 kg/m^3 • Energy savings up to 701.28 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.17 feddan • Net reduction of GHG emissions by 0.87 tCO_2e/feddan/season
Additional observations	The CSA model is conservative provided that it only estimates increased yields based on the effect of mulching. Yield has been adjusted to incorporate a potential decrease due to the application of reduced tillage. It does not include likely yield increases derived from the application of an improved cultivar. Water use productivity could be higher by combining canal lining with reduced tillage and mulching.
Additional observations	BaU scenario based on: IFAD, 2019 (a.k.a. STAR project). Adapted from field data of Menya, Asyut and Sohag governorates. CSA scenario based on: Canal lining data based on FAO, 2020a (OPEC Fund for International Development, OFID, Project: Technical Assessment), complemented by IFAD, 2019 (STAR project). IFAD's OFID project was implemented in eight governorates: Kafr el-Sheikh and Beheira in Lower Egypt; Minya, Beni-Sueif and Assiut in Middle Egypt; Sohag, Qena and Luxor in Upper Egypt. The main sources of information for this model were contrasted with mulching and zero tillage data from: Tsegay *et al.*, 2018; Sime *et al.*, 2015; and Abd El-Latif *et al.*, 2017.

CSA package	Maize – canal lining, mulching and fixed-furrow irrigation (FFI)
BaU scenario	Full tillage and flood irrigation
CSA package	Canal lining, FFI, mulching and improved cultivar
CSA strategy	Varietal improvement, soil management and higher irrigation efficiency
Expected impact of CSA compared to BaU	• Yield increased by 9.9% • Total variable costs reduced by 1.8% • Financial NPV increased by 6% (20 years at 12% discount rate) • Water productivity increased from 0.7 kg/m^3 to 1.36 kg/m^3 • Energy savings up to 646 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.24 feddan • Net reduction of GHG emissions by 0.86 tCO_2e/feddan/season
Additional observations	The model is based on two studies, one applying near-optimal production conditions with mulching, the other focusing on FFI effects only. In order to keep a conservative yield increase estimate, the model applies only the average yield increase from mulching and the additional proportion from FFI. It does not include likely yield increases derived from the application of an improved cultivar. Water use productivity could be higher by combining canal lining, FFI and mulching.
Sources of information	CF scenario based on: IFAD, 2019 (STAR project). Adapted from field data of Menya, Asyut and Sohag governorates. CSA scenario based on: Canal lining data based on FAO, 2020a (IFAD's OFID Project: Technical Assessment), complemented by IFAD, 2019 (STAR project) IFAD's OFID project was implemented in eight governorates: Kafr el-Sheikh and Beheira in Lower Egypt; Minya, Beni-Sueif and Assiut in Middle Egypt; Sohag, Qena and Luxor in Upper Egypt. Regarding FFI, the model is based on El-Halim, 2015.

CSA package	Maize - surface drip irrigation (SDI), nanofertilizers and improved cultivar
BaU scenario	Full tillage and flood irrigation
CSA package	SDI, NPK nanofertilizers and improved cultivar
CSA strategy	Varietal improvement, soil management and higher irrigation efficiency
Expected impact of CSA compared to BaU	• Yield increased by 37% • Total variable costs increased 33.4% due to the application of nanofertilizers but this is compensated by the expected boost in yields. • Financial NPV increased by 7% (20 years at 12% discount rate) • Water productivity increased from 0.7 kg/m^3 to 1.02 kg/m^3 • Energy savings up to 1617.44 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.33 feddan • Net reduction of GHG emissions by 0.32 tCO_2e/feddan/season
Additional observations	Field experiments of CSA models were implemented to assess the effect of using drip irrigation system on water requirement, water saving, water use efficiency, soil characteristics, and the net return. Efficiency factors of the filed experiments were applied to the CSA model in comparison with the BaU model, which is based on field data collected for the preparation of the STAR project (IFAD, 2019). The adjustments are compatible with relevant studies conducted in similar conditions (i.e. Badawy *et al.*, 2022). The performance of the SDI model is taken from Ouda *et al.*, 2016. They indicate that drip irrigation could generate up to 18% increase in yield for maize crop when irrigation takes place in the adequate phasing; and from Moursy *et al.*, 2022. The effects of nanofertilizers and improved cultivars is taken from Morsy *et al.*, 2021. The initial investment costs of SDI are based on Ali *et al.*, 2020.
Sources of information	BaU scenario based on: IFAD, 2019 (STAR project). Adapted from field data of Menya, Asyut and Sohag governorates.

	CSA scenario based on: Ouda et al., 2016; and Moursy *et al*., 2022. Productivity and profitability of modern irrigation from: Morsy *et al*., 2021; and Ali *et al*., 2020. Field experiments of the SDI were carried out during the 2020 summer season at the research station of Water Management Research Institute in the El-Qarda area, Kafr El-Sheikh Governorate, Egypt. The effects of nanofertilizers and improved cultivars were assessed in the Toshka region.

CSA package	**Maize – subsurface drip irrigation (SSDI)**
BaU scenario	Full tillage and flood irrigation
CSA package	SSDI, installed with a semi-mechanical method (15 cm depth and 1 m of lateral lines spacing)
CSA strategy	Higher irrigation efficiency
Expected impact of CSA compared to BaU	• Yield increased by 116% • Total variable costs reduced by 13.4% • Financial NPV increased by 67% (20 years at 12% discount rate) • Water productivity increased from 0.7 kg/m^3 to 1.27 kg/m^3 • Energy savings up to 2464.8 kWh/feddan/season • Potential land-use gain, based on increased productivity: 1.38 feddan • Net reduction of GHG emissions by 0.1.02 tCO_2e/feddan/season
Additional observations	Given the system specifications – 15 cm depth and 1 m lateral lines spacing – this method is more efficient in terms of costs and benefits than the manual and quad-row machine methods. Under the semimechanical installation method, it is estimated that higher water efficiency per unit of production could be achieved at 30 cm depth of SSDI and 0.6 m of lateral lines spacing, but initial costs would be higher.
Sources of information	BaU scenario based on: IFAD, 2019 (STAR project). Adapted from field data of Menya, Asyut and Sohag governorates. CSA scenario based on: Mansour *et al*., 2019. Drip irrigation system with installation of subsurface pipes by manual method, semimechanical method, quad-row machine method and different lateral spacing.

CSA package	**Maize - reduction of post-harvest losses**
BaU scenario	Conventional production and storage
CSA package	Improved production and storage with application of nanosilica and better storage conditions
CSA strategy	Post-harvest loss reduction
Expected impact of CSA compared to BaU	• Yield increased by 34% • Total variable costs increased by 30.9% due to the application of nanosilica, but this is compensated by the expected boost in yields and the post-harvest loss reduction. • Financial NPV increased by 4.5% (20 years at 12% discount rate) • Water productivity increased from 0.7 kg/m^3 to 0.97 kg/m^3 • Energy savings up to 1993.9 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.42 feddan • Net reduction of GHG emissions by 1.43 tCO_2e/feddan/season
Additional observations	The model is very conservative as it assumes post-harvest loss reduction of 5%. This is due to the limited number of performance assessments of the technology and the fact that its effect could vary depending on the effective application of the CSA model and local conditions.
Sources of information	CF scenario based on: IFAD, 2019 (STAR project). Adapted from field data of Menya, Asyut and Sohag governorates. CSA scenario based on: El-Naggar *et al.,* 2020. This model has been complemented with information from COMCEC, 2016. The model has been implemented at the Experimental Farm, Faculty of Agriculture, ARC, Sabahia, Alexandria, Egypt.

SOURCE: Authors' own elaboration.

Wheat – BaU and CSA investment models

CSA package	Wheat – contour tillage and water harvesting in rainfed wheat farming
BaU scenario	Rainfed farming with full tillage
CSA package	Contour tillage and water harvesting (rainfed)
CSA strategy	Soil management and higher irrigation efficiency
Expected impact of CSA compared to BaU	• Yield increased by 21.7% • Total variable costs reduced by 8% • Financial NPV increased by 50.4% (20 years at 12% discount rate) • Increased soil moisture storage capacity up to 95 mm (35 mm for rainfed BaU); reduced runoff up to 10 mm (100 mm for rainfed BaU) • Energy savings up to 1764.68 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.52 feddan • Net reduction of GHG emissions by 1.97 tCO_2e/feddan/season
Additional observations	Given the decreasing water availability, exacerbated by climate change, the CSA model is contrasted with conventional irrigated farming. However, the study selected to build the model indicates the net incremental benefits of the CSA model compared to conventional rainfed agriculture.
Sources of information	CF scenario based on: IFAD, 2019 (STAR project). Adapted from field data of Menya, Asyut and Sohag governorates. CSA scenario based on: Wassif *et al.*, 2022. The area of assessment is the Northwestern Coast Zone of Egypt. The assessment was conducted during the 2019/2020 season.

CSA package	Wheat – mechanized raised bed (MRB)
BaU scenario	Full tillage and flood irrigation
CSA package	MRB
CSA strategy	Soil management and higher irrigation efficiency
Expected impact of CSA compared to BaU	• Yield increased by 30% • Total variable costs reduced by 18.9% • Financial NPV increased by 54.8% (20 years at 12% discount rate) • Water productivity increased from 1.12 kg/m^3 to 1.57 kg/m^3 • Energy savings up to 866.42 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.71 feddan • Net reduction of GHG emissions by 0.77 tCO_2e/feddan/season
Additional observations	There is limited information about the costs of an MRB machine. The initial investment costs indicated in the WOCAT SLM Database technology profile seem to correspond to an MRB system procured from outside Egypt. Government information about the technology indicate that MRB machines are now locally produced from scratch, decreasing the initial investment costs substantially.
Sources of information	BaU scenario based on: IFAD, 2019 (STAR project). Adapted from field data of Menya, Asyut and Sohag governorates. CSA scenario based on: Verbist, 2020 (WOCAT SLM Database). This is complemented with Dhehibi *et al.*, 2017.

CSA package	Wheat – laser land levelling, sprinkler irrigation and deficit irrigation
BaU scenario	Conventional land levelling and flood irrigation
CSA package	Laser land levelling, sprinkler irrigation and deficit irrigation (60%)
CSA strategy	Soil management and higher irrigation efficiency
Expected impact of CSA compared to BaU	• Yield increased by 51.7% • Total variable costs reduced by 16.8% • Financial NPV increased by 100% (20 years at 12% discount rate) • Water productivity increased from 1.12 kg/m^3 to 1.98 kg/m^3 • Energy savings up to 1173.73 kWh/feddan/season • Potential land-use gain, based on increased productivity: 1.23 feddan • Net reduction of GHG emissions by 1.04 tCO_2e/feddan/season
Additional observations	It is not clear if laser land levelling equipment can be procured locally in Egypt. The model applies sprinkler irrigation but drip irrigation could bring even higher benefits according to Atta *et al.*, 2022. If deficit irrigation is not applied, the system could produce higher yields but water productivity would decrease.
Sources of information	CF scenario based on: IFAD, 2019 (STAR project). Adapted from field data of Menya, Asyut and Sohag governorates. CSA scenario based on: Eid *et al.*, 2014; information on application of the sprinkler irrigation system was complemented by Atta *et al.*, 2022.

CSA package	Wheat – surface drip irrigation (SDI) with application of nanosilica
BaU scenario	Full tillage and flood irrigation
CSA package	SDI with application of nanosilica to manage salinity and improve nutrient uptake
CSA strategy	Soil management and higher irrigation efficiency
Expected impact of CSA compared to BaU	• Yield increased by 65.5% • Total variable costs reduced by 45% • Financial NPV increased by 72% (20 years at 12% discount rate) • Water productivity increased from 1.12 kg/m^3 to 2 kg/m^3 • Energy savings up to 1202.56 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.64 feddan • Net reduction of GHG emissions by 0.26 tCO_2e/feddan/season
Additional observations	The model is based on a combination of studies. More conservative yield estimates were taken from Abd El-Rhaman, 2009; comparisons of cost estimates are based on Atta *et al.*, 2022. These were complemented by information of SDI system variants (in lateral spacing) and performance from Abdelraouf *et al.*, 2014. Initial investment costs of SDI system taken from Ali *et al.*, 2020.
Sources of information	CF scenario based on: IFAD, 2019 (STAR project). Adapted from field data of Menya, Asyut and Sohag governorates. CSA scenario based on: Abd El-Rhaman, 2009; Atta *et al.*, 2022; Abdelraouf *et al.*, 2014; Ali *et al.*, 2020. According to the reference studies, the model has been primarily assessed in new lands.

CSA package	Wheat – planting on wide ridges with drip irrigation and conservation tillage
BaU scenario	Full tillage and flood irrigation
CSA package	Planting on wide ridges with drip irrigation and conservation tillage
CSA strategy	Soil management and higher irrigation efficiency
Expected impact of CSA compared to BaU	• Yield increased by 79% • Total variable costs reduced by 19.6% • Financial NPV increased by 198% (20 years at 12% discount rate) • Water productivity increased from 1.12 kg/m^3 to 2.1 kg/m^3 • Energy savings up to 1152.11 kWh/feddan/season • Potential land-use gain, based on increased productivity: 1.38 feddan • Net reduction of GHG emissions by 1.39 tCO_2e/feddan/season
Additional observations	The initial investment costs of the model have been complemented and contrasted with information from Verbist, 2020 (WOCAT SLM Database); and Ali *et al.,* 2020.
Sources of information	CF scenario based on: IFAD, 2019 (STAR project). Adapted from field data of Menya, Asyut and Sohag governorates. CSA scenario based on: Meselhy *et al.*, 2021; Verbist, 2020 (WOCAT SLM Database); Ali *et al.*, 2020. The model has been implemented in South of Sinai Governorate.

CSA package	Wheat – reduction of post-harvest losses
BaU scenario	Full tillage, flood irrigation and conventional post-harvest management
CSA package	Improved production and storage with application of nanosilica and better storage conditions (hermetic polyethylene bags – barrier film 140 micron)
CSA strategy	Post-harvest loss reduction
Expected impact of CSA compared to BaU	• Yield increased by 50.6% • Total variable costs increased by 50% • Financial NPV increased by 12% (20 years at 12% discount rate) • Water productivity increased from 0.7 kg/m^3 to 1.8 kg/m^3 • Energy savings up to 1495.22 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.44 feddan • Net reduction of GHG emissions by 1.36 tCO_2e/feddan/season
Additional observations	Nanosilica effect in production is derived from Ayman *et al.*, 2020. Polyethylene bag information based on Matouk *et al.*, 2017. Post-harvest loss estimate references are taken from Yigezu *et al.*, 2021.
Sources of information	CF scenario based on: IFAD, 2019 (STAR project). Adapted from field data of Menya, Asyut and Sohag governorates. CSA scenario based on: Ayman *et* al., 2020; Matouk *et al.*, 2017; and Yigezu *et al.*, 2021. The field model has been implemented at the Zagazig University, Egypt. Assessment of hermetic polyethylene bags conducted at the Experimental Farm of the Rice Mechanization Center in the Meet El-Dyba, Kafr El-Sheikh governorate.

SOURCE: Authors' own elaboration.

Dates – BaU and CSA investment models

CSA package	Date palms cv. Medjool (nanofertilizers)
BaU scenario	Irrigated date palms (bubbler irrigation) using conventional NPK fertilization (500, 250, 250 g/tree)
CSA package	Renovation of the date orchard and irrigation (bubbler irrigation) with nanotechnology NPK fertilization (500, 250, 250 g/tree/year)
CSA strategy	Orchard renovation and soil management with improved fertilization technique
Expected impact of CSA compared to BaU	• Yield increased by 12.2% • Total variable costs increased by 1% due to the application of nanofertilizers (higher unit costs) and the marketing costs associated with increased yields. However, this is more than compensated with the expected higher net revenue. • Financial NPV increased by 20% (20 years at 12% discount rate) • Water productivity increased from 1.05 kg/m³ to 1.18 kg/m³ • Energy savings up to 987 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.12 feddan • Net reduction of GHG emissions by 0.60 tCO_2e/feddan/season
Additional observations	Incremental initial investment is equal to zero because the BaU and CSA models assume there is an investment in the renovation of the date palm orchard (with same density of date palms per feddan) and the irrigation system, although renovated, remains the same (bubbler irrigation).
Sources of information	Conventional model and CSA model: Initial investment costs for bubbler irrigation system are adjusted from Dhehibi *et al.*, 2018. Fertilization application and yield increased based on Roshydy *et al.*, 2016. Reference on variable costs (except for fertilizers) is taken from El Bakouri *et al*., 2021. Other sources consulted to complement/contrast information are: Salem *et al.*, 2021; Shabani *et al.*, 2016; El-Haggan Group; and, MALR Economic Affairs Sector (information shared during the World Bank/FAO mission in May 2022).

CSA package	Date palms cv. Medjool (SSDI + mulching)
BaU scenario	Date palm production using BIS without mulching and with application of 100% of irrigation water require-ment
CSA package	Renovation of the date orchard and adoption of SDI and mulching, with application of 70% of irrigation water requirement
CSA strategy	Orchard renovation, soil management and higher irrigation efficiency
Expected impact of CSA compared to BaU	• Yield increased by 15% • Total variable costs reduced by 2% • Financial NPV increased by 19% (20 years at 12% discount rate) • Water productivity increased from 1.05 kg/m³ to 1.72 kg/m³ • Energy savings up to 926 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.15 feddan • Net reduction of GHG emissions by 0.66 tCO_2e/feddan/season
Additional observations	Incremental initial investment is relatively low for the technology proposed in the CSA, renovation of date palm orchid and implementation of SSDI, because it is being compared to the full investment costs of renovating the orchard and BIS under the BaU scenario.
Sources of information	BaU and CSA model: Initial investment costs for BIS (BaU model), SSDI irrigation (CSA model) are adjusted from Dhehibi *et al.*, 2018. Water productivity based on Al-Wahabi *et al.*, 2018; and on Alnaim *et al.*, 2022. Yield reference also from Mohammed *et al.*, 2020. Reference on variable costs taken from El Bakouri *et al*., 2021. Other sources consulted to complement/contrast information: Salem *et al.*, 2021.; Shabani *et al*., 2016; El-Haggan Group; and, MALR Economic Affairs Sector (information shared during the WB/FAO mission in May 2022).

SOURCE: Authors' own elaboration.

Dairy: cattle milk production – BaU and CSA investment models

CSA package	Dairy – Improved breed (cross breed), feed and management
BaU scenario	Conventional dairy farming
CSA package	Improved breed (cross breed), feed (on-farm feed including CSA technologies) and housing
CSA strategy	Livestock breeding, feeding and housing improvement
Expected impact of CSA compared to BaU	• Yield increased by 67% • Total variable costs increased by 131% but this is compensated by incremental net revenues. • Financial NPV increased by 15% (20 years at 12% discount rate) • Water productivity increased from 0.7 kg/m^3 to 1.36 kg/m^3 for feed production (maize). The CSA model generates a net reduction of 1238.83 m^3 per feddan. • Energy savings up to 646 kWh/feddan/season • Potential land-use gain, based on increased productivity: 0.16 feddan • Net reduction of GHG emissions by 1.59 tCO$_2$e/feddan/season
Additional observations	The assessment of the feed produced in the farm is based on transition from conventional operation to CSA technologies and practices including canal lining, mulching and FFI, which increases yield while reducing costs and environmental impacts. The model is based on cross breed because the initial investment costs would be more accessible to small-scale milk producers. Moreover, farmers have expressed the importance of keeping traits of local breeds, which are better adapted to local conditions and the impacts of climate change.
Sources of information	BaU scenario based on: conventional milk farming model based on Ramadan *et al.*, 2014; Osman *et al.*, 2017; Atallah *et al.,* 2015. The feed produced on farm based on IFAD, 2019 (STAR project). CSA scenario based on: Ramadan *et al.,* 2014; Osman *et al.,* 2017; Atallah *et al.*, 2015. These studies are complemented by: Soliman *et al.*, 2014; Alary *et al.,* 2016. The CSA feed production model based on El-Halim, 2015; IFAD, 2019 (STAR project) and FAO, 2020a. The CSA feed production takes into consideration the benefits of intercropping and rotation of maize with legumes that are relevant for forage, such as berseem: Shimizu *et al.*, 2015; Rady *et al.,* 2022.

SOURCE: Authors' own elaboration.

Conditions to scale up CSA models by subsector, based on selected CSA and BaU scenarios

Maize

Gradual phasing out of water, nitrogen fertilizer and energy subsidies toward public investment in CSA adoption is necessary for scaling up.

In the CSA models, canal lining investment considers an area of 35 feddan (Mesqa) and could represent a significant amount for smallholder farmers. Nonetheless, even without investing in canal lining, CSA technologies and practices (i.e. mulching and reduced tillage – even under rain fed agriculture – or mulching and FFI) still provide incremental net benefits compared to BaU. Compared to BaU, mulching and reduced tillage have best results in highly degraded lands.

Investments in canal lining must be coupled with access to finance and technical support for scaling up CSA technologies, as well as improved water and energy regulation to incentivize water productivity and promote the introduction of energy efficient and renewable energy technologies (solar panels, more efficient machinery, etc.).

Mulching, reduced tillage and FFI are technologies that do not require substantial technical assistance. Even if mulching and reduced tillage are relatively easy to implement and imply a net reduction in costs, they are necessary to support adoption due to the perception that reduced tillage alone may reduce yields. Technical assistance and some degree of incentives are important to overcome knowledge and cultural barriers. The adoption of FFI is positively affected by improved water and energy regulation. Climate change impact and the multiple stressors of water availability are also becoming key factors for CSA adoption.

The initial cost for establishing an SDI system has been decreasing over time thanks to more local providers of assets and services. In addition, farmers are gradually adapting the technology to local conditions. SDI in combination with other CSA practices, such as mulching, has also shown potential for greater performance. In the case of SSDI, establishment costs are prohibitive for the vast majority of small-scale farmers without access to finance and substantial technical support. Contract farming and other approaches to access finance and manage risks are important for scaling up, as is continued adaptation of the technology to local conditions.

Improved cultivars and the use of nanoparticles have promising potential to increase productivity, but broader adoption would require various areas of support. Investments in research and development are still necessary to ensure a safe and adequate application of technologies. The number of local input providers is limited and only a few public or private technical service providers with full capacity to support the implementation of adequate technology packages. So, it is necessary to enhance input and service provision with attention to other potential needs for smallholder farmers (as certain inputs and services would initially represent higher costs than those incurred under the conventional system).

CSA models including investments in improved post-harvest infrastructure require access to finance, technical and logistic services to facilitate scaling up and sustainability, as well as focused support for smallholder farmers.

The potential land-use gain, derived from implementation of the CSA model, could be dedicated to diversifying production towards a nutritious crop that is more resilient to climate change, with higher water efficiency and at least the same level of production costs and net revenue – i.e. broad beans, chick peas, MAPs (caraway, cumin, coriander, bardacoch, anise). As farmers obtain technical assistance and access to finance, CSA models with SDI or SSDI would also support diversification to higher value crops.

Wheat	
	Gradual phasing out of water, nitrogen fertilizer and energy subsidies toward public investment in CSA adoption is necessary for scaling up.
	Reduced tillage and water harvesting are viable and relevant options for small-scale farmers in areas with highly constrained access to water for irrigation or who depend entirely on rainfed agriculture. Technical assistance is required to support the implementation of contour tillage and correct instalment of the water harvesting system. Incentives would be useful to support initial investment costs and promote adoption. Access to finance by means of contract farming is an option to implement the technology and manage risks. Investment in research and development of improved technologies for water harvest would also support scaling up.
	Investments in canal lining must be coupled with access to finance and technical support for scaling up CSA technologies, as well as improved water and energy regulation to incentivize water productivity and promote the introduction of energy efficient and renewable energy technologies (solar panels, more efficient machinery, etc.).
	MRB technology has been developed and extensively tested by the International Centre for Agricultural Research in the Dry Areas (ICARDA) and other development partners. Due to the very positive and robust results generated by this technology, MRB machines are locally produced. Based on the pilot implemented by ICARDA, ARC and FAO, the Government of Egypt intends to support the adoption of MRB technology in 2 million feddan. For adoption by small-scale farmers with areas smaller than 2.3 feddan, it is necessary to support strategies for efficient access to the MRB machine. One alternative is to support the procurement of MRB and the provision of technical assistance through cooperatives. This would also be a useful approach to facilitate access to equipment and technical assistance for laser land levelling and conservation tillage.
	Planting on wide ridges (MRB), conservation tillage, laser land-levelling and improved irrigation systems (i.e. sprinkler irrigation and SDI) could be implemented separately and still report incremental net benefits compared to BaU. In combinations, these technologies can bring higher incremental net benefits for farmers and the environment. In order to cover the initial investment costs of improved irrigation systems and complementary CSA technologies, the facilitation of contract farming is a relevant option. Technical assistance and access to finance, with a focus on small-scale farmers, are necessary to ensure the correct application of the technology and larger-scale adoption. It is important to support continued adaptation of these technologies to local conditions.
	Improved cultivars and the use of nanoparticles have promising potential to increase productivity but broader adoption would require various areas of support. Investments in research and development are still necessary to ensure a safe and adequate application of technologies. The number of local input providers in limited and only a few public or private technical service providers with full capacity to support the implementation of adequate technology packages. So, it is necessary to enhance input and service provision with attention to other potential needs for smallholder farmers (as certain inputs and services would initially represent higher costs than those incurred under the conventional system).
	CSA models, including investments in improved post-harvest infrastructure, require access to finance, technical and logistic services to facilitate scaling up and sustainability, as well as focused support for smallholder farmers.
	The potential land-use gain, derived from increased productivity, could be dedicated to diversifying production towards a nutritious crop that is more resilient to climate change, with higher water efficiency and at least the same level of production costs and net revenue – i.e. broad beans, chick peas, MAPs (caraway, cumin, coriander, bardacoch, anise).

Dates	
	Gradual phasing out of water, nitrogen fertilizer and energy subsidies toward public investment in CSA adoption is necessary for scaling up.
	The initial costs of establishing improved cultivars, improved irrigation (SSDI) and the application of nanoparticles are prohibitive for the vast majority of small-scale farmers without access to finance and technical support. Contract farming and other approaches to access finance and manage risks are important for scaling up. Besides contractual agriculture to link farmers with date packing houses and factories, the establishment of industrial clusters and logistic areas is encouraged, because it would enhance the organization of date collection in the areas of production and further strengthen the capacities of stakeholders (FAO, 2019). Moreover, it is necessary to support the development of date palm specifications to comply with international regulations and standards necessary for export.
	The land gain potential could be interpreted as an opportunity to further enhance the system's climate resilience through a transition towards an agroforestry ecosystem. Evidence shows multiple benefits from date palm monoculture to agroforestry, without sacrificing productivity (e.g. Abouziena *et al.*, 2011).
Dairy	
	Gradual phasing out of water, nitrogen fertilizer and energy subsidies toward public investment in CSA adoption is necessary for scaling up.
	The initial cost of the CSA model requires provision of technical support and access to financing. Innovative value chain financing extended by linking smallholders through partnership with value chain stakeholders would be a relevant means of alternative support.
	Due to the increased fixed and variable costs of the CSA model versus BaU, sensitization and technical assistance is important for small-scale farmers to adopt the proposed technological package. Improved feeding, housing and enhancement of other management aspects are relevant to ensure that investments in improved breeding pay off. There is evidence that improvements in feeding, infrastructure and management practices with lower costs can also contribute to increased yields and revenues.
	The potential land-use gain derived from the implementation of the CSA model could be dedicated to diversifying production towards a nutritious annual or perennial crop that could contribute greatly to the resilience of the system and to household food and nutrition security.

SOURCE: Authors’ own elaboration.

Annex 3

Support measures in Egypt's agrifood system

Subsidy	Subsidy type	Budgeted value (EGP million)	Responsible entity
Food purchase: supports food purchase across different government ministries, including the school feeding programme run by the separate ministries of Health and Education, but excluding any purchases made under the Tamween programme.	Indirect	6200	Various ministries including Health, Education, and MOSIT
Maintenance of irrigation canals: to maintain and expand irrigation networks, especially in the Nile Delta.	Direct	1100	Ministry of Water Resources and Irrigation
Tamween commodities subsidy: includes the baladi bread and flour subsidy, as well as subsidy and cash transfers for specific food items distributed by MOSIT.	Direct	87 000	MOSIT, General Authority for Supply Commodities
Fuel subsidies: though fuel subsidies have largely been removed, the GoE is still filling in the gap between the price cap on energy (fuel and electricity) and market prices, thus indirectly supporting the agricultural sector.	Indirect	18 000	Ministry of Petroleum and Mineral Resources
Export subsidies: support Egyptian exporters across all industries, in the form of export rebates reaching up to 10% of the export value.	Indirect	4200	MOSIT and MoF
Farmer subsidies: support to farmers via subsidized seeds and inputs (fertilizers and pesticides) for specific value chains, particularly wheat and maize.	Direct	664	MALR
Saiid Upper Egypt development subsidy: includes indirect support to the agricultural sector through major infrastructure investments.	Indirect	250	Saiid Development Authority
Subsidized loans: most of which are intended for the agricultural sector under ABE.	Direct	280	MALR and ABE
Livestock and water resources (operational expenditure): assists veterinary and irrigation operations.	Direct	330	MALR
Livestock and water resources (capital expenditure): assists veterinary and irrigation-related investments.	Direct	101	MALR
Land reclamation: budget support to reclaim 1.5 million feddan of desert land to agriculture.	Direct	135	MALR, Egyptian Agricultural Authority, and General Authority for Construction and Agricultural Development
Emergency provisions for subsidy: emergency fund allocated as part of the 2022/2023 budget to respond to increased food prices due to the war in Ukraine.	Direct	9900	MoSIT
Land reclamation: programmes that are part of a presidential agenda to provide cash transfers targeting lagging regions in agricultural areas. The programme is part of social safety net efforts developed by the GoE to divert policy away from direct subsidy to social protection.	Direct	19 000	Ministry of Social Security

NOTE Direct subsidies refer to support that directly benefits specific AFS actors, such as farmers and consumers. Indirect subsidies refer to support that benefits AFS and other sectors, or that is intended for other sectors and has major spill-over benefits to the AFS.

SOURCE: Authors' own elaboration.