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The Impact of Climate Change on Egyptian Agriculture and Mitigation Priorities

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Abstract: Environmentalists agree that the world's 6.6 billion people contribute to climate change, which is referred to as "global warming," "weather change," and other terms. Agriculture, hydropower, and biodiversity are all negatively impacted by climate change. This research focuses on the required adaptation methods, which include the necessary mitigation changes to boost Egypt's agricultural sector. Egypt's largest source of employment is the agricultural sector. This research focuses on how changing weather affects agriculture, how to manage risks, and how to employ hedging tactics to assist their economies to thrive. The value chain has been designed to focus on the scientific links between the ability to adapt to climate changes such as the sea-level rise and land laser leveling as a prerequisite for minimizing saline groundwater on the Mediterranean coast in northern Egypt and the ability to adapt to global warming in Upper Egypt to monitor the achievement of performance and equity in cropping patterns in Egypt by focusing on the current strategic preparedness plan for global climatic change. Farm profits will increase by 30.391%, 190.818 %, water use will fall by 28.159%, 28.180%, carbon dioxide emissions will reduce by 20.582%, 22.840%, and energy will decrease by 23.654%, 28.546% in Egypt's old and new lands as a result of more favorable crop trends.

Keywords: Sustainable Food Security through Climate Agriculture (SFSTCA) as a value chain consisting of: Climate Agriculture Assessment (CAA) and Climate Agriculture Analysis of Environmentally Extended Inputs and Outputs (CAAEEIO).

Introduction

Ecologists agree that the continual level of activity of the world's 6.6 billion people contributes to the planet's weather warming, which is referred to as "global warming," "weather change," and so on. Climate change is defined as an increase in global temperature induced by an increase in carbon dioxide (CO_2) and other greenhouse gases (**GHGs**). It is "a statistically significant variable in both the underlying state of the weather and its variability," according to ecologists (**Basil Hans 2011**). As a result of the global warming trend, catastrophic events are foreseen - events that will surely disrupt our day, and may even be in our own lives, and the lives of our children, assuming we get there. We are not only consumers and stewards of natural resources; we are also innovators, bringing new ideas to environmental activism in the hopes of finding a cure, at least in part, which is necessary to effectively address the global warming catastrophe. For the first time, we must be a part of our neighbors to prevent global warming around the planet with one conscience, one rationale, and intelligence (**Makeover Joel 2010**). Increased resource demands and wars are possible, posing significant challenges to emerging and agrarian economies. Year after year, farmers have become feeble as a result of material and economic losses. According to a study, agriculture and related industries account for 23% of total **GHG** emissions at the sectorial level. Agriculture, in general, faces a major challenge. As a result, in this research, we attempt to assess the disaster's impact on agriculture and the necessary control mechanisms, particularly on the side of civil society organizations.

Changes in the weather, such as greater temperatures and CO_2 regulations, are expected to have a favorable impact on agriculture, according to some (**Mendelsohn *et al.* 2010**). Because moisture is not always a limiting factor, increased CO_2 concentrations may potentially improve crop yields. Carbon dioxide at high levels can stimulate photosynthesis in some plants (30-100 percent). Plants grow larger and more quickly as they absorb more carbon, according to experimental findings. This is especially true for C3 plants (known due to the production of their first biochemical reactions during the photosynthesis period containing 3 carbon atoms). Increased CO_2 inhibits photorespiration in these plants, allowing them more water-efficient. The reaction of C4 plants would not be as dramatic. C3 plants can grow alongside mid-rise staples like wheat, rice, and soybeans, while C4 plants can grow with low-rise plants like corn, sorghum, and sugarcane. Even with mid-latitude yields declining by 10-30% due to excessive summer drought, it's difficult to predict the impact on low-range crop yields. Because C3 crops (wheat) are more responsive to CO_2 deficiency than C4 crops (corn), the results of the CO_2 boom may be better for C3 crops (wheat). Furthermore, as temperature and CO_2 levels rise, the protein content of grains diminishes. The amylase content of rice - the most important grain driver of cooking quality - rises below the CO_2 extended with wheat, and the prolonged CO_2 lowers the protein content of the grains and flour by 9-13%. Concentrations of iron and zinc, both of which are important for human nutrition, may drop.

Methodology

The agricultural sector represents significant stress with **GHG** emissions and land-use outcomes. Fossil fuels, land use, and agriculture were recognized as the three main sources of the **GHG** explosion over the last 250 years. Agricultural operations (rice cultivation and animal enteric fermentation) account for 54% of methane emissions, 80% of nitrous oxide emissions, and the majority of CO_2 emissions. Droughts will become more severe, frequent, and widespread as a result of major weather changes, posing the greatest threat to the agricultural sector. Droughts may become more severe due to rising temperatures, increased evaporation and transpiration, and lower winter precipitation. In favorable places, the chances of a winter drought will be higher. Flooding is anticipated to grow as a result of climate change in several river basins (**Gosain** ***et al.*** **2006**). Mitigation of climate change usually necessitates a reduction in human **GHG** emissions, which can be accomplished by increasing the capacity of carbon sinks. The use of renewable energy, nuclear energy, and increased forestry are priorities for mitigation. Professor Sir Nicholas Stern forecasts that climate unpredictability will impair the livelihoods and livelihood prospects of hundreds of thousands of people, resulting in biodiversity loss (projected impacts of climate change). Furthermore, Stern forecasts that rising sea levels would result in a mass exodus of people from coastal locations. Climate change necessitates a global response based only on a shared understanding of long-term goals and framework compromise.

Climate Agriculture (**CA**) is a method for guiding agricultural management in the face of climate change. The visualization was first released in 2009, and it has since been updated to include more feedback and interactions from the various parties engaged in the development and implementation of the concept. Climate agriculture's goals are to present generally applicable concepts for dealing with agriculture for food security under changing weather, which can be used as a foundation for policy evidence and recommendations (**Post** ***et al.*** **2001**). The dominant patterns of climate farming technology have evolved in response to boundaries within the global weather coverage area, and an internal understanding of agriculture's role in food security and its ability to occupy the synergies of collaborative interactions between adaptive capacity and mitigation (**Ringius 2002**). Using concepts and insights from agricultural development, and institutional and physical economics, this study develops and formalizes the conceptual foundations of **CA**. The research focuses on determining **CA**'s adaptive potential and resilience. The Climate Agriculture Assessment (**CAA**) specializes in comprehensive investigations on the long-term viability, efficacy, equity, and protection of aid programs. As a value chain, the Climate Agriculture Analysis of Environmentally Extended Inputs and Outputs (**CAAEEIO**) focuses on determining how to track the use of beneficial natural resources and environmental impacts in the context of an economic system.

Mathematical Model

The research builds on the idea and diffuses concepts of agricultural growth, and institutional and physical economics, to deepen and codify the conceptual foundations of **CA**. To concentrate on climate agriculture's adaptability/resilience length, with the assumption that it is the least well established in the economic literature. Conceptual, empirical, and policy analysis, and example case studies, make up a collection of conceptual analyses. The paper is offered as a case study to show that these pervasive ideas have broad international applications. The case-control technique will provide specific clarifications of the conceptual and theoretical framework, and examine the over-generalized extent of the range in the agro-environmental and socio-economic conditions that agricultural planners and policymakers are confronted with today. The case study examines the difficulties in determining vulnerability to changing weather and the damage that results. Improving resilience and the influence of earlier subjection to various political initiatives are key to solving the difficulties. Economists and policymakers will learn how to interpret and apply the ideas of resilience and resilience in the context of agricultural expansion for food security in this research. It's a one-of-a-kind blend of systematic agro-climatic analyses and empirical analyses based solely on an observed instance from the southeastern Mediterranean.

The research followed a set of guidelines, including a conceptual framework and a description of climate agriculture, its technology, and major components. This feature connects the **CA** model's most valuable assets to intermediate financial principles, demonstrating how the notions of resilience, adaptation, innovation, generation, and institutional adoption are related to the different economic aspects of **CA**. The following section is a case study on Agricultural Growth Economies in the Southeastern Mediterranean, to clarify the economic underpinning of **CA** in manifesting reduced susceptibility and greater resilience. It makes it simple to discern responses to improve agricultural policy, system, and standards' adaptive capabilities. It addresses climate change policy issues and provides a high-level overview of the **CA** model that is based purely on economic principles.

As a **value chain**, Sustainable Food Security through Climate Agriculture (**SFSTCA**) includes:

As a **value chain**, Climate Agriculture Assessment (**CAA**):

$$\text{Maxmize CAA}=\sum_{y1=1}^{Z1}(\text{Evy2-Evy1})+\sum_{y2=1}^{Z2}(\text{Evy4-Evy3}) \tag{1}$$

Z1: In the scheme of the old land, the total amount of production cultivated

Evy_1: Before climate change adaptation, the economic value of the production of old land

Evy_2: After climate change adaption, the economic value of the production of old land

Z2: In the scheme of new land, the total amount of productions cultivated

Evy_3: Before climate change adaption, the economic value of the production of new land

Evy_4: After climate change adaptation, the economic value of the production of new land

V: Total annual volume of water used in the scheme

Subject to

$$EVy = Qy \ . \ Py - Cy \tag{2}$$

$$Qy = Ry \ . \ Ay \tag{3}$$

Q_y: Quantity of production y

R_y: Yield of production y

A_y: Area allocated to production y

P_y: Marketing price of production y

C_y: Production costs dedicated to production y

Climate Agriculture Analysis of Environmentally Extended Inputs and Outputs (**CAAEEIO**).**as a value chain:**

$$\text{Maxmize EEI-OCAA} = \sum_{y1=1}^{Z1} (\text{Evy2-Evy1}) + \sum_{y2=1}^{Z2} (\text{Evy4-Evy3}) \tag{4}$$

Z1: In the scheme of the old land, the total amount of productions cultivated

Evy_1: Before adaptation to competition, The economic value of the production of old land

Evy_2: After adaptation to competition, The economic value of the production of old land

Z2: In the scheme of new land, the total amount of productions cultivated

Evy_3: Before adaptation to competition, the economic value of the production of new land

Evy_4: After adapting to competition, the economic value of the production of new land

V: Total annual volume of water used in the scheme

Subject to

$$EVy = Qy \ . \ Py - Cy \tag{5}$$

$$Qy = Ry \;.\; Ay \tag{6}$$

Q_y: Quantity of production y

R_y: Yield of production y

A_y: Area allocated to production y

P_y: Marketing price of production y

C_y: Production costs dedicated to production y

Results and Discussion

The **Climate Agriculture Assessment** (**CAA**) and **Climate Agriculture Analysis of Environmentally Extended Inputs and Outputs** (**CAAEEIO**) as a **value chain** formulated as an analytical tool to apply the use of the production value chain in old and new lands in Egypt within the Nile Valley agricultural region under water resource constraints and ability to adapt to climate change in Egypt.

The study region of old and new lands included 13 governorates in the Delta (Alexandria, Menoufia, Gharbia, Kafr El-Sheikh, Ismailia, Dakahlia, Qalyubia, Sharkia, Port Said, Suez, Damietta, Beheira, and Cairo) and 9 governorates within the Nile River Valley (Giza, Beni Suef, Fayoum, Assiut, Minya, Qena, Sohag, Luxor, Aswan) (**MALR 2022**) (**Figure 1**). The Nile Valley lands were the first to be cultivated in Egypt, and they are differentiated by a sampling of plants grown throughout a complex year, with crops grown during three agricultural seasons: winter, summer, and nili. Egypt's main supply of renewable and fresh surface water is the Nile River. Similar to the internal annual rate of return for crop production, the financial and economic evaluation, and risks were investigated.

Several steps were taken to conduct the **CAA and CAAEEIO as a value chain** (**Figure 2**): The first step was the optimal cropping pattern for winter crops in the Egyptian lands. The second step was to simulate the optimal crop pattern for Egypt. The third step was to simulate the highly efficient cropping pattern in the region with the current cropping pattern (2014 / 2015-2016 / 2017) to reallocate the cropping area in line with production and control technical risks. The use of field data to fill up the form has been reported. A thorough survey and unique inputs of crop fields based on easier winter farming, and detailed statistics relating to the current agricultural situation, and the corresponding socio-economic factors, were used to obtain basic information. The Egyptian Ministry of Agriculture and Land Reclamation (**MALR 2022**) provided statistics on crop area, productivity, and cost, while the Egyptian Ministry of Water Resources and Irrigation provided data on water use (**MWRI 2022**). From the initial characteristic, the necessary information for the crop pattern introduction of the remarkable generation structures was collated and transformed into appropriate crop pattern values. In accordance with the energy input, **GHG** emissions were computed and expressed. The statistics reported in this research are generic and/or combined statistics collected over the years 2014/2015-2016/2017. **Table 1** shows the current planting and its evaluation in place and season on old and new lands, with base year statistics to demonstrate the crops of the area (**ECAPMS 2022**).

To assess agriculture's sustainability, it's important to remember the whole performance of water use within the agricultural system; the overall performance of water use may often be improved by reducing water usage from inputs or boosting crop product outputs. Land use can be reallocated to boost farm profits through technical threat management, where the model was adjusted to fit the change under the ground to keep up with the change in the type of soil and water following the laser leveling of the land in the studied lands. **Table 2** presents the economic analyses of final agriculture in Egypt, which are mostly based on the **CAA** as a value chain and by the use of laser, land leveling in studied lands, and are analyzed using the current scenario. **Figures 3 and 4** depict changes in agro climatic value chains in agriculture within the region throughout the winter climate season from 2014/2015 to 2016/2017, according to the **CAA** in Egypt's old lands. **Table 3** depicts the environmental assessments of the best cultivation, which are primarily based on the **CAAEEIO** as a value chain and the use of laser land leveling within the studied lands, and the comparison to the current situation in Egypt. **Figures 5 and 6** depict changes in the Climate Agriculture Environmentally Extended Input and Output (CAAEEIO) analysis in agriculture during the winter climate season in the region from 2014/2015-2016/2017 to the **CAAEEIO** analysis within Egypt's old lands. The shifts in the analysis of environmentally extended inputs and outputs in agriculture within the region in the winter climate season from 2014/2015-2016/2017 to the **CAAEEIO** in Egypt's new lands are depicted in **Figures 7 and 8**. As a value chain of greenhouse gas fuel emissions, the **CAAEEIO** is significantly lower than the existing model for all agricultural operations, where pollutants impair the ecosystem, structures, and human health. The social value aligned with **GHG** emissions and air pollutants is calculated to obtain statistics on the best water use in the old and new lands of Egypt.

Table 2 shows that total water consumption for optimal agriculture decreased by 28.159% and 28.181% in old and new lands, respectively, and that the total area of crops cultivated in old and new lands could be 931749.034 and 319914.983 hectares, respectively, in addition to the expected model giving a higher net advantage than the current model. After applying the model, the large-scale net profits for the heterogeneous case reached 186530.800 and 69395.275 million Egyptian pounds, which were higher than the total of the fully homogeneous case (166259.954 and 20074.227 million Egyptian pounds), in addition, the total cost of crops in the heterogeneous scenario was 40629.067 million EGP, while the total cost of crops in the homogeneous case was 13102.565 million EGP (34968.102 and 8436.099 million EGP). This final discontinuance outcome may also suggest that discriminating between heterogeneous states influenced the optimal solution significantly. The internal annual rate of return has improved over the prevailing model for the region, increasing by 14.98% and 118.32% in the lands of old and new, respectively, and the absolute risk of optimal agriculture has decreased by 23.31% and 65.61%, according to the economic and financial analyses presented in **Table 3**. As a result, the value chain of Sustainable Food Security through Climate Agriculture (**SFSTCA**) can be implemented in Egypt's agriculture sector. Finally, farmers should laser level the la because it is the most cost-effective solution to the Egyptian problem (261.904 EGP per hectare).

Conclusion

CA is a method of directing agricultural control in the face of climate change. The abstract notion was first introduced in 2009, and as a result of the input and interactions of stakeholders interested in developing and realizing the concept, it has been reconfigured. The **CA** goals aim to establish globally relevant requirements for dealing with agriculture for food security in the face of climate change, which will serve as a foundation for policy handbooks and indicators across multilateral organizations, including the Food and Agriculture Organization of the United Nations. Climate farming strategies have evolved in response to limits in the global climate policy region in tackling the role of agriculture in food security and its functions to harness the synergies between adaptive capacity and mitigation.

The present **CA** controversies are rooted in protracted debates in all climates and the expanding fields of sustainable agricultural policy. It involves the role of emerging countries, particularly their agricultural sectors, in reducing global **GHG** emissions and selecting technologies that can improve sustainable agricultural practices. Because climate farming was widely followed earlier in the formation of a professional conceptual framework for the performance of the approach, there was a wide range of meanings used throughout the period, which led to the conflicts. It becomes evident what the framework may offer as it develops on the concept of climate farming approaches, procedures, equipment, and applications. Finally, the effectiveness of **CA** initiatives in incorporating climate change

Table 1: Changes area in winter cultivation of old and new land of Egypt flow values from the mean 2014/2015-2016/2017 to CAA (Green is values that have increased, red are values that have decreased)

Winter cultivation in old land of Egypt				
	Mean	***CAA***	*Change*	*%*
Wheat	997376.100	1154964.300	157588.2	15.80
Broad Beans	32374.860	19782.420	-12592.4	-38.90
Barley	4243.680	4642.680	399.0	9.40
Lentil	1054.200	596.820	-457.4	-43.39
Fenugreek	1090.320	1425.480	335.2	30.74
Chick Peas	1781.640	531.720	-1249.9	-1781.64
Lupine	78.120	196.560	118.4	151.61
Flax	5922.000	3116.400	-2805.6	-47.38
Onion	59165.400	52599.540	-6565.9	-11.10
clover	573769.140	488641.020	-85128.1	-14.84
Clover Tahreesh	84055.860	91413.840	7358.0	8.75
Garlic	9862.020	9459.660	-402.4	-4.08
Sugar Beet	159618.480	177925.860	18307.4	11.47
Tomato	28521.360	28990.920	469.6	1.65
Vegetables	167976.480	170641.380	2664.9	1.59
Winter cultivation in new land of Egypt				
	Mean	***CAA***	*Change*	*%*
Wheat	304816.680	236527.20	-68289.48	-22.40
Broad Beans	17001.600	20608.98	3607.38	21.22
Barley	34781.040	84106.68	49325.64	141.82
Lentil	15.120	0.00	-15.12	-100.00
Fenugreek	530.880	282.66	-248.22	-46.76
Chick Peas	0.420	117.60	117.18	27900.00
Lupine	136.920	0.00	-136.92	-100.00
Flax	10.500	128.94	118.44	1128.00
Onion	26946.780	19201.56	-7745.22	-28.74
clover	56476.140	184799.58	128323.44	227.22
Clover Tahreesh	4371.780	3517.920	-853.860	-19.531
Garlic	3123.960	3155.04	31.08	0.99
Sugar Beet	55149.360	60201.96	5052.60	9.16
Tomato	49605.780	42407.400	-7198.380	-14.511
Vegetables	116895.240	101933.58	-14961.66	-12.80

Data source: (1) MALR (2020) (2) **CAA** model (2022) (3) ECAPMS (2022)

Table 2: Changes area and energy consumption in winter cultivation of old and new land in Egypt flow values from the mean 2014/2015-2016/2017 to CAA (Green is values that have increased, red are values that have decreased)

Winter cultivation in old land of Egypt

	Mean	***CAA***	*Change*	*%*
Irrigated area of crop in old land	2149252.6	2218450.1	69197.5	3.2
Crop revenue	190051.6	247809.7	57758.1	30.4
Crop profit	166260.0	186530.8	20270.8	12.2
Crop production cost	34968.1	40629.1	5661.0	16.2
Labor Wages	5488.8	6723.4	1234.6	0.0
Other Expenses (Labor Wages)	1257.5	1696.3	438.9	34.9
Crop water consumption	12350.5	8872.7	-3477.8	-28.2
Kerosene fuel million tons	3212.7	2532.9	-679.8	-21.2
Energy consumption in cultivation TJ	100.8	76.9	-23.8	-23.7
Main crop yield	98.5	128.9	30.4	30.9
Secondary crop yield	33.0	43.1	10.2	30.8
Main crop price	7947.8	10282.3	2334.4	29.4
Secondary crop price	494.7	509.4	14.7	3.0
Manure	514.1	927.6	413.5	80.4
Fertilizers	2195.0	3002.0	807.0	36.8

Winter cultivation in new land of Egypt

	Mean	***CAA***	*Change*	*%*
Irrigated area of crop in old land	1613.1	1813.6	200.5	12.4
Crop revenue	32119.9	93410.7	61290.7	190.8
Crop profit	20074.2	69395.3	49321.0	245.7
Crop production cost	8436.1	13102.6	4666.5	55.3
Labor Wages	1967.5	2224.7	257.2	13.1
Other Expenses (Labor Wages)	447.6	539.8	92.2	20.6
Crop water consumption	4170.5	2995.2	-1175.3	-28.2
Kerosene fuel million tons	1400.8	1080.7	-320.1	-22.8
Energy consumption in cultivation TJ	37.7	27.0	-10.8	-28.5
Main crop yield	23.9	40.6	16.7	70.0
Secondary crop yield	10.5	12.0	1.6	14.8
Main crop price	1890.3	3741.4	1851.1	97.9
Secondary crop price	144.9	139.9	-5.0	-3.4
Manure	200.3	279.7	79.4	39.6
Fertilizers	802.2	940.2	138.0	17.2

Data source: (1) MALR (2020) (2) **CAA** model (2022) (3) ECAPMS (2022)

Table 3: Changes in the economic and financial values for the winter season in the old and new land in Egypt flow values from the mean 2014/2015-2016/2017 to CAA (Green is values that have increased, red are values that have decreased)

Winter cultivation in old land of Egypt

	Mean	***CAA***	*Change*	%
Irrigated area of crop in old land	2149252.6	2218450.1	69197.5	3.2
Main crop yield	98.5	128.9	30.4	30.9
Secondary crop yield	33.0	43.1	10.2	30.8
Main crop price	7947.8	10282.3	2334.4	29.4
Secondary crop price	494.7	509.4	14.7	3.0
Crop revenue	190051.6	247809.7	57758.1	30.4
Crop profit	166260.0	186530.8	20270.8	12.2
Crop production cost	34968.1	40629.1	5661.0	16.2
Labor Wages	5488.8	6723.4	1234.6	0.0
Other Expenses (Labor Wages)	1257.5	1696.3	438.9	34.9
Rate of return (IRR)	4.43	5.10	0.66	14.98
Absolute Risk	21.49%	16.48%	-5.01%	-23.31

Winter cultivation in new land of Egypt

	Mean	***CAA***	*Change*	%
Irrigated area of crop in old land	1613.1	1813.6	200.5	12.4
Main crop yield	23.9	40.6	16.7	70.0
Secondary crop yield	10.5	12.0	1.6	14.8
Main crop price	1890.3	3741.4	1851.1	97.9
Secondary crop price	144.9	139.9	-5.0	-3.4
Crop revenue	32119.9	93410.7	61290.7	190.8
Crop profit	20074.2	69395.3	49321.0	245.7
Crop production cost	8436.1	13102.6	4666.5	55.3
Labor Wages	1967.5	2224.7	257.2	13.1
Other Expenses (Labor Wages)	447.6	539.8	92.2	20.6
Rate of return (IRR)	2.81	6.13	3.32	118.32
Absolute Risk	134.93%	46.40%	-88.53%	-65.61

Data source: (1) MALR (2020) (2) **CAA** model (2022) (3) ECAPMS (2022)

Table 4: Changes in crop emissions of the winter season in the old and new land in Egypt flow values from the mean 2014/2015-2016/2017 to EEI-OCAA (Green is values that have increased, red are values that have decreased)

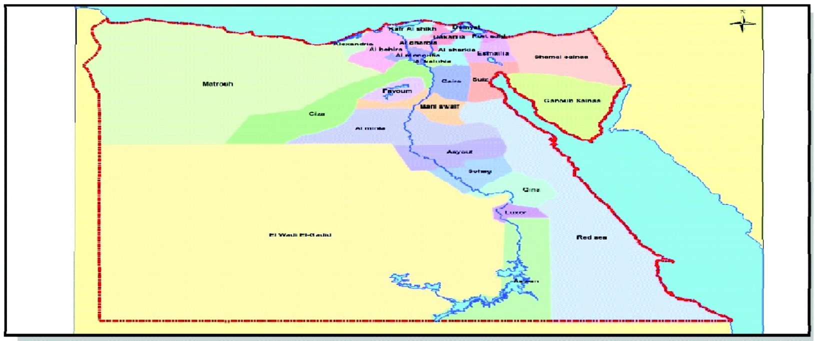
Winter cultivation in old land of Egypt

	Mean	***EEI-OCAA***	*Change*	%
NO_x	1.600	1.261	-0.339	-21.160
SO_2	7.720	6.087	-1.634	-21.160
CO_2	7760.600	6118.49	-1642.1	-21.160
SO_3	nugatory	nugatory		nugatory
CO	2.466	1.944	-0.522	-21.160
CH	nugatory	nugatory		nugatory
SPM	nugatory	nugatory		nugatory

Winter cultivation in new land of Egypt				
	Mean	***EEI-OCAA***	*Change*	*%*
NO_x	0.698	0.538	-0.159	-22.849
SO_2	3.366	2.597	-0.769	-22.849
CO_2	3383.846	2610.661	-773.19	-22.849
SO_3	nugatory	nugatory		nugatory
CO	1.075	0.830	-0.246	-22.849
CH	nugatory	nugatory		nugatory
SPM	nugatory	nugatory		nugatory

Data source: (1) MALR (2020) (2) **EEI-OCAA** model (2022) (3) ECAPMS (2022)

Figure 1: Nile River valley



Lower Egypt		Middle Egypt	Upper Egypt	Outside the Valley
Alexandria	Port Said	Giza	Assuit	New Valley
Gharbia	Sharkia	Beni Suef	Sohag	Matruh
Menoufia	Damietta	Fayum	Qena	South Sinai
Ismailia	Suez	Mania	Luxor	North Sinai
Kafr-El Sheikh	Behera		Aswan	Noubaria
Qalyoubia	Cairo			
Dakahlia				

Source: (**Hamada 2022**)

Figure 2: Structure model of Climate agriculture assessment (CAA) as a value chain in Egypt

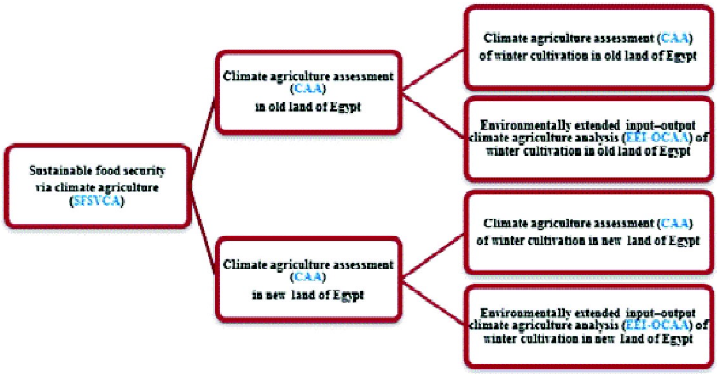
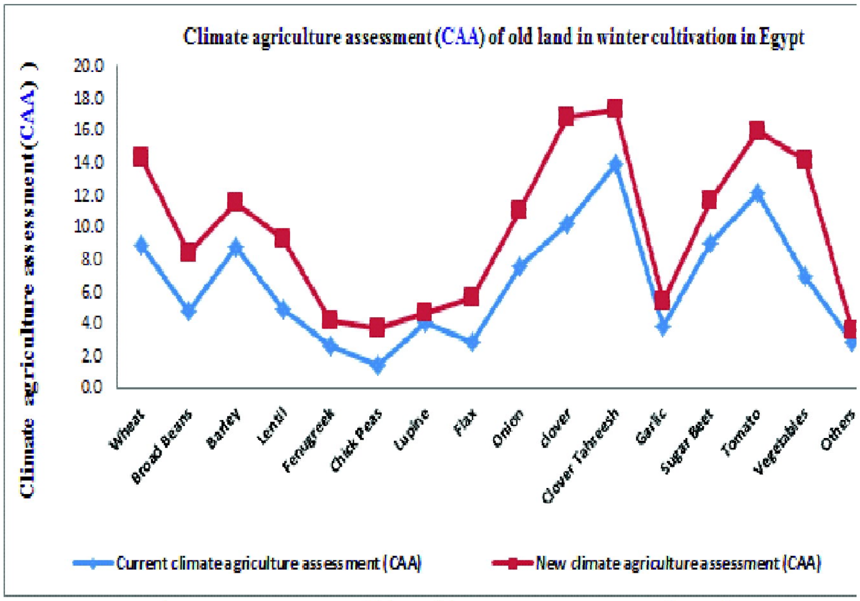
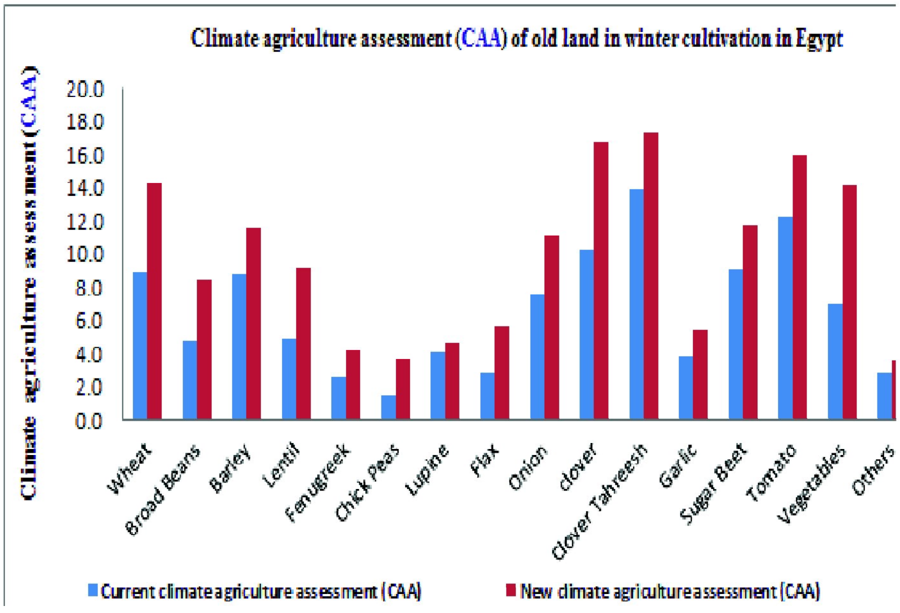


Figure 3: Changes climate agriculture assessments (CAA) from 2014/2015-2016/2017 to CAA



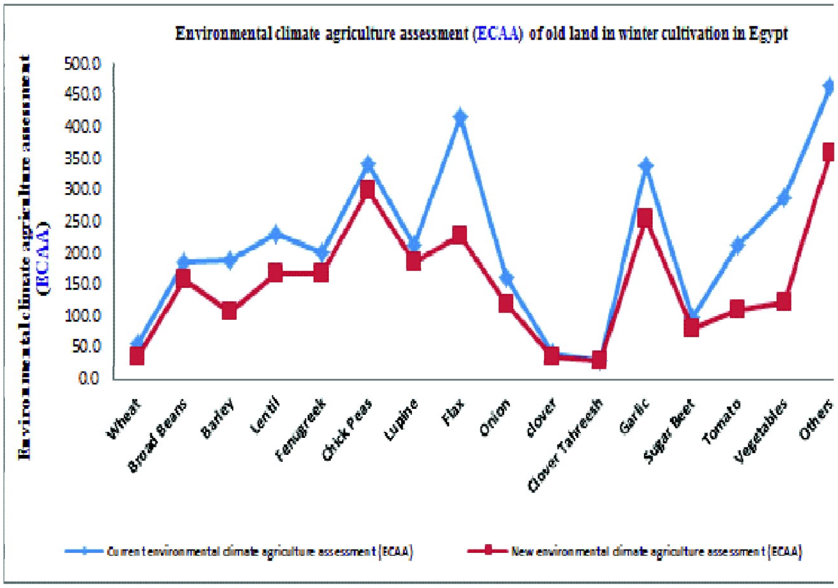
Data source: (1) MALR (2020) (2) CAA model (2020) (3) ECAPMS, (2022)

Figure 4: Changes climate agriculture assessments (CAA) from 2014/2015-2016/2017 to CAA



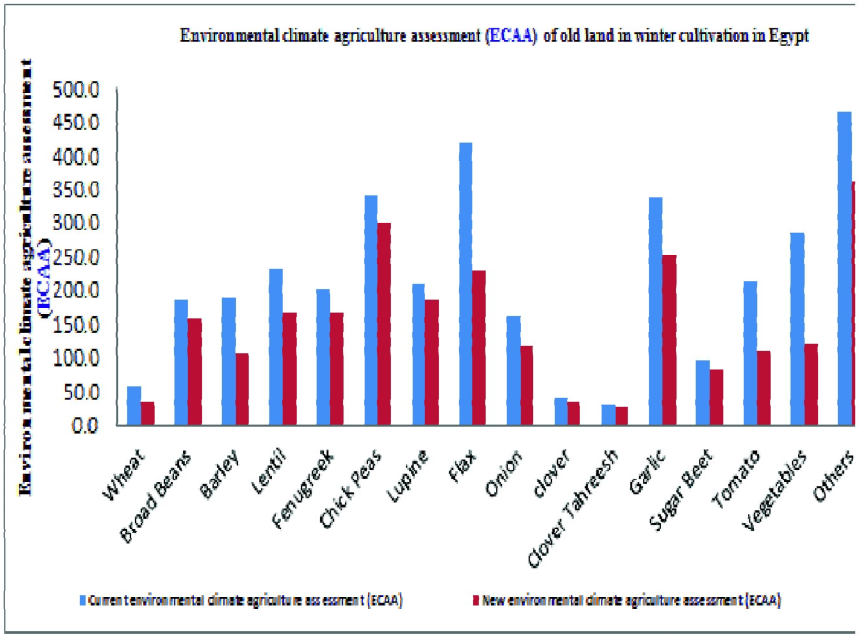
Data source: (1) MALR (2020) (2) CAA model (2020) (3) ECAPMS, (2022)

Figure 5: Changes environmental climate agriculture assessment (ECAA) from 2014/2015-2016/2017 to ECAA



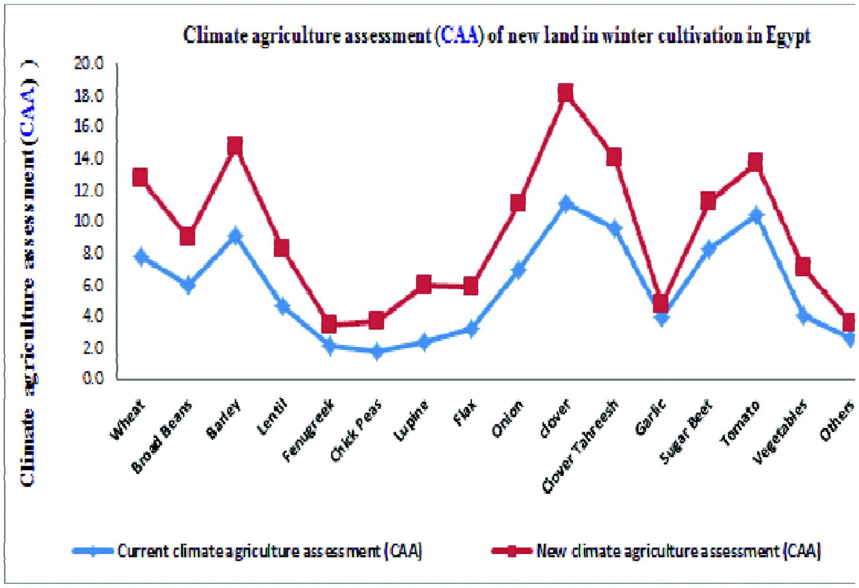
Data source: (1) MALR (2020) (2) ECAA model (2020) (3) ECAPMS, (2022)

Figure 6: Changes environmental climate agriculture assessment (ECAA) from 2014/2015-2016/2017 to ECAA



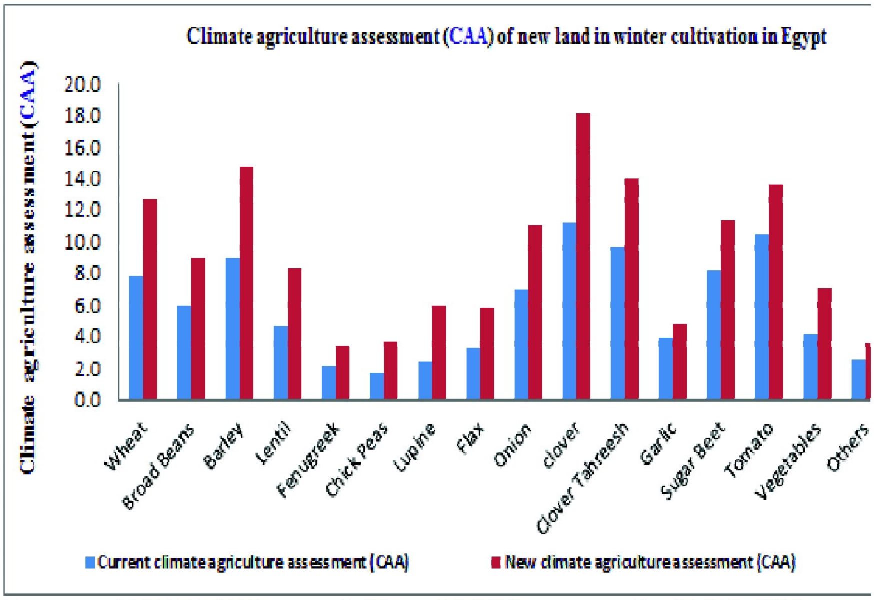
Data source: (1) MALR (2020) (2) ECSAA model (2020) (3) ECAPMS, (2022)

Figure 7: Changes climate agriculture assessments (CAA) from 2014/2015-2016/2017 to CAA



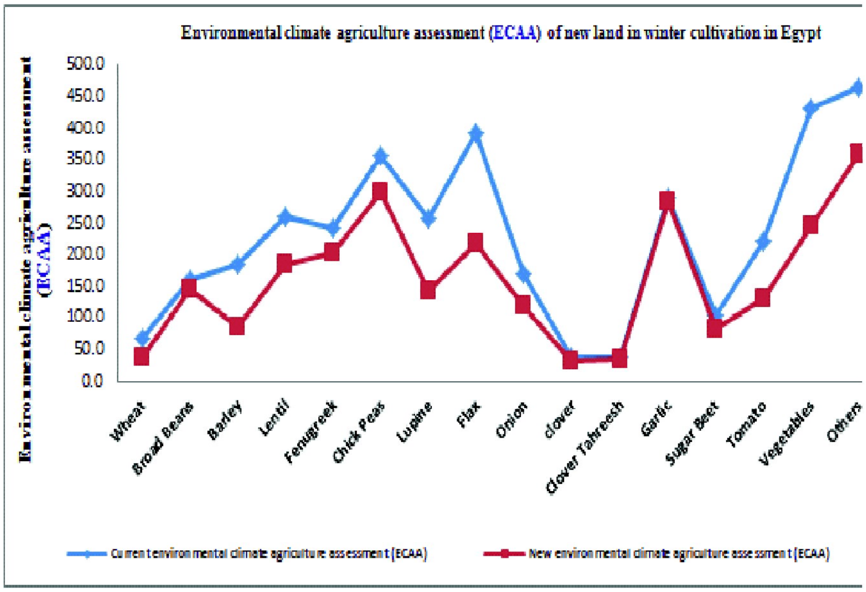
Data source: (1) MALR (2020) (2) CAA model (2020) (3) ECAPMS, (2022)

Figure 8: Changes climate agriculture assessments (CAA) from 2014/2015-2016/2017 to CAA



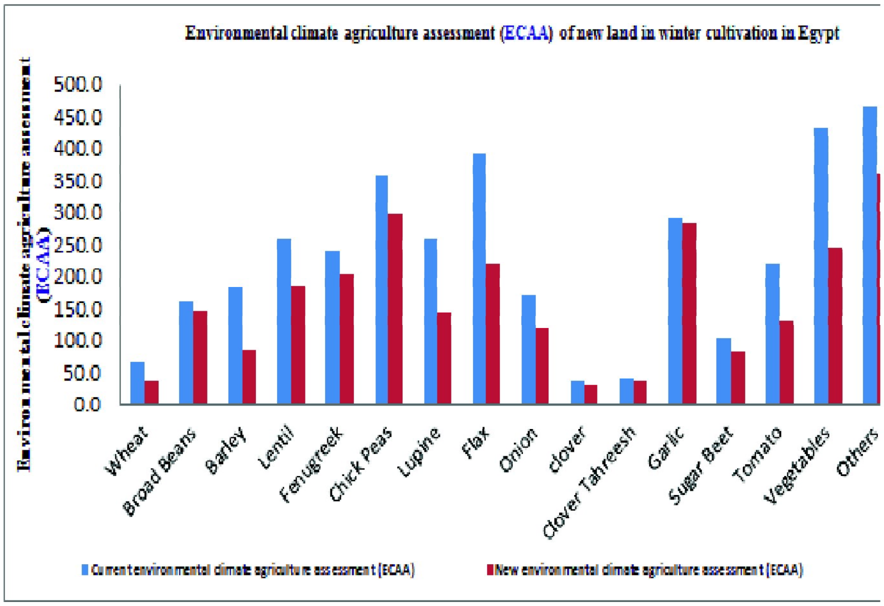
Data source: (1) MALR (2020) (2) CAA model (2020) (3) ECAPMS, (2022)

Figure 9: Changes environmental climate agriculture assessment (ECAA) from 2014/2015-2016/2017 to ECAA



Data source: (1) MALR (2020) (2) ECAA model (2020) (3) ECAPMS, (2022)

Figure 10: Changes environmental climate agriculture assessment (ECAA) from 2014/2015-2016/2017 to ECAA



Data source: (1) MALR (2020) (2) ECAA model (2020) (3) ECAPMS, (2022) responses into sustainable agricultural development strategies on the ground will likely be judged.

The goal of this research is to evaluate two methods for tracking overall performance in the **SFSTCA** value chain: the **CAA** and the **CAAEEIO**.

The **CAA** and **CAAEEIO** as a value chain revealed that in old and new lands, total water use for optimal agriculture was reduced by 28.159% and 28.181%, respectively. Furthermore, the total crops farmed within old and new lands are likely to be 931749.034 and 319914.983 hectares, respectively, and the expected model delivers a better net benefit than the existing model. After applying the model, the heterogeneous state's large-scale net economic benefits were 186530.800 and 69395.275 million Egyptian pounds higher than the total of the homogeneous case (166259.954 and 20074.227 million Egyptian pounds), in addition to the full cost of crops in the heterogeneous case 40629.067 and 13102.565 million Egyptian pounds, which did not achieve the general condition (34968.102 and 8436.099 million Egyptian pounds). Moreover, this close-end result could indicate that differences in some heterogeneous cases had a significant impact on the best option. According to economic and financial analyses, the sector's internal annual rate of return (**IRR**) improved by 14.98% and 118.32% within the old and new lands, respectively, and the absolute risk of high-quality agriculture decreased by 23.31% and 65.61%. As a result, the **CAA** and **CAAEEIO** can be used as a value chain in the agriculture sector in Egypt, avoiding the effects of climate change.

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